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NORTH AMERICAN STARFISHES.

BY

ALEXANDER AGASSIZ.

WITH TWENTY PLATES.

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PREFACE.

THE Plates which accompany this volume* have now been drawn on stone for more than twelve years. It was the intention of the late Professor Agassiz to add to them the anatomy of several of our more common species, but the duties connected with the care of the Museum prevented him from accomplishing this task. Although during the last twelve years several important papers have been published on the anatomy of Echinoderms which would necessitate a complete re-examination of the anatomy of Starfishes, it has been thought best, since there was no probability of being able to finish within a reasonable time the necessary anatomical investigations to complete this volume as originally planned, to publish the Plates as they were left by Professor Agassiz; all that has been added to them is the lettering necessary for their proper explanation. However incompletely the subject of Starfishes is thus presented, these Plates cannot fail to be of value not only as illustrations of a number of our American Starfishes, and as showing the systematic value of characters thus far almost completely neglected, but also as determining the homology of several genera not previously figured, the solid parts of which are given in detail. As several European naturalists are at the present moment engaged upon the study of the Starfishes, it appeared judicious to issue these Plates before they became antiquated.

* They were intended to accompany the text of the fifth volume of the "Contributions to the Natural History of the United States," by L. Agassiz.

The Memoir on the Embryology of the Starfish, Part I., has been republished substantially as it originally appeared in 1864, in advance of the remainder of the volume. I have added notes in brackets on the points where additions have been made by subsequent investigations for the sake of calling attention to the present condition of the subject, and I beg the reader to remember that it was written thirteen years ago.

ALEXANDER AGASSIZ.

MUSEUM OF COMPARATIVE ZOÖLOGY,
CAMBRIDGE, April, 1877.

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PART I.

EMBRYOLOGY OF THE STARFISH.

By ALEXANDER AGASSIZ.

[Part I., together with Plates I. – VIII., was published in December, 1864; the text included in brackets has been added with the subsequent part.]

EMBRYOLOGY OF THE STARFISH.

CHAPTER FIRST.

ARTIFICIAL FECUNDATION, AND HISTORY OF THE DEVELOPMENT OF THE LARVA.

Differences of the Sexes. — Since the existence of different sexual organs in separate individuals was first pointed out among the lower animals, the tendency of every additional advance in our knowledge of their structure has been to bring out more fully the differences of sex between them. But recently, we did not even know that among the Medusæ there were male and female individuals; and yet, at the present day, it is a comparatively easy task to distinguish, among the larger Jelly-fishes, the males from the females. The difference of coloring is very striking. The spermaries of the males are often brilliantly tinged, while the ovaries of the females are of duller hues. We thus find among Jelly-fishes the first indication of an almost universal law in the animal kingdom, and which is nowhere carried out to so great a degree as among Birds. A casual observer could not fail to distinguish a male from a female Aurelia, — though the great difference in the coloring of the males and females had not been perceived by naturalists till it was first pointed out by Professor Agassiz, in Aurelia flavidula *Pér. et Les.* In Melicertum, in Turris, in Staurophora, in Circe, a glance will suffice to determine the sex of the individual; while a single look through a magnifying-glass will reveal to us the sex of the smaller species, such as Eucope, Pennaria, Euphysa, and the like. The difference of the sexes of some Echinoderms is easily perceived by their difference of coloring at the time of spawning; among them are our common Starfishes and our Sea-urchins.

The males and females of our common species of Starfishes, Asteracanthion pallidus *Agass.* (A. vulgaris *Stimp.?*), and Asteracanthion berylinus *Agass.*, can readily be distinguished by their difference in coloring: all

those having a bluish tint being invariably females; a reddish or reddish-brown color indicating a male. Among the many specimens I have had occasion to open, I have thus far never found a single exception. When cut open, so as to expose the genital organs, the difference between the males and females is still more striking. The long grape-like clusters of reproductive organs extending from the angle of the arms, on both sides of the ambulacral system, to the extremity of the rays, present very marked differences in the two sexes. The ovaries are bright orange, while the spermaries are of a dull cream-color. At the time of spawning, which is very different in the two species mentioned above, the genital organs are distended to the utmost, filling completely the whole of the cavity of the ray; the abactinal system itself being greatly expanded by the extraordinary development of these organs.

Artificial Fecundation. — If we take a male and female Starfish in this state, and cut a portion of the genital organs into small pieces, we shall find that the eggs and spermaries escape in such quantities as to render turbid the water in which they are placed. Throwing these small pieces of the genital organs into shallow dishes containing fresh sea-water, and stirring the mixture thoroughly to insure the contact between the spermaries and the eggs, will be sufficient to fecundate the latter. In order to make the operation perfectly successful, some precautions are necessary: all the pieces of the genital organs, which are left after repeated stirring, must be carefully removed; there must not be too many eggs in one dish, so that the water can have free access to them in every direction. The removal of the remnants of the ovaries and spermaries is very necessary, as the pieces which remain clotted together decompose very rapidly, and endanger the safety of the eggs, even when the water can be changed with the greatest facility. As soon as the fecundation is fulfilled, the water in the dishes must be repeatedly changed until it becomes perfectly clear, for the presence of too many spermaries, rendering the water milky, prevents a favorable result. It is best only to use one male and one female for the mixture in each vessel, as eggs taken from many individuals lessen the chances of success. The eggs sink to the bottom, so that the water can be poured off and changed without much danger of throwing them away. Immediately after the mixture is made, the water should be changed three or four times in succession; after that, every half-hour, until the fourth hour, when an

interval of two to four hours may elapse before renewing the water. As it is extremely difficult to change the water after the embryos have hatched and are swimming freely about in the jar, without losing many of them, it is advisable, before they hatch, which is about ten hours after the fecundation, to reduce the water to a minimum volume, and then simply to add a little fresh sea-water and remove the contents of the vessel to larger and larger jars. In this way the water can be maintained sufficiently pure, until the young embryos have taken the habit of swimming near the surface, when it may all be drawn off by means of a siphon. A great deal of time and trouble will be saved by this mode of procedure, and fewer specimens lost. The jars containing the eggs should be kept in a cool place; the most convenient method of securing a low and even temperature is to place the small jars in large tubs filled with cold water.

Changes in the Egg. — At the time of spawning, the eggs in the ovaries are so closely packed that they are pressed into all sorts of shapes, triangular, polygonal, elliptical; but when placed in water, and allowed to remain a short time, they soon become perfectly spherical (Pl. I. *Fig.* 1). The following numbers are the ratios of the diameters of the yolk, the germinative vesicle, and the germinative dot, the outer envelope being 1: the yolk is 0.75, the germinative vesicle 0.22, and the germinative dot 0.08. The formation of the egg in the ovary, and its changes up to the time of spawning, I have had neither time nor opportunity, thus far, to examine.

The spermatic particles, which swim about with great rapidity on escaping from the spermaries, soon find their way to the outer envelope of the egg to which they attach themselves, beating about very violently the whole time. The particles remain imbedded in the thickness of the outer envelope, and are sometimes so crowded as to form a halo round the egg (Pl. I. *Figs.* 1–4). I have not, in a single case, seen any of the particles penetrate through the outer envelope and reach the yolk itself.

Probably a great deal of the difference of opinion prevailing among Physiologists, as to whether the spermatic particles penetrate through the successive envelopes of the egg to the yolk itself, is due to the want of precision still existing in our knowledge concerning the envelopes of the yolk in the different branches of the animal kingdom. We do not

know whether what we call the outer envelope of the egg of an Echinoderm is homologous to the outer envelope of the egg of an Acaleph, of a Polyp, or of Worms, Insects, or Crustacea, or how far these envelopes are found in the ovarian eggs of Mammals, Birds, Reptiles, and Fishes. And before we can come to a satisfactory result as to the place in the egg which the spermatic particles reach before changes can be observed to take place in the yolk, the eggs of the different classes of Animals must be carefully compared with reference to this point. The first phenomenon which precedes any change in the egg is a rotary motion given to the whole egg by the constant beating of the spermatic particles; the germinative vesicle disappears (Pl. I. *Fig.* 2) soon after this, and next the germinative dot (Pl. I. *Fig.* 3). The yolk has then all the appearance of an egg which has undergone segmentation, and the yolk of which should consist of innumerable small spheres. The yolk has the same granular structure previous to segmentation which has usually been considered to belong to it only after the segmentation is complete. [The phenomena preceding segmentation, the structure of the yolk, the mode of formation of the Richtung's-Bläschen, the manner in which the germinative vesicle disappears, are subjects which since the preceding investigations were made have all received considerable attention. The explanations given of these points are therefore all subject to revision and to correction. See more particularly the papers by Ludwig, C. Semper, Lankester, Hartwig, Fol, Auerbach, Balfour; sundry Embryological Memoirs by E. Van Beneden, Composition de l'œuf, 1870; Kowalewsky A. Mem. Akad. St. Peters, XVI., 1871; Blütschli, Die Eizelle; Haeckel E., Die Gastræa Theorie; Strassburger, Die Zelle.] The resemblance between these two stages is still more marked in the eggs of Ctenophoræ, where the ratio between the diameter of the yolk and that of the outer envelope is large, and in which the segmentation is carried on until the whole yolk consists of such minute spheres that it is impossible at first sight to distinguish an egg of a Ctenophorous Medusa, which has undergone complete segmentation, from one in which the segmentation has not even begun, after the germinative vesicle and dot have disappeared. The disappearance of the germinative dot is accompanied by a separation of the yolk from the inner wall of the outer envelope of the egg (Pl. I. *Fig.* 3); this is the first step towards segmentation, and the presence of such a marked interval would greatly facilitate the detec-

tion of spermatic particles upon the surface of the yolk, if any of them had penetrated through the outer membrane. The first trace of segmentation consists in a depression of the yolk, visible on one side of the sphere (Pl. I. *Fig.* 4), and is soon followed by a similar change on the opposite pole.

The segmentation takes place very rapidly, passing in about eight hours from the stage represented by Pl. I. *Fig.* 3 to that of Pl. I. *Fig.* 21, immediately before the escape of the embryo from the egg. The spheres in the earlier stages of segmentation are well separated (Pl. I. *Figs.* 7, 9, 11, 13). They have a centrifugal tendency, and, as they increase in number, arrange themselves in a shell-like envelope, which eventually becomes the wall of the embryo. This tendency is already apparent when there are not more than eight spheres (Pl. I. *Figs.* 13, 14); and as early as the stage represented on Pl. I. *Fig.* 16, where there are only thirty-two spheres, the envelope is quite prominent. The rotation of the spheres of segmentation commences before this (Pl. I. *Fig.* 6), and is entirely independent of the motion given to the whole egg by the spermatic particles; this stops soon after the rotation of the spheres of segmentation has commenced.

As the egg of the Starfish presents nothing peculiar in its process of segmentation beyond what has been just remarked, I refer the reader to the explanation of the plates for the details concerning every successive step of this process, as observed in Asteracanthion berylinus.

The Richtung's-Bläschen of Schultze, which he first noticed in the segmentation of Mollusks, and which were afterwards seen by Lacaze-Duthiers and by Robin, who traced their mode of development, were also observed in the segmentation of the yolk of our Starfish. They are noticed, before the yolk has been divided into halves (Pl. I. *Fig.* 5), as three or four small granules, situated at the extremity of the axis which is to divide the yolk into two portions (Pl. I. *Fig.* 6). They are developed from the yolk itself as a slight swelling, which afterwards becomes entirely distinct from the mass of the yolk (Pl. I. *Fig.* 7), retaining always throughout the whole process of segmentation the same relative position to the axis of segmentation (Pl. I. *Figs.* 9–17). What part they play in the subsequent history of the embryo I have not been able to ascertain. Without doubt they always hold the same relation to the first axis of segmentation, and are, as far as I have observed them in the segmentation of

Asteracanthion and of Toxopneustes, invariably at one pole of the first axis of segmentation.

The Embryo after Hatching. — At about the end of the tenth hour after fecundation, the segmentation has been carried so far that the walls of the future embryo have become quite conspicuous, and it is now ready to hatch (Pl. I. *Fig.* 21). When the outer envelope is torn, the young rotate slowly about, around a shifting axis, by means of very minute cilia placed over the whole surface; the walls are everywhere of the same thickness, and the embryo is perfectly spherical. A difference soon becomes evident; the walls thicken at one pole of the sphere (Pl. I. *Fig.* 22, *a*), and the thickening is accompanied by a flattening of the same side (Pl. I. *Fig.* 23, *a*); the embryo has lost its regular spherical shape and its homogeneous walls (Pl. I. *Fig.* 23, *a*). The next change consists in a slight depression at this flattened pole (Pl. I. *Fig.* 24, *a*); the wall bends inward, forming a very shallow depression, growing deeper and deeper, until it forms a pouch extending half the length of the embryo (Pl. I. *Figs.* 25, 26, *d*, 27, *d*). [This stage has become well known as the gastræa stage of Haeckel; for a fuller discussion of the gastræa theory see my Memoir on the Embryology of the Ctenophoræ, Mem. Amer. Acad., 1874, p. 379.] While a cavity (*d*) is thus formed by the simple folding in of the outer wall, the embryo is constantly lengthening and becomes more cylindrical; the walls of the extremity opposite the pouch becoming attenuated, while, immediately round the opening of the cavity, the walls have not lost their original thickness (Pl. I. *Figs.* 26, 27, *a*). Water flows freely into and out of this cavity; currents are established, running in different directions along opposite walls of the pouch, showing this opening to be for the present a mouth; the pouch, or digestive cavity, sustains the same relation to the whole body as in the most regular and circular radiated animals, such as young Actiniæ, or young Porites. The motion of the embryo, which immediately after escaping from the egg is an extremely slow rotation, increases in rapidity as it lengthens, and by the time the cavity equals half the length of the embryo (Pl. I. *Fig.* 27, *d*), the motion is much accelerated. Instead of a simple slow rotation, with scarcely any motion of translation, the latter is now quite rapid, and is accompanied by a slow rotation round a vertical axis, through the centre of the longer diameter of the animal; the opening leading into the cœcum is foremost during their motion.

At the end of about twenty hours after fecundation the embryo has reached the condition just described; it is now somewhat pear-shaped, with rounded extremities (Pl. I. *Fig.* 27), having at one end an opening (*a*), leading into a pouch (*d*), which extends half the length of the cylinder.* We have now the embryo in a condition which can best be compared to the embryos of other Radiates; for there is as yet nothing of the complication hereafter introduced in the subject by the development of bilateral parts, obscuring the plan upon which the embryo is built. It is an embryo closely resembling those of the other Radiates, in which, however, the class-characters, distinguishing it from the embryos of the other classes of the type, are already developed beyond question. In the young Polyps the earliest appearance of the class-characters is denoted by the presence of a few radiating partitions, dividing the cavity of the embryo into distinct chambers. In the Acalephs, in the most rudimentary stages, we already find the chymiferous tubes pushing their way through the spherosome; while in our larvæ the echinodermoid class-character, that of having distinct walls, forming the different organs, is already plainly visible from the mode of formation of this digestive cavity. What unites all these embryos in one great type is, that we have in them all an axis around which are arranged the different elements

* So far, the changes which have been observed do not differ materially from what we know of the earlier stages of Echinoderm larvæ, from the observations of Derbès, Müller, and Krohn. As I have shown, in the Memoirs of the American Academy for 1864, the earlier stages of the Echinus larvæ, as they have been figured by Derbès, agree in the main points with what has been observed of the earlier stages of our American Echinus larvæ (Toxopneustes dröbachiensis). With the exception, however, that Derbès, not having followed all the intermediate stages between his figures 15 and 16 in the Annales des Sciences Naturelles for 1847, did not see the transformations the digestive cavity undergoes, and committed, therefore, the very natural mistake of supposing that the first-formed opening, which we have described as a mouth, retained the same function afterwards. He, however, correctly noticed the separation of the three cavities, the œsophagus, the stomach, and the alimentary canal, into which this primary cavity is gradually differentiated, and has given a correct description of their relation to each other. Müller has taken up this same subject rather where Krohn and Derbès have left it, and although he has traced the development from the egg of several Echinoderm larva, yet he has not given us as detailed descriptions and figures of the earlier stages, as of those which were more advanced, and says simply, that in the main points his observations coincided with those of Krohn and Derbès. Krohn, who has artificially fecundated Echinus lividus, gives us in his figures some of the missing links in the chain of the observations of Derbès, and shows distinctly for E. lividus, that the first-formed opening becomes the anus eventually, and in what way this is brought about by the bending of the bottom of the digestive cavity towards one side of the larva, as is the case in our Starfish, and the formation at that point of a second opening, which becomes the true mouth, while the first-formed opening henceforth assumes the function of an anus.

of which they are composed. Our young Echinoderm in this condition (Pl. I. *Figs.* 23–28) can be strictly homologized with the earlier stages of a Polyp at the time when the digestive cavity is first formed, before the appearance of the partitions; and with an acalephian embryo, where the digestive cavity alone is developed, previous to the pushing of the chymiferous tubes through the gelatinous mass. The stages subsequent to the condition of the embryo here described, represented in Pl. I. *Fig.* 24, not having been traced very carefully by previous observers, we have not had before us the means of forming a true conception of the mode of development of the Echinoderms; for to obtain a clear and precise idea of the functions of those problematic bodies which have puzzled Müller during the whole of his investigations, it is necessary to follow, step by step, the changes taking place in the pouch of the embryo, which is in this early stage its digestive cavity (*d*); for it is as much a digestive cavity as that of a young Actinia or a Scyphistoma, where the same opening serves as mouth and anus. The mode of formation of the digestive cavity is entirely different in the two classes; in the Polyp it is hollowed out of the interior of the embryo, while in the Echinoderm the bending in of the wall forms the stomach. Hence the two cavities are not homologous, and the openings which lead into them, though performing similar functions — those of mouth and anus — are likewise in no way homologous, though they are in all built upon the plan of radiation. This opening always retains its double function in the Polyps and some of the Acalephs, while in the Echinoderms it becomes the anus after the true mouth has been formed, and the currents have ceased to circulate in the extremity of the pouch and to pass out through the same opening which admitted them.

If there is any doubt that Echinoderms, Acalephs, and Polyps belong to the same great type of the animal kingdom, a comparison of the young Echinoderm, Acaleph, or Polyp in their earlier stages of growth, at a time when the spherosome has not yet been divided into its component spheromeres, will show how great is their identity of development, and how little there is in nature to justify the separation of this most natural great division of the animal kingdom, the Radiates, into Echinoderms and Cœlenterata. I shall return to this point when speaking of the homologies of the larvæ of Echinoderms.

Formation of the Mouth. — The perfect symmetry of the larva (Pl. I.

Fig. 27) is soon modified, and in the next stages of development (Pl. II. *Figs.* 2, 4), the digestive cavity (*d*) no longer runs in the centre of the larva, but is bent slightly to one side. If we examine one of the embryos about forty hours old (Pl. II. *Figs.* 5, 6), we find that great changes have taken place in the thickness of its walls. The outer wall has everywhere become much thinner, except near the opening thus far called mouth, where the decrease is not so marked. The walls of the digestive cavity, which were of an equal thickness for the whole length, have become exceedingly attenuated at the bottom of the sac, and have dilated to a considerable extent, forming a sort of reservoir with very thin walls at the extremity of the pouch (Pl. II. *Figs.* 4, 6, *d*, magnified and isolated, *Fig.* 1, *d*). These changes in the thickness of the walls, and in the form of the internal cavity, are also accompanied by corresponding changes of form in the embryo as a whole. The extremity opposite the so-called mouth has increased in bulk, and greatly exceeds in size the perforated extremity (Pl. II. *Figs.* 4, 6) of the body.

When seen in profile (Pl. II. *Figs.* 2, 4, 5), still greater changes are visible; there is a decided difference between the two sides of the embryo, forming what is to become above and below; calling that part below, where the mouth is situated in the adult larvæ, and which is carried downward in its natural attitude while moving. The dorsal portion of the larva projects beyond the so-called mouth, so that the perforated extremity has become bevelled; the narrowing of the central portion of the larva has increased, and the digestive cavity which, in younger embryos, occupies the centre of the cylinder (Pl. I. *Figs.* 27, 28), is bent towards the lower side (Pl. II. *Figs.* 2, 4, 5, *d*). The outer wall has become thickened at a point opposite the bent extremity of the digestive cavity, and the thickening of the wall, together with the bending of the digestive cavity, goes on till the closed end touches the lower side at *m*.

The changes which have taken place during the time elapsed since the twentieth hour have been very gradual. The embryo now enters into a state where the changes are exceedingly rapid and important; so much so that at the end of the third day the embryo has, in a rudimentary state, all the parts characteristic of older, fully developed larvæ.

At the end of the second day the reservoir at the extremity of the digestive cavity has changed its outline from a circular to a lobed one (Pl. II. *Fig.* 8, *o*); the lobes widen towards the sides, almost forming

diverticula (*w*, *w'*), from the digestive cavity. During this time the main digestive cavity has entirely lost its cylindrical form; it has become narrowed at the extremities and bulging in the centre (Pl. II. *Fig.* 8, and isolated, *Fig.* 9). When seen in profile, and comparing it with earlier stages (Pl. II. *Figs.* 2, 4, 5, 7, isolated, *Fig.* 10, *a*), it is at once noticed that the opening at one end, the present mouth of the larva, has little by little changed from a position at one extremity of the embryo (Pl. I. *Figs.* 27, 28, *a*) to a slightly eccentric one (Pl. II. *Figs.* 4, 5, 7). While the present mouth is changing its position from a terminal to an eccentric one, and while the digestive cavity has been expanding at the bottom into a large reservoir, its closed end is bending more and more towards one side (Pl. II. *Figs.* 2, 4), until it finally touches the outer wall of the embryo at *m* (Pl. II. *Fig.* 5). At this point of junction an opening is formed, leading into the bottom of the digestive cavity (Pl. II. *Fig.* 7); this second opening (*m*) is now the true mouth, and performs hereafter all the functions of a mouth, while the first-formed opening of the young embryo (*a*, Pl. II. *Figs.* 2, 4, 5, 7) is restricted in its functions, and performs hereafter only those of an anus; although in the early stages (Pl. I. *Figs.* 25, 26, 27, 28; Pl. II. *Figs.* 2, 4, 5, 6) it had performed the functions of a mouth. We have thus an apparent anomaly in the fact that the first opening becomes the anus, while the true mouth is only formed afterwards; but this difficulty is readily explained if we compare the functions of this first-formed opening, the so-called mouth, with what we find among Polyps, where one and the same opening performs the double functions of mouth and anus throughout life.

The diverticula (*w*, *w'*, Pl. II. *Figs.* 7, 10) do not extend, as would seem when seen from above (Pl. II. *Fig.* 8), at right angles from the main cavity, but trend obliquely upwards, as seen in profile (Pl. II. *Fig.* 7), towards the other extremity of the embryo, as in *Figs.* 7, 10, Pl. II. The outer wall, which had formed a connection with the closed extremity of the digestive cavity, on the lower side, has been drawn out in the shape of a slender cone (*o*, Pl. II. *Figs.* 7, 10, 11, 14, 17), and becomes the œsophagus, which leads to an opening (*m*, the mouth), connecting the ventral side with the digestive cavity.

Nomenclature. — It will materially assist in the explanation of the subsequent changes of form, and obviate a great deal of circumlocution, if we at once call the different organs by their true names. The original open-

ing (*a*), which performed at first the functions of the mouth, is hereafter the anus (*a*); the second opening, the true mouth (*m*), is not formed until the embryo has arrived near the end of the second day; it is placed in the middle of the lower surface, and from this time forward the former mouth assumes the function of an anus. That portion of the digestive cavity which leads from the mouth to its bulging portion is the œsophagus (*o*), the bulging portion is the true digestive cavity, or stomach proper (*d*), the short tube leading from the stomach to the anus is the intestine (*c*), while the diverticula (*w*, *w'*) are the two branches of the future water-system. The reasons for calling these parts mouth, anus, œsophagus, stomach, intestine, and water-system will become apparent as we trace the development of the embryo in its more advanced stages, in the following pages.*

The currents, which before had entered through the mouth (*a*), passed to the extremity of the cavity (*a*), and been expelled again through the same opening (*a*), now change their course completely; there is a current which enters the mouth (*m*), flows through the œsophagus (*o*) into the diverticula (*w*, *w'*), then into the true stomach (*d*), and is finally rejected through the anus (*a*). From this time forward it is quite an easy thing to observe the course of the food; it is taken into the mouth by means of the currents produced around its opening, passes rapidly through the œsophagus, rotates for some time in the spherical stomach (*d*), and then passes out slowly through the opening (*a*) of the alimentary canal (*c*). As these currents are more and more distinct as the larvæ grow older, there can be no doubt that the function of the first-formed opening is eventually confined to that of an anus, after having performed the function of mouth during the first stage of growth of the larva.

Formation of the Water-Tubes. — By water-tubes I mean the bodies which have received from Müller the name of problematic bodies, in their earlier stages of growth, and which he has called Schlauchsystem, when they appear, in the older larvæ, as broad tubes running on each side of the œsophagus and stomach. These parts he considered as independent systems, but as they are only different stages of the same thing, as will appear below, they have received here the name which denotes most

* Other terms are also frequently used, to denote the different parts of radiated animals, which are not usually adopted; they will be found fully explained in the third volume of the Contributions to the Natural History of the United States, by Prof. Agassiz, p. 73, and seq.

appropriately the function they assume of circulating water through the body of the larva.

The water-tubes (*w*, *w'*), at first (Pl. II. *Figs.* 7, 8, 9, 12, 13, 14) only diverticula from the main digestive cavity (*d*), become less and less connected with it; and by the end of the second day the constriction at the point of attachment has almost entirely separated them from the digestive cavity (Pl. II. *Figs.* 15, 16, *w*, *w'*). A marked difference is noticed in the rapidity of growth of these two bodies; the right-hand one (*w'*), when the anus is placed in advance, and the mouth downwards, increases more rapidly, extending towards the dorsal side, which it eventually reaches, opening into the surrounding medium by a small aperture (Pl. II. *Fig.* 17, *b*), the water-pore, or, as Müller has called it, the dorsal pore. A comparison of *Figs.* 8 and 18 of Pl. II. will perhaps render more evident the transformation of the diverticula (*w*, *w'*) from the digestive cavity into two separate bodies. All we have to do is to swell out the lobed pouches (*w*, *w'*) of *Fig.* 8, Pl. II., then cut them off, removing them a short distance from the digestive cavity, and we shall have the two independent bodies (*w*, *w'*) of Pl. II. *Fig.* 18, which have little by little been changing their relation to the digestive cavity, as described above. This transformation I have actually observed in every stage of its progress, as it is represented here isolated (Pl. II. *Figs.* 9–16).

The walls of the œsophagus (*o*), of the digestive cavity (*d*), and of the intestine (*c*), which up to this time are of nearly the same thickness, quite rigid, capable of very limited expansion and contraction (Pl. II. *Figs.* 2, 4, 5, 7, isolated, *Figs.* 10, 11), lose their uniform character with the gradual circumscription of these three regions. The walls now become quite different in their appearance, and the more marked the separation between these three organs, the greater the difference in the character of the walls which circumscribe them (Pl. II. *Figs.* 17, 19, 21, 23). In proportion as the stomach (*d*) grows more spherical, the angle between it and the intestine (*c*) is more acute, and the intestine (*c*) becomes a longer and narrower tube, with walls much less thick than those of the stomach (*d*). The walls of the œsophagus (*o*) are even more flexible; the conical tube, leading from the mouth to the stomach, widening and taking a pistol-shaped form, the walls have become so movable, that the opening leading into the stomach can be closed and opened by the greater power of expansion and contraction of this part of the walls (Pl. II. *Figs.* 23, 25). The mouth (*m*),

as it increases in size, grows triangular, with rounded corners; the depression in which it is placed divides the larva into two very distinct regions (Pl. II. *Figs.* 19, 23, 25). Since the formation of the mouth, and the change of position of the first-formed opening to an eccentric one, we find the mouth and anus placed on one side of the larva. These openings present, at this stage (Pl. II. *Fig.* 17), the same relations as the mouth and anus of Clypeaster and Scutella-like Echinoids, while at a much earlier period they are more like Pygorhynchus.

If we now return to the water-system, we find that the two diverticula (*w*, *w'*), mentioned above (Pl. II. *Figs.* 15, 16), have entirely separated from the digestive cavity (Pl. II. *Fig.* 18), and are now distinct cavities, having no connection whatever either with the cavity from which they originated or with one another; one of these cavities is entirely closed (*w*), the other (*w'*) connects with the surrounding medium by means of a very small opening, the dorsal pore (*b*, Pl. II. *Fig.* 23, and isolated, *Fig.* 17). Such is the appearance of an embryo at the close of the second day after fecundation.

Müller never knew the origin of the water-tubes; in his last paper only he becomes aware that they are independent at first, but subsequently unite. It must be remembered, in reading his earlier papers, that he sets at rest, in his last memoir, the doubts he expressed concerning the independence of the two branches of the water-tubes; in fact, to obtain a clear conception of Müller's views, it is advisable to read his last memoirs first, to be able to adopt at once the corrections he himself makes during the laborious course of his investigations. The problematic bodies, however, still remained a puzzle to him, even at the time of his last memoirs, as he was never aware that they were simple diverticula of the digestive cavity, and were finally transformed into the two independent branches of the water-tubes, uniting, in subsequent stages of growth, to form the Y-shaped water-system. Van Beneden saw, in the young Bipinnaria (Brachina *Van Ben.*), that the water-tubes are at first separate, but he did not trace their mode of formation, and no other observer has since returned to this subject.

[Metschnikoff states that in some cases there is but a single water-tube, and that I have mistaken an accumulation of cells for a second water-tube. I can only state that I have frequently repeated my observations on the Pluteus of Starfishes, Ophiurans, and Echini, and have invariably found

two water-tubes present, but I have also seen in Starfishes and Ophiurans, as he has well shown in Ophiurans alone, that the whole rosette of the future ambulacral system is developed only upon the surface of one of these, the one communicating with the exterior through the dorsal pore, the future madreporic body.]

Appearance of the Chords of vibratile Cilia. — The cilia, spreading over the whole surface, which moved the embryo so rapidly at first, have almost entirely disappeared, and are no longer capable of propelling such a large mass; consequently, at this last-mentioned stage (Pl. II. *Fig.* 20), the larva is very sluggish, advancing but little, and rotating slowly about a longitudinal axis at the same time. During the third day, the movements become still more sluggish; it is then that we find the first appearance of the organs which are to propel the larva in future. The general outline does not change during the third day; the principal transformations are the greater bending and extending of the œsophagus and alimentary canal, the increase in size of the mouth, of the water-tubes, and the appearance of slight projections, small clusters of vibratile cilia, near the anterior and posterior sides of the mouth, which are the beginning of rows, extending in older larvæ in continuous lines all round the body, and their only means of locomotion (Pl. II. *v*, *v'*, *Figs.* 20–28). These rows are at first two very short arcs (*v*, *v'*, Pl. II. *Fig.* 22), with their convexities placed opposite one another on each side of the depression in which the mouth is placed (*v*, *v'*, Pl. II. *Fig.* 21).

The general outline of the larva has, up to this stage (Pl. II. *Fig.* 20), undergone but slight modifications, the changes taking place principally in the digestive organs. The phases through which the larva passes in the next three days are of a very different character; the alimentary canal, the stomach, and the œsophagus become more circumscribed by the increasing difference noticeable in the walls of these regions. The stomach (*d*) is always marked by the greater thickness of its walls; while, with increasing age, the walls of the œsophagus (*o*) become more attenuated, and capable of greater expansion and contraction (Pl. II. *Figs.* 25, *o*, 27). We observe, also, a rapid increase in the growth of the water-tubes (*w*, *w'*), which by the end of the sixth day (Pl. II. *Figs.* 27, 28) extend as far as the corners of the mouth and along the edge of the walls of the stomach, towards the anal extremity (Pl. II. *Figs.* 24, 26, *w*, *w'*). When viewed in profile (Pl. II. *Figs.* 25, 27), it will be seen that the

plane in which these water-tubes run is not parallel to the longitudinal axis, but inclined to it in such a manner, that the œsophagus passes between these two tubes. It is in these stages, represented in Pl. II. *Figs.* 20–28, that the passage from the initial, truly radiate form to a bilateral one is the most obvious, and it may be well to dwell for a moment on the changes which are going on here, and compare them to what we find in other Radiates. Müller has always maintained that, the Echinoderm larvæ being bilateral, we had a passage from a bilateral symmetry to a radiate type, while in reality this seeming bilaterality is subordinate to a truly radiate plan of structure. The first question to settle with regard to this is, whether we have a strictly bilateral form among the larvæ or not, and whether we do not find here a repetition of what is so constantly met with in the animal kingdom, — the undue preponderance of some parts, hiding effectually the plan upon which the whole animal is built; in fact, the engrafting of a subordinate type upon the type which remains predominant. With the gradual development of the plastrons alluded to, as formed from the chord of vibratile cilia, the embryo assumes more and more a shape which renders it quite difficult to perceive the original plan of radiation, concealed, as it gradually becomes, by the symmetrical arrangement of the edges of these plastrons, which leads one involuntarily to mistake their mode of execution for the plan upon which the animal is built. This apparent passage from a strictly radiating form to a seeming bilateral one is nothing more than what we find constantly among the adults of this same class, and yet no one has attempted, for that reason, to make bilateral animals of the Echinoderms. The Spatangoids might as well be called bilateral, and not radiating animals, on account of the perfectly regular symmetrical arrangement of the fascioles, extending over all the spheromeres composing the body of such Spatangoids, and in which even the ambulacral system presents marked features of bilateral symmetry. The case is exactly a parallel one; this chord of vibratile cilia, and the chord of fascioles, arranged so regularly, simply conceals in both cases the plan upon which the animal is built, but does not, in either case, change the plan of radiation into that of bilaterality. As little should we be justified in removing some of the Holothurians, such as Cuviera and the like, from the Radiates, simply because the greater preponderance of some of the ambulacra has brought out, in these animals conspicuously, a dorsal and a ventral side, and an

anterior and posterior one. In the embryo of our Starfish, which told so plainly, in its early stages, of the plan upon which it is built, that plan is now lost sight of in the extraordinary bilateral development of some of the parts. But, until Spatangoids and flat-soled Holothurians are proved to be truly bilateral animals, and not genuine Radiates, with subordinate bilateral features, these seeming bilateral Echinoderm larvæ must be considered as truly radiate, with bilateral features engrafted upon them.

Development of the Plastrons. — The cylindrical shape, characterizing the earlier stages of the larva, disappears soon after the appearance of the first trace of the appendages which give to these larvæ such a peculiar appearance, and they now assume the features of the adult. The depression (Pl. II. *Figs.* 25, 27, *m*), in which the mouth is placed, becomes more marked; we have a greater separation of the oral (*v'*) and anal (*v*) swellings of the vibratile chord, little by little changed into two independent breastplates, the edges bound with chords of powerful vibratile cilia, becoming the locomotive organs of the larvæ (Pl. II. *Figs.* 20, 22, 24, 26, 28). These plastrons, at first mere crescent-shaped shields (Pl. II. *Figs.* 20, 22, 24), extend gradually towards either extremity, become elliptical, and then somewhat triangular. The outline of the anal shield becomes sinuous, slight indentations point out the position of the future arms (Pl. II. *Fig.* 26, *e' e'*, *Fig.* 28, *e' e'*, *e''' e'''*); the rows of cilia creep gradually round the edge of this anal shield, turn towards the mouth again, and extend, on the dorsal side, along the whole length of the larva (Pl. II. *Fig.* 25); this chord of cilia makes a complete circuit, while the cilia, extending along the edge of the oral plastron, do not meet.

The formation of these plastrons is attended with great changes in the general outline of the larva; the anal extremity becomes pointed, triangular, with rounded edges; the body, on each side of the oral opening, bulges out beyond the general outline, and the oral plastron is more and more pointed, as it separates from the rest of the larva. This change of shape can perhaps be better appreciated when seen in profile, and by comparing the drawings of larvæ three days and six days old; compare Pl. II. *Fig.* 19 with Pl. II. *Figs.* 25 and 27 seen from opposite sides. The great elongation of the oral extremity and the marked separation made by the opening of the mouth between the anal and oral plastrons cannot fail to be noticed.

Comparison of Larvæ of Asteracanthion pallidus and A. berylinus. — Up to this time all the larvæ described were raised by artificial fecundation from eggs taken out of the ovaries of Asteracanthion berylinus *Ag.* When I first discovered the larvæ of our Starfishes, I immediately examined the ovaries of our two most common species, the A. berylinus *Ag.* and A. pallidus *Ag.* I found that the eggs of the former were not sufficiently advanced to be fecundated, while those of the second species (A. pallidus) had all escaped. I am, therefore, positively certain that all the larvæ I am about to describe belong to the second species, as they were all found swimming about previous to the time of spawning of the A. berylinus. As the interval between the time of spawning of these two species is not less than three weeks, I had been able, during this period, to make a general sketch of the whole development, from the youngest larva found (Pl. III. *Fig.* 1), to the time when the Starfish is formed, before beginning the artificial fecundation of the species just described, the A. berylinus *Ag.*

I thus obtained a general knowledge of the changes these larvæ undergo, and was enabled, when making the artificial fecundation, to pay special attention to the development of those parts, the origin of which was not easily traced in older larvæ. I was able in this way to carry on, at the same time, the comparative study of the development of two closely allied species, belonging, undoubtedly, to one and the same genus, and to see how far differences could already be noticed in their early stages of growth; a glance at the figures of the young of one species (A. pallidus *Ag.*) on Plate III., compared with the figures of Plate II. of the second species (A. berylinus *Ag.*), will show how far the development of allied species diverges. What is particularly characteristic is the fact that specific differences make their appearance so early. Soon after it became evident that the embryos we were studying belonged to Echinoderms, it was apparent that they were different species. The order of appearance of the characters of the classes, the orders, the families, and genera, is one of the greatest importance in a zoölogical point of view; and we owe to Professor Agassiz to have pointed out, that the characters which make their appearance first are by no means those which have been usually supposed to take precedence; in the present case we do not find it possible to discern the class, the ordinal, the family, the generic and the specific characters, in the order in which they are here mentioned. On

the contrary, the specific characters are early stamped upon the embryo, and did we but know how to recognize individual differences among the lower animals as well as we can already in some of the Fishes, we might find that with Echinoderms, as has been shown for Fishes by Professor Agassiz, the stamp of individuality is very early impressed upon the embryo. Long before we can tell that a young Perch belongs to the genus Ctenolabrus, we can already say with certainty whether it will be colored red or gray or brown or green.

The time of spawning of Starfishes is very short, as, three or four days after the A. berylinus began to spawn, it was quite difficult to find females with eggs; and a week after the beginning of the spawning, I never succeeded in finding a single one. Owing to this great difference in the time of spawning and its short duration, there can be no doubt, from the date at which I first caught the Starfish larvæ floating about, to which of our two species they belong. A careful comparison of the youngest specimens also shows very striking differences, and will always enable an observer to distinguish readily the larvæ of the two species, even in their earliest stages. Compare Pl. III. *Figs.* 1, 2, 3, 4, 5, with *Figs.* 22–28 of Plate II. These differences become more marked as they grow older, as will be seen when we describe adult larvæ. In fact, the larva of A. berylinus is pear-shaped, with the thick end at the oral extremity, while in the larva of A. pallidus the thick end of the equally pear-shaped, but relatively shorter body is at the anal extremity.*

The principal points of difference in the young larvæ of this second species (the A. pallidus), from those previously described, are differences of proportions. The larvæ of the A. berylinus are elongated cylindrical; the oral extremity is somewhat broader and more prominent than the anal. The larva of A. pallidus can at once be recognized by its shortness; the small size of the oral extremity, when compared to the anal, the latter being by far the most prominent.

Water-System. — Before going on with the description of more advanced

* Though we now consider the further progress of development of our larvæ in a different species from the first, we proceed without interruption, as the phenomena of growth are identical in both; and we link them here together only because our most complete observations for the younger stages relate to A. berylinus, and to A. pallidus for the older stages. Had we presented these changes for a single species only, the one would have been defective in the beginning, the other in the end. As it is, our history is tolerably complete, the course and nature of the changes being identical in both species.

stages, I will take up the development of the water-tubes at the point to which we had traced them (Pl. II. *Fig.* 28) in the larvæ of A. berylinus. After the ends of the water-tubes have extended beyond the oral opening (Pl. III. *Fig.* 4), the tubes increase rapidly in diameter (Pl. III. *Figs.* 6, 8, *w*, *w'*), bending at the same time towards the longitudinal axis (Pl. III. *Figs.* 4, 5, 6, 8, 10, *w*, *w'*), the other extremity of the tubes creeping round the stomach until they touch, but without uniting (Pl. III. *Figs.* 6, 8, 10, *w*, *w'*). The tubes at the oral extremity bend towards each other (Pl. III. *Fig.* 4), come in contact (Pl. III. *Fig.* 6), and, soon after, a communication is made, the water-system assuming the shape of an elliptical ring (Pl. III. *Fig.* 6, *ww'*); and the water which enters into the right tube through the dorsal pore (Pl. III. *Figs.* 2, 5, 7, *b*) passes into the other branch on the opposite side of the stomach, through the fork at the oral extremity, and not round the stomach, where the water-tubes simply touch, but do not communicate. The small tube leading from the dorsal pore to the main branch of the water-system widens and becomes funnel-shaped as it approaches the main tube. The dorsal pore is cut obliquely across the end of this small tube, giving it an elliptical shape. By the time the two branches of the water-system have joined (Pl. III. *Fig.* 6) at the oral extremity of the larva, it has assumed an entirely different outline from any we have met with in the former species. The anal extremity is very much flattened, the corners of the anal plastron project slightly beyond the general outline, the indentations have become very distinct, the oral plastron has grown rectangular with rounded angles and concave sides, the oral triangular opening leads into a deep pouch. The sides of the body are marked by three strong indentations (Pl. III. *Fig.* 8). The oral extremity of the water-system changes rapidly from a rounded to a pointed outline (Pl. III. *Fig.* 8, *ww'*); it advances more and more towards the oral extremity. In proportion as the dorsal region projects beyond the oral plastron, the water-system extends into this projection, sending off, at the same time, two branches leading into small appendages (Pl. III. *Figs.* 10, 11, *f*, *f*), (only developed in more advanced larvæ), which have, in the adult larvæ, a peculiar structure (Pl. IV. *Figs.* 4, 5, 6).

Changes of Form of the Larva. — The prominent changes now going on are only changes of degree. The larva has completely lost its cylindrical shape, and even the pear-shaped form it assumed afterwards; it has become rectangular, with deep indentations, gradually assuming the char-

acter of short arms. The transformation from the pear-shaped (Pl. III. *Fig.* 1) to the rectangular flattened larva, with undulating outline (Pl. III. *Fig.* 6), can readily be traced by comparing the successive stages here represented. After the digestive cavity of the younger embryo (Pl. II. *Fig.* 7) is bent at the extremities, bringing the mouth and the anus on the same side of the larva, the anal and oral extremities increase rapidly in bulk, and the larva, when seen from above (Pl. II. *Fig.* 18) or in profile (Pl. II. *Fig.* 19), becomes somewhat dumb-bell shaped. The depression thus formed grows deeper, especially on the lower side, at the time when the chords of vibratile cilia make their appearance (Pl. II. *Fig.* 21), and the mouth (Pl. II. *Fig.* 21, *m*) is placed in the convexity of a deep curve. As the oral and anal vibratile chords extend towards the oral extremity, slight grooves arise (Pl. II. *Fig.* 23), starting from the depression in which the mouth is placed, and extending towards the oral extremity. These grooves are gouged out from the oral extremity; they extend but little way towards the stomach, forming a very well-marked channel separating the anal from the oral vibratile chord (Pl. II. *Figs.* 25, 27). The oral is less broad than the anal plastron; the former retains its shield-like shape, while the sides of the latter become somewhat undulating from the bending of the ciliary chord (Pl. II. *Figs.* 26, 28). These slight undulations, as the larva grows older and more elongated, increase in size, giving it more and more a rectangular outline (Pl. II. *Figs.* 27, 28; Pl. III. *Figs.* 3, 4). With its quadrangular shape, the larva assumes also a more flattened character, and loses its cylindrical form, as will be readily seen on comparing *Figs.* 21 and 27, of Pl. II. These slight undulations of the ciliary chord are formed at points where accumulations of pigment cells have taken place. The ciliary chord, at first simply a wavy line (Pl. III. *Fig.* 4), soon becomes quite deeply indented by the formation of loops at these indentations (Pl. III. *Fig.* 6). The loops, at first, scarcely project beyond the general outline of the larva (Pl. III. *Figs.* 6, 7). Little by little they increase in length (Pl. III. *Figs.* 8, 9), extending slightly beyond the edge of the outline, like short arms; until, passing through somewhat older stages (Pl. III. *Fig.* 10), these loops are gradually transformed into larger and larger arms (Pl. III. *Figs.* 11, 12), and finally attain the shape of the long, slender arms of the adult Brachiolaria (Pl. IV. *Figs.* 1, 2, 4; Pl. VII. *Fig.* 8). During the process of the formation of the arms, the cut in which the mouth is placed becomes deeper (Pl. II. *Figs.* 25, 27; Pl.

III. *Figs.* 2, 5, 7, 9, 12; Pl. IV. *Fig.* 4), as well as the groove extending along the sides of the larva, which runs from the median anal arms (e') to the oral extremity, and separates the anal from the oral plastron. In all these larvæ the ventral part of the anal and the oral plastron are much narrower than the dorsal portion of the anal plastron. This difference is at first slight (Pl. II. *Figs.* 26, 28; Pl. III. *Figs.* 3, 4); it becomes more marked with advancing age, passing through the different stages represented in Pl. III. *Figs.* 6, 8, 10, 11); Pl. IV. *Figs.* 1, 2; Pl. VII. *Fig.* 8; and in proportion as all the ridges and edges are more prominent, the surfaces circumscribed by them become flattened and more spreading.

Nomenclature of the Arms.—For the sake of brevity, I shall call the rudimentary appendages by the names proposed for them in the adult larvæ, and shall adopt the names given by Müller, with slight modifications, viz. ventral side, that on which the mouth is situated; dorsal, the side on which the water-pore is placed; anal plastron, what Müller has called "anales Bauchfeld," or "hinteres Bauchfeld"; oral plastron, what he calls "antorales Feld," or "vorderes Bauchfeld"; the oral region (m) is situated between these two plastrons. The arms are designated according to their position by the following names: the median anal pair (e' e'); the dorsal anal pair (e'' e''); the ventral anal pair (e''' e'''); the dorsal oral pair (e'''' e''''); the ventral oral pair (e^5 e^5); the odd anterior arm (e^6), from which projects, at the base, a single arm of a different character from the others; the odd brachiolar arm (f''); and another pair of smaller brachiolar arms (f f), connected with the oral ventral pair (e^5 e^5) of arms (Pl. III. *Fig.* 11). The brachiolar arms are provided at their extremity with wart-like appendages (Pl. IV. *Figs.* 4, 5, 6; Pl. VII. *Fig.* 8); the other arms have nothing of the sort, but are surrounded by chords of vibratile cilia, making a complete circuit from the anal extremity round the dorsal side, while on the oral side it is not closed.

Development of the Arms.—In adult larvæ the arms have, at their extremity, clusters of orange pigment cells. These colored cells make their appearance early in the younger stages, and it is easy to trace the first appearance of the arms by the presence of these pigment cells. Before the appearance of the arms, the course of the chord of vibratile cilia is very sharply defined; it is like a narrow binding extending round the outline of the larva, seen either from above or from below (Pl. III. *Figs.* 3, 4, 6, and Pl. II. *Figs.* 26, 28). When seen in profile (Pl. III. v, v',

Figs. 2, 5, 7, and Pl. II. *v*, *v'*, *Figs.* 25, 27), it follows the two edges of the deep groove which separates the dorsal from the ventral side. The median anal arms (*e'* *e'*) are the first to make their appearance (Pl. III. *Figs.* 2, 3, 4, 6, 7); these arms take the greatest development in the adult larvæ; the other arms appear also at the same time, but as simple bulgings of the ciliary chord. The anal ventral pair (*e'''* *e'''*) and the odd dorsal arm (e^6) are both developed about the same time (Pl. III. *Figs.* 8, 9, e^6); the odd anterior arm increasing in size, and changing its shape more rapidly at first than the median anal pair. The next set of arms formed is the dorsal pair (*e''* *e''*); then follows the oral dorsal pair (*e'''* *e'''*), and next the ventral oral pair (e^5 e^5). These develop very rapidly, and soon attain as large a size as the dorsal oral pair, which had preceded them (Pl. III. *Fig.* 10). In this same figure we see the first trace of a small thick arm (*f''*), cut off square at the extremity, placed at the base of the odd anterior arm (e^6), and also a similar arm (*f f*) at the base of each of the ventral oral pair (e^5 e^5); the water-system branches into this small pair of arms which are not surrounded with vibratile cilia (Pl. III. *Figs.* 9, 10, 11). Of the brachiolar arms, the one which is odd precedes the two that form a pair.

The chord of vibratile cilia keeps pace with the growth of the arms, and extends to their very extremity; the most important change which takes place, from the time when the median arms first appear, is the extraordinary increase of one of the diameters of the water-tubes. The portions (*w*, *w'*) extending along the stomach become much flattened; when viewed from above (Pl. III. *Figs.* 8, 10, 11), their great increase in size is not seen, and it is only when examined in profile that the changes the water-system has undergone in the vertical diameter, compared to the transverse, can best be appreciated (Pl. III. *Figs.* 9, 12, *w*).

It is in this condition that Müller has seen the greatest number of his larvæ; struck by their symmetry, he has, throughout his memoirs, insisted upon the bilateral symmetry of the Echinoderm larva, as contrasting directly with the radiate structure of the adult animals. It appears to me that this interpretation of the form of the larvæ of Echinoderms is incorrect; they are radiate animals, and are no more bilateral than a large number of Radiates exhibiting, as will be shown hereafter, bilateral characters, such as Arachnactis, the Ctenophoræ, the Spatangoids, and the Holothurians.

The larvæ figured on this plate (Pl. III.) correspond to the larvæ observed by Van Beneden, and called by him Brachina; the latter resemble more our larvæ than any figured by Müller. I am strongly inclined to believe that Van Beneden's Brachina will eventually prove to be the larvæ of the Asteracanthion rubens *M. T.*, or of a closely allied species. The more advanced specimens of his Brachina began to show signs of the brachiolar appendages, though Van Beneden did not notice them. See *Fig.* 8 of the Plate accompanying his notice in the Bulletin de l'Académie des Sciences de Belgique for 1850. These larvæ are easily distinguished from ours by the shortness and thickness of the arms, as well as the less elongated shape of the larva. The time of breeding is also different; the European species spawning during the end of March and beginning of April. The A. berylinus spawns in the last part of July; by the 26th no eggs could be found in any of the females, and the other species (the A. pallidus) spawns during the third week in August. These facts are additional proofs of the specific difference between our species of Asteracanthion and the Asteracanthion rubens of Europe.

[I have retained in this memoir the specific names adopted in 1863. At that time no description had been published of Stimpson's A. vulgaris; his name has subsequently been adopted by writers on American Starfishes, although the figure given on Pl. VIII., had it been baptized and described as a new genus and species, and subsequently proved to be the young of A. vulgaris, would have obtained precedence; but failing to give it the mythical diagnosis, this memoir was not entitled to recognition by the strict rules of systematic zoölogy!

It is only comparatively recently that A. berylinus and A. arenicola of Stimpson have both proved to be probably identical with A. Forbesii of Desor, so that the name of pallidus would at any rate have to give way to that of Desor.]

When seen in profile (Pl. III. *Figs.* 9, 12, *w*, *ww'*; Pl. IV. *Fig.* 4, *w*, *ww'*), the water-system runs in an arch, from the alimentary canal to the opening of the mouth; here the diameter increases, forming a reservoir (*ww'*), from which are sent off small pouches (*f' f'*), leading into the brachiolar arms (*f f*); the whole of the oral opening is placed below the water-system. When seen from above or below (Pl. III. *Figs.* 6, 8, 10, 11; Pl. IV. *Figs.* 1, 2; Pl. VII. *Fig.* 8) the water-system is an elliptical ring

tapering to a point in the odd brachiolar arm, enclosing the stomach and œsophagus, which form, as it were, a solid axis to this elliptical envelope. On one side of the stomach appears a large hole (Pl. V. *Fig.* 7, *h*, anal part only; Pl. VII. *Fig.* 8), the opening of a cul de sac of one branch of the water-system passing between the stomach and the intestine. The portions of the water-system extending along the stomach appear to be made up of distinct chambers (Pl. V. *Figs.* 6, 7, 8, *w*, *w'*): these chambers are merely the result of an optical delusion, arising from the greater or less flattening of certain parts of the tube; this gives it the appearance of having been divided off into segments.

The Adult Larva. — The anal part of the larva, in its adult condition (Pl. IV. *Figs.* 1, 2), has become pointed; the general shape is still somewhat rectangular; the ventral and dorsal side are separated by a deep groove (Pl. IV. *Fig.* 4), extending from the stomach, from the base of the median anal pair of arms, to the base of the ventral oral arms, thus separating the larva into very distinct dorsal and ventral regions (Pl. IV. *Fig.* 4), from the earliest stages of its growth. The body of the larva itself is capable of great motion; nothing is more common than to see the larvæ almost broken in two, by the strange habit they have of bending the oral extremity upon the opening of the mouth as a pivot, to such an extent as to make quite an angle with the anal part (Pl. III. *Fig.* 5). The larvæ generally assume this position when disturbed, and usually remain stationary in the same attitude, simply striking violently up and down with their extremities (compare *Fig.* 5 and *Fig.* 2, where the larva is at rest). The whole substance of the body is tinged with yellow, and is made up of large transparent cells with irregular nuclei, giving the mass about the consistency of a Salpa; very minute granular epithelial cells cover the whole surface. The powerful contraction of portions of the body is simply that of the cells themselves, and what has frequently been mistaken by Müller, when describing these larvæ, for muscular striæ, are strings of such contracted cells. The extremities of the arms are tipped with orange, the stomach and the alimentary canal are of a slight yellowish-brown color, the chords of vibratile cilia are somewhat darker. The œsophagus is perfectly transparent, capable of violent movements; it expands and contracts by sudden jerks, forcing open violently the passage leading into the stomach, when the contents of the œsophagus rush in, and are set slowly rotating in the stomach. The interior surface

of the œsophagus is covered with vibratile cilia, so closely crowded that the walls appear striated from the regularity of these rows (Pl. IV. *Fig.* 1; Pl. VII. *Fig.* 8); they are particularly powerful round the opening of the mouth.

The rejection of the digested food takes place quietly, and there are none of those violent jerks attending its admission into the digestive cavity. The anal opening simply expands, and the fecal matter is forced out slowly, in a constant stream, until the whole of the contents of the alimentary canal, which had become very much distended before the operation, has been cleaned out.

Motion and Habits of the Larvæ.—The adult larvæ move about rapidly by means of the cilia; their natural position is more constant than when young. The oral extremity is kept in advance while in motion, and the larva still rotates about a longitudinal axis, though not frequently; it generally moves with either the dorsal or ventral side uppermost, and quite frequently in such a way as to show the lateral groove.* When at rest, the larvæ invariably assume one and the same position; the anal extremity is the lowest, and the oral extremity inclined to the vertical; in this attitude they often remain a long time, drifting about with the currents; their only movements being the expansion and contraction of the œsophagus and the play of the arms. The movements of the arms are exceedingly graceful; comparatively longer and more slender than the tentacles of the Tubularians, they have none of the stiffness of their movements, the constant curving and thrusting in every direction

* The position in which the larvæ figured in this memoir have been placed requires a short explanation. To be able to compare readily the different stages, it is necessary to have them all in the same position, and this should, if possible, be the natural attitude. But in the younger stages of the larva the body of the embryo is not loaded down at one extremity by the young Starfish, thus compelling the larva to assume always one and the same general attitude when in motion. It is more common, in the younger stages, to see the embryo moving with the anal extremity uppermost; it would be as unnatural to turn these younger stages upside down, as it would be to represent an adult larva in anything but its natural attitude (Pl. VII. *Fig.* 8) with the anal extremity downward. I have therefore compromised, by representing all the stages in the same position in which they are generally represented by Müller, to facilitate the comparison with his figures, and have given one figure of an adult Brachiolaria, in its natural attitude (Pl. VII. *Fig.* 8), with which the others can be readily compared in their theoretical position. The figures here given are drawn from the larvæ as they appear swimming through the water; and I have endeavored, as much as possible, in representing them, to give an accurate idea of the mobility of the arms; avoiding, in this way, the unnatural stiffness which characterizes drawings made under compression, like the majority of those of Müller.

reminding us rather of the motions of the tentacles of Phyllodoce and similar Annelids. They are never at rest, being always kept in motion to produce currents round the mouth of the larvæ; and, in addition to the action of the powerful vibratile cilia placed round the mouth, are continually bringing fresh water into the œsophagus.

The large triangular mouth (Pl. IV. *Figs.* 1, 2, 4, *m*; Pl. VII. *Fig.* 8) opens into a rectangular pouch (Pl. IV. *Fig.* 4, *m'*, *m''*), extending back from its posterior edge; from this pouch the œsophagus tapers rapidly, and attains, near the apex of the mouth, the size (*o*) which it retains till it joins the stomach. The surface of the œsophagus (*o*) presents a more or less corrugated appearance near its junction with the digestive cavity, owing to the somewhat greater thickness of the walls (Pl. IV. *Fig.* 1).

Brachiolar Arms. — The brachiolar arms (*f f*, *f''*) are appendages belonging only to adult larvæ. Our larva has three of them (Pl. IV. *Figs.* 1, 4, 5, 6), one pair (*f f*), and a somewhat larger odd arm (*f''*), placed at the base of the odd anterior arm (e^6); the branches of the water-system terminating in these arms proceed from a large pouch (*ww'*) in the oral extremity (Pl. IV. *Fig.* 4). The brachiolar arms are, like the others, tipped with orange, but have, in addition, wart-like terminal appendages, each having six to eight nipples, according to the age of the larva (Pl. IV. *Figs.* 4, 5, 6, 8; Pl. VII. *Fig.* 8). These knobs give to the short arms the appearance of the hind feet of Sphinx larvæ. In the hollow between the base of the brachiolar arms there is a small elliptical disk (*f'''*, Pl. IV. *Figs.* 4, 5, 6; Pl. VII. *Fig.* 8), reminding us of the madreporic body of a Starfish, and a row of similar disks, two or three on each side of the odd brachiolar arm, the pair of small brachiolar arms having no such appendages. It has been found convenient to retain for these peculiar arms the name of brachiolar, used by Müller to distinguish one of his genera (Brachiolaria) of Echinoderm larvæ. I have not succeeded in ascertaining the functions of the disks; the terminal buttons undoubtedly are used in the last stages of growth of the larva as supports, by means of which they can attach themselves, while the young Starfish is resorbing the larva; for during that process the larvæ never float about, but invariably sink to the bottom of the jar in which they are kept, and remain attached, apparently by means of the brachiolar arms, during the resorption of the larval appendages.

These larvæ are found floating in large numbers at night near the

surface, among cast-off skins of barnacles, which furnish them with food during the time when they swim freely about, in company with multitudes of small Crustacea, Annelids, and Hydroids. They seem to be nocturnal, as I have only found here and there single specimens when fishing for them under exactly the same circumstances of tide and wind during the daytime.

CHAPTER SECOND.

HISTORY OF THE DEVELOPMENT OF THE STARFISH PROPER.

We have thus far described the changes the embryo undergoes from the time it leaves the egg, and have traced its gradual transformation into the complicated being called Brachiolaria. All the phases through which the embryo passes thus far have not the least resemblance to a Starfish, nor have we yet alluded to any of the changes which must take place to produce the Echinoderm proper. However wonderful the process by which an animal seems to pass from a radiate form to an apparently bilateral one be, the changes we shall now see taking place, by which this seeming bilateral animal is again reduced to a strictly radiate structure, are perhaps still more remarkable.

For the development of the Starfish itself, we must turn back and examine the larva in some of its younger stages, in order to trace the first changes in its anal extremity. There alone transformations take place affecting the development of the Echinoderm proper, until the whole of the complicated framework upon which the Starfish is fastened has disappeared, being resorbed by the very Echinoderm it has helped to raise. The Brachiolaria is completely drawn into the body of the young Starfish, before it leads an independent existence. This is contrary to the observations of Müller and of Koren and Danielssen respecting Bipinnaria asterigera; where it is said that the Starfish and the Bipinnaria separate, both becoming free. [Metschnikoff's and my own observations on this point seem to throw doubt on the separation of the Pluteus and of the Echinoderm, so that renewed observations are necessary regarding the Bipinnaria of Koren and Danielssen to establish the fact which thus far is contrary to all the observations of Müller, Metschnikoff, and myself on the Starfish Pluteus, and on the other orders of Echinoderms.] The process by which the young Starfish eventually resorbs the Brachiolaria (Pl. IV. *Figs.* 7, 8, 9) is similar to that observed by Sars in the develop-

ment of Echinaster, where the whole larva and all its appendages are gradually drawn into the body, and appropriated during the growth of the young Starfish.

It has already been shown that the anal portions of the water-system, as they increase in size, spread little by little over the surface of the stomach; the edges creeping towards each other and surrounding the stomach on both sides, like a cap, yet without uniting. The funnel leading from the dorsal pore shortens as the water-system extends towards the dorsal region, and the anal extremities of the water-tubes come so near together (Pl. V. *Figs.* 1, 2, 3, 5, *w*, *w'*) that we might almost be tempted to believe they join, like the oral portions, and thus form a complete circuit (Pl. III. *Fig.* 10); this, however, is not the case, as an examination in profile of the above figures readily shows.

First Appearance of the Starfish.—In the drawings here given to illustrate the development of the Starfish, only a small portion of the Brachiolaria is figured, that which has direct reference to the Starfish itself; as this part is limited to the anal extremity of the larva immediately surrounding the stomach, the anal extremity alone of the Brachiolaria is drawn, with the arms cut off, somewhat beyond the opening of the anus. To make the references to the figures of Plate V. more satisfactory, a reference has also been made to a drawing of a whole Brachiolaria, in a stage of growth nearly identical, in order to show more readily the relation of the Starfish to the whole framework of the Brachiolaria. These stages are so similar that, with this explanation, it will always be possible to refer the anal extremities, upon which we are tracing the development of the Starfish in its different phases of growth, to some figure of Brachiolaria, very nearly representing its actual condition. The stages of development figured in Plate V. have been selected simply for the sake of the young Starfish, without reference to the Brachiolaria, and would, if drawn on the same scale as the other figures of the Brachiolaria here given, show no differences, which would make the mode of growth of the young Echinoderm more intelligible. For instance, the earlier stages of the development, such as *Figs.* 1–7, correspond to the stage of Pl. III. *Fig.* 10; while the more advanced *Fig.* 8 corresponds to that of Pl. III. *Fig.* 11, and the others to the adult stages of the Brachiolaria on Plate IV., when the Starfish undergoes extensive changes, while none take place in the general appearance of the Brachiolaria.

Up to the stage of the larva represented on Pl. III. *Figs.* 6, 7, the outline of the *left water-tube* (*left* when seen from above in its *natural attitude*), in a profile view, is that of a flattened cylinder (Pl. V. *Fig.* 1, *w'*), with the end slightly bent towards the anal opening. Near the point where the upper line of the water-tube bends downwards, a marked indentation is formed, having in the centre a slight projection. There appear, soon after starting from the anal edge of this depression, five very faintly defined folds, the first trace of the future ambulacral system, extending obliquely across the water-tube (*w'*) (Pl. V. *Fig.* 2, *t*; Pl. III. *Fig.* 8). If we examine the other side of the anal extremity, we find deposited opposite the angles of these folds (Pl. V. *Fig.* 2, *r'*), five rods of limestone; the anal part of the larva having at the same time lost its former transparency, and assumed a dull yellow color. These two parts are the first traces of the future Starfish. The limestone rods, and the whole of the granular surface covering the *right water-tube*, with the dorsal pore, forms eventually the abactinal area of the adult Starfish; while the folds, running obliquely across the *left water-tube*, are the first rudiments of the future rows of suckers extending along the lower side of the future rays; the rods are placed exactly opposite what will hereafter be the extremity of the rays.

It is apparent, from the above description, that the abactinal area (the rods), and the suckers (the folds across the water-tube), are not situated in one plane, or even in parallel planes. The arc containing the rods and the arc passing through the folds make an acute, nearly a right angle, as is better understood by referring to older stages. It will also be seen, by a glance at the drawings (Pl. V. *Figs.* 1, 2, 3, 5; Pl. III. *Figs.* 7–10, *t*), that the folds denoting the place where the suckers will make their appearance, and the rods (*r'*, *r''*) marking the position of the future rays, *are neither of them closed curves, but are always open*, forming a sort of twisted crescent-shaped arc. When describing the young Starfish immediately after it has resorbed the larva, and is ready to crawl about by means of its suckers, I shall show how these curves become closed; and also point out the changes these parts undergo to form diverging rays, as well as the manner in which the warped surfaces developing the actinal and abactinal regions are brought into parallel planes.

Relative Position of the Actinal and Abactinal Areas. — The folds of the water-tube (*w'*), which forms the actinal area, are not contained in one plane,

but are placed upon a spiral; the same is the case with the five limestone rods situated on the surface of the other water-tube (*w*), which forms the abactinal region. When we look at the Brachiolaria from the side, that is, when facing the groove which separates the ventral from the dorsal side, as in Pl. IV. *Fig.* 4, or in the corresponding profiles, from the side of the right and left water-tubes of Pl. V. *Figs.* 1, 2, 3, 5, 10, 11, 12, we see either the actinal or abactinal side of the Starfish. We look in one case at the water-tube (*w*) upon which is developed the abactinal system; while in the other profile, drawn from the opposite side, we see the water-tube (*w'*) which develops the actinal system; the two water-tubes are placed on different sides of the stomach, and have no connection whatever at this extremity, but are separated by the whole diameter of the stomach, over parts of which these tubes have spread like a cap. It will at once be noticed that, in any of these figures, each side of the future Starfish makes an independent open curve; these curves form what appears to us, when seen from the profile view, part of a circular arc. On looking, however, at the same sides from the ventral or dorsal view of the larvæ, as in Pl. IV. *Figs.* 1, 2, or the corresponding views of Pl. V. *Figs.* 4, 6, 7, 8, 9, 13, 14, we do not see the arc formed by these sides projected as a simple straight line, as it would be were it all contained in one plane. The extremities of the arc, both of the actinal and abactinal area, — that is, the two ends of it which are nearest, one to the water-pore, and the other to the anus, — are seen, as in Pl. V. *Figs.* 1, 2, 3, 5, 10, 11, 12, one on one side of an axis passing through the centre of symmetry of the Brachiolaria, and the other on the other side. The only curve which fulfils the conditions of such a projection is that of a warped spiral, so that, in reality, when passing (in Pl. V. *Fig.* 10) from r'''_1, along the edge of the disk, to r'''_2, r'''_3, r'''_4, r'''_5, we do not move in a plane, but are constantly winding, somewhat as when ascending a spiral staircase; this is seen in Pl. V. *Fig.* 9, when passing from r''_5, the arm placed nearest the anus, along the edge of the abactinal area, to r''_1, the arm next to the water-pore (*b*). It is the same for the actinal arc, which forms a spiral identical to that of the abactinal area, only bent in the opposite direction.

The actinal and abactinal regions are, in reality, two warped spiral surfaces, making an angle with one another, separated by the whole width of the stomach. This is best seen in a view from the dorsal or

oral side (Pl. VII. *Fig.* 8), when the folds are distinctly visible one above the other, but so arranged as to be all seen at the same time (Pl. V. *Figs.* 4, 6, 7, 8; Pl. III. *Figs.* 8, 10, 11). Three of the folds are near the edge, while the other two are placed close to the digestive cavity on the ventral side. This spiral, seen from the dorsal or from the ventral side, has all the appearance of the foot of a bivalve (*t*, Pl. V. *Figs.* 4, 6, 8). The spiral position of the five rods indicating the position of the future rays of the Starfish ($r'''_1 - r'''_5$) is also apparent from the same point of view. Two of the rods are placed on the dorsal side of the larvæ, running somewhat obliquely (r'''_1, r'''_2), the three others (r'''_3, r'''_4, r'''_5) turning away still more from the median line; the last (r'''_5) placed very near the edge, on the ventral side, close to the base of the median arms (Pl. V. *Figs.* 3, 5, 6, 8, 9, $r'''_1 - r'''_5$); the nearest distance between these two spiral surfaces being fully as great as the width of the water-tube: in fact, it seems as if the rudimentary tentacles and the dorsal system had as yet no connection whatever with one another (Pl. V. *Figs.* 6, 8).

It is very important that this oblique position of the actinal and abactinal areas, as well as their great distance apart, should be distinctly kept in mind; as it will explain many of the errors committed by previous writers on this subject, and greatly assist us in correctly understanding many points in the anatomy of Echinoderms hitherto unexplained.

From what has been shown thus far, it is self-evident that the water-tubes, the problematic bodies, as Müller has called them in their early condition, are the surfaces from which the future Starfishes are developed, and not the surface of the stomach. The spiral of tentacles is developed by folds placed on one side of the stomach (Pl. III. *Figs.* 6, 8, 10, 11), on one of the water-tubes (*w'*), that with the water-pore (*b*); while round the other water-tube (*w*), placed on the other side of the stomach, is formed the spiral surface of the abactinal system. The stomach has remained as it was before, and has in no way contributed to the formation of the young Starfish. A glance at any figure of the larvæ, either in profile or from above or from below, will show that no change has taken place in the shape of the stomach, or any part of the alimentary canal, as Müller believed (Pl. V. *Figs.* 1, 8; Pl. III. *Figs.* 1–11), but that a kind of cap has been formed round it by the water-tubes. Owing, however, to the accumulation of very fine granules of limestone, the anal extremity has by this time lost its transparency; this would be easily

mistaken for an encroachment on the stomach itself. In proportion as the abactinal region becomes solidified (Pl. III. *Fig.* 11; Pl. IV. *Figs.* 1, 2; Pl. VII. *Fig.* 8), the stomach loses its globular shape, and becomes from this time forward flattened and pear-shaped. Previously to the formation of the Starfish on the surface of the two water-tubes, placed on opposite sides of the stomach, we could trace no change of form in the stomach itself. From the time, however, when the Starfish encroaches little by little upon the anal extremity of the larvæ, it pushes the stomach and the intestine slightly to one side, owing to the great increase in bulk of its actinal and abactinal areas. The anal portion of the water-tubes now swells and contracts in such a way as apparently to divide that portion of the water-tubes into chambers; but, on watching the circulation of the fluid in the water-tubes for any length of time, the currents can be followed flowing from one of these elliptic chambers to the other, plainly showing the different planes in which the ventral and dorsal part of the tubes are placed to be the only cause of this delusion.

Müller has distinctly stated, over and over again, during the course of his investigations, that the young Echinoderm was formed by encroaching upon the stomach itself; I am satisfied, from repeated observations of this point, in Starfish, Sea-urchin, and Ophiuran larvæ, that this is not the case. The mistake arises from the fact that the water-tubes, by their extension and increase, cover and conceal part of the stomach, forming a sort of hood over it; while the two sides of the young Echinoderm, separated by the whole width of the stomach and the thickness of the two water-tubes, form upon the outer surface of the latter, and do not in any way encroach upon the stomach, which is simply enclosed by the actinal and abactinal areas of the Echinoderm. Had I not traced this with the greatest care, I should scarcely venture to doubt the statements of Müller, but I am satisfied that he was mistaken in this explanation of the mode of the formation of the Echinoderm.*

Formation of the Ambulacral System. — We have already seen that the very first changes which take place in the water-system (*w*, *w'*) consist of the five folds (*t*, Pl. V. *Fig.* 2) extending obliquely across the exterior surface of one of the water-tubes (*w'*). From the fact that these folds

* It may not be out of place to say, that Professor Agassiz, during this investigation, satisfied himself of the accuracy of every point which seemed in the least contradictory to the statements of Müller.

develop across the surface of an elliptical tube, the five folds naturally form a twisted spiral, with a pentagonal outline, each side of this spiral forming the first nucleus of the five ambulacral tubes. I speak constantly of pentagonal spirals, pentagonal ambulacral system, and pentagonal abactinal system. In using these terms, I do not mean a pentagon with five equal sides, the adjacent sides making equal angles with one another and surrounding a closed surface, but simply that we have five sides limiting an open space, the two extremities of this five-sided figure being separated by the whole vertical diameter of the water-tubes. One extremity of the ambulacral five-sided open figure is placed at the water-pore (*b*, Pl. V. *Fig.* 2), the other at the opposite side of the water-tube on the surface of which the ambulacral system is developed. The two extremities of the abactinal open five-sided figure are placed, one above the water-pore (*b*, Pl. V. *Figs.* 8, 9, 13, r_1'''), the other on the opposite side of the water-tube, which develops the abactinal surface on one side of the anus (*a*, Pl. V. *Fig.* 14, r_5'''). A glance at the figures of the Brachiolaria from the dorsal or ventral side (Pl. IV. *Figs.* 1, 2; Pl. VII. *Fig.* 8; Pl. V. *Figs.* 8, 9, 13, 14) shows that the two surfaces, upon which the actinal and abactinal areas are developed, do not correspond to one another, or fit into each other as in the full-grown Starfish. That is, if the ambulacral system were projected upon the abactinal system, in order to bring these two surfaces into the same relation which they hold in the adult Asteracanthion, we should find the ambulacral system projecting beyond the outline of the abactinal system, and placed nearer the mouth of the Brachiolaria, while a portion of the abactinal system — that which is placed at the anal extremity of the larva — would, in the same way, project beyond the outline of the ambulacral system.

The sides of this twisted pentagonal spiral are somewhat concave, and the apex of the angles of adjacent sides are rounded. It is in consequence of the changes taking place at the apex of the sides of this irregular ambulacral pentagon that we have the simple apex transformed, by its gradual extension beyond the general outline of the open pentagon, into the five-folded loops (Pl. V. *Figs.* 10, 12), each of which corresponds to an ambulacral tube and its accompanying suckers in an adult Starfish.

The ambulacral pentagon with concave sides and rounded angles, seen in profile (Pl. V. *Figs.* 2, 5; Pl. III. *Figs.* 7, 9, *t*), changes its shape

rapidly; the convex cavity becomes greater, the apex of each angle of the pentagon more prominent and less pointed, a double line is formed by the ruffling of their folds (Pl. III. *Fig.* 11), and each apex of the pentagon has the appearance of a small loop projecting beyond the curved sides; the loops grow larger and larger, until they have reached a size somewhat less than one third of the diameter of the water-tube, when they stand out freely from the pentagon, and seem to form no part of the water-tube (Pl. V. *Figs.* 10, 11, 12, *t*; Pl. IV. *Fig.* 4). When seen either from above or from below, the folds appear as small flaps on the broad side of the foot-like appendage projecting from the surface of the stomach, formed by the folding of the water-tube (Pl. V. *Figs.* 4, 6, 8, 9, 13, 14, *t*; Pl. III. *Figs.* 10, 11; Pl. IV. *Figs.* 1, 2; Pl. VII. *Fig.* 8). These small folds are, in reality, nothing but open bags communicating with the main water-tube (w'); small pouches leading from it. The outer and inner fold of each loop do not remain concentric, and we can soon trace, in the inner fold, changes similar to the first folding of the water-tube. The rounded end of the inner fold becomes triangular; this is the first indication of the formation of the separate suckers (Pl. V. *Figs.* 10, 11, 12, *t t t t t*). The ambulacral pentagon remains in this state until the Starfish has resorbed the many appendages of the larva.

Formation of the Abactinal System.—Let us now follow the corresponding changes of the abactinal system, accompanying the modifications, just described, of the ambulacral pentagon. On examining the anal extremity, at the time when the larva has reached the state represented on Pl. III. *Fig.* 10, we are at once struck with the fact that the outline of the abactinal system has undergone analogous changes to those of the actinal pentagon. Instead of remaining a uniform spiral, the two ends of which are separated by the whole height of the water-tube, while the two areas are divided by the combined width of the stomach and the two water-tubes, it has a slightly lobed pentagonal outline, the convexities corresponding to the apex of the pentagon of suckers (Pl. V. *Fig.* 5, r'''_1–r'''_5; Pl. III. *Fig.* 10). The rods, simple at first (r', Pl. V. *Fig.* 2), have increased in size; small Y-shaped appendages have developed at their extremities. We also see that in the intermediate spaces, corresponding to the concavities of the lobes of the actinal system, a second set of small rods (r'', Pl. V. *Fig.* 5), of a similar character to the large ones, have developed. The whole of the abactinal system has become coated with a very fine

granular deposit of limestone; and the edge of the surface, connecting the two extremities of the abactinal pentagon, can readily be seen in profile (Pl. V. *Fig.* 5). The five large rods placed in the middle of the sides of the spiral abactinal pentagon, and the five small ones placed in the angles of this same pentagon, are the first trace of the plates composing the abactinal surface of the young Starfish.

The water-pore (*b*, Pl. III. *Fig.* 10; *b*, Pl. V. *Figs.* 7, 8) remains open, the only change being an accumulation of limestone matter round the opening, forming a sort of solid tube to protect it. This water-pore, as we shall see hereafter, eventually becomes the madreporic body; and the canal formed by the deposition of limestone is the stone canal of the full-grown Starfishes.

Abactinal System. — The double line on the edge of the abactinal pentagon (Pl. V. *Fig.* 2) is formed by the thickness of the surface of the abactinal system. This double line, at first only slightly undulating, becomes gradually more indented (Pl. V. *Figs.* 3, 5); at the same time, additional rods arise round the primary ones with such rapidity that we soon find a complicated network of limestone rods, forming ten clusters (Pl. V. *Figs.* 8, 9, 13, r', r''), five large (r') and five smaller ones (r'') round the original rods. This network is produced by the addition of a Y-shaped rod, at each extremity of a simple primary rod; presently, eight Y-rods arise upon the shanks of the first set of Y-rods, followed by a third set upon the shanks of the second set, and so on; in this manner are formed the closed polygons composing the clusters of the patches of limestone deposit (Pl. V. *Fig.* 9, r', r''). The small granular cells, filling the larger meshes of the network, increase in number, rendering the whole abactinal system somewhat opaque; when the larva is seen in profile from the abactinal side, the outline of the stomach (Pl. V. *Fig.* 5) can be traced exactly as it was before the Starfish had begun to form; and outside of it, the edge of the future back is distinctly visible (Pl. V. *Fig.* 5).

As the two water-tubes are placed on opposite sides of the larva, it follows that when seen in profile (Pl. V. *Figs.* 11, 12), from the left or from the right, it presents, in the one case, a full view of the tentacular pentagon (*t*), and only the lower oral edge of the abactinal system, the network of limestone meshes being quite indistinct, as seen through the thickness of the abactinal surface (Pl. III. *Fig.* 7; Pl. IV. *Fig.* 4; Pl. V.

Figs. 10, 12); while, in the other case, a full view of the abactinal pentagon (Pl. III. *Fig.* 10; Pl. IV. *Fig.* 4; Pl. V. *Figs.* 5, 11) is obtained, and the arrangement of the different rods forming the plates of the limestone network is distinctly seen. A view of the larva from the dorsal side (Pl. III. *Fig.* 11; Pl. VII. *Fig.* 8; Pl. V. *Figs.* 8, 9, 13) shows the abactinal system extending in such a way as to surround the stomach entirely on one side, while the tentacular pentagon covers it on the opposite side. This attitude gives us the position of the lobes ($r'''_1 - r'''_5$), the future rays of the Starfish, next to the water-pore (r'''_1, r'''_2), while a view from the oral side (Pl. V. *Figs.* 4, 14) indicates the trend of the lobes on the opposite extremity of the spiral of the abactinal system (r'''_4, r'''_5).

[Metschnikoff was able to trace most satisfactorily the development of an Ophiuran in which the formation of the abactinal system was shown to be identical in every respect with that here given of the Starfish. In the Ophiuran of which I had previously* traced the growth the formation of the plates of the disk could not be seen. These I only traced at that time in one of the viviparous species.]

Formation of the Rays of the future Starfish.—The plates of the abactinal system early reach a condition when the changes they undergo are merely quantitative, and the only modifications affecting the appearance of the Starfish take place on the edge of the disk. A depression is formed in the middle of the convexity of the lobes of the abactinal area; this is soon followed by two other depressions in the middle of the small arcs thus formed, dividing each lobe of the pentagon into four smaller lobes; at the same time the indentations between the original sides of the pentagon have grown much deeper, separating these five lobes in a very marked manner. We can now no longer mistake the true character of the lobes; they are the five rays of the Starfish, but as the actinal and abactinal regions are not yet fitted together, as in the adult (Pl. V. *Figs.* 10, 11, $r'''_1 - r'''_5$; Pl. IV. *Fig.* 4), they represent only the dorsal sides of the rays. A glance at *Fig.* 9 of the same Plate (Pl. V.), seen from the dorsal side, will show how far the suckers (t) are removed from the abactinal portion of the arm which is to protect them. The position of the water-pore (b) is immediately on the edge of the disk, at the extremity of the dorsal end of the pentagon (Pl. V. *Figs.* 10, 13, b).

* Mem. Am. Acad. 1864.

Formation of the Spines. — Such is the state of the abactinal system when the pentagon of tentacles is composed of simple loops; let us now examine this system in more advanced larvæ, at the time when the inner fold of the loops has become triangular at the extremity. When seen from the ventral side (Pl. VII. *Fig.* 8), we find that the small lobes have become wart-like projections, surrounding the whole edge of the abactinal system (Pl. V. *Fig.* 9). These projections are composed of accumulations of Y-shaped rods, connected with the system of network in the larger plates. The surface of the abactinal system has also become covered with these wart-like projections, rendering the outline irregular. In an abactinal profile, smaller tubercles are seen on each arm, identical, in everything except size, with those of the edge; the tubercles are young spines, arranged in regular lines (Pl. VI. *Figs.* 2, 4, 6); one row of four alternating on the edge of the abactinal system with one row of three, this again with one of two, followed by single tubercles, forming a pentagon, placed in the apex of adjoining rows, in the angle between two arms; the older tubercles are those nearest the edge.

When the young Starfish has reached this state, it has the rudiments of nearly all the external parts of the adult. I shall, therefore, apply to these rudimentary organs the names usually given to them. The spines are warts, not rising much above the general level of the abactinal region, and they are arranged in regular rows. The position of the network of limestone meshes has become well circumscribed, the plates formed by them occupying the position of the original rods. The five smaller plates in the angles of the arms are arranged round a central plate, the larger plates alternate with them and occupy nearly the whole of the surface of the arm; this arrangement is identical with that of the plates of the abactinal surface, as shown in Pl. VI. *Fig.* 10, l, l_1, l_2. The indentations of the rays are now so well marked (Pl. V. *Figs.* 12, 13) that there is quite a large open space between the outer spines on the edge of any two adjoining arms. On examining the plates formed by the network of limestone meshes, we see that the cells are polygonal; they are usually hexagonal, and are more or less quadrangular near the exterior of the plate. The original rod can be recognized by the larger cell it has developed (Pl. V. *Figs.* 9, 13, r'); and it is from this central cell that the others diverge, growing smaller and smaller as they approach the edge.

In the present stage of the young Starfish the anal extremity of the

Brachiolaria (Pl. VII. *Fig.* 8) has almost entirely disappeared, and the embryo Starfish has taken its place (Pl. V. *Figs.* 9–14). This embryo is so heavy that, when floating about, it loads down the anal part, which is always the lowest, and the larva is compelled to move always more or less obliquely, having to drag this great weight after it. The water-pore remains in the position in which it was at first, in the angle of the arm (r_1'''), which opens the pentagon, and is encased in a stronger deposit of limestone.

Resorption of the Brachiolaria. — While the Starfish is growing upon the outer surfaces of the two opposite water-tubes, and is gradually becoming a part of the Brachiolaria, no changes take place in the external appearance of the larvæ (Pl. IV. *Figs.* 1, 2; Pl. VII. *Fig.* 8). But when the Starfish has become so far advanced as to occupy a very prominent position at the anal extremity of the larva (Pl. IV. *Fig.* 4; Pl. VII. *Fig.* 8), the complicated appendages designated as arms, which have served for the development and for the locomotion of the Starfish, are resorbed by the little Echinoderm.

We now come to a most interesting period in the history of our Starfish. The larvæ, very active up to this time, grow sluggish; the body, which, with the exception of the anal portion, is, in the early stages, perfectly transparent and clear, becomes cloudy and opaque. Changes are first visible in the side arms (Pl. IV. *Figs.* 7, 8, 9); they contract, and apparently divide into many large cells. Next in turn the anal ventral arms, and, lastly, the dorsal arms, contract in the same manner. This contraction of the arms is accompanied by a corresponding shrinking of the anal part of the larva, beyond the mouth (Pl. IV. *Fig.* 9), so rapid that in a few hours the anal arms have shrunk to quite a small compass (Pl. IV. *Fig.* 9); the oral dorsal arms and the oral ventral arms contract in their turn, until there remains nothing but the brachiolar arms, brought close to the Starfish by the shrinking of the mass of the body (Pl. IV. *Fig.* 8). They soon follow the rest, and we can actually see the gradual disappearance of this complicated fabric. It has served its purpose of developing and feeding the young Starfish, which has now reached a state when, in a few hours, it will move about independently, having resorbed, for what purpose is not known, the whole of the framework. *Not a single part is dropped off, the whole of the larva passes into the Starfish,* and, before twelve hours have elapsed from the commencement of the first sign of

contraction of the anal tentacles, nothing is to be seen of the larval appendages, except a few indistinct swellings on the actinal side of the little Starfish (Pl. VI. *Fig.* 1).

The Starfish after the Resorption of the Bipinnaria. — The process of resorption, which I have frequently had the opportunity to examine and trace in all its stages, leaves no doubt, at least in this case, that the young Starfish does not separate from the Brachiolaria. We cannot, therefore, consider the Starfish and the framework (the Brachiolaria) as two individuals, leading a separate existence at different stages of growth, but must regard them both as one and the same thing. This is in direct contradiction to the statements of Müller, and of Koren and Danielssen, with regard to the Echinoderm, the development of which they have had occasion to watch. I must add that my own observations concerning the development of Echinoids and of Ophiurans have led me to an entirely different opinion from the one they have expressed; see my remarks on the Embryology of Echinoderms, in the Memoirs of the American Academy for 1864.

Closing of the Actinal and Abactinal Areas. — Although the young Starfish has now resorbed all the appendages of the Brachiolaria (Pl. VI. *Figs.* 1, 2, 3, 4, 6, 7), it is very different from the adult; the rays do not yet make a complete circuit, nor are they similar to each other; the pentagon of tentacles is still open, and the first step, preceding any other great change, is the closing of the actinal and abactinal areas, by which the two regions are brought into their proper relations. While the arms of the larva are shrinking away, the tentacular and abactinal pentagons are drawn closer together by the contraction of the water-tube. The extremities of the two open pentagons approach each other simultaneously by the flattening, in opposite directions, of the two pentagonal spirals, until the surfaces are brought into parallel planes, and the space, still separating the two ends of the pentagon (Pl. VI. *Fig.* 4) gradually diminishes, when they finally join; the Starfish is then in its normal condition, and the circuit is completed, though the embryo is by no means symmetrical.

[Metschnikoff has since also shown the same thing in his development of an Ophiuran. See l. c. Pl. IV.]

Development of the Ambulacral Tentacles of the Starfish. — While the closing of the spiral goes on, the pentagon of the tentacular side is undergoing

great changes. We will follow these until the tentacles have acquired their normal shape, and then return to the changes of the abactinal surface. The points of the inner folds of the tentacular pentagon, as seen in Pl. V. *Figs.* 11, 12, *t t t*, become rounded, forming a rosette, dividing each loop into five lobes. The terminal lobe in its turn goes through the same process; two smaller lobes are developed on each side of it (Pl. VI. *Figs.* 3, 5), thus dividing the original simple loop into seven lobes, a terminal one (*t'*), and three pairs (*t t t*) arranged symmetrically on the sides. The first-formed lobes retain their greater size until the tentacles are well developed, which at first is always in proportion to their proximity to the base of the loop. The odd lobe, from which the last pair of tentacles was formed, does not participate in the rapid growth of the others, and is soon outstripped by all the lobes formed along the side of the original loop (Pl. VI. *Figs.* 3, 5). The point at which additional tentacles are formed is plainly seen in this early stage of growth; a pair is always added at the outer extremity of the arm, immediately at the base and on the side of the odd tentacle (the eye-bearing tentacle), which remains at the termination of the ray during the whole life of the Starfish. It is quite the reverse with the additional spines of the abactinal surface of the disk; they are always formed upon the disk, and are pushed out upon the arms by younger spines growing up nearer the centre of the disk. This will be plainly seen when describing more advanced conditions of the young Starfish. As the loops increase, they expand, lose their character of simple folds, and soon become quite extensive sacs (*t t t*, Pl. VI. *Fig.* 8), opening into the main tube (*t''*), from which they were formed, until, finally, they attain the shape represented upon Pl. VI. *Fig.* 9. They soon grow long enough to be quite movable; they contract at the base, the walls thicken towards their extremity, and they become club-shaped. The result of this contraction is a change of the tentacular cavity into a rudimentary radiating tube (*t''*), with the tentacles attached to it; it also draws together the first pair of tentacles, which are usually seen in such a way as to appear like knobs (Pl. VI. *Fig.* 5). This basal pair does not lengthen so rapidly as the second pair, which in a couple of days becomes the longest (Pl. VI. *Fig.* 9). Before the base of the radiating tube (*t''*) has contracted, the adjacent basal tentacles of adjoining loops are placed nearer together than those of the same basal pair, the basal tentacles thus forming five pairs of tentacles

(Pl. VI. *Fig.* 8, *t t*), separated by the radiating tube (*t''*). In proportion as the tentacles elongate, the separation between them and the radiating tube is more distinct, and very soon the tentacles appear like club-shaped branches projecting from it (Pl. VI. *Fig.* 9); the first pair of tentacles are somewhat shorter and stouter than the second, which is the longest, while the three terminal tentacles have nearly the same size, the odd tentacle (*t'*) not showing as yet the slightest tendency to become club-shaped, though developed so much earlier than the larger basal pairs at its base.

Formation of the Sucker of the Tentacles of the Starfish. — When the tentacles have reached the state of Pl. VI. *Fig.* 9 they develop rapidly; the walls at the extremity of each tentacle thicken so much, that the cavity becomes a pointed tube set into a somewhat conical head, which grows more club-shaped, and projects beyond the walls of the tentacles as they increase in length, so that, when the basal pair of tentacles equals again in length the second pair (Pl. VI. *Fig.* 12), the clubs at the extremities are supported upon comparatively narrow bases. This club-shaped termination is the future disk of the tentacle, the sucker, by means of which the Starfish adheres so firmly to rocks. From an early period, even when there is only one large pair of tentacles at the base of the ray, and when the others exist only in the most rudimentary condition (Pl. VI. *Fig.* 5), these tentacles are used by the embryo in adhering to the surfaces upon which it is placed; and, though they are not provided with a regular sucking disk, they fasten themselves so firmly, by means of these loops, that it requires considerable force to make them loose their hold.

Formation of the Eye. — We have seen that, unlike the others, the odd terminal tentacle does not become club-shaped, but increases slowly in length alone, the walls retaining a uniform thickness. It is not till all the pairs of tentacles are well developed that we begin to perceive slight changes (Pl. VIII. *Fig.* 5). The opening leading into the radiating canal contracts, the basal portion of the tentacle swells, and it assumes a somewhat pear-shaped form, the swelling at the base increases, principally on the oral side, and we soon trace in it an accumulation of pigment cells (Pl. VII. *Fig.* 6, *c*), which, by the time the other tentacles have developed knobs, and equal in length the diameter of the arms, has become a brilliant carmine spot (Pl. VI. *Fig.* 12, *c*; Pl. VII. *Fig.* 6, *c*, and Pl. VIII. *Fig.* 5, *c*). This odd tentacle, placed at the extremity of the radiating

tube, is the ocular tentacle. Ehrenberg discovered the presence of eyes in Starfishes, but their true relations to this odd terminal tentacle was first pointed out by Professor Agassiz, in his Homologies of Radiata.

[The nature of this terminal tentacle in the young Starfish and all young Echinoderms seems to have been entirely overlooked by all writers who have described the eye of the Starfishes, which they have usually represented as an organ totally unlike any other Echinodermal appendage.

The Embryology of Echinoderms certainly shows most distinctly that the eye of the Starfish is only a modified tentacle, an organ of sense, such as we find at the base of the marginal tentacles of Acalephs.]

Formation of the Mouth of the Starfish.—From the manner in which the tentacles are formed by folds of the water-tube, it is plain that, in the younger stages of the Echinoderm, the two ends of the circular tube must remain disconnected; the rapid accumulation of limestone particles on the lower surface prevents us, however, from ascertaining this point. Soon after the larva has disappeared, the whole actinal surface between the pentagon of tentacles is covered by a membrane; this membrane, in the centre of which is placed the mouth, is the remnant of that part of the larva situated in the groove between the anal and oral plastrons (*m*, Pl. VI. *Fig.* 12; Pl. VII. *Fig.* 1). The mouth of the Starfish, however, is not in reality the mouth of the larva. During the shrinking of the larva the long œsophagus has become shortened and contracted, bringing the opening of the mouth of the larva to the level of the opening of the œsophagus, which becomes eventually the true mouth of the Starfish.

Before the limestone particles have accumulated sufficiently to cover the base of the radiating tubes, the mouth is movable, shifting its position from one side to another indifferently (Pl. VI. *Figs.* 3, 7, 8, 12, *m*; Pl. VII. *Fig.* 1), though by the time the deposit of limestone has formed a small pentagon inside of the base of the radiating tubes, it has lost its mobility. The water-pore (Pl. VI. *Fig.* 12, *b*), or the madreporic body, connects with the circular tube through a long, narrow tube, and is placed on the actinal side in the angle between two rays; it is, as yet, only a simple opening, protected by a thick funnel-shaped limestone projection (Pl. VI. *Fig.* 12, *b*). The young Starfish has no other anus than that of the larva, which is placed on the very edge of the disk; but,

with the rapidly increasing deposit of limestone cells, it is soon hidden from view, and I have not been fortunate enough to find it again in more advanced young. I am therefore unable to say where the anus opens outside, though it undoubtedly discharges, at this time, through one of the many limestone cells. Owing to the difficulty of tracing its opening in the dædalus of round cells, I am not able to state this positively, never having seen, from any point, discharges of fecal matters. Like the madreporic body, it is not yet upon the abactinal area, but on the actinal side, near the edge of the disk. The madreporic body itself would have been lost in a similar manner, had it not been possible to track it by means of its connection with the circular tube (Pl. VI. *Fig.* 12); and, even then, it was only by the closest attention, and at moments when the position of the young Starfish was especially favorable for the inspection, that the opening of the madreporic body could be distinguished from that of the surrounding limestone cells.

[With regard to the functions of the mouth of the Pluteus and its subsequent fate in the young Starfish and Ophiuran, my observations as well as those of Metschnikoff would show that it becomes the mouth in both. This does not seem to be the case in Auricularia, and the fate of the openings (both the anal and oral) of the Pluteus of Echinoderms is not yet definitely known for all the orders. Additional observations are needed on this point. Embryological studies on Mollusca would seem to favor the formation of a new mouth distinct from that of the early stages of the embryo, but the direct observations on Echinoderms all tend to prove that there is no new opening formed, and that the mouth of the Pluteus passes directly into that of the young Echinoderm.

Selenka shows for Holothuria also that the original opening of the Pluteus becomes the permanent anus.]

Formation of the Actinal Limestone Surface. — The actinal side of the disk is at first a narrow flat band (Pl. VI. *Fig.* 3), following the general outline of the rays. This band increases in breadth, loses its convex outline, and soon reaches the terminal tentacle, when the actinal band has assumed a pentagonal shape. Inside of this small pentagon is situated the ambulacral system, entirely independent, as yet, from the limestone deposit on the actinal surface, the whole rosette of tentacles expanding and contracting, with perfect liberty, in every direction. This freedom soon ceases; the points of the limestone pentagon develop rapidly towards the centre

of the disk, and soon reach the base of the radiating canal (Pl. VI. *Fig.* 7). There they unite by bridging the intervening spaces, and form five triangular openings, enclosing the tentacles, which are still at liberty, with the exception of this band across the base of the radiating tubes (Pl. VI. *Fig.* 9). The additions made to this deposit of limestone take place more rapidly near the bridge, where additional limestone cells are sent out, enclosing at first the basal pair of tentacles, but leaving the remaining five still unconfined. The next pair is then imprisoned by a similar process, without, however, interfering with the terminal tentacles. Finally, the last pair of tentacles is surrounded in a like manner, and all the tentacles are now confined somewhat as we find them in the adult (Pl. VI. *Fig.* 12; Pl. VII. *Fig.* 1). A row of limestone cells, extending along the median line, separates the base of the suckers, while transverse bands join the larger cells of adjoining spaces. It is plain that the transverse bands correspond to the ambulacral plates of the adult, and that, in the earlier stages, the embryo Starfish has no trace whatever of any interambulacral system. This mode of formation of the ambulacral system may explain the absence of interambulacral plates in the Crinoids and Ophiurans. The deposit of limestone is not sufficiently transparent to allow a good view of the radiating canal, or of the formation of the vesicles of the tentacles.

Formation of the Spines of the young Starfish.—We have seen that, at the time of the closing of the young Starfish, the abactinal region is already covered with regular rows of spines (Pl. VI. *Fig.* 4). These spines are, however, simple warts, slight protuberances, in which limestone cells are formed, connecting with the general network. The cells of these spines are arranged in regular tiers one above the other; the younger cells, formed at the base, being always more numerous, and pushing up the older ones. All the cells send off Y-shaped appendages, which unite, forming stories (Pl. VII. *Figs.* 3, 4, 5) of circular cells; the cells of the spine near the edge do not close, but project beyond the margin, giving the spines the appearance of small Gothic spires.

The spines of the first row — viz. those immediately on the edge of the rays — increase rapidly, curving sideways, expanding at the tip, and assuming as fantastic shapes as those of Rhabdocidaris Orbygniana (Pl. VI. *Figs.* 10, 11, 12, *p p*). The other rows of spines, diminishing in size as they approach the centre, are exactly similar to the former (p_1,

p_2), but not so broad at the extremity, and somewhat more slender. New spines are always added between those originally at the extremity of the rays and the centre of the disk; the latter always remain the most advanced and most prominent of the spines, even when the young Starfish has assumed many more of the features of the adult than it has at present, and has reached a stage when it would not be mistaken for anything but a Starfish, closely allied to our common species.

Network of Limestone Cells. — As we have seen in the earliest stages of the Starfish, there are, on the abactinal area, rods from which, by the addition of Y-shaped processes, clusters of polygonal cells are gradually formed (Pl. VII. *Fig.* 7); one cluster in the middle of each ray (Pl. VI. *Fig.* 10, l_2), one around the smaller rod placed in the angle of the rays (l_1), and a still smaller one round the rod placed in the very centre of the abactinal area (l). The large clusters extend and unite along the edge of the rays, forming a continuous network; it is from the cells of the edge that the limestone deposit is formed, which extends over the abactinal surface. The clusters of cells placed in the angle of the rays do not unite laterally, though they become indirectly connected in the more advanced stages of our Starfish, joining with the plates of the rays by a few cells (Pl. VI. *Fig.* 10). The central plate remains unconnected with the others in the most advanced of the young which I have raised from the Brachiolaria. The whole of the network is quite movable, and the plates, before they become united, are capable of independent motion by the contraction of different portions of the abactinal area.

[Lovén has given excellent figures of the young of Asterias glacialis, corresponding to some of the stages here figured. They differ, however, in having the plates more distinctly separated even in the young stages (Pl. VI. *Fig.* 10). The reticulation is compact, so that it is only in certain stages of expansion that the original composition of the abactinal surface can still be traced.

It is from the careful comparison of these young stages (Pls. VI. VII. VIII.) with the corresponding stages of the young Ophiurans, given by Metschnikoff, Pl. IV. of his memoirs, and in my memoir on the Embryology of Echinoderms, *Figs.* 29, 32 (Mem. Am. Acad.), and of young Echini with the young of Comatula figured by Allman, Carpenter, and Thomson, that we can make out a satisfactory homology of the test of Echinoderms as has been so successfully done by Lovén in his superb

Memoir on Sea-Urchins,* where he has most thoroughly proved the homology of the basal and radial plates of Crinoids with their corresponding plates, still readily to be traced in the young Starfish, and with their homologies in the apical system of Echini.

An admirable paper by Selenka in the Zeits. f. Wiss. Zool. (June, 1876) gives us a complete history of the development of Holothuria, showing an entire agreement in its general features with the Embryology of other Echinoderms in the mode of formation of the water-system as diverticulum for the alimentary canal, forming eventually (as in the Starfish) the circular canal with the ambulacral system.]

Change of Outline of the young Starfish. — With advancing age, the outline of the young Starfish is greatly modified; at first, when the actinal and abactinal areas are not yet closed, while the larval appendages are still visible on the lower side of the young Starfish (Pl. VI. *Figs.* 1, 2), immediately after the larval appendages have disappeared, and the surfaces of the actinal and abactinal areas are brought nearer together (Pl. VI. *Figs.* 3, 4), it is hardly more than an irregular pentagon, with slightly convex sides, and small rounded notches cut in at the angles (Pl. VI. *Figs.* 3, 4). These notches become deeper, the arms of the Starfish assume more the appearance of a Greek cross (Pl. VI. *Figs.* 6, 7); the sides of the rays are strongly concave, and the concavity is increased with the development of the spines to such a degree that the extremity of the ray is almost twice as broad as its base (Pl. VI. *Figs.* 10, 11, 12). The outline of the inner wall of the disk can be easily seen through the limestone network. The pentagonal form, so different from that of the adult, is still less like it when seen in profile (Pl. VII. *Fig.* 2). The abactinal area rises like a high, rounded cone, supported upon the spines (*p*) of the edge of the disk; the tentacles project far beyond the edge on every side (Pl. VII. *Fig.* 2). In fact, the regular rows of spines, their great size, the convexity of the disk, are features so unlike our usual conception of a Starfish that, without closer examination, one would readily mistake this Echinoderm, at first sight, for a young Sea-urchin, like the flat, conical Echinocidaris.

The tentacles are longer than the rays, extending far beyond the edge in front and on the sides. The pairs of tentacles move in every direc-

* Kongl. Svenska Vets. Akad. Handl. XI. No. 7. Études sur les Echinoidées par S. Lovén. Stockholm, 1874.

tion; but the odd tentacle is always curved upward, and carried between the two middle spines of the extremity of the rays. When we see the Starfish in profile (Pl. VII. *Fig.* 2), the red eye-speck appears prominent near the edge of the disk, surmounted by the upturned tentacle (*t′ t′*), of a slight rosy hue. This manner of carrying the terminal tentacle reminds us strongly of the way in which Æginopsis, as well as the young of so many of our Hydroid Medusæ, carry their marginal tentacles: Nemopsis, Staurophora, Turritopsis, Willia.

This is the most advanced stage of the young Starfishes (Pl. VI. *Fig.* 11) which I have succeeded in raising in confinement. When we compare this with an adult, having long, slender-pointed rays, four rows of suckers, its surface covered with pedicellariæ and water-tubes, surrounding individual spines, like so many wreaths, we cannot fail to be struck with the astonishing changes of form which must still take place to bring this pentagonal star to any shape resembling a slender five-rayed Starfish. In fact, when we remember how rarely embryologists continue the study of the egg beyond the moment of hatching of the embryo, it is not to be wondered at that this same young Starfish should be introduced to us again and again, in its different stages of growth, under half a dozen new names, both generic and specific. It is only by a thorough knowledge of all the changes of form through which these young embryos pass, from the first moment of their existence till they are full-grown, that we can hope to remedy this evil.

The next state of our young Starfish is, when magnified (Pl. VIII. *Fig.* 1), even more different from the adult than the pentagonal state of Pl. VI. *Fig.* 11. The young Starfishes figured on this Plate (Pl. VIII.) were all found attached to roots of Laminaria, thrown up on the beaches, in the neighborhood, after a storm; and from their different stages of growth, as compared with the oldest Starfish raised from a Brachiolaria (Pl. VI. *Fig.* 11), specimens of which were also found upon these roots, it is probable that the sizes here figured are one (*Fig.* 1), two (*Fig.* 8), and three (*Fig.* 10) years old. A considerable number of specimens were picked up in this way, and they could all be arranged into very distinct groups, representing the Starfishes of the present and of two previous seasons. There seemed to be no gradation from one group to another, such as we have among the young Sea-urchins, which, in consequence of their manner of breeding during the whole year, form

series, the relations of which it is impossible to determine. In this connection I would say, that by arranging the Starfishes found upon our rocks into series according to their size, we are able to obtain a rough estimate of the number of years required by them to attain their full development; this I presume to be somewhere about fourteen years.* They begin to spawn before that time, as specimens have been successfully fecundated which evidently were not more than six or seven years old. It is during the fourth year that the rate of growth seems to be most rapid. A young Starfish, measuring one and a half inches across the arms, was kept, during five months, alive in Mr. Glen's tank at the Museum, and during that space of time it grew to three inches.

In the youngest specimens (Pl. VIII. *Fig.* 1) it is easy to see how the young Starfish has changed its outline from a pentagonal cross (Pl. VI. *Fig.* 11) to the one here represented. The original plates are sufficiently distinct to enable us to trace the process. The arm-plates at the extremity have been pushed away from the body by the addition of new spines formed at the base of the ray, and on each side of the interradial plates (l_1) (the ovarian plates?). The terminal plate (l_2) is perfectly well defined at the extremity of each ray, and, by cutting out the remainder of the arm, and bringing the extremity of the ray close upon the disk, we should have our former pentagonal Starfish almost identically the same; the only change being the greater stiffness of the suckers, the more rounded character of the spines, as well as their greater number upon the original radial plates. The spines have almost entirely lost their fan-shaped embryonic type, and are gradually assuming the aspect of the full-grown rounded spines of the adult Starfish. Here and there, however, a spine still occurs which has retained its fan-shaped outline.

Owing to the elongation of the ray, the single median line of spines stands out very prominently, and this, together with the rows of large spines extending from the interradial plates on each side of the rays, gives to the young Starfish the appearance of a small Oreaster. The median line of spines is supported by a long, narrow limestone plate, extending distinctly from the basal plate almost to the terminal radial, plates totally independent, also, of the prolongation of the ovarian plates

* For an account of the method adopted by Professor Agassiz for ascertaining the age of many of our marine animals, see Proceed. Essex Inst., 1863, p. 252.

(p_c), which make a broad binding on each side of the ray, uniting with the terminal plate so as to form a continuous limestone cord round the edge of the Starfish. The interradial plate projects from the angle of the rays towards the basal plate, spreading somewhat, to fill up the space between the median arm-plates. We find, in this stage (Pl. VIII. *Fig.* 1), the first dorsal water-tubes (d'); there are five pairs, one tube on each side of the ovarian plate (p_c). But, as yet, no pedicellariæ have appeared.

From the lower side, no trace of the plates of the interambulacral system can be seen, beyond the spines which have formed at the extremity of the ambulacra. The ambulacral pores are arranged in a single row on each side of the median line, and the slender last-formed tentacles are placed at the extremity of the ray, nearest to the odd ocular tentacle; while the tentacles nearest the mouth are quite short and stout, having a large sucking disk, and resembling, in all respects, those of the adults. The separation of the different ambulacral plates is very faint, and does not become well marked till a later stage. The odd ocular tentacle has retained its function; the eye-speck has increased greatly in size, as well as the bulb to which it is attached, while the walls of the tentacle are nearly as thin as in the younger stages (Pl. VIII. *Fig.* 5), exhibiting no trace of the formation of any sucking disk. Nearest to this are found the last-formed tentacles, easily recognized by their length, and the somewhat less developed sucker. These and subsequent stages of the young Starfish show undoubtedly that new tentacles are formed at the extremity of the rays, while new portions of the upper part of the arm are formed at the base; that is, the actinal system is developed at its periphery, while the abactinal system is developed at the centre.

In young Starfishes of two years (Pl. VIII. *Fig.* 8) the median plate is longer, more closely crowded with spines; the terminal plate being less prominent, though still distinct, while the processes from the median and lateral plates are quite large. No additional dorsal water-tubes have been formed since the last stage (Pl. VIII. *Fig.* 1). When examined from the oral side, the median line is becoming more strongly marked, and the lateral and ambulacral spines more prominent. These features give to the young Starfish a more pointed appearance, and the resemblance to the adult now becomes more apparent.

In somewhat older specimens (three years old) (Pl. VIII. *Fig.* 10), we finally trace the first appearance of pedicellariæ (Pl. VIII. *Figs.* 2, 3, 4,

p′, *p″*), the dorsal tubes (Pl. VIII. *Fig.* 10, *d″ d″*) are found arranged in greater number along certain portions of the rays; while the median and lateral plates have increased so much in size that the terminal plate has lost entirely the preponderance which it had in younger stages, and the extremity of the arm actually assumes a rounded outline. The dorsal tubes (*d‴*) are found numerous on both sides of the median arm-plate, and along the edge of the oral lateral plates (*d″*), diminishing somewhat in size as they approach the extremity of the ray; they are not open at the tip. The central basal abactinal plate is still distinct from the others.

The development of the pedicellariæ around the base of the spines gives us no clew as to the function which they perform in Starfishes (Pl. VIII. *Figs.* 2, 3, 4). At first a simple projection, they early assume the character of the head of pedicellariæ without stems, the rounded swelling becoming conical, after which the fork of the head begins to be distinguished. In Plate VIII. *Figs.* 2, 3, 4, we have the different stages of the spines (*p*), and the pedicellariæ (*p′*, *p″*), found at their base. It was impossible in these young Starfishes to discover the place of the madreporic body.

[Professor E. Perrier has published a very elaborate and beautifully illustrated memoir on the Pedicellariæ of Echinoderms in the Annales des Sciences Naturelles. For the discussion of the nature of Pedicellariæ see an account in the Revision of the Echini, Part IV., by A. Agassiz, and an article in the American Naturalist, Vol. VII.]

From the oral side these Starfishes (Pl. VIII. *Fig.* 9) exhibit scarcely any difference from those of the stage last described, with the exception of the somewhat more crowded ambulacra. There is a row of median ambulacral spines (*u′*), quite small, defining the plates distinctly, as well as the presence of a very distinct row of spines (*u*), the ambulacral spines, along the edge of the ambulacral plates. In the most advanced of these Starfishes we must specially call attention to the absence of a well-defined interambulacral system. The young Starfish is still eminently ophiuroid in its most important embryonic features.

Professor Sars, in his Norge's Echinodermer, has described a new genus, which he has named Pedicellaster. I think there can be but little doubt, on comparing the figure he has given of his Starfish and the different stages of our Asteracanthion, that his Pedicellaster will turn out

to be the young of one of the species of Asteracanthion of the northern coast of Europe. The single row of ambulacral pores, the ocular tentacle, the arrangement of the pedicellariæ, the size, all confirm the idea of its being only the young.

Successive Phases of Development of the Larvæ of Starfishes. — Before applying the information thus far obtained to the solution of more general problems, it may be well to consider what are the normal stages of growth, at different periods, in the history of our Starfish larvæ. During the earlier stages of its existence, the young developed from the egg (Pl. I. *Figs.* 22 – 28) laid by one of our Asteracanthion has no resemblance whatever to the future Starfish. This first condition we might call the pyriform, or Scyphistoma stage; when it is simply a symmetrical radiate animal, reminding us of earlier stages of Polyps and Acalephs. It then assumes the shape of a dumb-bell, becomes slightly one-sided (Pl. II. *Figs.* 2 – 19), and has, in its most advanced state, no other appendages but the simple crescent-shaped, slightly undulating, vibratile chord (Pl. II. *Figs.* 20 – 24). The simple, straight digestive cavity is now differentiated into three distinct regions. This second stage we might call the Tornaria stage, from its resemblance to the Echinoderm larvæ, called Tornaria by Müller, in which all the parts of the adult larva are simply hinted at in the most rudimentary form, and during which it is eminently cylindrical. [This Tornaria has been proved by Metschnikoff and myself to be a young Balanoglossus.] Another well-marked epoch is that during which the larva passes from the cylindrical, or, as we have called it, the Tornaria stage, into a quadrangular, somewhat compressed form; and the complicated system of locomotive appendages, so greatly developed in the Brachiolaria, is gradually laid out, thus preparing the larva for the last stages of its existence, characterized by the development of the young Echinoderm. This third stage, corresponding to that observed by Van Beneden, may appropriately be called the Brachina stage. During this period the former independent water-tubes (*w*, *w'*) of the Tornaria stage (the problematic bodies of Müller) become united, and are gradually transformed into the Y-shaped, elliptical water-system (the Schlauch-System of Müller); this present stage (the Brachina stage) is therefore marked by the great modifications of the water-system (Pl. II. *Figs.* 25 – 28; Pl. III. *Figs.* 2 – 10). In the last stage, which we shall call, with Müller, the Brachiolaria stage (Pl. III. *Fig.* 11; Pl. VI. *Figs.* 1, 2, 4; Pl. VII.

Fig. 8), the rudimentary locomotive organs, laid out during the Brachina stage, attain their greatest development, as long, slender arms. The great changes which take place on the anal extremity of the water-tubes on both sides of the stomach, characterize the present stage (the Brachiolaria stage). These changes upon the surface of the two branches of the water-tube lead to the formation of the future Starfish. But the incipient Starfish is, as it were, a part of the Brachiolaria, or rather the Brachiolaria is undergoing local transformations which lead to the formation of a Starfish. They present thus, for a time, the appearance of a double existence, as if a new being were forming in one which had completed its growth. This third period, during which the twofold nature is preserved, is the one which constitutes the Brachiolaria stage. In the Brachiolaria stage there are several marked periods: the parts which appear at first on the surfaces of the water-tubes have no connection, and stand in such indefinite relation to each other, that they do not seem to tend towards a common result. But in proportion as the young Echinoderm progresses in its development, the relations of the two areas, formed on the surfaces of the two water-tubes, are more apparent; and we finally reach the last of the strictly larval stages, when the Brachiolaria, with its complicated system of locomotive appendages, becomes secondary to the young Echinoderm and is completely resorbed by it, when the embryo enters into its truly echinodermoidal condition (Pl. VI. *Fig.* 1), the different stages of which we have already described.

Examination of the Character of the Development. — The mode of development of Starfishes, thus divided into phases as observed in our Asteracanthion, cannot be called a case of alternate generation, nor is it a metamorphosis in the ordinary sense of the word. It is a mode of development peculiar to Echinoderms, entirely different from that of any other class of Radiates. It is not an alternate generation, for the Brachiolaria can in no way be called a nurse, as each Brachiolaria produces but one Starfish, and the whole of the larva is resorbed by the Starfish, not an appendage being left out. Nor is it strictly a metamorphosis, as the changes which take place are so gradual that at no time can the line of demarcation be drawn between two stages with any degree of precision, as in Crustacea or Insects, where the casting of an envelope marks distinctly different epochs. There is, however, something in these successive phases of development which reminds us of the meta-

morphoses of Insects. There is a sort of general similarity between this process of resorption and the growth and changes in the chrysalis of Lepidoptera, ending in a butterfly. In the latter case, the chrysalis, though retaining its character throughout the whole growth and development of the Insect, has an earlier stage when it seems to be purely chrysalis, and a later one immediately before the hatching of the perfect Insect, when the butterfly seems to be gaining the ascendency, and the whole outline of its form may be seen through the chrysalis, which now seems to be only its envelope. And yet the character of the development of the Starfish during its Brachiolaria stage recalls also vividly the phenomena of alternate generations. It is, nevertheless, strictly echinodermoid, and whether we observe it in the Ophiurans, the Sea-urchins, or the Holothurians and Crinoids, there seems no doubt, from the observations of Müller, Busch, Thomson, Krohn, and Agassiz, that it is carried on according to one and the same plan in all the orders of the class, where we have corresponding differences in their various modes of development. With reference to the separate existence of the larva and of the Echinoderm, urged by other observers, I can only say that nothing of the kind has occurred in those Echinoderms the changes of which I have traced, whether it be an Ophiuran, an Echinus, a true Starfish, or a Holothurian.

RECAPITULATION.

I shall, in a few words, recapitulate the development of these Starfishes, in order to be able more fully to compare my observations with those of previous writers, and to explain the differences, when they exist.

Changes of the Yolk. — The yolk, after fecundation, separates slightly from the outer envelope. The segmentation takes place rapidly; as soon as the yolk has divided into eight portions, they arrange themselves in such a manner as to enclose the remaining space, which is more and more separated as the spheres increase in number, until, finally, there is a complete envelope formed of spheres of segmentation.

Scyphistoma, or pyriform Stage. — At the time the young escapes from the egg, it is spherical, and the walls of the envelope are of the same thickness. One side becomes thicker, the embryo flattening at this extremity, which is bent in so as to form a slight cavity, in which fluids circulate. This cavity extends half-way the length of the larva, then

swells at the extremity, the walls become thinner, the pouch formed at the end of this cavity develops laterally, forming two smaller pouches, which afterwards become hollow bodies, entirely separated from the main cavity, whence they originated (the problematic bodies of Müller).

Tornaria Stage.—The main cavity bends slightly towards one side, and eventually unites with a depression formed there. This depression becomes the mouth; the other opening, which was the first to be developed, and served the purpose of a mouth, is changed to an anus. This agrees with the observations of Krohn, who shows that in an Echinus larva the mouth is formed after the anus. The bent tube, or cavity, divides into three distinct regions, forming the œsophagus, the stomach, and the alimentary canal.

Brachina Stage.—The small disconnected hollow bodies (the water-tubes, the problematic bodies of Müller) are not alike; the left one (*left*, when seen from above) connects with the surrounding medium by means of an opening, the water-pore. This opening in the Starfish is the madreporic body. The water-tubes elongate so as to reach beyond the mouth, when they approach each other and unite, forming a Y-shaped tube.

Brachiolaria Stage.—Arms are developed from the sides of the larva, edged with rows of vibratile cilia. Some of these arms are of a different character, having peculiar appendages, the so-called brachiolar arms. It is on the outer surface of the water-tubes that the Starfish is developed (not from the stomach, as stated by Müller); one of the tubes, the left, when seen from above, developing the actinal or ambulacral side, the other developing the abactinal area. These two areas are open, pentagonal, warped, spiral surfaces, making almost a right angle with each other. The open pentagons do not close till after the Starfish has resorbed the whole of the larva.

Echinodermoidal Stage.—The complicated system of arms and the whole of the Brachiolaria are resorbed by the Starfish, which does not separate from the larval stock, as seems to be the case of Bipinnaria, from the statements of Müller and of Koren and Danielssen. The arms of the Starfish are broad and short in the young, and not symmetrical; the suckers are pointed, have no terminal disk, and are arranged in two rows, the sucking disk being developed later. The embryo, if compared to Acalephs, might then appropriately be said to be in its Ephyra stage. The

odd terminal tentacle has an eye at its base, and no disk is ever formed at the extremity of this tentacle. The abactinal surface is very arched, the spines are arranged in regular rows, and the arrangement of the plates reminds us of the plates of Crinoids; the plates first formed retaining their embryonic or crinoidal character. The anus opens near the edge of the disk, on the lower side; the madreporic body is situated on the edge, but moves to the abactinal area, in more advanced stages. About a fortnight is required for the egg to pass through its different stages, or the embryo to be hatched, and the larva to have reached the condition when the young Starfish is ready to resorb the Brachiolaria; and another week must elapse before it reaches the stage represented in Pl. VI. *Fig.* 11. Those which I raised from eggs artificially fecundated retained this shape four months.

CHAPTER THIRD.

EMBRYOLOGICAL CLASSIFICATION OF STARFISHES.

THE study of the young forms, or morphological embryology, if I may so call it, is destined to play an important part in Systematic Zoölogy; though investigations of this kind can only be carried on under peculiar advantages not easily obtained. The fact that many marine animals live, in their early stages, under stones, or firmly attached to roots of Laminarians, in deep water, and are only occasionally thrown upon the beaches after storms, when their small size prevents us from obtaining them in any great number, increases the difficulty of this kind of observations. We must, therefore, limit ourselves to those animals which pass the greater part of their lives near the surface of the water, or within the limits of tide-marks. A commencement has already been made in this direction, in the study of Fishes, the young of which live among the eel-grass, and in that of the young of the several species of Ctenophoræ, so abundant during the summer months along our coasts. For an account of these investigations, I would refer the reader to the Illustrated Catalogue of the Museum of Comparative Zoölogy.*

Comparison of Young and Adult Starfishes. — The difference in appearance between the young and the adult of our Starfishes is so great, that they would not be placed in the same family by one unacquainted with their transformations. The young has characters which, if taken singly, recall a variety of families; in fact, the combination of characters belonging to different families is almost always a sign that these features will disappear, or become modified with age.

Here I must again insist on the importance of the constant comparison of the younger stages of growth with the adult. We are but little accustomed to consider these younger stages in our description of animals,

* [See also my papers on Young Stages of Annelids, Ann. Lyc. Nat. Hist.; Young Echini, No. VII. Ill. Cat. Mus. Comp. Zoöl.; Embryology of Ctenophoræ, Mem. Am. Acad. 1874.]

and we necessarily lose many elements of the greatest importance, whenever we attempt to associate the adults of any class in natural groups, without taking into account the characters of their young. Naturalists, who have not yet entered upon this method of study, cannot conceive what extraordinary facilities this kind of investigation affords for tracing the more complete affinities among animals. One of the principal reasons why embryologists have overlooked these investigations may be found in the fact that they rarely examine more than one species of each type at a time. Who would place the young Echinus, with its Cidaris-like spines and straight simple ambulacra, among the true Echinidæ, or take a young Spatangoid for anything but an Echinus? What has the pear-shaped outline and long tentacles of a young Bolina — which is, indeed, a diminutive picture of a Pleurobrachia — in common with the adult, with its long, twisting rows of ambulacra, and wing-like projections of the spheromeres beyond the actinostome? Yet these embryonic characters remind us of familiar forms, and cannot fail to give us an insight into the relative standing of the forms through which they pass.

Let us commence with our embryo Starfish at the time when it is just forming, and when the first outlines of the abactinal region can be traced. Suppose its development were to stop there (Pl. V. *Fig.* 5), and that the slight lobes should close soon after the formation of the coating of limestone granules over the abactinal area, we should then have a condition strongly reminding us of a Culcita, with its arched back, its almost circular outline, and the total absence of any very prominent spines. In the next stage (Pl. V. *Fig.* 12), the cuts between the rays have become somewhat more marked, the plates of limestone cells are well developed, and there are tubercles in place of future spines. The resemblance of this stage to such forms as Anthenea, Pentagonaster, and the pentagonal Starfishes, in which we find a great development in the abactinal plates, is at once apparent. In a somewhat more advanced stage, the rays are slightly more marked, the spines quite well developed; this type is represented among living Starfishes by such forms as Pteraster, Paulia, Pentaceros, Artocreas, Oreaster: unless it were known beforehand that Pl. VIII. *Fig.* 1 represents a highly magnified young Starfish, the figure would readily pass for a new species of Oreaster. The corresponding changes of the actinal surface are not the less important. In the early stages the tentacles are pointed, they have no disk (Pl. VI. *Figs.* 3, 9);

it is only afterwards that they are developed (Pl. VII. *Fig.* 1; and Pl. VI. *Figs.* 10, 11, 12). In fact, the tentacles of our young Starfish, in its earlier stages, resemble those of Astropecten, Luidia, and Ctenodiscus. We are, therefore, at once provided with a set of characters taken from the young, enabling us to decide the comparative value of the various features, and the order in which they are to be taken. From the tentacles alone we are fully justified, upon embryological data, in placing Starfishes with pointed tentacles lower than those which have disks, like Asteracanthion. Another embryological feature is the fact that the embryo has only two rows of tentacles, while in the adult Asteracanthion we find the tentacles arranged in four rows. [The arrangement of the ambulacral tentacles into furrows seems due simply to the crowding together of adjoining plates in consequence of increasing age, and has not the systematic value formerly assigned to it.] Combining these characters, as we find them in the adults, we have at once good and conclusive reasons for placing all those Starfishes which have, like Ctenodiscus, a pentagonal outline, and at the same time pointed tentacles, lowest in the scale; next in order would come the Starfishes with pointed rays and pointed tentacles, without suckers, like Luidia and Astropecten; above them pentagonal Starfishes, with plates like Anthenea and Hippasteria, and two rows of tentacles, provided with suckers; then those with more prominent rays, and tentacles also ending in suckers, like Pentaceros and Artocreas; higher still, the Starfishes, with long slender arms, and only two rows of tentacles with suckers, such as Cribrella, Ophidiaster, and the like; while highest in the order we should place the genuine Asteracanthion, with four rows of tentacles, with suckers, and highly developed spines on the abactinal area.

The same principles applied to the different families would place Starfishes having plates without spines lower than those in which the network of limestone is covered with spines on the abactinal surface. This classification is not very different, as far as regards the order from that of the three families proposed by Müller and Troschel. It differs materially, however, from the standing given to pentagonal Starfishes in a short paper by Professor Agassiz, in the Proceedings of the Natural History Society of Boston. From this it is plain, that the mere study of the adult is not a sound foundation for a natural classification. The echinoid characters of the young Starfishes were not known at that time, which would natu-

rally give the pentagonal Starfishes an entirely different position. Nor is it always sufficient to have traced the development of any one species; unless it happen to stand highest in its group, its different phases would not tell us anything of the relative standing of the other members of the group with which the adult is associated. Embryologists should, therefore, whenever it is possible, select those species for investigation which, upon anatomical evidence, stand highest in their group.

There are other embryonic features, recalling not simply families of the same suborder, but characters of other lower orders. The situation of the anus on the actinal side, the presence of the madreporic body on the same area, are features of the Crinoids and Ophiurans. These peculiarities are soon lost, and the madreporic body gradually finds its way to the abactinal area. The opening of the anus next to the mouth is eminently crinoidal, and it is accompanied by other structural details reminding us still more of that order. Were there a stem on the central plate of its abactinal area, the young Starfish, when seen from the abactinal side, would have all the appearance of a Crinoid. The central plate corresponds to the basal plate (Pl. VI. *Fig.* 10), the set of five plates in the angles of the arms to the interradial plates, and the arm-plates themselves to the radial plates of a Crinoid; and, to make the resemblance still stronger, the anus opens near the mouth, on the same side with it, as in Comatula. This analogy had already been pointed out by Professor Agassiz, in his Lectures on Embryology; and it shows conclusively that Starfishes are built upon the same plan with other Echinoderms, contrary to the views long entertained by Johannes Müller. This comparison to the plates of a Comatula can be carried out to its fullest extent, and is exceedingly instructive if made with the young Comatula, of which an admirable figure has been given by Professor Allman, in his valuable memoir on the prebrachial stage of Comatula, in the Memoirs of the Royal Society of Edinburgh for 1863. The arrangement strikes one, at once, as identical, though the plates are by no means homologous. The central plate occurs in both, but the most prominent plates, occupying indeed the greater part of the abactinal region of the young Starfish, are the same plates which eventually develop with others at the base of the arms, those at the angle of the arms being but little developed. It is quite the reverse with Comatula, in which the arm-plates are but small at this stage; though, according to

Professor Allman, who quotes Carpenter, these small radial plates eventually encroach upon the others, at the time of the appearance of the arms, the rest of the calyx being formed by the five large interradial plates. I cannot agree with Professor Allman in considering the central plate otherwise than as a solidified homologue of the basalia of the other Crinoids figured by him; the only difference being that in some cases the plates composing this piece are soldered together, as in Comatula, while in others they are kept distinct, as in Coccocrinus, and the like. From the peculiar way in which young tentacles are formed in Starfishes may not the strange toothed plates noticed by Professor Allman, at the base of the tentacula (or cirri, as he calls them), be young tentacles? Their position seems to me to make this very probable.

Position of the Madreporic Body. — There has lately been a great deal of discussion among writers on Echinoderms, as to whether the madreporic body was, or was not, a proper point to start from in determining the axes of the body; Agassiz, on one side, maintaining that the madreporic body was constantly in the same relation to the different parts of the Echinoderms, while Müller, Cotteau, and Desor have warmly opposed this view. The mode of formation of the madreporic body seems to me to decide this question in favor of the former view. The madreporic body is invariably formed on the left water-tube of the Brachiolaria, and is placed, during the development of the Starfish, at the angle of the upper arm. The future position of the madreporic body opposite the third arm of the open pentagon is therefore, after it has closed, the natural consequence of its position. The opening of the anus, on the contrary, has no such clear and precise relation to the middle arm. At any rate, however this may be, one thing is perfectly apparent, viz. that the madreporic body is always placed in the suture of the terminal arms of the pentagon, which brings it opposite the third arm. Thus the madreporic body gives us the means of dividing the Starfish into symmetrical halves, and of determining the position of the odd arm. The case of the Echinometradæ and Salenidæ is constantly quoted to show that the madreporic body is not connected with any definite axis. But might it not be that a stage which is embryonic in the young Starfish — viz. that preceding the closing of the actinal and abactinal areas — is probably retained in those Echinoid families in which the process of closing is not completed? And may not the unsymmetrical position of the madreporic

body in such cases be owing to the continuance of this embryonic character? — the natural result of which would be, to throw the madreporic body slightly on one side of the middle line, so that, though still retaining its position opposite the third arm, an axis passing through them both would not divide the spherosome into symmetrical portions. If there were in nature such forms as asymmetrical Starfishes, analogous to the Echinometradæ, they would be represented by the embryonic Starfishes of Pl. VI. *Figs.* 1–6, in which a line drawn through the madreporic body and the middle of the odd arm would not divide the Starfish into symmetrical halves. Suppose the flattening of the young to be completed without the loss of this want of symmetry, and we have a form representing Echinometra-Starfishes, if any such exist in nature. The fact that in some of these Echinometradæ the axis, passing through the madreporic body and this long arm, crosses the median line from opposite sides, could be easily explained on the supposition that the former is placed on the ventral instead of the dorsal side of the larva, — an assumption which is not unfounded, as this occurs in Ophiurans and in young Starfishes. In this way the change of position in the direction of the axis which is found in Acrocladia and Podophora on one side, and in Echinometra on the other, could be easily explained. [For fuller discussion of the bearing of the positions of the madreporic body determining the anterior axis of the Echinoderms, see my Revision of the Echini, Part IV., and the description of Salenia. Consult also the Memoir of Lovén (Études sur les Echinoidées).] In Echinoids the actinal and abactinal areas are formed upon the exterior surfaces of the water-tubes, as in Starfish larvæ. This I have shown in the paper referred to above, published in the Memoirs of the American Academy for 1864. The earlier appearance of the tentacular pentagon in Echinoids and in Ophiurans is that of a spiral on the surface of the water-tubes, similar in plan to that observed in our Starfish larva; it is evident that the additional plates formed in a young Sea-urchin arise spirally, and from what is known of the mode of formation of the young Echinus and young Ophiuran, it follows, necessarily, that the ambulacral system in both must have been open pentagons, becoming connected only by the closing of the surfaces upon which the young Sea-urchin or Ophiuran were developed.

An examination of the figures of our young Starfish, just after the re

sorption of the larva (Pl. VI. *Figs.* 2, 3, 4), in which a line, drawn from the madreporic body through the middle of the odd arm, would by no means divide the Starfish symmetrically, confirms the above explanation of the eccentricity in Echinometra. Supposing the spiral to have been formed from the other side, the obliquity would be in the opposite direction. Of course this is simply a supposition on my part, which future examination alone can verify; but it seems to me such a natural explanation of the whole difficulty, that I give it here for what it is worth. The multiplication of madreporic bodies in many Starfishes need not invalidate the view I have taken of its value, as we need only ascertain which is the original one, the others being supplementary. I have found larvæ with two water-pores (madreporic bodies), but have never succeeded in raising them.

CHAPTER FOURTH.

EXAMINATION OF THE INVESTIGATIONS OF FORMER OBSERVERS.

Review of Müller's Observations. — It is with the greatest diffidence that I enter upon this part of my subject. It seems the height of presumption, for one who has scarcely any claim to recognition, to begin by criticising so many statements of one of the great masters of our science. Yet I hope to show, from Müller's own figures, that the observations I have made upon the development of our Starfish, though they do not agree with his earlier memoirs, yet coincide entirely with a few figures which he has given on the last plate of his great memoirs on the embryology of Starfishes; and that it is only because Müller neglected the earlier stages of development, that he failed to arrive at the conclusions to which I have been led by the above investigations. I trust that I have succeeded in describing the successive stages in this development with clearness enough to enable me now to draw a comparison, which the reader may easily follow, with the last drawings made by Müller, and to show that, had he had the good fortune to see so complete a series as that which I have traced, he would undoubtedly have entirely remodelled his former views, with the same frankness which has characterized all his memoirs. No preconceived theories, no observations, however careful, have ever been allowed by him to interfere in the least with his subsequent observations. Hence the great difficulty of following Müller in his intricate discoveries; each memoir modifying, correcting, and sometimes entirely contradicting, the previous ones, so that we must, as it were, begin his book at the end, in order rightly to understand his meaning. Any one who has tried to follow the development of a single animal, so that nothing should be wanting in the evidence of the successive stages, will easily understand how later observations continually modify and explain what had previously been considered as well understood.

Although Sars was the first who followed the development of an Echi-

noderm, which, at first sight, did not seem to differ very materially from what was known of the development of other Radiates, yet Müller was the first to trace the wonderful changes of the young Echinoderms; his memoirs have been the basis of all subsequent investigations, which are insignificant when compared to the immense amount of labor involved in his researches. Not alone the history of a single animal, but the history of a whole class, is gradually unfolded in his successive memoirs. The very fact that so little has been done in the embryology of Echinoderms since the days of Müller — for, in fact, with the exception of Krohn and Thomson, no one has followed these transformations — is a sufficient proof of the great difficulty attending investigations of this kind. It must also be remembered that these animals are so small that it requires the most practised eye to detect their presence; their habits also are such that we may spend days in watching for them, without obtaining a single specimen, and again be overwhelmed with such an amount of material as to be at a loss where to begin. This can but heighten our admiration of the untiring zeal and perseverance of Müller in following out the development of so large a number of species, in a field where everything was unknown, and where his powers as an observer must have been taxed to the utmost.

Bipinnaria and Brachiolaria. — A glance at the figures of Bipinnaria and of Brachiolaria of Pl. IX. of Müller's seventh Memoir will show how different they are, with few exceptions, from the figures of the same larvæ in his former memoirs; compare Pl. VII. of his third Memoir and Pl. II. of his second Memoir. From the figures and explanations given by the author, it is evident that he had observed, in the last larvæ of Starfishes found by him, the very characters which have enabled me to correct his observations. He has seen the two Y-shaped water-tubes extending the whole length of the Bipinnaria. He has seen, also, that the pentagon of the future back of the Starfish was open in its younger stages, though he did not succeed in tracing the position of the tentacular pentagon, nor does he perceive the connection of these two pentagons with the water-tubes. And, finally, if he had kept his Bipinnaria alive but a short time longer, he would have seen brachiolar appendages develop, and have satisfied himself that Brachiolaria is only an adult state of what he calls Bipinnaria. It must be remembered, however, that the original Bipinnaria of Sars, the Bipinnaria asterigera, has en-

tirely different characters from the Bipinnaria of Müller. Judging from the development of our Starfish, it seems to me that Müller's Bipinnaria von Helsingör, second Memoir (Pl. I. *Figs.* 1–7), is probably nothing but a younger stage of his Brachiolaria von Helsingör (Pl. II. *Figs.* 4, 5; and Pl. III.). Van Beneden's Brachina, in its turn, is a still younger stage of the same thing, or of an allied species. A comparison of the above figures of Müller, and of the figures of Pl. III. of this Memoir, will leave no doubt on this subject. For the same reasons the Brachiolaria of Marseilles is probably only the adult of a Bipinnaria, closely resembling that of Marseilles (second Memoir, Pl. I. *Figs.* 8, 9), if it is not the same species. In the Brachiolaria figured on Plates II. and III. of the second Memoir of Müller, the young Starfishes are evidently on the point of resorbing the arms. The larvæ present all the appearance of contraction and distortion usually accompanying this process, and Müller's figures agree entirely with the various attitudes which they assume during this resorption.

If we now turn to his fourth Memoir, which contains the fullest descriptions, we shall see that although in many of the figures of Müller the Starfish, or at least one side of it, has been drawn correctly, yet his statements and some of the figures which he gives cannot be reconciled with one another. On Plate II. *Figs.* 5, 6, of his fourth Memoir, we have the evidence, from his own drawings, that his Bipinnaria had two water-tubes; yet, in the subsequent stages, Müller says positively that it has only one water-tube, the one with the water-pore, — a statement entirely contrary to the earlier stages of his Bipinnaria. From what I have shown of the mode of development of these water-tubes, of their increase in size in proportion to the age of the larva, it is quite improbable, notwithstanding the statement of Müller, that one of them should disappear; he also says that they are not to be confounded with what he calls "wimpernder Schlauch," while our observations of Asteracanthion go to show that these two systems are but one.

The discovery of the water-pore in Müller's Bipinnaria was a great step towards solving the question of the origin of the madreporic body, which he rightly conjectures to be nothing but the water-pore. He also notices the rosette of tentacles, or, more properly speaking, the five radiating tubes from which the tentacles eventually branch. He fails, however, to notice that this rosette, like the cap of the Starfish, as he calls

the back, is open; and although he has occasionally represented it as such, he has not perceived the true relation between the positions of these two areas. He says distinctly that the cloak-like envelope, or the abactinal area, originates upon the surface of the stomach, whereas it lies, in reality, upon the surface of the second water-tube, which he says does not exist in his Bipinnaria; while the water-system, or the ambulacral system, originates on the water-tube in such a way that the two open warped pentagonal surfaces, the actinal and the abactinal areas, make a very large angle with one another; Müller, however, did not notice that they were open and warped surfaces.

Van Beneden's observations, in which he says that the two branches of the Y-shaped water-tubes are separate in the young, and become united in the adult, are fully confirmed by my observations. Müller has called these small bodies, while they are still separate, problematic bodies; he says they disappear in older larvæ, and have nothing to do with the "Schlauch-System." It is evident, from my observations, that the Schlauch-System is only the advanced condition of the problematic bodies, which are isolated on each side of the body in the young larvæ (see Pls. II., III. of this Memoir, and Van Beneden's Brachina), and become united in a Y-shaped water-system (Schlauch-System), when they reach the condition of Bipinnaria of Müller. It would seem, from his figures, as if the abactinal pentagon closed, while the Bipinnaria is still visible. I am rather inclined to think that more advanced larvæ will be found to be Brachiolaria-like, as is the case with our Starfish and the Brachiolaria from Messina; and that this apparent closing up is due to the fact that the larva is not in its normal state, or that the drawings are made somewhat foreshortened. In the second Memoir of Müller, on Plate I., we see that the Y-shaped water-system (Schlauch-System) has been noticed in two of the larvæ (*Figs.* 4, 7), while in the intermediate stages, and in younger larvæ, it has escaped his notice. It is undoubtedly to Müller's want of acquaintance with the earlier and later stages of his Bipinnaria that we must ascribe the discrepancies in his observations. Many of the more important points in the structure of the young larvæ naturally escaped Derbès and Krohn, who were not familiar with the adult larvæ; neither of these observers tells us anything of the presence of the water-tubes, or of the first appearance of the young Echinoderm.

Bipinnaria asterigera. — Müller's views concerning the different organs of

Bipinnaria asterigera of Koren and Danielssen are undoubtedly correct. What they took for a respiratory opening, leading into the cavity, is the mouth; they had correctly seen the anus, as well as its connection with the intestine of the Starfish. Judging from the figures of Müller, and of Koren and Danielssen, there are evidently striking differences in the termination of the intestinal canal, from that of our Starfish. In Bipinnaria asterigera the anal opening is on the abactinal side of the Starfish, while in our young Starfish it is still on the actinal side. The position of the young Starfish, with reference to the stomach of the larva, seems still to require further investigation, as it is not possible to say, from the figures of Müller, or from those of Koren and Danielssen, what is its true relation, and whether it has the same oblique position which it occupies in our young Starfish. The investigations of younger specimens than those examined by Müller, or Koren and Danielssen, will at once settle this point, as well as determine the mode of formation of the mouth of the young Starfish, and the question of its separation from the Bipinnaria. From the figure given by Müller, in his third Memoir (Pl. VII. *Figs.* 5, 6, 7), I am led to think that the position is also an oblique one; and that, though the Starfish may separate from the Bipinnaria, yet it is undoubtedly the opening of the œsophagus into the stomach, which becomes the future mouth of the Starfish, as in our Asteracanthion. In his third Memoir Müller shows conclusively that the madreporic body is not the scar left by the junction of the young Starfish with the Bipinnaria, but corresponds to an opening leading into a short tube between two of the arms; and also points out the probability of its correspondence with the opening leading into one of the water-tubes which he had noticed in Auricularia. This supposition is fully confirmed by the observations we have made of the coincidence of the water-pore and of the madreporic body. The slit in the Starfish, noticed by Müller and by Koren and Danielssen, was probably owing to the fact that in their young specimens the spiral was not yet closed and flattened, as is the case in older Starfishes.

From the drawings of Sars, and of Koren and Danielssen, it would seem as if a large tube extended into the long appendage opposite the arms. If this is truly so, it leaves no doubt that the long, tail-like appendage of the Bipinnaria is homologous to the brachiolar appendages of our larvæ, only developed to a much greater extent, and with all the arms placed nearer together, immediately round the mouth. A comparison, after care-

ful examination of the position of the Starfish in the Bipinnaria asterigera with the mode of development as noticed in Echinaster (Cribrella) A. flaccida, and A. Mülleri, will give the means of settling the true affinities of the singular ventral appendage of these larvæ, and of deciding whether they are, as I have suggested, the homologues of the brachiolar appendages, — a result which seems probable from the observations made by Professor Agassiz, of a circulation in this peduncle, in a species of Asterias (A. flaccida, *Ag.*) closely allied to Asteracanthion Mülleri, the mode of development of which is identical with that observed by Sars in Echinaster.

Professor Thomson, who has had occasion to study the sedentary mode of development of several Echinoderms, has given us the most accurate description of the structure of this peduncle, in a species which he calls Asterias violaceus. A glance at his figures and descriptions will suffice to show us the complete identity between the brachiolar appendages and this peduncle, in which there is a circulation arising from a branch of the water-tube, and at the base of which, at the point of junction of the three arms, we find a peculiar disk, having the same structure as the elliptical disk, noticed at the base of the brachiolar arms in our Starfish larvæ. But we cannot agree with Professor Thomson, that this peduncle is the first sign of an ambulacral tentacle, the ambulacral tentacles being developed at a totally different part of the water-tube.*

Different Types of Larvæ. — Müller did not suspect that his Bipinnaria and Brachiolaria were the larvæ of different species of Asteracanthion. The observations of Sars, who had traced the embryology of Asteracanthion Mülleri, in which the eggs attain their full development without leaving the mouth of the parent, seemed to preclude the possibility of these nomadic larvæ belonging to the same genus. He even went so far as to say that his Bipinnariæ belonged to the same genus as the Starfish of the Bipinnaria asterigera. This is undoubtedly an error, for the Starfish of the Bipinnaria asterigera, as figured by Müller, and by Koren and Danielssen, has already the characters of a Pteraster; and it is evident that the Bipinnaria of Müller, being a young Brachiolaria, which I have shown to be the larva of an Asteracanthion, cannot belong to that genus.

The larvæ which I raised by artificial fecundation from Asteracanthion

* [See also a most interesting paper by Thomson in the Journal of the Linnæan Society, Vol. XIII. p. 57, 1876.]

berylinus and Asteracanthion pallidus — species which have their representatives in Europe, and which have, up to the present time, been included in the same genus with Asteracanthion Mülleri — are free-swimming larvæ, resembling the Bipinnaria of Müller. These facts can, therefore, leave but little doubt that Müller and Van Beneden have observed the larvæ of Asteracanthion rubens *M. T.*, and of allied species, the larvæ of which have been called by them Bipinnaria, Brachiolaria, and Brachina, and are only different stages of one and the same generic type. The difference of the two modes of development of A. Mülleri and A. pallidus is so great, that these two groups of species have been separated into two genera by Professor Agassiz. [Verrill has subsequently placed A. Mülleri in a separate genus (Leptasterias), to which have been added Asterias tenera and A, compta. The former is probably what I have seen called A. flaccida. See also Memoirs Am. Acad. *Fig.* 34, 1864, for an account of its mode of development. Compare also the development of Pteraster militaris, M. Sars, Norges Echinodermer, 1861. (Pl. VI. *Figs.* 3–13).] The Brachiolaria from Trieste and Messina present very striking differences from the northern Brachiolaria. These larvæ are probably the young of Asterias tenuispinus, so common in the Mediterranean. In his revision of the Starfishes, Professor Agassiz has also separated this species from the true Asteracanthion, under another generic name. We have next the Bipinnaria asterigera, still another type of larva, belonging in all probability to another family, differing from both the other larval forms. As Bipinnaria asterigera can only be the larva of a Pteraster, a Ctenodiscus, an Astropecten, or of an Hippasteria, either of which belong to families distinct from the Brachiolaria type of larvæ, we find differences in form, modified by structural features, characterizing the larval conditions, as well as the adult stages of families of the same order; while structural peculiarities in the larvæ characterize the different generic divisions more plainly than in the more advanced conditions. It is evident, from the observations of Professor Agassiz and of Sars, that the Asterias violaceus of Thomson, the embryology of which he has traced in the Microscopical Journal, must be placed in the same genus with A. Mülleri, and may, perhaps, be identical with it, unless the true A. violaceus *L.* has also a similar mode of development. [This would most certainly prove that A. violaceus, at least what the English call A. violaceus, cannot be the male of the European of A. rubens, as has been suggested by several European writers on Star-

fishes.] There is still another type of Echinoderm larvæ, which in all probability are the larvæ of Starfishes, viz. the Tornaria type. [For the history of Tornaria, which has been proved to be the embryo of Balanoglossus, see my paper in the Memoir of the American Academy, Jan. 1873, where the relations of Balanoglossus and Tornaria to Echinoderms and their mode of development are fully discussed.] In this type there is not the excessive development of the ciliary chord into long, slender arms, characteristic of the Brachiolaria; there are only slight, wavy indentations, corresponding to the position of the arms of the Brachiolaria, as we find them in the younger stages of the larvæ (Pl. III. *Fig.* 4; Pl. II. *Fig.* 26). In fact, this type of larva, in its adult condition, seems to be a permanent embryonic type of the younger stages of the Brachiolaria. I would infer from this that the Tornaria will probably prove to be the larva of Ctenodiscus, Astropecten, or Luidia, or of some Starfish with pointed ambulacral suckers. Having had the opportunity to examine several of the Tornaria type of larvæ at Naushon, in different stages of development, I hope to return to this subject at a future time.

[The only important embryology relating to Echinoderms in general published since the distribution of copies of this Memoir in 1864, is that of Metschnikoff.* He has confirmed the explanation I had given of the mode of development of the Echinoderm upon the surface of the water-tubes, the spiral nature of the young embryo, the mode of development of the water-tubes as diverticula of the original imaginated cavity, and the resorption of the pluteus by the young Echinoderm in Starfishes; he has also been able to follow very carefully the mode of development of the water-system of an Ophiuran, and showed its entire agreement with the changes I have traced in the development of the Starfish as far as relates to the formation of the abactinal system and the ambulacral system. Although Metschnikoff has added some new points to the development of Echinoids, still the mode of formation of the original plates composing the test of the young sea-urchin is not yet clearly shown, beyond the very earliest stages. As far as relates to the development of Auricularia, we can form a better idea than formerly of the nature of the change from the Auricularia to the young Synapta; and certainly in a general way this development is different from the normal growth of some of the other

* Studien über die Entwickelung der Echinodermen und Nemertinen, Mem. Acad. St. Petersb. XIV. No. 8. 1869.

Echinoderms (Starfish, Echini, or Ophiurans). The changes in the relative position of the organs remind us strongly of the mode in which the Tornaria gradually passes into a Balanoglossus by a mere difference in the topography of the organs of the Pluteus and of the enclosed Synapta The mode of development of Holothurians seems to be intermediate between the pelasgic pluteus, with its gigantic arms (Starfish, Ophiuran, Echinus) and the sedentary or viviparous development of certain Ophiurans, Starfishes, and Echini. See also the excellent paper by Selenka on Holothuria in Zeitscrif. Wiss. Zool., Vol. XXVII.]

FIFTH CHAPTER.

ON THE PLAN OF DEVELOPMENT OF ECHINODERMS.

We have constantly insisted, during the whole of this Memoir, upon the radiate plan of our Starfish larvæ in their different stages of growth. We have, however, seen that this radiate plan of structure, at certain periods of their existence, is so far hidden by the apparent bilateral arrangement of the locomotive appendages as readily to escape notice. We have also had occasion, in discussing the development of these apparently bilateral appendages, to show that Müller's views of the bilateral nature of these larvæ were founded upon mistaken analogies. It now remains for us to examine, somewhat in detail, the theory put forth by Huxley, in his review of Müller's observations, concerning the articulate nature of the Echinoderm larvæ. The facts already stated respecting the development of these larvæ show that they have only a very remote analogy to some of the larval forms, quoted by Huxley in order to strengthen his interpretation of the investigations of Müller. Misled, perhaps, by the names which Müller has given to some of these larvæ ("Wurmförmige Larven"), he has allowed this analogy to influence him so far that he revives the old opinion of Oken, and refers the Echinoderms to the type of Articulates. [See my Memoir on Balanoglossus, for a later review of the views of Huxley, Haeckel, and others, who have urged the affinities of Echinoderms with worms.] Huxley has given us no observations of his own, bearing upon the subject, but endeavors to justify his assertion by reducing all these forms to one hypothetical type, having an elongated form, a straight intestine, with the mouth at one extremity, the anus at the other, and girded by a circular ciliated fringe, just like the larvæ of some Annelids. The region in front of the ciliated fringe he calls *prætrochal*, and the region behind the fringe *postrochal;* and then, by an ingenious process, he shows how all these different forms might be produced by the greater or less development of one or other of these region. He

then attempts to prove, further, that there is an intimate connection between the point where the young Echinoderm is developed, and the position of the rows of vibratile fringes; Starfishes being, according to him, developed in the postrochal and the Echini in the prætrochal region. Any one who has observed these larvæ alive cannot fail to see that whatever may be the position of these vibratile fringes, the young Echinoderm, whether it be an Echinus, a Starfish, or an Ophiuran [also a Holothurian Selenka], is developed in exactly the same spot on the sides of the stomach, upon the outer surface of opposite water-tubes, one of them forming the actinal, the other the abactinal surface of the future Echinoderm. The hypothetical form of Huxley is indeed one which has never been observed, as in all larvæ of Echinoderms the mouth and anus are always on the same side, viz. on the lower surface of the larva. It is only during the first few days, after hatching from the egg, that the so-called mouth is placed at one end; this, however, is not observed beyond the time when this opening performs the double function of mouth and anus, and leads into a very short digestive cavity. By the time the true mouth begins to be formed, the future anus, which has served the purpose of mouth thus far, has already changed its position to the lower side. The mouth is, in fact, never formed at one extremity, but always in the centre of the lower surface, and only some time after the anus, which performs the functions of a temporary mouth. This has been demonstrated by Krohn and myself, with reference to the Echinus larvæ, and I trust that the preceding pages have shown it to be also the case with our common Starfish. [See also Selenka for Holothuria.] The division into rings, of what Müller calls the Wurmförmige Asteridenlarve, is only an optical delusion, due to the lines formed upon the abactinal surface during the closing of the pentagon.

The radical difference in the mode of formation of the œsophagus, stomach, and intestine, in the Echinoderm larvæ, as compared with the larvæ of Annelids, a number of which, including those most resembling Echinoderm larvæ, I have examined myself, will, perhaps, be the strongest proof that they do not belong to one and the same type. The digestive cavity of Annelid larvæ is formed by the liquefaction of the interior of the larva, while in the Echinoderm larvæ the digestive cavity is formed by the bending in of the outer wall of the larva itself. The superficial resemblance of Annelid larvæ to those of Echinoderms is due to the appendages surrounding the mouth, while the principal appendages of the Echini

and Starfish larvæ are developed from the vibratile chord developed round the anus. Nothing is more characteristic of the Echinoderms among Radiates than the isolation of the digestive cavity by means of distinct walls. This feature is so strongly marked that a larva can be recognized as an Echinoderm larva before its radiate characters are developed. It is only later that the circular tube, the water-system, is formed, while the ciliary appendages, which have nothing to do with the formation of the Echinoderm, make their appearance later still long after the first rudiments of the Echinoderm (the water-tubes) are present.

It seems to me that the different modes of development in Holothurians, Echini, true Starfishes, Ophiurans, and Crinoids, different as they are apparently, may easily be reduced to a single type. [See the Memoirs of Metschnikoff on the affinities of Echinoderms, in Siebold's Zeitschrift for 1874. Since this paper was written Haeckel has put forth his views of the relationship of the Sponges and Cœlenterates, and of the Echinoderms and Worms. As the whole subject is intimately connected with the history of Tornaria and Balanoglossus. I would refer to my Memoir* for an analysis of the modifications which these views are likely to bring about regarding the classification of Echinoderms and of Cœlenterates; also to my Memoir on the Embryology of Ctenophoræ, Mem. Am. Acad. 1874.] We have in Ophiurans two different modes of development, — one by means of the Pluteus, the other by means of the viviparous mode of development observed by Krohn and Schultze. We have two similar modes of development in the Starfishes, — the one as observed by Sars and Agassiz in Echinaster, the other in which the embryo assumes the shape of a Bipinnaria or Brachiolaria; and, finally, in the Holothurians we have these two modes represented by the Auricularia type and the type of the "Wurmförmige Holothurienlarve." [See also for Echini Thomson's paper in Journal Lin. Soc. and A. Agassiz, Viviparous Echini from Kerguelen, Proc. Am. Acad. 1876.] The difference between these two modes seems to be one of time; in one case, the eggs are retained by the parent until they have passed through many of their changes, and are freed in a stage corresponding to that of our young Echinoderm after it has resorbed its Pluteus, its Brachiolaria, or its Auricularia. In the other case the egg goes through all these changes after it has left the parent, developing this complicated system of arms, which seems to be

* A. Agassiz Balanoglossus and Tornaria in Memoirs American Academy, 1873.

simply a means of locomotion for the young Starfish till it shall have acquired a sufficient size to be able to take care of itself, and use its suckers as organs of locomotion.

Have we not here, in Echinoderms, something analogous to what we have in Discophorous Medusæ? In Cyanea and Pelagia, for instance, where, in one case, the young Acaleph passes through a Scyphistoma stage before it reaches the Ephyra condition, while in Pelagia, on the contrary, the Ephyra is at once produced from the egg, without passing through the Scyphistoma stage.

I think it can be easily shown that there is, in reality, no difference between these two modes of development; it is merely a question of quantity. In Cribrella, in Pluteus, in Brachiolaria, or in Auricularia, the young Echinoderm is developed on the outer surface of the water-system. The water-tubes obtain a great prominence in Auricularia, in Brachiolaria, and in the Pluteus-like form of the Ophiurans and Echini, while in types of development like those of Echinaster they remain more rudimentary; the only appendages developed in this last type being those which correspond to later periods of growth in the Starfish larvæ, viz. the brachiolar appendages. The peduncle and its appendages, by means of which the young Echinaster fastens to the rocks, are strictly homologous to the brachiolar appendages of our Starfish larvæ. In fact, when the young Starfish has resorbed all the arms, and there is nothing left of them, except a few swellings on the actinal side, to mark their former position, the brachiolar appendages are in exactly the same position as that occupied by the peduncle of the Echinaster larva. Had we known nothing of the previous modes of development, and found those young Starfishes in the open sea in this stage, nothing would have been more natural than to have assumed that they had reached this condition by the same mode of development. The cavity noticed in the peduncle of the Echinaster larvæ is part of the water-system, corresponding to the branch of the water-system leading into the brachiolar arms of our Asteracanthion larva.

The same is the case with the two modes of development of Ophiurans and of Holothurians; they are shorter ways of arriving at the same point, whether they pass through what we shall call hereafter the Pluteus type of development or the Echinaster type; in either of the orders it is one and the same thing differently carried out. The larvæ of our Cribrella,

which I have had frequent occasion to examine, have satisfied me that the process of development is the same, with the exception that it is shorter. The larvæ of Ophiurans examined by Professor Agassiz at Charleston would lead to the same conclusion with reference to the Ophiurans; while, from the drawings of Müller, it is easy to satisfy one's self, with the above data, that the two types of development of Holothurians examined by him are only modifications of each other. As the only larvæ of Holothurians which I have seen belong to the "Wurmförmiger" type, I am unable to state this from actual observation. It is evident that we have also in Comatula these two types of development. Professor Agassiz frequently observed that in a species of Comatula found in Charleston, S. C., the young embryos remain attached to the parents; while Thomson and Busch have found the larvæ swimming freely about.

[An important paper on the development of Comatula by Goette, in the Archiv für Microscopische Anatomie for April, 1876, gives us the early stages of its embryo. Goette shows conclusively that the type of the crinoidal development is echinodermoid. We have, as in Echini, Starfishes, Ophiurans, and Holothurians, an original digestive cavity, from which arises the water-system, as diverticula. This observation is in direct contradiction to that of Metschnikoff, who distinguishes the Crinoids from the other Echinoderms by the absence of these processes. Goette's observations of the early stages are, however, in complete agreement with the usual mode of development among Echinoderms. Unfortunately the subsequent stages are all figured from embryos preserved in osmic or chromic acid, and while I have the greatest respect for Goette's technical skill, the very fact that in so many general points he differs, both from Metschnikoff and myself, throws considerable uncertainty on the whole of his memoir. He begins by stating that the larval mouth (the subsequent anus of the other Echinoderms) is entirely obliterated. As he has not followed this from living embryos, we must be pardoned if, knowing, as we do, the difficulty of tracing the gradual changes in living embryos of the most transparent kind, we doubt many of his conclusions obtained from the study of opaque embryos acted upon by reagents. Although Goette has derived his knowledge of the present paper from the excellent abstract in Leuckart's Jahresbericht, he has not only credited me with a very indifferent treatment of the embryology of

Echinoderms, but also with several errors contained neither in the abstract nor in the original. He does not appear to know my paper on the Embryology of Ctenophoræ, nor on Balanoglossus, published in the Memoirs of the American Academy in 1873 and 1874, and distributed at the time; consequently, in what he now writes, the older views regarding the affinities of Echinoderms with Cœlenterata and Annelids, which had been discussed from a different standpoint, do not receive the least recognition.

The mode of development of these two types having been shown to be on one and the same pattern, modified in such a way that a like result is reached either by fewer stages or by a greater or less rapidity in the process, it remains for me to show that the larvæ we have had before us, in the complicated form of a Brachiolaria or a Pluteus, is really built upon the radiate plan. We find a good starting-point in the water-tubes, which, as I have shown, become the circular tube of the young Starfish, from which the ambulacral system is afterwards developed. This water-tube, it is true, is not circular; it is not continuous, and yet it is the homologue of the circular tube of Acalephs, the radiating tubes being developed only afterwards, when the pentagon of tentacles is formed. The mouth is placed within this circular tube; and the fact that the mouth of the larva is brought, by the contraction of the œsophagus, close upon the stomach, does not change its position with reference to this circular tube. The water-system contracts with it, changes its position, and surrounds eventually the new opening, by the flattening and closing of the Starfish.

The Brachiolarian and Plutean stages are the Acalephian stages of the Echinoderms, corresponding to the Hydrarium forms of the Acalephs, in their Polyp stage; while the arms of the Pluteus stage, with their cords of locomotive cilia, recall strongly the strange filiform appendages of portions of the spheromere, covered with locomotive flappers as in Euramphæa, and other Ctenophoræ. The resemblance of the larvæ of Echinoderms to Ctenophoræ had already been pointed out by Baer, and more recently by Professor Agassiz, who was not then acquainted with the observations of Baer. This comparison seems to have found but little favor with more recent investigators. Leuckart, in his Bericht for 1862, simply says that no further proof has been adduced by Professor Agassiz to show that the homology holds good. A writer in the Natural History Review for 1861

seems to consider the whole comparison so puerile as not to be worth even a moment's consideration; and the off-hand way in which he dismisses the whole subject shows his total want of appreciation of the arguments by which this view is supported. If the writer of the said article had ever seen the young of Brachiolaria, of Pluteus, or, still better, the young of Tornaria, swimming about amongst crowds of young Ctenophoræ, such as Idyia, Pleurobrachia, Mertensia, or Bolina, he would not have passed such a sweeping judgment on this comparison. The motions of a Tornaria are so similar to those of young Ctenophoræ, that I venture to say that many a skilful naturalist would be deceived as to their true nature, on first seeing them moving about together in the water. The Tornaria has no appendages developed into long arms as in the adult Brachiolaria or Pluteus. The appendages remain always abortive, the larvæ in their adult condition resembling young Ctenophoræ. From an examination of drawings given by Müller, Professor Agassiz was induced to make the same comparison already hinted at by Baer, and we have seen that it is sustained in every particular. Gegenbaur has also noticed the resemblance between young Trachynemæ and Echinoderm larvæ.

From what has been said, it is evident that the plan of radiation underlies this apparent bilaterality of the Brachiolaria and of the Pluteus. The throwing of the whole of the stomach and the alimentary canal on one side, the complicated system of arms arranged with perfect symmetry on each side of the axis, passing through the mouth and the anus, does not change, though it partially conceals, the radiate plan. We have Holothurians which always creep upon three of their ambulacra, where a dorsal and a ventral side, an anterior and a posterior region, are subordinate to the plan of radiation; and the same takes place to a less extent in Spatangoids. Among Polyps even, which are, as it were, the simplest type of radiate animals, an anterior and a posterior region are strikingly shown in the case of Arachnactis. The additional spheromeres are all added at one extremity of the mouth-slit, and yet the Actinia is made up of radiating spheromeres. The earliest stages of the larvæ of Echinoderms, before the appearance of the water-tubes, reminds us forcibly of the young Actinia soon after it has escaped from the egg, or of the first stages of growth of a Scyphistoma, after it has attached itself to the ground, previous to the formation of tentacles. Let us now consider what constitutes the difference in the structure of these animals in their primary stages

of growth, as far as the different classes of the type are concerned. They are all built according to one and the same plan, yet this plan is so carried out as to be eminently echinodermoid in one instance, acalephian in another, and polypoidal in a third. In young Echinoderms, as in young Ctenophoræ, we find nothing of the remarkable preponderance of certain parts which gives these young their bilateral appearance in more advanced conditions. Their radiate character is extremely prominent at first, but becomes gradually obscured and hidden under the guise of this bilaterality, which is, after all, due only to the excessive development of certain spheromeres as compared with the others.

The case of these larvæ is only an additional example of what we find so often in nature, that a plan of structure which seems to prevail is in reality only an external analogy produced by great predominance in certain parts, but subservient to the primary plan, even though the latter be perceived only on closer examination. This view solves a question which has hitherto perplexed all investigators of this subject, viz. how it was possible that a larva, which has always been considered as bilateral, should produce a radiate animal by a process of internal gemmation. It is, indeed, a bilateral larva, but built upon a radiate plan; a larva recalling a lower class of this branch of the animal kingdom, an acalephian larva giving rise to an Echinoderm, which, from its very beginning, is a radiate animal, having all its spheromeres developed at the same time, and equally.*

These transformations are, however, peculiar to the class of Echinoderms; they constitute neither a metamorphosis nor a case of alternate generation. The egg becomes the embryo larva, nothing essential is lost during the process, no intermediate individual comes into the cycle. It is the yolk which becomes the larva, the latter being, in its turn, transformed into the young Echinoderm. This larva is, in short, an Acalephian larva, reminding us somewhat of the twin individuals of free Hydroids, the Diphyes, though adapted to the mode of development of the Echinoderms. But in the latter we have no intermediate condition corresponding to the Polyp-like Hydroid in Acalephs from which the Medusæ or reproductive individuals arise, and in their turn, bring forth the Hydroid again, which completes the cycle by developing another set of Medusæ.

* For a closer comparison of young Ctenophoræ and Echinoderm Larvæ, see the Chapter on Ctenophoræ, Illustrated Catalogue of the Museum of Comparative Zoölogy, No. II.

If the views here taken of the plan of development of Echinoderms be correct, they introduce a new set of facts respecting their affinities with the Polyps and Acalephs, which cannot fail to have an important bearing on the question of the separation of the Echinoderms as a distinct type from the two latter groups. The Echinoderm plutean form, with its mouth, stomach, intestine, and with its water-system originally forming a part of the digestive cavity, bears, as it seems to me, the same relation to the Ctenophoræ which the Hydroid Polyps hold to the true Polyps. The Ctenophoræ may be considered, as it were, the prototype of the Echinoderms, as the Polyps are the prototype of Acalephs. We have in the Ctenophoræ a digestive cavity, from which branches the water-system, and that peculiar funnel opening outwards, through which the fecal matters of the Ctenophoræ are discharged, reminding us at once of the almost identical arrangement of an Echinoderm Pluteus, in the relations of the intestine to the stomach. The plutean forms certainly show that the plan upon which the Echinoderms are built does not differ from that upon which the Acalephs are built, and that we have between the Echinoderms and Acalephs the same connection, based upon identity of plan, as exists between the Acalephs and Polyps. We cannot, therefore, admit that the views so frequently urged and so universally admitted, in support of the separation of the Acalephs and Polyps as a distinct type (Cœlenterata), from the Echinoderms, have any real foundation in nature; and still less can we concur in them when we remember that the main argument in their favor rests upon the assumed total want of connection between the ambulacral system and the digestive system. This connection has been shown by Professor Agassiz to exist in the adult of many Echinoderms, while the facts above stated prove that it also exists in the early stages of the embryonic development, where, in fact, the water-system is formed from the digestive system. With this evidence falls the strongest argument for the validity of a classification by which the type of Radiates would be broken up, and the Polyps and Acalephs separated from the Echinoderms, as a distinct type, under the name of Cœlenterata. We are, therefore, justified in affirming that the type of Radiates constitutes an independent type of the animal kingdom, containing three equivalent classes, — Echinoderms, Acalephs, and Polyps.

PART II.

ON THE SOLID PARTS OF SOME NORTH AMERICAN STARFISHES.

HOMOLOGIES OF ECHINODERMS.

Comparatively little use has been made thus far, in the study of Starfishes, of the structure of their hard parts. With the exception of the short paper by Gaudry, the occasional references to them in sundry memoirs of Müller, Duvernoy, Agassiz, Perrier and others, only show that we know but little of the solid frame concealed under the mass of appendages covering a starfish. The study of these solid parts is instructive, as it throws new light on their homologies with other Echinoderms, and enables us to form a better idea of the relationship between Ophiurans, Echini, and Starfishes. The homology between these orders, as usually understood, can be stated in a general way as follows; the great development in Starfishes of what has been called the tergal system, covering the centre and arms, forming a system where no special regular arrangement could be traced, joined to the presence of distinct ambulacral and interambulacral plates, limited to the furrows occupying the lower face of the arm; also the absence of specialized genital plates, or anal plates, and the presence (in some genera) of a special ocular plate. The essential character in a general way of the Ophiurans as distinguished from Starfishes is the presence of genital plates, and the limitation of the tergal plates to a comparatively simple casing, consisting of few plates enclosing an ambulacral system, no interambulacral system having been traced; while in Echini the tergal system is reduced to a minimum, ocular and genital plates being present, and the ambulacral and especially the interambulacral plates greatly developed.

From the more careful examination of Echini a hypothetical Echinoderm was formerly established, which has served as the type to which the other Echinoderms were to be reduced, and with which they should homologize. In the absence of embryonic data, however, the fundamental facts derived from the study of young Echinoderms already point to

a different interpretation of the Echinodermoidal homologies. Taken in connection with our knowledge of the hard parts of Starfishes as compared with those of Ophiurans and Echini, they throw much light upon many imperfectly known structural features of Crinoids. The living Crinoids, on account of their small number, have till recently seemed to promise but little help in explaining the fossil forms. The collections of the Challenger include, however, a variety of stalked Crinoids, and until the information to be derived from them is on hand it does not seem advisable to extend the comparison of the hard parts beyond the more common orders.

All young Echinoderms, while still in the Pluteus stage, or soon after its resorption, are strikingly alike. They all have an actinal and an abactinal area. The actinal area is occupied almost entirely by the ambulacral canals radiating from the central ring enclosing the actinostome, with their lateral ambulacral tubes existing as mere loops, the different tubes not being as yet encased in any limestone plates. The abactinal surface consists of the outer integument, in which rudimentary plates begin to appear, made up in the early stages merely of Y-shaped rods, more or less closely connected together, so as to form patches of reticulated network to become in the future the solid plates of the Echinoderm.

Thus far all Echinoderms are alike, and show no structural difference between the different orders. We shall greatly facilitate our examination of them by beginning our comparison at this early and uniform stage, so that we may see how far we can, by merely tracing the development, explain the mode of differentiation by which the orders gradually assume the structural features of the adults.

Before proceeding any further in this comparison, I must state that I have given already in detail* my reasons for considering the Echinoderms as more closely related to the Polyps and Acalephs in opposition to the view lately revived of their affinity to Worms. I have stated the objections mainly on embryological grounds, by comparing the development of the most Echinodermoid larva among Annulata, that of Balanoglossus, with other vermiform Echinoderm Plutei. Haeckel has recently strongly urged, on theoretical grounds chiefly, their annulate

* See A. Agassiz, Embryology of Ctenophoræ; Revision of the Echini; The History of Bananoglossus and Tornaria.

affinity, and has assumed the composite nature of Echinoderms, which he considers as a colony of five persons united at the buccal extremity in a somewhat similar way to that of a colony of compound Ascidians having a common cloacal opening.

He considers each arm of a Starfish, for instance, — and it will apply equally well to any Sea-urchin, — as made up of a series of distinct articulations, just as well marked as the articulation of any Annelid. To a certain extent this analogy is correct; we find a repetition of very similar parts, a remarkable vegetative capacity in all Echinoderms, which at first glance might seem to be of great importance as confirming their articulate affinities. Yet the earliest stages of the young Echinoderms in the Pluteus show beyond doubt that they have nothing in common with a community.

As well might we compare the simple chymiferous tube of an Acaleph with a single individual, and make a many-rayed Zygodactyla a community of individuals with a single central digestive cavity. The very fact that we can trace the passage between an Acaleph with a polymeral chymiferous system like Zygodactyla and a Siphonophore zoid in which we can trace but a single chymiferous tube, shows, at any rate, that the number of ambulacral tubes should not be taken as any proof whatever of a composite structure. When we come to the articulation of the arms, can we consider that as anything beyond the adaptation of the ambulacral system to the deposition of limestone plates, allowing certain limited movements? In the whole order of Echinoderms traces of this adaptation can be seen, as in some genera of Echini, which, like Astropyga and the Armored Echini, retain a more or less movable test, while in Holothurians the limestone deposition is reduced to a minimum, the latter showing the range of a dermal and closed ambulacral system, while the Ophiurans show the limits within which the articulation can be developed in the Starfishes proper (Crinoids not being in question at present). In consequence of this articulation and their presumed Annulose affinities, Haeckle does not hesitate to derive Echinoderms from worms, but as far as the orders of Echinoderms now known are concerned, it seems impossible to imagine, even with the light palæontology has thrown upon their appearance, how they have succeeded one another, much less whence they have been derived. We can readily see from the presence of several of the orders of Echino-

derms in the older geological deposits, that, if any development from one order to another has taken place, it must have been during much earlier geological periods. As far as we now know, palæontology throws no light whatever upon such a transition, however possible it may seem from embryological data. Starfishes, Ophiurans, Echini, and Crinoids existed in the oldest-known Echinodermoid fauna, having all the typical features of Echinoderms of our day, or only so far modified as to be readily homologized with them. If there has been such a thing as a single ancestral Echinoderm, his primordial descendants early assumed different lines of development diverging to a great degree, and retaining their characteristics from the earliest-known geological period. This at least appears to be the case with Starfishes * and Ophiurans; while the different groups of Crinoids which have appeared and vanished are numerous as compared to those of the other orders.

The Echini again continued to develop until the secondary period with very little modification, and only after the Jurassic period did the marked changes begin through which they subsequently pass; changes fully equalling those of the Crinoids in their earlier geological history.† And yet, great as these changes have undoubtedly been, were we to measure them simply by palæontological evidence, we must remember that they are not greater in degree than the changes known to take place among the Echini of the present day during their embryological development. But while the successive appearance of the great types of Echini in geological time — in other words, their palæontological development — is in the strictest harmony with what we know of their embryological development,‡ we as certainly know nothing whatever of the causes which have brought about their sequence in time, in such striking agreement with

* The attempt made by G. O. Sars to prove Brisinga to be the living representative of the palæozoic Starfishes seems to be very far-fetched, and I must acknowledge I have been unable to see any such radical difference between Brisinga and ordinary Starfishes (Solaster, Crossaster, and Pycnopodia, for instance) as Sars insists upon in his Memoir on Brisinga. The type of Starfishes, as I have already shown, has been remarkably persistent from the earliest geological periods to the present day, and there is no indication that the Starfishes now living have undergone such changes as to make the agreement of Brisinga or other genera with the older forms a matter worthy of especial notice as survivals or representatives of the earlier types.

See also the view taken by Lütken in regard to the affinities of Protaster in his Ophiur. Add. III.; he does not agree with the view taken by Sars.

† See A. Agassiz's Revision of the Echini, Part IV.

‡ See Part IV., Revision of the Echini, by A. Agassiz.

the sequence in their phases of growth. All we can say at present is that the course of the embryological development of the Spatangoids is such that we can, as it were, read off upon it the sequence of echinoidal development since the Jurassic time in the developmental history of some genera of that group. In the one case, however, this development is accomplished in the course of a few years, in the other it stretches over a comparatively infinite period. We have no data for any such comparisons in the other orders of Echinoderms.

The case of successive modifications of the ancestral horse, which has so often been brought forward as conclusive regarding the genealogy of the group, although more familiar, is far less complete and much more limited in time than the succession to be traced from the palæontological evidence of Echini. But while natural selection gives a plausible explanation of like problems among Vertebrates, it fails utterly when applied to the majority of the Invertebrates, and we have completely failed thus far to find any causes for their palæontological development differing from those acting upon their successive embryological stages at the present day, of which we know absolutely nothing.

Let us return now to the comparison of the changes undergone by the embryo Echinoderm from its earliest post-Pluteus stages, until the structural features characteristic of the several orders are clearly differentiated. The actinal and abactinal surfaces of the embryo Echinoderms in the different orders are, as has been stated, identical; and it would be impossible to characterize them from early stages immediately following the resorption of the Pluteus, in the same way as from the adult. The abactinal surface consists, in all cases, of a central plate, round which are arranged radial and interradial plates, while the actinal surface is entirely occupied by the pentagonal rosette of the water-system, held by the abactinal system as it were in a cup, — a combination which is strictly crinoidal. It is only later that ordinal distinctions appear, but in such succession as to show that the homologies of the several orders as usually understood are not correct.

In the case of the young Starfish the radial plates of the abactinal system, which form the dorsal part of the arms, gradually extend towards the edge of and down on to the actinal side, enclosing the water-system little by little, and finally, as has been described, covering the ambulacral tube, leaving only openings for the passage of the tentacles. This is a stage which

is passed through by Ophiurans and Echini as well as Starfishes, the only difference in the subsequent development being that the Ophiurans always remain in an embryonic condition, closely resembling the one just described. In the Starfishes the actinal plates formed by the bridges separating successive pairs of tentacles become resorbed along the central line, the edges forming inwardly by spurs the true ambulacral plates, and the plates which little by little develop so as to form the edge of the arms are likewise formed from the plates originally a part of the abactinal system. Those which are on the outside of the tentacles become the interambulacral plates, but differ in no way from the plates forming the sides of the arms. In the case of the Starfishes these side arm-plates are often very numerous; in the case of the Ophiurans they are reduced to a minimum, the upper arm-plate being, as in young Starfishes, very prominent and distinct, while the lower arm-plate is formed by the junction of opposing spurs of the interambulacral plates, as can readily be imagined from a comparison with Brisinga, where we find a spur from the interambulacral plates extending nearly one third across the arms. We must only remember that in Ophiurans the lower arm-plates represent the original plates derived from the abactinal side extending across the tentacles, while in Brisinga and Starfishes the median part of the plate has become resorbed, so that the tentacles passing between the ambulacral plates are inside of the interambulacral plates, while in Ophiurans they pierce the connected interambulacral plates (or the lower arm-plate).

Something analogous to what takes place in Ophiurans occurs in Echini. The plates which cover the water-system never become resorbed (as in Starfishes); there is no internal ambulacral system of plates developed, from the fact that new plates in the Echini are always developed near the basal plate (the apical system), while new plates in Ophiurans and Starfishes are invariably formed at the extremity of the arms. In Echini, therefore, the extremity of the water-system (the ocular tentacle) remaining connected with the original apical system, the water-system thus forms a loop, one end of which is attached to the so-called ocular plate, while the other connects with the circular canal at the mouth, and hence, both ends being fixed, the new plates must necessarily cover the water-system, while in Ophiurans and Starfishes, one end alone being fixed, it is possible, as in the case of Starfishes, for the water-system, owing to the resorption of the central part, to appear in a peculiar position. But in spite of this similarity

in the position of the water-tube in Echini and Ophiurans, the latter are really more closely allied structurally to Starfishes than to Echini. This will readily account for the position of the water-system inside of the test in Ophiurans and Echini, contrasted to the Starfishes. We can also homologize Holothurians with Echini by supposing that in that group the limestone plates never form ambulacral and interambulacral plates, but that the abactinal system of the embryo, as it elongates, covers irregularly the water-system, the suckers of which pierce the plates as they do in the embryonic stages of other Echinoderms. In fact, the external limestone plates forming the test of a Sea-urchin, the reticulated network of the actinal and abactinal surface of a Starfish together with the ambulacral and interambulacral plates and the plates forming the disk of an Ophiuran, the upper, lower, and side arm-plates, as well as internal skeleton, are all directly derived from the simple system of limestone plates of the abactinal surface of the Echinoderm embryo. This system consists, in all cases, of a basal plate, five radial and five interradial plates. In Ophiurans the genital plates are formed from the angles of the five interradial plates; similar plates can still be traced in the young Starfishes, while in the full-grown Starfishes their presence is shown by the interbrachial partition, on each side of which the ovaries discharge. Thus there exists a complete homology between the genital plates of Ophiurans and the interbrachial partitions of Starfishes, a homology fully carried out in its details when we examine the relations held by the genital plates to the ovaries in Ophiurans and by the interbrachial partitions to the ovarian openings in Starfishes.

From the primitive number of plates existing in the disks of all embryo Echinoderms, it is evident that palæontologists have laid altogether too much stress upon the arrangement of the plates of the arms in Crinoids. The study of the solid parts of Starfishes, while valuable as accessories, would certainly furnish no very satisfactory data for a classification, at least if this were based entirely upon an examination of the hard parts of the abactinal system alone, as is so frequently the case in Crinoids.

HARD PARTS OF SOME NORTH AMERICAN STARFISHES.

ASTERIAS.

In the genus Asteracanthion (Asterias) the true character of the plates of the abactinal and actinal surfaces is far more difficult to trace than in other genera where the plates retain more or less homogeneous features.

In Asteracanthion, although in the younger stages (as shown in Plate VIII.) the reticulation consists entirely of plates readily distinguished one from the other, yet in the adult the plates have become changed to a mere irregular network anastomosing in all possible directions (Pl. IX. *Fig.* 3), and thus rendering it quite difficult, if not frequently impossible, to trace the connection of the actinal and abactinal reticulation with the interambulacral plates.

In the majority of species of this genus the plates adjoining the interambulacral plates are cross-shaped (Pl. IX. *Fig.* 6), connecting with adjoining plates at three ends, in front, behind, and towards the abactinal surface; the other end connects with the interambulacral plates. These plates lose their regularity as they ascend towards the abactinal side on the edge of the arms, the prongs becoming gradually short processes, and finally simply rods or irregularly shaped plates all more or less imbricating (Pl. IX. *Fig.* 4). The spines are generally attached to the rods by a very shallow socket fitting into a rudimentary tubercle and ring. The spines of the interambulacral plates are movable, those of the actinal and abactinal less so, and frequently soldered to the reticulation.

Asteracanthion berylinus.

Asteracanthion **berylinus** * Ag., A. Ag. 1863. Proc. Amer. Acad. Boston.

Asterias **Forbesii** Des. 1848. Proc. Bost. Soc. Nat. Hist., III. p. 67.

Pl. IX.

The base of each of the interambulacral plates at its junction with the ambulacral plates is marked by a pore for the passage of a water-

* For the typography used to explain the synonymy, see A. Agassiz, Revision of the Echini, p. 26.

tube (Pl. IX. *Figs.* 5, 6) between this plate and the following reticulations, forming a part of the sides of the arms; similar pores are found arranged like the first row of pores in a line parallel to the longitudinal axis of the arms. The other water-pores are irregularly placed over the surface of the arms.

Near the mouth the interambulacral plates come together in the angle of the arms and form the mouth-papillæ so called. They are readily seen in a Starfish examined from the lower side (Pl. IX. *Fig.* 5) when denuded of spines. Seen from above (Pl. IX. *Fig.* 6, an interior view), the connecting plate between adjoining ambulacral systems is formed by the rising of the outer edge of the plate (the outer pore not being present) towards the limestone network formed by the junction of the interambulacral imbricating pieces which constitute the framework of the abactinal system.

This structure is best seen in large specimens of A. vulgaris, in which the alternate arrangement of the ambulacral plates commences at once at the base of the arms, and where the interbrachial fold at the angle of the arms is high and well set off from the pores left for the passage of water-tubes.

The spines placed on the junction of the interambulacral plates (*a''*, Pl. IX. *Fig.* 5) form the papillæ (Pl. IX. *Fig.* 6), near the actinal opening; they differ in no respect from the other spines.

The arrangement of the pores in double rows (Pl. IX. *Figs.* 5, 6) for the passage of the ambulacral suckers is, as is well known, only due to age, owing to the crowding of adjoining plates; in large specimens there is no trace of the original linear arrangement of the ambulacral pores beyond the plates nearest the actinostome or at the extremity of the arms. But while the ambulacral pores thus alternate, the plates themselves extend entirely across from the median line to the interambulacral plates; they are wedge-shaped, the broad and pointed ends of adjoining plates alternately extending to the median line of the arm or to the edge of the interambulacral plates (Pl. IX. *Figs.* 5, 6). See a note on the fecundation of A. berylinus and A. vulgaris in Archives de Zool. Expér., which suggests a plausible cause for the great number of varieties of the genus Asterias. A. Forbesii (berylinus) extends from Halifax, N. S., to Florida, while A. vulgaris (pallidus) has a more limited southern range, and extends farther north, from Labrador to Long Island Sound. In Massachusetts Bay the two species are about equally common.

Asterias ochracea.

Asterias ochracea Br. 1835. Prodrom.

Pl. XI.

The striking differences which apparently exist on a cursory examination of the species allied to A. ochracea are not found to be of sufficient importance, when analyzed, to warrant us in considering the genus Pisaster, as recognized by Professor Agassiz, anything more than a convenient systematic generic subdivision; the special points of difference are the great width of the ambulacral system, its elongated plates, the breadth of the furrow forming the median ambulacral ridge (seen from the interior) (Pl. IX. *Fig.* 5), the proximity of the openings for the passage of the ambulacral tubes on each side of the median ridge, with the corresponding slender interambulacral plates carrying only one row of long spines at the outer extremity. When denuded of spines the reticulation of the actinal surface of the arms adjoining the interambulacral plates forms a close pavement with small interstices (Pl. XI. *Fig.* 4); the tubercles carrying the spines are arranged in three or four rows at right angles to the longitudinal axis of the arm; they have a deep slit at the top of the boss; these tubercles are connected laterally by a comparatively low ridge. In the reticulation of the abactinal surface of the arms the primary spaces are quite large, but these are greatly subdivided by a secondary system (Pl. XI. *Figs.* 1, 2) (more or less prominent), consisting of smaller plates, most irregular in shape, which encroach upon the primary areas and subdivide them again, or materially reduce the area through which the water-tubes can be protruded. The reticulation of the actinal surface carries large club-shaped spines of moderate length, while the spines of the upper surface are shorter but similarly shaped, presenting the appearance of having been ground down so as to form nearly continuous walls on the separating ridge of the reticulations (Pl. XI. *Fig.* 1). The interambulacral papillæ are generally cylindrical, sometimes pointed or somewhat club-shaped at the tip, contrasting with the generally flattened and slightly spatulate interambulacral spines of Asteracanthion proper. The interbrachial partition (Pl. XI. *Fig.* 5) is naturally very well developed, owing to the great number of narrow interambulacral plates from which the brachial reticulations arise. The whole reticulation of the arms is far more solid than in any other group of species of Asteracanthion (Asterias); compare Pl. IX. *Fig.* 6, the

corresponding interbrachial partition of A. berylinus, and also Pl. XI. *Fig.* 4, the prolongation of the plates separating adjoining ambulacral systems in A. ochracea and in A. berylinus (Pl. IX. *Fig.* 5). To show the difference in the thickness of the limestone reticulation of the abactinal and actinal systems compare Pl. XI. *Fig.* 3, and Pl. IX. *Fig.* 4, which are similar views of the interior of the abactinal systems of A. berylinus and A. ochracea, or compare the horizontal sections shown in Pl. XI. *Fig.* 5, and Pl. IX. *Fig.* 6. The range of Asterias ochracea is from Sitka to San Diego, California; it is the most common species of Starfish on the coast of California.

Echinaster sentus.

Asterias **sentus** SAY, 1825. Journ. Acad. Nat. Scien. Phila., V. 143.
Echinaster sentus VERR. 1867. Notes on Radiata.

Pl. X.

The meshes of the abactinal limestone network are larger than in Asteracanthion, especially near the centre of the disk, where the irregular polygonal spaces covered by the abactinal membrane are quite large (Pl. X. *Fig.* 3). The same loose structure extends a short distance along the abactinal surface (Pl. X. *Fig.* 4) and the sides of the arms; but towards the extremity the meshes become smaller, and on the actinal side, immediately adjoining the interambulacral plates, the limestone work is quite compact (Pl. X. *Figs.* 5, 6), and leaves only a few small openings for the passage of the water-tubes.

In addition to the water-tubes in the actinal surface of the arms, there is a row of very large tubes (Pl. X. *Fig.* 1′) passing between the interambulacral plates. The madreporic body differs considerably from that of Asteracanthion, and is not as well separated or as distinct from the general abactinal surface as is the case in that genus.

The interambulacral plates, forming the so-called teeth, are larger than the others; they form the extremity of the single lateral rows (Pl. X. *Fig.* 5), and do not make a partition or division-wall between adjoining ambulacra, as in Asteracanthion proper, the actinal part of the limestone network extending nearer the actinostome. The solid character of the actinal part of the limestone network covering the arms is well shown in an interior view (Pl. X. *Fig.* 6). This figure also shows how far the ambulacral and interambulacral plates become soldered together with the

actinal limestone network. The small size of the first set of ambulacral plates is characteristic of the genus as well as of other Starfishes with two rows of suckers; the plates of the actinal are scarcely more prominent than the other ambulacral and interambulacral plates, forming a striking contrast to the immense development they take in Asteracanthion and allied genera. The interambulacral plates, as is well shown on Pl. X. *Fig.* 5, are remarkably uniform in size; the secondary ambulacral plates forming the brachial limestone network adjoining them are compactly soldered together. In this genus the spines of the limestone network are completely sheathed by the outer membrane covering the whole abactinal and actinal system (Pl. X. *Figs.* 1, 2); they are large, sharply pointed, generally placed only at the angles of the limestone polygons, and form irregular longitudinal rows, from the central part of the abactinal part of the disk, gradually diminishing in size towards the extremity of the arms. This species is particularly abundant in the West Indies and Florida, and extends northward to New Jersey.

CROSSASTER.

Crossaster M. T. 1840, Monatsb. d. Akad. Berlin, (emend.) A. Ag.

The genus Crossaster, as originally established by Müller and Troschel in the Monatsbericht d. Akad. d. Wiss. of Berlin, was identical with Solaster of Forbes, which had the priority of a year. In the System d. Asteriden, Müller and Troschel adopted Forbes's genus. From an examination of the hard parts, it is evident that Solaster papposus and Solaster endeca should not be included in the same genus, having really nothing in common beyond the great number of arms. The accompanying descriptions will fully show my reasons for placing these two species in different genera. In order not to multiply names, I have retained the genus Crossaster, which is quite closely related to Pycnopodia, only limiting it to S. papposus, and have kept Solaster for S. endeca and its allies, which are more nearly related to Cribrella.

Crossaster papposus.

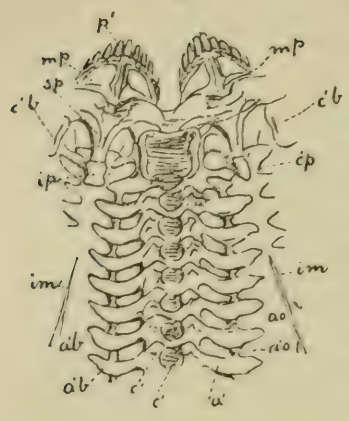
Crossaster *papposus* M. T. 1840. Monatsb. d. Akad. Berlin.

Pl. XII.

In Crossaster the membrane covering the abactinal system, like that of Pycnopodia, forms a mere film, but it is strengthened by a regular reticulation, with open meshes, carrying, at the points of junction of the horizontal limestone plates, prominent club-shaped processes, upon the tip of which are attached minute slender spines, forming more or less prominent tufts (Pl. XII. *Figs.* 3, 4). The interbrachial partition consists of a membrane, without limestone plates, extending towards the base of the arms, connecting the few limestone plates reaching from the actinal plate to the abactinal surface with the triangle formed by the rising of the actinal floor at the point of junction of adjoining arms (Pl. XII. *Fig.* 3). The actinal floor, with the exception of the plates of the interambulacral area, is entirely composed of a compact pavement formed of small irregularly shaped imbricating plates, gradually passing into the open reticulations of the abactinal surface, along the sides of the arms (Pl. XII. *Fig.* 2).

The ambulacral plates of this genus are broad and well separated; the ambulacral groove is broad and prominent (Pl. XII. *Fig.* 2); at the junction of the ambulacral and interambulacral plates the former are well separated; they are pointed, bulging in the central portion, leaving a wide opening for the passage of the sucker. The basal plates take an unusual development, forming a prominent ring round the actinostome; they are well separated by the interbrachial basal plates, forming the base of attachment to the limestone plates, which constitute the basal part of the interbrachial arch (Pl. XII. *Figs.* 2, 3). The actinal side of the interambulacral plates forms a series of slightly curved plates, at right angles to the ambulacral groove, carrying tubercles diminishing in size as they recede from the edge of the arms; these plates form a prominent row along the edge of the arms on the actinal surface (Pl. XII. *Fig.* 2); the tubercles of the interambulacral plates, arranged in narrow belts, carry slender spines, similar to those of the tufts of minute spines found on the abactinal surface. The basal interambulacral plates, like their corresponding ambulacral plates, are immensely developed, projecting far into the large actinal ring, and carrying, like all the interambulacral plates, long, slender spines; these form powerful papillæ,

Fig. 1.*



surrounding the mouth; though their use, as in all Starfishes, is evidently very limited, the principal work of digestion being done by the stomach itself, which folds over the substance to be introduced, and thus gradually dissolves it.

The accompanying woodcut (*Fig.* 1) shows somewhat more plainly than *Fig.* 3 on Pl. XII. the plates composing the parts round the actinostome and base of the arms.

This species is common to both sides of the Atlantic; it is found in Norway, Denmark, Great Britain, on the west coast of France, in Ireland, Greenland, and extends on the east coast of America as far south as Massachusetts Bay.

Pycnopodia helianthoides.

Pycnopodia *helianthoides* Stimps. 1861. Proc. Boston Soc. Nat. Hist., VIII.

Asterias **helianthoides** Br. 1835. Prodrom.

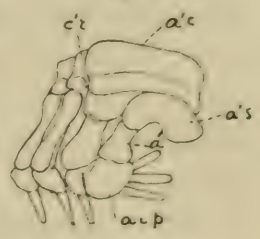
Pl. XIII.

In Pycnopodia the opening at the end of the large ambulacral plate near the actinostome is best seen in profile (*Fig.* 2); it differs in no way from the structure of the corresponding plates in Asteracanthion, though apparently, on first examination, the actinal plates forming the actinal ring seem quite peculiar, owing to the disappearance near the mouth of the interbrachial membrane, and the isolation of the interbrachial partition; this connects the actinal and abactinal reticulated surfaces by a mere film only. The large plate at the actinal ring, forming the base of the interbrachial partition (Pl. XIII. *Fig.* 6 *i p*), is entirely disconnected from the interambulacral system, as can easily be seen by an examination of the actinal extremity of the arm from the inside of

* Fig. 1. *Crossaster papposus.* — Internal view, seen from above, the abactinal surface of the plates at the base of one of the arms, round the actinostome, removed. *c' c'*, attachment of muscular bands connecting adjoining ambulacral plates; *a o*, *a o*, openings for passage of ambulacral suckers; *a'b*, *a'b*, ambulacral plates with projecting spur; *i m*, termination of film forming the interbrachial partition; *c'p*, spur from interambulacral plates forming connecting floor of actinal surface; *c'b*, large muscular plate at base of the arm; *i p*, interbrachial plate to which the film forming interbrachial partition is attached (when it extends to that point) at the base of the arms; *s p*, spur of interambulacral basal plates forming the base of attachment of the interbrachial partitions; *m p*, interambulacral plates forming the so-called mouth-papillæ; *p'*, spines of *m p*.

the actinal ring, showing the plate rising up on the side of the two large ambulacral plates of the actinal ring. The interambulacral plates (Pl. XIII. *Fig.* 7) form small scale-like plates near the base of the arm, carrying slender pointed spines; they increase somewhat in size at a distance from the base. They are followed on the edge of the arm by two lozenge-shaped plates, with extended points, carrying large club-shaped spines forming a thin low wall for the support of the line of attachment of the abactinal membrane covering the abactinal surface of the arms. This membrane extends also over the central part of the disk; over the abactinal surface it is strengthened here and there by a few small limestone plates or rods, placed at the base of the large spines irregularly scattered on the surface of the abactinal region; these plates sometimes form in the disk a very irregular disconnected reticulation, the lines of which are composed of small irregularly shaped rounded plates. Within the space where the arms are united the ambulacral plates rise nearly vertically, but towards the extremity they gradually slope more and more, inclining towards the actinostome, so that the ambulacral plates form a hard flat area, occupying nearly the whole of the actinal surface of the arms.

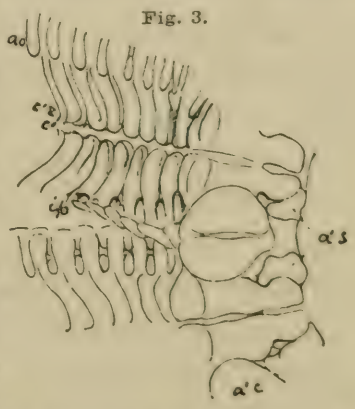
Fig. 2.*



The genera Pycnopodia and Crossaster are specially interesting on account of the close relationship they have to Brisinga. In fact, compared with Brisinga, they prove conclusively that the latter genus,

* *Fig.* 2.— Profile view of actinal extremity of arm of Pycnopodia (the dermal covering of arm removed). *c'r*, small plates forming the ridge, covering the ambulacral groove, repeated along the whole length of the arm. *a'c*, the corresponding plate of the second interambulacral plate. The upper projecting part of this plate is the support of the basal plate of the interbrachial partition, and below it is seen the plate which strictly corresponds to it. This plate *a'c* also covers in part the plate *a's* of the basal ambulacral plate *a'*, at the base of which is situated the interambulacral plate *a i p* carrying the short spines forming the mouth-papillæ.

Fig. 3.



The relative position of the plates *a's* to the basal plate of the interbrachial partition is well shown in *Fig.* 3, which represents an inside view, seen from above, of a part of the actinal ring. *a's*, *a'c*, the same as in *Fig.* 2, *i p*, the interbrachial partition, reduced in this genus to a few scale-like plates, supported on spurs of the interambulacral plates. *c'*, longitudinal groove, line of junction of ambulacral plates. *c'r*, ridge of connecting plates forming groove *c'*. *a o*, opening for passage of ambulacral suckers.

far from being so exceptional in its structure as has been generally supposed, is structurally very intimately connected with Pycnopodia and Crossaster. We might readily transform a Pycnopodia or a Crossaster into a Brisinga by reducing the actinal and abactinal interbrachial spaces into a minimum, which would give us a Starfish with a small disk, in which the ambulacral plates adjoining the actinostome assume a great development, and thus the numerous arms would appear quite disconnected (as in Brisinga). The connection of the arms in Starfishes does not depend so much on the greater or less development of the ambulacral and interambulacral systems, as upon the greater or less increase of the limestone network forming the interbrachial spaces, which, although a feature greatly affecting the physiognomy of the Starfish, yet influences but slightly its internal structure.

The range of this species is from Sitka to Mendocino City, California. In the Gulf of Georgia and at Mendocino it is a very common species in shallow water and at low-water mark.

BRISINGA.

The genus Brisinga, with its long slender arms, the whole actinal side of which, with the exception of the large interambulacral plates forming the edge of the arm, is occupied by the ambulacral plates, shows us very distinctly how we can pass from the Starfish to the Ophiuran by the joining of the large interambulacral plates on the lower surface, and their becoming soldered together into one plate to form a lower arm-plate, so that the absence of interambulacral plates, which has always been cited as the great difference by which Starfishes and Ophiurans could always be distinguished, is readily explained; the lower arm-plates of Ophiurans being only modified interambulacral plates. We further find, on examining, in Brisinga, the secondary imbricating plates forming the arches which support the abactinal membrane covering the arms, each of which carries only a single spine, and is arranged in more or less regular curves, that we have some approach already to the side arm-plates so characteristic of Ophiurans, the separation of the so-called disk from the arms, — which, although so striking a feature of the genus, is less important than it seems at first sight, — being merely brought about by the reduction to a minimum of the lateral spreading of the actinal part of the secondary and interambulacral plates. In the case of Brisinga this

forms at once an arch over the arms without expanding, as in other Starfishes, into a flat actinal floor of greater or less extent on the side of the interambulacral plate, from the extent and shape of which the various families are determined. This obtains its maximum of development in the extreme forms like Culcita and Palmipes; in one case the actinal and abactinal floors are well separated, in the other closely united by vertical shafts and walls. The analysis of the structure of Brisinga gives a most satisfactory explanation of the general homologies existing between Starfishes and Ophiurans, and reduces the gap hitherto unfilled between Starfishes and Ophiurans to a comparatively unimportant method of development.

As the madreporic body of Starfishes is placed in one of the interbrachial arches, and this arch reduced as it often is to a minimum (Solaster), or limited sometimes to the mesenteric support of the stone canal, we have a ready explanation of its position in the Ophiurans on the homologous plates in the interbrachial spaces, namely, the single plate in the continuation of the line of the interambulacral plates; at the same time the homology between the genital plates and the single interbrachial plate found in some Starfishes at the angle of the arms is fully carried out, as it is well known that it is on each side of the interbrachial arch that the ovarian openings are found. An examination of the base of the arms of Brisinga near its junction with the disk shows already quite a constriction, and of course a corresponding reduction in the length of the interbrachial arch. The great extension of the interambulacral plates across the space covering the ambulacral canal reduces it to its minimum at that point. The mode of articulation of the ambulacral plates of joints in the arms of Brisinga has been compared rather with Ophiurans than with Starfishes, but the articulation of the internal skeleton in Ophiurans is not specially different, although somewhat more perfect, from the articulation of the joints of arms in the Starfishes proper, and the homology between the internal skeleton of Ophiurans and the ambulacral system of Starfishes can be clearly established. If we imagine for each primary interambulacral plate but a single row of secondary interambulacral plates composed of a small number of plates, we shall of course have a side arm-plate and an upper arm-plate; the lower arm-plate being formed of the opposed interbrachial plates, which have become soldered together, and through which the tentacles have pierced their way.

The abactinal membrane of the disk of Brisinga is eminently Asterian; it is only slightly strengthened by a few minute limestone plates, as is the case in Crossaster and Pycnopodia, and in spite of the general resemblance, at first glance, of this well-defined disk to an Ophiuran disk, we have nothing whatever corresponding to the arrangement of the central plates so characteristic of the disk of Ophiurans. But we have in a great many genera of Starfishes the central part of the disk, showing in the young stages only, as regular an arrangement of the plates of the abactinal system as in any Ophiuran, though it is lost in the adult. Such a young stage is figured in Pl. VIII., a corresponding stage has also been recently figured by Lovén in his Memoir on the Echini (1875), and a similar structure of the disk will undoubtedly be found to exist in the very youngest stages of each genus, as it seems to be a general structure of the young of all Starfishes, as far as observed.

While Brisinga is a most important form, as showing the relationship between Starfishes and Ophiurans, there certainly is nothing in its structure or in its affinity to Protaster to warrant the palæontological importance ascribed to it by the younger Sars; and it cannot be considered, any more than several other genera of Starfishes now living,* as the representative at the present day of the oldest-known Echinoderm. I think we can show from the study of the hard parts of Starfishes that they have been a remarkably persistent type, and that the apparent changes of form due to the excessive increase or diminution of the interbrachial limestone deposit is a very secondary feature, which, though greatly modifying the external appearance of the Starfishes, yet does not affect the main structure, which, as has been stated, is remarkably uniform throughout the order. While fully admitting the many important points (so well brought out by Sars in his Memoir on Brisinga) wherein the genus differs from the other Starfishes, yet I must call his attention to the fact that many of the structural details which he strongly insists upon as specially characteristic of Brisinga † are common to the other Starfishes, and do not constitute features by which this family can be contrasted with the remaining Starfishes.

* Pycnopodia, Crossaster.

† For an opportunity of examining both dry and alcoholic specimens of Brisinga, I must thank Sir C. Wyville Thomson, and Dr. G. O. Sars. Brisinga endecacnemos is found in deep water off the Lofoten Islands, Norway. It has been collected by the "Challenger" in eighty fathoms, on the La Have Bank off Nova Scotia.

Linckia Guildingii.

Linckia **Guildingii** GRAY, 1840. Ann. Mag., VI.

Pl. XIV. Figs. 1–6.

A longitudinal section of one of the arms (Pl. XIV. *Fig.* 6) shows the great thickness of the irregularly shaped polygonal plates composing the limestone network of the abactinal surface. The plates (as seen in *Fig.* 4, Pl. XIV., when they are denuded of the finer granulation covering them, Pl. XIV. *Fig.* 1, and the intervening spaces) are very closely packed; the processes connecting plates laterally often do not exist in the median space of the arm, and appear only as short rods along the sides of the arms and on the outer edge of the lower surface (Pl. XIV. *Fig.* 3), where they are closely packed, forming in older specimens a compact pavement, and losing on this surface the imbricating arrangement to be traced only along the sides of the arms or to be seen in a transverse section. The fine granulation mentioned above extends over the whole actinal surface of the arms, concealing almost completely the three to four longitudinal rows of small plates immediately succeeding the interambulacral plates (compare *Figs.* 2 and 3, Pl. XIV.; see also *Fig.* 2′).

The top of the large papillæ (Pl. XIV. *Fig.* 6) attached to the interambulacral plates forms a close pavement when seen from the actinal side; these large papillæ pass very rapidly into the minute granules covering the lower side of the arms (Pl. XIV. *Fig.* 2). Toward the actinostome the papillæ flare inwardly, forming several rows placed one behind the other, and appear, when seen in section, as if there were a series of secondary interambulacral plates forming the mouth-papillæ, but on examination we find that the structure of the actinal interambulacral plates is that of other Starfishes. Seen from the interior on the actinal floor, the interbrachial plate is sunk far below the level of the ambulacral groove; the interbrachial arches are reduced to the thickening produced by the junction of the arms, which extend in wedge shape a short distance toward the actinal ring; the space in which the limestone canal is situated alone connecting by a low ridge with the actinal ring.

This is specially a West-Indian and Florida species.

Asterina folium.

Asterina **folium** Lütk. 1859. Vidensk. Meddel.

Pl. XIV. Figs. 7–9.

In Asterina, as in the bulk of the pentagonal Starfishes, the great lateral development of the secondary interambulacral plates introduces some modifications in the structure and position of the hard parts in this genus. The plates forming the actinal and abactinal floors are irregularly lozenge-shaped, imbricating at the extremities of the adjoining points, leaving thus a greater or less free space for the passage of the water-tubes; the plates of the two floors at the ridges of the disk become soldered together, thus forming, as it were, a new system of plates, which in some genera are regularly arranged and often furnish characteristic specific distinctions. At the actinal ring the interbrachial arches exist only as columns rising directly from the actinal to the abactinal floors in the interambulacral spaces. As in all the species of the genus, the lozenge-shaped plates of the actinal and abactinal surface carry short slender spines, with a more or less regular fan-shaped arrangement on the abactinal side; the spines are less numerous on the actinal side, somewhat longer on the interambulacral plates, especially near the actinostome, forming mouth-papillæ of considerable prominence (Pl. XIV. *Figs.* 7 and 7′).

The simple structure of the short, pointed terminal tentacle at the extremity of the arm is well seen in this genus (Pl. XIV. *Figs.* 8′, 8); adjoining tentacles are, as in Asterias, long, slender, without a prominent sucking-disk. The water-tubes are specially large in this genus (Pl. XIV. *Fig.* 9).

This species has the same range as Linckia Guildingii.

Asteropsis imbricata.

Asteropsis **imbricata** Grube, 1857. Wiegm. Archiv., XXIII.

Pl. XV.

The abactinal limestone reticulation of this species consists of flat, irregularly star-shaped plates, from which diverge longer flat pieces, connecting the adjoining centres of radiating plates (Pl. XV. *Fig.* 2); the plates and their connecting links are all imbricating. Towards the central part of the disk the larger spaces between the rods are partially closed by shorter spurs, and are further separated by disconnected plates into ellip-

tical areas, through which the water-tubes are protruded (Pl. XV. *Figs.* 1, 2); the network becomes closer towards the tip of the arms, and there are a great number of small areas for the passage of the water-tubes (Pl. XV. *Fig.* 3). In the living state the limestone skeleton is deeply imbedded in a thick epidermis, completely covering the upper and lower surface of the disk. Compare Pl. XV. *Figs.* 1, 1′, with the figures Pl. XV. *Figs.* 2, 3, showing preparations of the plates of abactinal surface from the exterior and interior. The interbrachial arches are reduced in this genus to a mere vertical column, consisting in portions of not more than a single plate placed close to the actinal ring, and leaving a large open space between it and the edge of the arm (Pl. XV. *Fig.* 6).

The plates of the actinal floor form a regular pavement, diverging from the interbrachial angle parallel to the axis of the arms; the actinal and abactinal systems of plates form, at their junction on the edge of the arms, a double row of large plates forming a binding at the periphery (Pl. XV. *Fig.* 4), one row placed on the actinal side, the other on the abactinal side (see Pl. XV. *Figs.* 4 and 2). There is a well-marked abactinal orifice near the centre of the disk (Pl. XV. *Fig.* 1).

In Gymnasteria, otherwise closely related to Asteropsis, there is no special difference between the plates of the actinal and abactinal systems; they are more distinct, and not arranged quite so regularly as to form a pavement.

In the greater number of the pentagonal Starfishes we find the same general distinction between the pavement-like plates of the actinal side, extending to the junction of the actinal with the abactinal system, although we do not always find so regular a peripheric series of plates. This is the case in Culcita (see *Figs.* 4, 5). Where the actinal plates acquire a great thickness, forming a lower floor through which the passages between the plates and beams make an intricate system of openings placed at different levels (*Fig.* 4), while the abactinal system is reduced to a comparatively simple series of rods having the general arrangement of triangular network with the longer or shorter rods separating them set on edge and imbricated (*Fig.* 5). The whole limestone system is, as in Asteropsis, entirely imbedded in the thick epidermal layer in which the plates have been deposited, so that but a trace of the limestone network appears when seen either in a natural condition or merely in dried specimens. The interbrachial arch of Culcita is reduced to a few

vertical plates rising close to the actinal ring from the interbrachial interambulacral plate.

Fig. 4.*

Fig. 5.†

This species of Asteropsis occurs on the West Coast, from Vancouver's Island to San Francisco.

The general arrangement of the limestone plates of the European Asteropsis pulvillus does not differ materially from the one here figured. The European species carries spines on the edge of the marginal as well as of the interambulacral plates, and the interbrachial arch is more fully developed, separating adjoining arms more completely.

Pentaceros reticulatus.

Pentaceros reticulatus LINCK, 1733. De Stellis Marinis.

Pl. XVI.

Figs. 1, 2, 4, 5, on Pl. XVI., show the extent to which the limestone network of the actinal and abactinal surfaces is hidden by the spines and granules covering the plates and rods of the two surfaces. Seen from the abactinal side, the network consists of a central plate more or less hexagonal, with projecting angles connected together by short stout rods, overlapped by the plates, so as to form an open triangular network, covered by minute granules, and in their interstices giving passage to the thickly clustered water-tubes (Pl. XVI. *Fig.* 1). The same granulation covers the plates and rods as well as the greater

* *Fig.* 4 is an interior view of the actinal plates of a Culcita, as seen in an alcoholic specimen, of which the abactinal floor has been removed to show the intricate system of passages lying between the limestone rods. *a b*, abactinal system; *s*, section across a limestone rod; *f*, interior muscular sheath connecting limestone rods; *o*, passages between adjoining plates.

† *Fig.* 5, edge of a Culcita, to show the gradual passage of the open reticulation of the abactinal surface into the closely packed vertical wedges *m p*, forming the outer edge of the disk of a Culcita.

part of the spines scattered over the abactinal area, leaving but a short piece of the end of the spines bare. The meshwork of course becomes closer towards the extremity of the arms; the plates and rods are of considerable thickness, as is seen in their section along the edge of the arm (see *Fig.* 5, Pl. XVI.).

The junction of the actinal and abactinal systems forms a double row of large contiguous plates carrying a heavy spine (see *Figs.* 4, 5, Pl. XVI.). The pavement-like plates of the actinal surface are arranged in rows parallel in a general way to the longitudinal axis of the arms (Pl. XVI. *Fig.* 4), and also in indistinct rows at right angles to this (Pl. XVI. *Fig.* 2). They are well covered by a coarser granulation than that of the abactinal surface, the central part of the plate carrying a cluster of three to five larger granules, becoming in some cases nearly fixed spines; these granules, on the actinal surface of the interambulacral plates, become a large flat pointed movable spine, with smaller flat lateral spines, rounded at their extremity. Round the edge of the interambulacral pieces forming the jaws they increase materially in size, becoming very prominent mouth-papillæ (Pl. XVI. *Figs.* 2, 3).

In all the pentagonal Starfishes the fact that the jaw pieces are simply the modified interambulacral plates of the last joint is very apparent, as well as that the interbrachial plates forming the base of the interbrachial arch are also only a modified part of the interambulacral plates formed by the soldering together of the inner lateral spaces of the opposite interambulacral plates of the joint of the jaw.

The interbrachial arches are composed of comparatively few large solid plates; their breadth varies materially in different specimens, either nearly filling the whole space between the actinal ring and the angle of the arms, or limited to a shorter wall next to the mouth. The ambulacral system is composed of tall plates rising well above the actinal floor, forming a broad median groove, seen from the abactinal side (Pl. XVI. *Fig.* 5); when seen in profile (Pl. XVI. *Fig.* 7), large elliptical spaces are left for the passage of the powerful ambulacral suckers (Pl. XVI. *Fig.* 2). The interambulacral plates are large, distinct, and of great thickness, with their actinal face well developed (see *Figs.* 4, 7, Pl. XVI.); the last joints of the plates of the actinal ring are prominent, raised high above the interbrachial plates. The jaws are large, projecting far into the central actinal space (Pl. XVI. *Figs.* 4, 5, 7); the papillæ when extended meet,

nearly closing the actinostome, only leaving (Pl. XVI. *Figs.* 2, 3) a small pentagonal opening.

The interambulacral spines, when the suckers are drawn in close, completely cover the ambulacral furrow (see *Fig.* 2, Pl. XVI., where they are closed over a portion of the ambulacra at the base of one of the arms).

Pentaceros reticulatus is found on both sides of the Atlantic, at Cape Verde Islands, and in the West Indies, extending north to South Carolina. Several other West India species of Echinoderms are also found at Cape Verde Islands and on the main coast opposite.

In the pentagonal Starfishes the plates forming the so-called jaws are huge interambulacral plates extending far towards the centre of the mouth, where they nearly meet, to form, with the papillæ, the so-called jaws and teeth of Starfishes. So far we have not been able in any way to homologize the teeth of Echini with any of the solid parts of Starfishes or Ophiurans; the auricles of the regular Echini and the peculiar spur of the interior of the test near the mouth of some Spatangi being the only processes which appear to have analogous position. For a comparison of the Starfish mouth parts with those of Ophiurans compare the figures here given with those of Lyman in the Bull. Mus. Comp. Zoöl., Vol. III., from which it is evident that in Starfishes and Ophiurans the mouth parts are strictly homologous, and are formed by the terminal oral interambulacral plates. Comparing profile figures of the oral extremity of one side of an arm in Culcita (*Fig.* 7), Acanthaster (*Fig.* 6), and Solaster (*Fig.* 8), we cannot fail to be struck with the great size of the terminal oral interambulacral plate *a i p*, carrying the mouth-papillæ *m p*.

In the views of the arms, seen from the interior (the abactinal system being removed), the great development of the oral terminal plate (*a′c*) is well shown. In *Fig.* 6′, Acanthaster, *Fig.* 8′, Solaster, and *Fig.* 9, Anthenea, the lettering corresponds to the profile figures. The only additional notation introduced is *i p* for the interbrachial partition, and *i p b* for the spur forming the basal plate of the interbrachial partition. The mobility of the arms of Starfishes depends entirely upon the comparative width of the ambulacral and interambulacral plates compared in their length, upon the solidity and extent of the interbrachial partition, and the extent to which the abactinal system corresponds in its articulation

Fig. 6.*

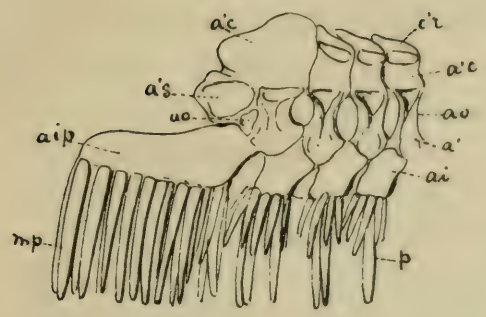


Fig. 7.

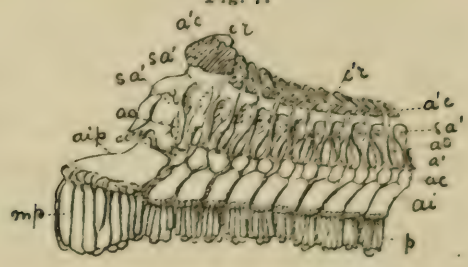
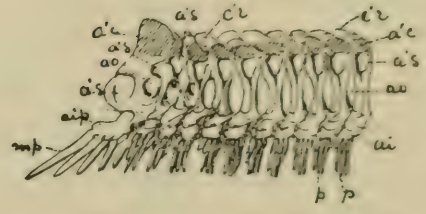


Fig. 8.



to the number of plates of the ambulacral system. Genera where there are large marginal plates, as in Astropecten, and the pentagonal Star-

Fig. 8′.

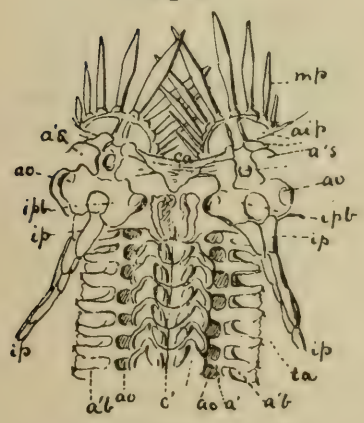


Fig. 6′.

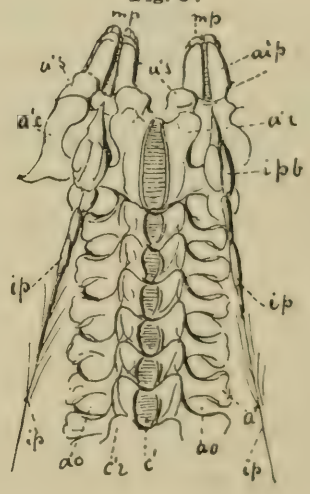
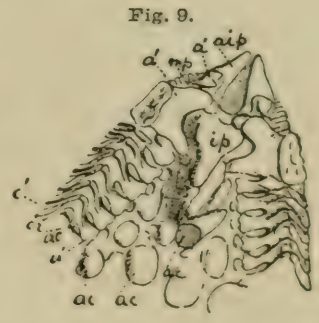


Fig. 9.



* In *Figs.* 6, 7, 8, *c′ r* are the small plates or spurs forming the ridge covering the ambulacral groove; *a′ c*, the corresponding plates of the ambulacral plates *a′*; *a o*, the opening for passage of ambulacral tentacle; *a i*, the interambulacral plates carrying papillæ *p*. The large terminal plate *a′ c* at the actinostome encroaches upon the corresponding ambulacral plate, so as to cover it by a spur *a′ s*, so much so that, when seen from above, this plate appears to be directly connected with the terminal interambulacral plate *a i p*, but the profile view clearly shows in all these genera that the terminal plates, although of different proportions, do not differ in their arrangement from those forming the body of the arm. The spur *a′ s* of the terminal oral plate *a′ c* sometimes forms a secondary cup-shaped plate along the edge of the arms; in *Figs.* 7, *s a′*, and 8, *a′ s*, this plate is quite prominent; while in *Fig.* 6 it is less developed.

fishes, or Starfishes in which the abactinal system is stiffened by heavy interbrachial partitions extending from the oral ring to the angle of the arms, or Starfishes where the abactinal reticulation is extremely solid, as in Ophidiaster, are all capable of but slight movements. On the contrary, Starfishes in which, as in most of the Asteracanthidæ, the reticulation is loose, the interbrachial partitions reduced often to a film, or to a mere arch of limestone plates, and in which the ambulacral plates are high, are much more flexible. The extremes are found in such forms as Anthenea and Brisinga. In some genera the arms are rendered more stiff by long flat spurs extending on the inner side of the actinal surface from the sides of the ambulacral plates towards the edge of the arms (see *a′ b*, *Fig.* 1, and *a′ b*, *Fig.* 8′). These spurs are also highly developed in Cribrella (*Fig.* 10), where, as in the preceding figures, they conceal the interambulacral plates, which are small compared with the ambulacral plates of Culcita, Anthenea, Acanthaster, and the like. The interambulacral plates retain their preponderance even towards the extremity of the arms quite near the tip, where the ambulacral and interambulacral plates become separated from the abactinal system proper (see *Fig.* 11, the tip of an arm of Culcita).

Fig. 10.

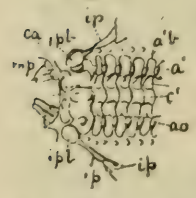
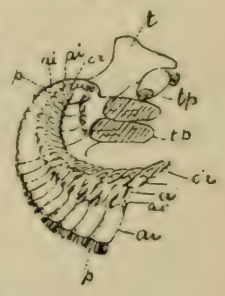


Fig. 11.



Solaster endeca.

Solaster *endeca* FORBES, 1839. Mem. Wern. Soc.

Asterias endeca LIN.

Pl. XVII.

In Solaster endeca the arrangement and general structure of the ambulacral and interambulacral plates are identical with those of Crossaster; the plates are, however, more closely articulated, and the basal ambulacral plates attain a still greater prominence even than in Crossaster. The mouth-papillæ are also more powerful. The fundamental difference between these genera, Crossaster and Solaster, lies in the structure of the abactinal floor (compare Pl. XVII. *Fig.* 1, and Pl. XII. *Fig.* 4). The actinal floor between the arms is composed of small, somewhat elongated plates, arranged in more or less regularly diverging rows, quite similar to those of Crossaster. The interbrachial partitions can hardly be in-

tended for the support of the abactinal floor, either in this genus or in Crossaster. In Solaster it forms a broad band when it connects with the abactinal surface, and is gradually changed into a mere chord at the point of attachment to the interbrachial basal plates. These partitions are all exactly similar to the one supporting the stone canal. At the base of the arms the sides of adjoining arms come together, forming rounded angles, and do not, in the specimen examined, form an interbrachial partition for the support of the abactinal floor (see Pl. XVII. *Fig.* 3). The reticulation of the sides of the arms and of the abactinal region is compact, composed of small meshes forming diagonal lines across the arms, and more or less irregularly radiating lines from the centre of the disk. All the plates of the actinal floor carry tufts of small spines (Pl. XVII. *Fig.* 2), arranged usually in parallel rows, corresponding to the long axis of the plates; so that on the actinal side the spines of the interambulacral plates are at right angles to the arms; on the plates forming the triangular interbrachial space, the spines diverge from the actinostome, while those of the plates at the angles of the arms, of the arms themselves, and of the abactinal surface, form more or less circular tufts arranged on the lines of the plates of these surfaces.

Solaster endeca and Cribrella sanguinolenta are both found on the two sides of the Atlantic, occurring in Norway, Denmark, Great Britain, the northwest coast of France, Iceland, Greenland, Labrador, and as far south as Massachusetts Bay; C. sanguinolenta extending as far south as Long Island Sound.

Cribrella sanguinolenta.

Cribrella sanguinolenta LÜTK. 1857. Vidensk. Meddel.
Asterias **sanguinolenta** O. F. MÜLL. 1776. Zool. Dan. Prod.

Pl. XVIII.

The genus Cribrella is most closely allied to Solaster. It has, like Solaster proper, a compact system of limestone network, forming, when denuded of spines, small meshes on the abactinal surface (Pl. XVIII. *Fig.* 1), while the actinal surface and a part of the edge of the arms are covered with larger plates, forming longitudinal rows parallel to the longer axis of the arms, with more or less irregular shorter rows at right angles to the axis (Pl. XVIII. *Fig.* 4). The arrangement of the spines on this network is very similar in the two genera, consisting of short sharp spines placed on the abactinal surface, either in clusters or in semicircular fan-

shaped rows as they approach the edge and lower surface of the arms; the sharp spines often become quite blunt in larger specimens. On the actinal surface the spines are longer and sharper, usually arranged in lines parallel with the longitudinal axis of the plates upon which they are carried (Pl. XVIII. *Fig.* 2). They gradually increase in size towards the ambulacral furrow; the spines of the interambulacral plates are still longer, and those which form the actinal papillæ attain the greatest development (Pl. XVIII. *Fig.* 3). The above features this genus has in common with Solaster, differing from it, however, in not having in the interbrachial angles the sharp line of demarcation between the arrangement of the plates and rods forming the actinal and abactinal surfaces. The genera differ also greatly in the structure of the interbrachial arch. In Cribrella the arch is well developed (Pl. XVIII. *Fig.* 7), starting from the angle of the arms and extending the whole way, between the two floors, towards the actinal ring, while in Solaster the arch is limited to a free loop, swinging between the abactinal surface and its basal interbrachial plates at the actinal ring in the interambulacral space. The last actinal joint of the ambulacral system is large, the ambulacral plates distant, and the interambulacral plates prominent, with a wide actinal face, upon which are placed numerous spines of different sizes, arranged in rows at right angles to the ambulacral furrow (Pl. XVIII. *Fig.* 2).

On the actinal surface two to four water-tubes pass through the free space enclosed by the limestone rods; the water-tubes on the actinal surface are less numerous, but longer.

Astropecten articulatus.

Astropecten articulatus M. T. 1842. Syst. d. Ast.

Asterias **articulatus** Say, 1825. Journ. Acad. Nat. Scien. Phila.

Pl. XIX.

On account of the great prominence of the marginal plates of the actinal and abactinal surfaces in this genus, the limestone network is reduced to a small surface. This is particularly the case on the actinal surface, where the reticulation corresponding to the actinal surface of the arms is reduced to a few minute plates between the interambulacral and marginal plates placed at the angle of the arms near the base of the jaws (see *Figs.* 4, 7, Pl. XIX.). The remainder of the lower side of the

arm is occupied by the marginal plates; these project beyond the marginal plate of the abactinal surface; forming, when seen from above, what appears like a second row of marginal plates (see *Fig.* 3, Pl. XIX.). The abactinal limestone network extends over the disk and over the narrow elongate space left on the upper side of the arms between the marginal plates (Pl. XIX. *Figs.* 1, 3, 6). The marginal plates are firmly soldered together, leaving no space between the floors where they are placed, with the exception of a single large opening for the passage of water-tubes along the line of junction of two plates, across the arms; the whole space in the arms between the plates being thus reduced to a narrow flattened space, of which the larger part is occupied by the ambulacral plates (Pl. XIX. *Fig.* 5).

The interbrachial arches are reduced to a thin partition at the angle of the arms, where the abactinal marginal plates attain their greatest height. The abactinal limestone network is, when seen from above, found to be closely covered by short club-like spines, often with a broad base and constriction in the middle below the head, attaining their greatest diameter a short distance from the base of the arms, passing gradually into mere granules towards the extremity of the arms and the centre of the disk; these spines are attached to the abactinal limestone network (Pl. XIX. *Fig.* 3) by a very shallow sucker, shaped like a saucer, with edges slightly turned up. On the tip of these spines are arranged concentrically a number of minute spines more or less cylindrical, with rounded ends, often completely filling the interval between adjoining spines, so that they appear to form at first glance a smooth surface (Pl. XIX. *Fig.* 1) over the whole space lying between the marginal plates. The grooves between the adjoining marginal plates are lined by similar, but even more delicate spines, which appear to perform the same functions as the delicate spines on the fascioles of Echini, namely, to sift the foreign matter contained in the water admitted to the water-tubes.

Seen from the actinal side, the abactinal floor consists of small circular plates (Pl. XIX. *Fig.* 6) corresponding to the flat saucer-like plates of the centre of the disk; seen from the opposite side, these gradually pass into the flattened plates closely soldered together, which extend into the arms, leaving only, however, on each side of the solid central band, a number of passages for the water-tubes (see Pl. XIX. *Fig.* 6). The general surface of the marginal plates of the abactinal side is covered by

short rounded spines passing mainly into granules similar to those covering the abactinal surface of the arms; they are in addition provided with one or two long flat triangular movable spines similar to those covering the outer edge of the actinal side of the marginal plates, which are arranged in irregular diagonal lines across the plates, varying in size, generally flattened and triangular; but we find with them, along the edge of the furrows separating the plates, slender spines similar to those of the grooves of the abactinal side.

The interambulacral plates carry flat spatula-shaped spines placed at right angles to the longitudinal axis of the arms; these plates, when denuded, are seen to be in contact with the marginal plates, except near the actinal ring (Pl. XIX. *Fig.* 5). Spines similar to those carried by the interambulacral plates, only shorter, cover the actinal side of the jaws (Pl. XIX. *Fig.* 2).

The ambulacral plates seen from the interior of the arm occupy, with the base of the interambulacral plates, the whole space between the marginal plates; the median furrow formed by the junction of adjoining plates is deep; the ambulacral plates themselves are narrow, elongate, spreading somewhat at their junction with the interambulacral plates, leaving a wide space for the passage of the ambulacral feet.

It is not uncommon in this genus to find the ambulacral and interambulacral plates soldered together, either wholly or in part, so that it becomes difficult to trace the line of contact.

In Astropecten and Luidia the interambulacral plates of the last basal joint of the adjoining arms are connected together, forming a prominent point at the angle of the arms; but those plates which carry the mouth-papillæ are not, as in other families of Starfishes, at a lower level than the adjoining interambulacral plates. The jaws are on the same level, in direct continuation of the other interambulacral plates, only somewhat more prominent (see Pl. XIX. *Figs.* 7, 8).

Astropecten articulatus and Luidia clathrata extend from New Jersey to the West Indies. Luidia clathrata is one of the most common Starfishes of the sandy coasts of North and South Carolina.

Luidia clathrata.

Luidia clathrata LÜTK. 1859. Vidensk. Meddel.

Asterias **clathrata** SAY, 1825. Journ. Acad. Nat. Scien. Phila.

Pl. XX.

The genera Astropecten and Luidia are most closely allied, not only by their possessing but two rows of pointed ambulacral suckers (Pl. XX. *Fig.* 2), but also by the structure of the limestone network of the two surfaces of the spines and other appendages covering them. As in Astropecten, the actinal limestone network is limited to a small triangular area close to the mouth in the angle between two arms; this area reminds us of the interbrachial space on the actinal side covered by small plates in such genera as Solaster and Crossaster; with the latter they are closely connected. The rest of the actinal surface of the arms is covered by the narrow elongated marginal plates which correspond in number to the ambulacral and interambulacral plates (Pl. XX. *Fig.* 4).

The actinal marginal plates are, as in Astropecten, separated at the surface by deep grooves edged by minute spines less numerous along the main lines of the grooves than in the grooves of Astropecten, but much more crowded at the openings near the interambulacral plates, forming a regular sieve from plate to plate. The spines when removed leave upon the face of the plates markings exactly similar to those found as bands upon Echini, and known as fascioles. The spines carried upon these minute granules are similar in every respect to the spines of the fascioles of Echini. Their function is evidently identical, namely, that of filtering and clearing the water before it reaches the water-tubes. Their use is much more apparent than in the Spatangoids, where the bands of fascioles are really of use only when lining the edges of the sunken ambulacra of such genera as Hemiaster, while their extension from the tip of one ambulacral rosette to the other seems to be a remnant of a structure having at the present day in Echini but little if any use, while in Spatangoids it still performs its function of accumulating minute muddy particles floating in the water, which would to a certain extent impede the access of clean water to their lobed ambulacral tentacles. I have not observed these fascioles in other genera besides Astropecten and Luidia. The presence, however, in some genera of minute spines arranged in tufts on a solid basis projecting above the general surface shows us a regular transition from the closed area formed by them on

the abactinal surface between the marginal plates in such genera as Astropecten and Luidia, to a somewhat looser arrangement in Solaster endeca and Cribrella. This arrangement is still further modified in Crossaster papposa and Pycnopodia, and leads to such spines as are found in Asterina and Palmipes, where the tufts consist of a smaller number of minute spines more uniformly scattered over the surface, thus forming an approach to the usual distribution of spines in Asteracanthion. Finally we pass to genera where the spines are long and few in number, and do not, as in the genera of the Asteriadæ proper, perform the part of sieves.

In place of the single row of large marginal plates along the abactinal edge of the arms, we find in Luidia a series of much smaller plates, corresponding in number, as on the actinal side, to the number of ambulacral plates. There are sometimes four or five rows of such plates, forming regular longitudinal and transverse rows (Pl. XX. *Fig.* 3), followed towards the median band of the arm by more irregularly arranged plates. These plates form the base of prominent pillars, somewhat constricted in the centre, flaring at the extremity, surmounted at the tip by short spines or merely granules articulating in a shallow socket. These spines are so closely packed as to leave but very narrow passages between adjoining rows (see Pl. XX. *Fig.* 1), generally mere slits edged by minute spines, so that longitudinal and transverse passages run the whole length of the arms for the passage of water, which must be all carefully sifted before it enters either through the passages protected by the fascioles or through those screened by the minute spines of the abactinal surface.

The plates of the abactinal limestone networks are completely soldered (Pl. XX. *Fig.* 6), leaving but few irregular rows of holes for the passage of the water-tubes to the abactinal side, where they are completely sheltered under the floor formed by the minute spines of the abactinal surface of the arms.

In no other genera of Starfishes do we find so great a simplicity in the structure of the plates of the actinal ring as in Astropecten and Luidia. Usually the ambulacral and interambulacral plates of the arms differ in no essential way except at the actinal ring formed in most Starfishes by such a modification of the last joint as to make it somewhat difficult to trace the homology of all the parts. This last joint is extremely

simple in Astropecten, being but slightly modified and differing from the others mainly in length. Thus the homology I have attempted to trace between the jaws can there be seen in its simplest form (Pl. XX. *Figs.* 4, 5, 8). The plates of the extremity of the arms are soldered together when seen from above (Pl. XX. *Figs.* 9 – 11), forming a prominent knob with a deep groove on the actinal side for the passage of the ambulacral tentacles.

The spines of the actinal side increase slightly in length towards the outer edge of the arms, where there is found a prominent row of larger flattened spines fringing the edge of the arms.

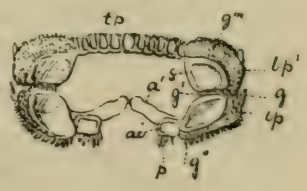
The actinal face of the jaw-plates is prominent and thickly studded with irregularly arranged minute spines, forming a marked feature at the actinal angle of the arms, between adjoining ambulacral rows (Pl. XX. *Fig.* 7).

The madreporic body is often irregular in outline (Pl. XX. *Fig.* 12), and is frequently completely hidden by the surrounding spines of the abactinal surface.

FASCIOLES OF STARFISHES.

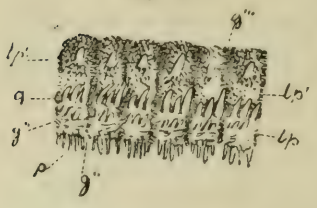
The description of the accompanying figures of Luidia and of Astropecten will explain the disposition of the minute spines of those genera which I have homologized with the fascioles of Echini. *Fig.* 12 represents a transverse section of an arm of Astropecten, *a′* being the ambulacral, *ai* the interambulacral, plate, with its spines *p*. *lp* is the plate on the edge of the lower side of the arm, and *lp′* the corresponding plate of the upper edge of the arm, *tp* being the small columnar plates surmounted by tufts of minute spines forming the close covering of the central part of the abactinal side of the arm. The surfaces *s* of the upper and lower plates on the edge of the arm are the articulating surfaces which rise somewhat above the surrounding edge of the plate, leaving a flat space *g″* on the lower arm-plate, *g‴* on the upper arm-plate, and from *g* to *g′* between these two plates, through which water from outside can circulate as in a groove all round the articulation, and thus find its way between the columnar plates of the abactinal surface of the arm. The small papillæ which

Fig. 12.



cover these marginal plates, but more especially the minute spines crowded upon the surfaces of the grooves g, g', g'', and g''' form an effective sieve, and in thus freeing the water from its impurities before it circulates through the channels between the abactinal plates, act exactly like the fascioles of Echini. Only in Starfishes we can much more readily see their great use in the economy of the animal, while their action in the Echini is much less efficient. In a profile view of a part of the edge of the arm of Astropecten (*Fig.* 13), the openings, left for the passage of the water, which are lined by these so-called fascioles are very plainly defined. lp and lp' are the lower and upper marginal plates, with the deep grooves g'' between the lower plates and the furrows g''' between the upper plates, these furrows being completely arched over by the minute spines acting as meshes of a sieve. At the angle of the junction between the shallower horizontal grooves and the deeper vertical grooves a prominent opening g is formed for the passage of the bulk of the water, which is thus admitted to be sifted. The lettering of *Fig.* 13 is the same as in *Fig.* 12.

Fig. 13.



In Luidia the only difference in the mechanism of the fascioles is the greater number of openings through which the water is admitted to circulate between the columnar plates covering the abactinal surface and a part of the arms. In *Fig.* 14 we have a section of the arm of a Luidia, corresponding to *Fig.* 12 of an Astropecten. The lettering is the same, only, there being a larger number of upper marginal plates, the passages between them (g, g', g'', g''', g'''') are more numerous. The lower marginal plate alone is as prominent as in Astropecten. The articulation forms a continuous ring round the arm, broken by the columnar plates surmounted with their tufts of minute spines. These tufts are so thick as to form a uniform shield almost solid and unbroken on the abactinal surface of the arms. Seen from below (*Fig.* 15), the deep groove g' of the lower marginal plate edged with minute spines, the fascioles, is well shown. A view of the edge of the arm of Luidia (*Fig.* 16, corresponding to *Fig.* 13 of Astropecten) shows the small rectangular areas into

Fig. 14.

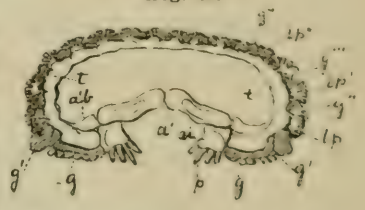
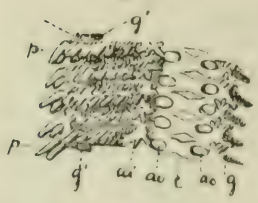


Fig. 15.



which the edge of the arm is divided by the deep furrows, allowing the passage of the water; at their crossing, the furrows form larger, more prominent openings; the edges of all these rectangular spines are crowded with fascioles. The genus Cribrella is interesting as showing the gradual transition of the interambulacral and marginal papillæ into tufts of such minute spines that the difference between them and true fascioles is hardly appreciable. In fact, in Solaster we have already certain parts of the surface covered by such minute spines that we must consider them as rudimentary fascioles and as probably acting as such. *Fig.* 17, a cross section of Cribrella, shows a close approximation to the cross section of Luidia as far as the tufts of spines are concerned; these need to be but slightly more crowded to form a most effective sieve. Seen in profile in a section (*Fig.* 18), the tufts of spines, the interambulacral papillæ, are seen to be somewhat more crowded into tufts than is the case in such genera as Asteracanthion. A similar arrangement is also found in Solaster (see *Fig.* 8), where the spines of the interambulacral plates, with the exception of those of the so-called jaws, are arranged in closely crowded tufts.

Fig. 16.

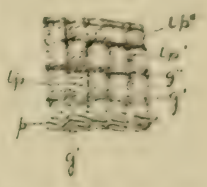
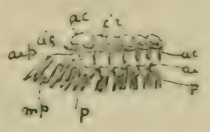


Fig. 17.

Fig. 18.



NOTE.

The arrangement of the Starfishes into families from the study of their hard parts does not differ materially from the families adopted by Perrier in his Revision of the group.* He himself has in a general way made use of the characters furnished by the skeleton to limit the families he has recognized. The modifications we should suggest go so far as to transfer Pycnopodia from the Asteriadæ proper, and Crossaster from the Echinasteridæ, placing them in close proximity to Brisinga, while Solaster (limited) and Cribrella would be placed with the Asterinidæ.

The disposition of the digestive cavity and its appendages does not appear to furnish systematic characters of great value. The anatomy of the ovaries of the coecal appendages of the digestive cavity proper with

* Asteriadæ, Echinasteridæ, Linckiadæ, Goniasteridæ, Asterinidæ, Astropectinidæ, Pterasteridæ, Brisingidæ.

its abactinal pouch is remarkably uniform in groups apparently differing so widely as the extreme pentagonal Starfishes, and the long slender-armed genera like Ophidiaster, Asteracanthion, or even the apparently abnormal group to which Brisinga, Pycnopodia, and Crossaster belong.

I do not give a list of our North American Starfishes, much less a Synonymic Catalogue, as it would be most incomplete and premature. Quite a number of species collected by Mr. Pourtalés in deep water between Florida and Cuba are at present in the hands of Professor Perrier for determination; of these several are undoubtedly new to our fauna. Numerous additions have recently been made by Professor Verrill, while engaged on the dredgings made in connection with the United States Fish Commission. In addition the "Challenger" expedition, while cruising in the Atlantic from Halifax to Bermudas, hence to New York, and then to St. Thomas, added quite a number of remarkable forms to our American species. As these collections are either in process of identification or about to be worked up, any general list now given would soon become antiquated. The Starfish fauna of North America, as far as now known, can be made out with sufficient accuracy from the articles by Professor Perrier on the "Stellérides du Musseum in the Archives de Zoologie Expérimentale" for 1875 and 1876, although the Synonymy he has adopted for several of our species will probably be modified when larger material than is now available has been collected. The principal localities of specimens in the Museum collections are added.

EXPLANATION OF THE PLATES.

To avoid useless repetitions in the description of the Figures, the same letters are used, throughout these Plates [I.–VIII.], to denote identical parts. It will greatly facilitate the reading of this memoir to become familiar with the notation here adopted.

Explanation of the Lettering on Plates I.–VIII.

a, anus.
b, dorsal or water pore, madreporic opening.
c, alimentary canal.
d, digestive cavity, stomach.
d', abactinal water-tubes in angle of rays of young Starfish.
d'', water-tubes of lateral line of rays of young Starfish.
d''', water-tubes of median line of rays of young Starfish.
e, eye of Starfish at base of odd tentacle (t').
e', median anal arms of Brachiolaria.
e'', dorsal anal arms of Brachiolaria.
e''', ventral anal arms of Brachiolaria.
e'''', dorsal oral arms of Brachiolaria.
e^5, ventral oral arms of Brachiolaria.
e^6, odd terminal oral arm of Brachiolaria.
f, brachiolar arms.
f', branch of water-tube ($w\,w'$) leading into f.
f'', odd brachiolar arms.
f''', surface-warts at base of odd brachiolar arm (f'').
h, hole of cul de sac of water-tube w.
l, central abactinal plate of young Starfish.
l_1, l_1, l_1, . . interbrachial abactinal plates of young Starfish.
$_2$, l_2, l_2, . . brachial plates of young Starfish.
m, mouth.
m', pistol-shaped oral pouch of œsophagus.
m'', anal pouch of œsophagus.
n, opening for passage of ambulacral sucker.
o, œsophagus.
p, spines on edge of ray of Starfish.
p_1, spines of exterior rows along abactinal surface of rays.
p_2, spines of middle row on abactinal surface of rays.
p_3, central spine of abactinal surface of Starfish, on central plate (l_1).
p_c, plate at junction of adjacent rays (ovarian plate).
p', p'', different forms of pedicellariæ.
r, abactinal surface.
r', first set of five limestone rods which appear on abactinal surface, and which eventually become the brachial plates (l_2).
r'', second set of five interbrachial limestone rods, which eventually become the interbrachial plates (l_1).
r'''_1–r'''_5, rays of young Starfish; r'''_1 being ray next to madreporic body, when Brachiolaria is seen from the dorsal side.
$s\,t$ and s, actinal region.
t, t, t, . . tentacles of the young Starfish.
t', odd tentacle.
t'', ambulacral tube.
u, lateral ambulacral plates, surmounted by spine.
u', median ambulacral plates with very small spines.
v, vibratile chord, anal part.
v', vibratile chord, oral part.
w, water-tube, developing abactinal area.
w', water-tube of Brachiolaria leading to madreporic opening (b), developing actinal area.
$w\,w'$, portion of water-tube of Brachiolaria formed by junction of w and w'.

In all the figures of the Brachiolaria (Plates I.–IV.), the attitude which has been given to them is not a natural attitude. This has been done purposely, for the sake of making the comparison with the memoirs of Müller easier. The only figure of a Brachiolaria which is in its natural attitude is that of Pl. VIII. Fig. 8. The young Brachiolaria does not, however, move with the anal part below, till the latter is loaded down by the development of the Starfish, and we see them swimming about, before that time, almost in every possible attitude.

Plates I., II. Embryology of Asteracanthion berylinus *Ag.*

Pl. I. Figs. 22–28, Pl. II. Figs. 2–19, Scyphistoma stage; Pl. II. Figs. 20–24, Tornaria stage; Pl. II. Figs. 25–28, Brachina stage.

PLATE I.

Fig. 1. A mature egg, surrounded by spermatic particles, soon after the artificial fecundation. The egg has assumed a spherical shape, and contains the germinative vesicle and dot. There is no trace of any interval between the yolk and the outer envelope.

Fig. 2. The germinative vesicle has disappeared, but the germinative dot remains.

Fig. 3. The germinative dot is no longer visible; the yolk has contracted, and is separated by a slight space from the outer envelope. The egg has all the appearance of having already gone through the segmentation; the whole yolk being made up of small spherical cells, resembling very minute spheres of segmentation, although the segmentation has not yet commenced. Two hours after fecundation.

Fig. 4 shows the first trace of segmentation, consisting in a depression on one side of the yolk.

Fig. 5. The yolk has become flattened on opposite poles; the Richtungsbläschen are visible on one side of the yolk.

Fig. 6 shows the yolk divided into two united ellipsoids, the whole yolk rotating slowly, always in one direction, from right to left. The Richtungsbläschen are at one pole of the axis of segmentation.

Fig. 7. The two segments of the yolk have entirely separated. The Richtungsbläschen are likewise isolated at one pole of the axis of segmentation.

Fig. 8. First trace of a further segmentation; one half of the yolk is partially divided.

Fig. 9. The two yolk segments are about to separate into four.

Fig. 10. The four yolk segments are all distinct, and almost transformed into regular spheres.

Fig. 11. Different view of Fig. 10, showing the position of the segments.

Fig. 12. The yolk about to separate into eight spheres.

Fig. 13 shows eight spheres of segmentation, all of which are more or less spherical; the spheres are arranged in two clusters of four, on opposite sides of the envelope.

Fig. 14. This view of the egg shows the tendency of the spheres of segmentation to arrange themselves on the circumference.

Fig. 15. The yolk is divided into sixteen spheres.

Fig. 16. The shell of segmentation is composed of thirty-two spheres; owing to the position from which the egg is viewed, only half the shell of segmentation is visible.

Fig. 17. The thirty-two spheres are again subdivided.

Fig. 18. The spheres of segmentation are still smaller than in the preceding figure.

Fig. 19. These spheres have become so small, that the walls of the spherical shell formed by them can be readily distinguished

Fig 20. The walls have become still more distinct in consequence of the close packing of the small spheres, which are now somewhat polygonal, owing to their pressure upon each other.

Fig. 21 represents an egg ten hours after segmentation; the spheres are still more polygonal; the rotation of the yolk is quite rapid, and the embryo is ready to break through the outer membrane; the shell envelope is very distinct from the inner contents, and has a uniform thickness.

Fig. 22. An embryo after its escape from the egg; the wall is no longer of the same thickness throughout, but has become very much thickened at one pole (*a*), while the spheres of segmentation are somewhat indistinct.

Fig. 23. The embryo has been slightly flattened at the pole (*a*), where the wall is thickest; the planula, if we may so call it in its present condition, reached this stage at the end of about eleven hours.

Fig. 24. The wall of the flattened pole has been pressed in so as to curve slightly inward (*a*).

Fig. 25. The depression (*a*) has become much deeper, and the spheres of segmentation have entirely disappeared, twelve hours after fecundation. The depression at *a* assumes here somewhat the aspect of a digestive cavity.

Fig. 26. Seventeen hours after fecundation; the embryo has lost its spherical shape and has become somewhat pear-shaped; a transverse section is still circular. The depression made by the thickened walls has increased in depth; the opening (*a*) performs the functions of a mouth and anus; *d* indicates the bottom of the digestive cavity.

Fig. 27. Twenty hours after fecundation; the depression has the appearance of a small pouch (*d*) hanging in a pear-shaped body with circular section, showing no deviation from the absolute radiate type; the opening (*a*) still performing the double functions of mouth and anus. Currents of water circulate in this cavity, as they would in the digestive cavity of any Polyp or Acaleph in about the same stage of development.

Fig. 28. Twenty-two hours after fecundation; the embryo has become somewhat more cylindrical, losing its pear-shaped form, but is still circular when seen in a transverse section. The cavity (*d*) has slightly expanded at the closed extremity, and is comparatively deeper and wider; the walls of the body are much reduced in thickness, except at the perforated region. The body is somewhat translucent, and slightly tinged with ochre color. The opening (*a*) still serves as a mouth, although, in more advanced stages, a second opening is formed, which is the true mouth, at which time the present mouth then becomes the anus.

PLATE II.

In Figs 1, 3, 9–17, the digestive cavity alone is represented.

Fig. 1. The digestive cavity of Fig. 2, seen by itself from above, has expanded into a large reservoir at the extremity, the walls of which are quite thin.

Fig. 2. The embryo of Fig. 1 seen in profile; the cavity is no longer in the axis, but is bent to one side. The larva has also lost its symmetrical outline, and the dorsal part of the perforated extremity projects somewhat beyond the opening of the present mouth (the future anus).

Fig. 3. The digestive sac of a larva somewhat more advanced than Fig. 2, in which the present mouth (*a*) (the future anus) has been brought to the lower side.

Fig. 4. The larva of Fig. 3 seen in profile; the pouch at the closed extremity of the bent digestive cavity is now nearer the lower side than in Fig. 2, having approached the slight depression (*m*) placed in the middle of the larva.

Fig. 5. A larva somewhat more advanced, seen in profile, in which the pouch has actually come in contact with the wall of the lower side at *m*. The dorsal region of the perforated extremity projects still more beyond the opening of the present mouth (*a*) (the future anus) than in the preceding stage (Fig. 4). The digestive cavity is not yet divided into distinct regions.

Fig. 6. The same larva as Fig. 5, seen from above, forty-two hours after fecundation; large epithelia-cells have appeared on the surface.

Fig. 7. A somewhat more advanced larva, seen in profile; the digestive cavity is no longer a simple bent tube, as in Fig. 5; it is strongly contracted near the extremities, one of them projecting upwards (*w*). At the point of contact of the digestive cavity with the outer wall at *m*, a second opening has been formed, connecting by a short tube with the pouch of the digestive cavity. This second-formed opening (*m*) is the true mouth, while the first-formed opening (*a*) now becomes the anus, after having, up to this stage, performed the functions of mouth and anus; end of the second day.

Fig. 8. The same larva as Fig. 7, seen from above, to show the position of the lobes (*w*, *w'*) formed on each side of the pouch of the digestive cavity (*d*), which in Fig. 7 appear like projecting angles (*w*).

Fig. 9. Isolated digestive cavity of a more advanced larva, showing still more plainly the transverse contractions of the digestive cavity by which the œsophagus (*o*), the stomach (*d*), and intestine (*c*) are gradually formed, and also the greater projection of the earlets of the pouch, which have become quite elongated laterally; the opening (*o*) in the centre is the tube leading to the mouth.

Fig 10. The same as Fig. 9, seen in profile; the tube (*o*) now connects very freely with the mouth (*m*), formed in the depression, mentioned in Figs. 4, 5, and with the digestive cavity; the currents now change their course, and circulate in the opposite direction. While the larva was in the state represented by Fig. 6, the currents of water enter at the mouth, the future anus (*a*), circulate in the pouch (*d*), as well as in the earlets formed from the thickening of the wall, and then issued again from the same opening (*a*). Now the water enters through the mouth (*m*) (the last-formed opening), passes through the narrow conical tube (*o*) into the digestive cavity (*d*), communicating with the earlets (*w*, *w'*), and out through the anal opening (*a*), which was the first formed, and formerly performed the functions of mouth.

Fig. 11. Isolated digestive cavity, seen in profile, showing the tube leading from the mouth (*m*) to the digestive cavity (*d*), and earlets (*w*, *w'*), more developed than in Fig. 10.

Fig. 12. The same seen from above.

Fig. 13. Oral end of an isolated digestive cavity, in which the earlets, formed by the pouch, are more

distinct from the digestive cavity than in any of the former stages. There is a slight constriction at their base of attachment, the first indication of their final separation from the alimentary canal.

Fig. 14. Isolated digestive cavity seen endwise, to show the tube leading from the mouth to the digestive cavity, at right angles to the pouch of the earlets.

Fig. 15. Isolated digestive cavity seen from above, in which the earlets (*w*, *w'*) (the future water-tubes) are so far differentiated as to be quite distinct from the digestive cavity. The walls of the earlets are exceedingly attenuated, and are scarcely connected with the main digestive cavity.

Fig. 16. The same as Fig. 15, seen from below, to show the position of the mouth and anus on the same side of the larva.

Fig. 17. Part of the same larva seen in profile: on account of the obliquity of the earlets, one of them (*w'*), as it increases in size more rapidly than the other, soon reaches the outer surface of the larva and opens into the surrounding medium by means of a small aperture (*b*). The walls of the tube (œsophagus) leading from the mouth to the first swelling of the digestive cavity (*d*) (the stomach), and of that part of the tube leading from the stomach to the anus, have a very different thickness. They are sufficiently distinct in their character to enable us to distinguish readily three regions; forty-eight hours after fecundation.

Fig. 18. The two small bodies (*w*, *w'*), the former earlets of younger stages formed from the pouch at the closed end of the digestive cavity (the problematic bodies of Müller), have entirely separated from the digestive cavity from which they were formed; seen from above, the three divisions of stomach, intestine, and œsophagus are plainly marked out.

Fig. 19. The same larva in profile.

Fig. 20. The same figure from below, shows the presence of short crescents of vibratile cilia (*v*, *v'*) placed in opposite directions near the mouth and anus; sixty-five hours after fecundation.

Fig. 21. A somewhat more advanced larva, seen in profile; the anal crescent (*v*) of vibratile cilia is seen as a small wart between the mouth of the anus, the oral crescent (*v'*) projects beyond the general outline. The division into œsophagus (*o*), stomach (*d*), and intestine (*c*) is quite prominent. The stomach has a tendency to approach the anal dorsal extremity.

Fig. 22. The same as Fig. 21, seen from below, to show the triangular shape of the mouth (*m*). The greater size of the problematic bodies (*w*, *w'*) (the water-tubes), which increase independently at an unequal rate, and also the position of the oral and anal vibratile crescents.

Fig. 23. The same larva seen in a profile, to show the position of the mouth in a strongly marked depression; the great increase in size of the oral part of the œsophagus; the swelling out of the stomach, and the bending of the intestine back towards the mouth, so as to make a small angle with the trend of the stomach; at the end of the third day after fecundation.

Fig. 24. Larva seen from above. The only difference in this stage from the preceding is in the greater increase of the vibratile crescents, forming two small plastrons, and of the water-tube. The intestine also bends so as to make almost a right angle with the stomach, which is pushed out further towards the anal extremity.

Fig. 25. More advanced larva, seen from the left profile, in which the oral pouch has assumed its characteristic pistol-shape. The stomach and intestine make a sharp angle with each other, the latter being much longer than the stomach proper. In its present aspect it closely resembles a retort, the stomach being the receiver, the intestine the tube. The anal and oral vibratile crescents have greatly extended, the one on the oral and the other on the dorsal side, to the extremity of the body.

Fig. 26. The same as the preceding, seen from below; the oral plastron is quite large, projects beyond the sides of the body; slight indentations can already be traced in the anal plastron, indicating the position of the future arms (*e'*). The water-tubes have increased in length, and extend half-way from the base of the stomach to the oral plastron.

Fig. 27. A larva six days after fecundation, seen from the right profile, the water-tubes extend beyond the opening of the mouth. The tube leading from the water-pore (*b*) (dorsal pore) to the water-tube (*w'*), is quite distinctly seen.

Fig. 28. The same larva as Fig. 27, seen from below; the intestine, as in Fig. 26, is thrown to one side of the axis of the larva. The water-tubes extend also along the sides of the stomach towards the anal extremity; the sinuosity of the anal ciliary chord indicates the position of the future anus.

Plates III.–VIII. Embryology of Asteracanthion pallidus *Ag.*

PLATE III.

Owing to the transparency of these larvæ, it is not easy to ascertain whether they are seen with the mouth downwards or upwards, unless we ascertain the position of the madreporic body. In all these figures, whenever the water-tube w' is on the left of the figure, the mouth is turned upwards.

Fig. 1. The youngest larva of this species, seen from the mouth side, corresponding to Pl. II. Fig. 20; a comparison of these two figures will show the great difference between the larvæ of these two species of Starfishes. In the former, the chords of vibratile cilia appear much earlier, and the oral plastron is well defined; while, in the other species, it is not before it has reached the condition of Pl. II. Fig. 26, that the oral plastron is as well developed.

Figs 2–10. Brachina stage.

Fig. 2. A larva seen from the left profile, corresponds to the stage of Pl. II. Fig. 27, of A. berylinus; with the exception of the size of the water-tubes, the larva of this species is much stouter, shorter, and the anal portion is the most prominent, while the larva of the A. berylinus is quite slender and elongated.

Fig. 3. The same larva as Fig. 2, seen from the dorsal side.

Fig. 4. A more advanced larva, seen from the dorsal side; the undulations of the ciliary chord indicate the future arms, the water-tubes extend beyond the mouth, and have already begun to bend towards each other.

Fig. 5. The same larva seen from the left profile, to show the bent attitude frequently assumed by the larva when disturbed.

Fig. 6. This larva, seen from the mouth side, is more developed than any raised by artificial fecundation from the eggs of A. berylinus. The water-tubes have greatly increased in diameter; they have united beyond the mouth, and extend on each side of the stomach so as almost to meet, but without uniting. The mere indentations of the previously figured larvæ correspond to accumulations of pigment cells, and to the thickening of the vibratile chord, accompanied by the formation of rudimentary lobes, which indicate plainly the position of the median arms (e'), the dorsal anal (e''), the ventral anal (e'''), and dorsal oral arms (e''''). The greatest accumulation of pigment cells, and the thickening of the vibratile chord, is found at the rudimentary median arms (e'). The anal ventral pair of arms (e''') is especially well marked.

Fig. 7. The preceding figure seen in profile, the mouth to the right, shows the great development which the oral position of the water-tube has taken; also the mode of formation of the oral ventral pair of arms (e^5), as well as the first sign of the odd brachiolar appendage (f'').

Fig. 8. Larva seen from the dorsal side. The arms have increased greatly in size since the stage represented in Fig. 6. The oral portion of the water-tube has become very pointed; it extends into the odd oral arm (e^6), which has also elongated, and stands out prominently beyond the oral plastron.

Fig. 9. The same figure seen in profile, with the mouth downward. The vibratile chord is a deeply undulating line, following the edge of the arms, which extend beyond the general outline. The water-tube, it will be seen, forks also at the oral extremity; one branch extending into the odd arm (e^6), the other toward the angle made by the base of this arm and the pair of oral ventral arms (e^5). The great increase in size of this odd arm will be seen when compared to Fig. 7 of this plate.

Fig. 10. Larva seen from the mouth side. Thus far the arms had altered but little the character of the outline of the larva. In this figure, however, some of them are sufficiently developed to be capable of extensive motion. The median arms (e') especially are far in advance of the others. All the anal arms develop so as to become more slender at first, and assume their true character sooner than the oral arms, which, during the early stages, are always more heavy, and take their final shape later than the anal arms. At the angle, where the oral ventral arms and the odd arm come together, at the base of the oral arms, slight swellings are formed (f), which are the first trace of the pair of brachiolar arms ($f f$), the odd brachiolar arm being only seen in the profile view (Fig. 12, f'), though it can be traced as a double outline of the odd arm (f''). We can already see a constriction in the water-tube as it passes into the odd arm, and from this (nearer the mouth) are sent off two small pouches ($f' f'$), which enter into the brachiolar pair of arms (f). The first trace of the actinal area of the future Starfish is also plainly visible (t) on the water-tube (w'), on the left of this figure.

Fig. 11. A more advanced larva than Fig. 10, seen from the mouth side, in which the oral arms have assumed all the characters of the anal appendages. The brachiolar arms are quite well developed; the intestine and the stomach are slightly crowded to one side by the greater increase of the actinal area (*t*) of the Starfish; the ambulacral pentagon of the future Starfish is still more marked (*t*) than in previous stages. Brachiolaria stage.

Fig. 12. The same as Fig. 10 seen in profile, with the mouth downwards.

PLATE IV.

Fig. 1. Seen from the mouth side. A larva with its arms fully developed and in full activity; no further changes take place in the general aspect of the larva, with the exception of those of the anal part where the Starfish is developing, and those of the brachiolar arms. All the arms are nearly equally advanced, with the exception of the median arms (e'), which still retain their greater size. The odd terminal arm (e^6) has also greatly increased in length, as well as the brachiolar arms (ff), which are capable of motion, and into which the branches of the water-tubes can easily be traced. Brachiolaria stage.

Fig. 2. The same larva, seen from above, on a somewhat smaller scale, shows in what way the stomach and the intestine have been pushed to one side, by the great development of the actinal part of the Starfish, on the right of the figure (*s t*). The shape of the mouth (*m*) is particularly well seen, in a dorsal view, at this stage of growth.

Fig. 3. The same larva on a different scale, seen endways, from the oral end, to show the connection between the pair of brachiolar arms (ff) and the oral ventral pair (e^5), as well as the position of the odd brachiolar arm (f'') at the base of the odd terminal arm (e^6).

Fig. 4. An adult larva seen from the right, actinal profile; the arms are in the position which they take when moving rapidly, arched towards the median arms, the brachiolar arms alone being curved in the opposite direction from the others. Here the crescent-shaped ambulacral pentagon, as well as the lobed pentagonal outline of the abactinal area are plainly seen.

Fig. 5. A magnified profile view of the brachiolar arms.

Fig. 6. The brachiolar arms seen from the ventral side of the larva, to show the position of the single disk and of the double row of disks at the base and on each side of the odd brachiolar arm, somewhat less magnified than Fig. 5.

Fig. 7. The anal part of the larva soon after the shrinking of the arms has begun. The whole of the terminal anal part of the larva has gradually been absorbed, so that the disk of the Starfish occupies the whole of the space between the median arms, seen from the ventral side; the oral extremity of the Brachiolaria is unchanged and not represented.

Fig. 8. The shrinking has gone so far that the whole of the anal part has been affected, and the oral extremity alone, with the brachiolar and the terminal arms, retain their original shape and proportions.

Fig. 9. A different view of the anal part of a larva from that of Fig. 7; in a slightly more advanced condition than that of the preceding figure, showing the great height of the abactinal region of the young Starfish; the oral extremity of the Brachiolaria is omitted, as it remains almost unchanged.

PLATE V.

Development of the Starfish proper.

The Figures on this Plate show the gradual development of the actinal and abactinal regions of the Starfish, and the figures represent simply the anal part of the Brachiolaria, which is alone affected during this development.

Figs. 1 – 7 correspond to a Brachiolaria, having reached a state about as advanced as that of Pl. III. Fig. 10.

Fig. 8 is a Starfish developed on the Brachiolaria of Pl. IV. Fig. 11; while Figs. 9 – 14 are stages of development which are only found on Brachiolariæ having their full complement of arms, and in which, except these changes of the Starfish, but slight modifications take place.

Figs. 1, 2, 10, 12, represent that profile of the anal part of the Brachiolaria, in successively more advanced stages, which shows the water-tube upon which is developed the actinal area.

Figs. 3, 5, 11, represent the opposite profiles of the anal extremity of the Brachiolaria, showing the water-tube, upon which is developed the abactinal area.

Figs. 4, 14, represent the ventral side of the anal extremity of the Brachiolaria, showing the extremities of the actinal and abactinal areas of the Starfish.

Figs. 6 – 9, 13, represent the dorsal side of the anal extremity of the Brachiolaria, in the successive stages of growth of the young Starfish, showing the opposite extremities of the actinal and abactinal areas of the Starfish.

Owing to the partial transparency of the Brachiolaria, either the actinal or the abactinal area is always projected upon the other, when the larva is seen in profile. In the dorsal or ventral views, the angle made by the actinal and abactinal areas becomes visible.

Fig. 1. Actinal profile of the anal part of the water-tube (w') of the Brachiolaria, previous to the appearance of the pentagon of lobes. In stage of Pl. III. Fig. 7.

Fig. 2. Somewhat more advanced actinal profile, showing the ambulacral pentagon, as well as the position of the five rods of limestone, opposite the angles of the actinal pentagon, seen through the thickness of the larva on the surface of the other water-tube (w). In Stage of Pl. III. Fig. 8.

Fig. 3. The same larva seen from the opposite profile, to show the abactinal area; small Y-shaped rods have appeared at the extremities of the simple rods.

Fig. 4. The same larva seen from the ventral side of the Brachiolaria, to show the relative position of the pentagons of the two areas; only two of the rods of the abactinal side are seen, while the edges of three of the actinal folds (t) can be perceived, one above the other, on the foot-like projection formed by the folding of the water-tube w'.

Fig. 5. A more advanced Starfish, in stage of Pl. III. Fig. 10, from the abactinal profile; the Y-shaped appendages of the original rods have increased in number; smaller independent Y-shaped rods have made their appearance in the intervals between the larger ones, in the spaces corresponding to the middle of the pentagon of the actinal side. The angles of the actinal pentagon are formed of a double fold, the sides of which are concave; the stomach is almost concealed by the great accumulation of limestone granules on the abactinal area.

Fig. 6. The anal part of a larva from the dorsal side, to show the apparent dividing into elliptical compartments of the water-tubes (w, w'), made by folding and the bending of the extremities of these tubes (Pl. III. Fig. 10).

Fig. 7. The same larva from the dorsal side, to show the manner in which the first fold (t) is made on the exterior surface of the water-tube (w'), and the greater size of the right water-tube extending over the digestive cavity to the madreporic opening (b).

Fig. 8. A Starfish from the dorsal side of the Brachiolaria (Pl. III. Fig. 11); shows the lobes formed by the two arms which are in view, with the large cluster of rods in the centre of the lobe, and the small cluster in the space opposite the angle of two lobes.

Fig. 9. The same view of a more advanced embryo, somewhat older than Pl. IV. Figs. 1, 2; the lobes of the arms have become indented, the arms themselves are separated by a deep cut, the Y-rods extend so as to form almost a continuous network over the whole abactinal area. The actinal pentagon has assumed the shape of prominent loops projecting beyond the foot-like, oblique fold of the water-tube.

Fig. 10. The same embryo, seen from the actinal profile; the tentacular loops stand out independently from the surface of the water-tube; the stomach and nearly the whole length of the intestine are enclosed by the abactinal area.

Fig. 11. Seen from the abactinal profile in stage of Pl. VII. Fig. 8; tubercles have formed upon the surface, the Y-shaped rods extend into them, the lobes of the edge of the disk are deeper, the second set of clusters of limestone cells have greatly increased.

Fig. 12. The same embryo from the opposite profile; the inner tentacular folds have become tipped with a triangular point. The thickness of the abactinal surface prevents the network of cells on the edge of the arms from being seen.

Fig. 13. A view of the embryo from the dorsal side of the Brachiolaria; the madreporic body (b), the opening of the water-pore, is placed at the edge of the upper arm (r_1'''), the tubercles on the edge of the arms are well shown by the great accumulation of small Y-shaped rods.

Fig. 14. The same from the ventral side of the Brachiolaria (Pl. VII. Fig. 8). This figure shows, perhaps better than any other, the relative position of the extremity of the two pentagonal warped surfaces. The rough outline of the Starfish is due to the manner in which the tubercles of the abactinal surface project above. The Starfish in this condition is at the point of resorbing the larva, and of closing the actinal and abactinal areas.

PLATE VI.

The young Starfish after the Brachiolaria has been resorbed.

Fig. 1. A young Starfish, seen from the actinal side; the anal and oral clusters of arms of the Brachiolaria appear like small knobs, placed on opposite sides of the new mouth. The future rays are mere lobes, and are not symmetrical.

Fig. 2. The same embryo, seen from the abactinal side, to show the arrangement of the network of limestone meshes.

Fig. 3. A more advanced embryo, in which all traces of the appendages of the larva have entirely disappeared. Each side of the pentagon of suckers is a rosette made up of seven loops; the limestone particles are deposited so as to project at the angle of the arms between these loops. The mouth is movable, the pentagon is not closed, and the Starfish is not yet symmetrical; the shape of the different rays is not identical.

Fig. 4. The same embryo, seen from the abactinal side, showing the arrangement of the successively formed rows of rounded spines and of the plates. The two ends of the open pentagon have approached nearer than in Figs. 1, 2; the outline is not yet regular.

Fig. 5. Magnified view of one of the ambulacral tubes, with its rudimentary tentacles.

Fig. 6. The young Starfish, in which the two pentagons have almost closed, and been brought into parallel planes. There has been a great increase in the size of the cut between adjoining rays; the spines also have grown longer and more pointed; the limestone points of the angle of the rays have advanced nearer the centre. The Starfish is not quite symmetrical, nor are the arms exactly alike.

Fig. 7. The same embryo, from the actinal side, shows the great increase of the ambulacral system, the tentacles being distinct pouches on each side of the main tube. The basal tentacles of one system are much further apart than all the others, and this is the last indication that the ambulacral pentagon is not closed.

Fig. 8. A more magnified view of the actinal side, when the ambulacral pentagon is entirely closed, and the Starfish has become symmetrical, and all the basal suckers are equally distant.

Fig. 9. The ambulacral system of one arm, when confined by the circle of limestone which has been formed round each ambulacral system; the first two pairs of tentacles begin to develop disks; they become club-shaped; the three terminal tentacles are still closely connected, and show no sign of any disk.

Fig. 10. An abactinal view of one ray and the centre of a young Starfish, in which the spines project far beyond the edge of the disk. The arm-plates and the interradial plates have become connected by a narrow bridge. The limestone rods are so much thickened by additional deposits, that they form elliptical cells which have entirely lost the polygonal character of the younger stages.

Fig. 11. One arm and a portion of the centre, from the abactinal side of the most advanced of the young Starfishes which have been raised by artificial fecundation. The spines are very prominent, long, somewhat spreading, and becoming even fan-shaped. The limestone cells are gradually assuming the character of the limestone cells of the adult, small cells within larger ones; the cut between the rays is very deep.

Fig. 12. The same young Starfish as Fig. 11, seen from the actinal side; the three pairs of tentacles have suckers; the deposit of limestone of the actinal area having the same cellular structure as that of the abactinal area, though formed by the increase of small cells instead of rods. This Starfish also shows the position of the madreporic body, immediately on the edge of the disk of the lower side; the eye is very prominent at the base of the odd terminal tentacle. The young Starfish (Figs. 11, 12) is about four months old.

PLATE VII.

Fig. 1. Two rays and the centre of the Starfish (Pl. VI. Fig. 10), seen from the actinal side. All the tentacles are encased separately by the limestone deposit of the actinal region. The tentacles have grown so long that they extend beyond the edge of the arm. The pair of terminal tentacles has, as yet, increased but little in comparison to the other pairs. The odd terminal tentacle has, at its base, a bright carmine spot, the eye, which appears about this time. The

mouth, limited by the limestone deposit, takes the shape of a pentagonal opening; the ambulacral tube is concealed.

Fig. 2. The same Starfish as Pl. VI. Fig. 11, seen in profile, to show the great development of the abactinal area, and the Echinus-like arrangement of the spines in the young Starfish. The odd tentacle is seen turned up, between two of the spines, with the eye at its base.

Figs. 3 – 5. Spines of the young Starfish in different stages of growth.

Fig. 6. An enlarged view of the terminal tentacle, to show the position of the eye at the base of the odd tentacle.

Fig. 7. An enlarged view of the meshwork of limestone cells, to show the mode of formation of additional cells, by means of Y-shaped rods.

Fig. 8. A greatly magnified figure of a full-grown Brachiolaria in its natural attitude, at rest, with the Starfish almost ready to resorb the larva; the obliquity of the planes, in which the actinal and abactinal pentagons are situated, is especially well seen in the pointed anal extremity of this Brachiolaria. No letters have been added to this figure, as the different parts can readily be distinguished by comparing it with Pl. IV. Figs. 1, 2, 4.

PLATE VIII.

Fig. 1. Young Asteracanthion about one year old, seen from the abactinal side.

Figs. 2 – 4. Magnified views of spines (p), and of rudimentary pedicellariæ (p', p'').

Fig. 5. Odd terminal tentacle of a Starfish in the stage of Pl. VIII. Fig. 10, at the extremity of the arm with the eye-speck (e).

Fig. 6. One of the abactinal water-tubes (d') at the angle of the rays.

Fig. 7. One of the abactinal water-tubes (d'') along the edge of the rays.

Fig. 8. Abactinal view of the arm of a young Starfish, probably two years old.

Fig. 9. Actinal view of an arm of a young Starfish in its third year.

Fig. 10. Abactinal view of a young Starfish, in which the rudimentary pedicellariæ have made their appearance, also having median and lateral lines of abactinal water-tubes along the arm. Probably three years old.

PLATE IX.

Asteracanthion berylinus.

Fig. 1. Living specimen, seen from the actinal side.

Fig. 2. Living specimen, seen from the abactinal side.

Fig. 3. Preparation showing the calcareous network, abactinal side.

Fig. 4. Abactinal calcareous network seen from the interior.

Fig. 5. Preparation showing the connection of the solid parts, seen from the actinal side.

($a\,i$) Interambulacral plates, with two rows of pores at base.

(a') Ambulacral plates, showing the alternating arrangement of the ambulacral pores penetrating between the ambulacral plates.

(a'') Base of interbrachial partition.

(c) Ambulacral groove.

(l) Lateral imbricating pieces forming the calcareous network of the abactinal surface.

Fig. 6. The same, seen from the interior. Lettering as in Fig. 5.

(c) Dorsal groove of ambulacral system.

($i\,p$) Interradial partition formed by soldering of the imbricating pieces attached to the interambulacral plates.

Fig. 7. Longitudinal section of preparation of arm, to show the formation of the interradial partition by the soldering of the imbricating lateral pieces of the interambulacral plates.

All Figures natural size.

The color of this species, as of all the species of the genus Asterias, varies greatly; it ranges from dark chocolate (on the abactinal side) to light violet. The actinal side is of a much paler shade of the same color. The general tint of the abactinal side depends also greatly upon the state of expansion of the water-tubes and the development of the light-colored pedicellariæ clustered around the spines.

PLATE X.

Echinaster sentus.

Fig. 1. Living specimen seen from actinal side.
Fig. 1′. Portion of arm of Fig. 1, somewhat more magnified.
Fig. 2. Same from the abactinal side.
Fig. 2′. Water-tubes of part of abactinal surface.
Fig. 2″. Madreporic body.
Fig. 3. Calcareous network of abactinal side.
Fig. 4. Internal view of abactinal surface.
Fig. 5. Calcareous network of actinal side (same as Fig. 3).
Fig. 6. Inner view of actinal calcareous network.

All Figures natural size, except Figs. 1′, 2′, 2″, which are somewhat enlarged.

The color of this species varies from a dark reddish-brown to a pale violet, sometimes more or less yellowish-brown or purple. The water-tubes are light pink or violet.

PLATE XI.

Asterias ochracea.

Fig. 1. Single arm and disk, seen from the abactinal side.
Fig. 2. Single arm, seen from the abactinal side, with the spines of the limestone network removed.
Fig. 3. Interior view of limestone network.
Fig. 4. Actinal view of the disk and arm, to show the narrow ambulacral plates, the marginal interambulacral plates, and the adjoining actinal limestone network.
Fig. 5. Inner view of the same, showing the huge spaces left between the pillars forming the marginal support of the limestone work adjoining the interambulacral plates.
Fig. 6. Portion of half of the arm, to show the arrangement of the ambulacral and interambulacral plates, seen from the actinal side near the base of the arm-plates forming the median groove on top.
Fig. 7. Profile view of a similar portion of the arm (as Fig. 6) toward the central part of the arm, seen from the interior of the arm.

All Figures natural size, except Figs. 6 and 7, which are somewhat magnified.

This is often a very brilliantly colored species. Brandt has separated as species the extreme variations in color. The most common coloring is a dark orange, passing in some specimens to an almost pure yellow, or in the other direction to a rich chocolate color. We find also frequently violet as the prevailing tint. The ridges, on the abactinal network, are invariably of a lighter tint than the ground-color.

PLATE XII.

Crossaster papposus.

Fig. 1. Seen from the actinal side, with the spines of the interbrachial surface, and of the lower surface of the arms. (The abactinal surface has been removed.)
Fig. 2. Seen from the actinal side, with the spines removed to show the structure of the plates carrying the spines along the edge of the arms, round the actinostome, and of the limestone plates strengthening the interbrachial membrane; the limestone network of the inner surface of the abactinal surface is seen through the opening of the actinostome.
Fig. 3. Fig. 1, seen from the interior (from the abactinal side), showing the portion of the membrane extending as a division wall between arms, and forming the support as well as the connection between the actinal and abactinal surfaces; this membrane is often a mere film strengthened with limestone plates only at its outer and inner extremities, where it connects by more numerous and stronger plates the two surfaces of the interbrachial space. The plates near the actinostome are frequently drawn out into a long comma-shaped support on the abactinal part of the connecting membrane.

Fig. 4. Same as Fig. 2, seen from the abactinal side, to show the network of the abactinal surface and the projecting knobs forming the support of the clusters of spines of that surface.

Fig. 5. Longitudinal section through the median line, seen in profile.

All figures natural size.

The coloring of this species is of all shades, between a brilliant red and a light orange or a dark violet.

PLATE XIII.

Pycnopodia helianthoides.

Fig. 1. Portion of disk, seen from abactinal side, with papillæ fully expanded (from life).

Fig. 2. Same as Fig. 1, seen from the actinal side.

Fig. 3. Actinal view of central part of the disk, showing the connection of the arms around the central opening.

Fig. 4. Limestone network of part of the abactinal membrane, with the pillar separating adjoining arms seen from the interior.

Fig. 5. Profile view of the extremity of one arm.

Fig. 6. Interior view of the arm; the abactinal membrane is removed, showing the mode of connection of adjoining arms at actinostome, ambulacral vesicles all removed.

Fig. 7. Same as Fig. 6; seen from below, the soft parts all being removed.

Fig. 8. Profile view of Fig. 6.

Fig. 9. Section across Fig. 6.

Fig. 10, 10″. Profile views of two of the large spines of the abactinal surface.

Fig. 10′, 10‴. The same spines, 10, 10″, seen from above.

Figs. 1 – 5 are natural size; all others slightly enlarged.

The color of the abactinal surface varies greatly in this species, from a brilliant carmine to yellow, violet, or bright vermilion, with the intermediate shades of orange.

PLATE XIV.

Linckia Guildingii.

Fig. 1. Seen from above.

Fig. 1′. Enlarged tip of one of the arms.

Fig. 2. Fig. 1, seen from the actinal side.

Fig. 2′. Magnified portion of arm of Fig. 2.

Fig. 3. Preparation of actinal side, showing the limestone plates after the granulation is removed.

Fig. 3′. Magnified view of opening of actinostome of Fig. 2.

Fig. 4. Preparation of abactinal surface, showing the limestone plates of that surface.

Fig. 4′. Enlarged view of madreporic body.

Fig. 5. Interior view of abactinal surface of one of the arms, showing the small openings left between the nearly united plates.

Fig. 6. Section across one of the arms, to show the depth of the ambulacral furrow, with its single line of ambulacral pores.

Linckia is generally of an ashy-violet color, with darker spots scattered over the abactinal surface of the arms.

Asterina folium *Lütk.*

Fig. 7. Actinal view prepared to show the plates of that surface.

Fig. 7′. Enlarged view of plates, forming edge of actinal opening, in Fig. 7.

Fig. 8. Somewhat enlarged view, natural attitude, with suckers expanded.

Fig. 8′. Enlarged view of arm, showing ocular tentacle, at base of pointed terminal ambulacral tube.

Fig. 9. Water-tubes of abactinal surface somewhat enlarged.

Figs. 1 – 7, natural size; others somewhat enlarged.

The abactinal surface of Asterina is of a pea-green color. The actinal surface is more yellowish. Specimens frequently occur of a yellow color on both sides.

PLATE XV.

Asteropsis imbricata.

Fig. 1. Seen from above; in two of the arms the water-tubes of the abactinal surface are represented as fully expanded, while they are drawn in on the others.

Fig. 1′. Actinostome with the tentacles drawn in, taken from life; the plates, except the marginal ones, are all imbedded and hidden in the membrane of the actinal surface.

Fig. 2. Preparation showing the irregular limestone plates and needles of the abactinal surface.

Fig. 3. Portion of abactinal surface, seen from the interior, showing the original reticulation, which is lost in the exterior view from the abactinal side.

Fig. 4. Fig. 2, seen from the actinal side, to show the arrangement of the limestone plates.

Fig. 5. Interior view of the actinal floor, showing the broad ambulacral groove, the connection of the ambulacral plates round the actinostome, and the position of the pillars connecting the actinal and abactinal surfaces.

Fig. 6. Same as Fig. 5, seen in profile, to show the interbrachial arches and the great height of the ambulacral plates.

Fig. 7. Section across the arm near the tip; the ambulacral plates almost touch the abactinal surfaces.

All figures are natural sizes.

On the actinal side Asteropsis is of a brownish color, with yellow edge along the ambulacral furrows. The abactinal surface is most brilliantly colored with large patches, irregularly arranged, of vermilion, bright green, blue, yellow, with prominent carmine spots enclosing the areas for the passage of the water-tubes.

PLATE XVI.

Pentaceros reticulatus.

Fig. 1. Arm and portion of the disk with water-tubes fully expanded and ambulacral tubes extending beyond the edge of the arms near the tip, seen from the abactinal side.

Fig. 2. Same as Fig. 1, seen from the actinal side, the two rows of tentacles drawn in and ambulacral furrow almost closed near the face.

Fig. 3. Actinostome natural size, with the ambulacral tentacles at base of furrow fully expanded.

Fig. 4. Actinal view of the lower surface, showing the limestone plates of the margin of furrow supporting the papillæ, and the plates covered by the granulation of Fig. 2.

Fig. 5. Interior view showing the ambulacral system, the connection of the ambulacral plates round the actinostome, the thick abactinal surface with the nearly solid interbrachial limestone arches.

Fig. 6. Central portion of the abactinal surface of the disk, natural size, showing the massive reticulation of the surface.

Fig. 7. Section through the centre of the ambulacral system, seen in profile, with the interambrachial arches.

Figs. 3 and 6 somewhat enlarged; others, natural size.

The general coloring of this species is yellowish or pinkish brown, sometimes bright carmine. The ridges separating the spaces for the passage of the water-tubes are a darker shade of the general color. On the actinal edge the plates are of a darker brown color, while the actinal surface itself is faintly colored gray.

PLATE XVII.

Solaster endeca.

Fig. 1. Limestone network of the abactinal surface.

Fig. 2. Dried specimen, with spines bordering the ambulacral furrows and covering the actinal surface.

Fig. 3. Interior view of the actinal floor, showing the narrow furrow of the ambulacral system, its connection round the actinostome, the absence of a prominent interbrachial arch separating the central arm-spaces.

Fig. 4. Same as Fig. 2, only denuded of spines to show the plates of the actinal surface supporting them.

Fig. 5. Longitudinal section through the median line of the ambulacral furrow.

All Figures natural size.

This species is generally, on the abactinal side, a dirty orange yellow, passing into red; more yellowish and lighter in shade on the actinal surface.

PLATE XVIII.

Cribrella sanguinolenta.

Fig. 1. Seen from the abactinal side, to show the minute spines covering the whole disk and arms.

Fig. 2. Fig. 1, seen from the actinal side.

Fig. 3. Enlarged view of spines round the actinostome and base of the arms.

Fig. 4. Actinal view; specimen denuded of its spines to show the close system of limestone plates forming the actinal surface.

Fig. 5. Interior view of the abactinal surface, showing its close reticulation.

Fig. 6. Longitudinal section across the central line of the ambulacral furrow, somewhat enlarged.

Fig. 7. Interior view of the ambulacral system of one of the arms and its central connection, somewhat enlarged.

Figures 3, 6, 7 are somewhat enlarged; all others, natural size.

This species varies in color from brilliant orange-yellow to dark purple or dull violet.

PLATE XIX.

Astropecten articulatus.

Fig. 1. Dried specimen, from the abactinal side.

Fig. 2. Fig. 1, seen from the actinal side.

Fig. 3. Abactinal view of denuded specimen.

Fig. 4. Actinal view of denuded specimen.

Fig. 5. Interior view of actinal floor, showing ambulacral system, the interbrachial arches, the connection of ambulacra round the actinostome.

Fig. 6. Interior view of the abactinal surface.

Fig. 7. Actinal region of specimen somewhat larger than Fig. 4.

Fig. 8. Longitudinal section through arm, showing the great thickness of the marginal plates.

All Figures are natural size.

The marginal plates are of a light brown color with darker edges; the abactinal surface of nearly the same shade, somewhat lighter than the plates. The color is sometimes arranged in darker rectangular patches along the edge of the arms on the abactinal side. The marginal plates are also bright yellow, enclosing a violet abactinal surface.

PLATE XX.

Luidia clathrata.

Fig. 1. Abactinal view from life.

Fig. 2. Same, seen from the actinal side, showing the two rows of pointed tentacles.

Fig. 3. Same view as Fig. 1, denuded specimen.

Fig. 4. Preparation showing the plates of the actinal surface.

Fig. 5. Interior view of actinal floor, showing ambulacral system and mode of connection round actinal opening.

Fig. 6. Interior view of abactinal surface.

Fig. 7. Actinal view of central part of disk, with tentacles contracted, showing the spines along the edge of ambulacral furrows and at their junction.

Fig. 8. Longitudinal section of arm.

Fig. 9. Terminal knob of arm seen from above.
Fig. 10. A terminal knob, seen from the actinal side.
Fig. 11. The same, seen from the end.
Fig. 12. Madreporic body.

All Figures natural size, with the exception of Figs. 9 – 12, which are somewhat enlarged.

The coloring of this species is quite dull; it has a grayish hue, with large square patches of brown arranged along the margin of the arms. The color of the abactinal surface is frequently in lines, one in central part of the arms, the others along their margin. The ambulacral tentacles are yellow.

ERRATA.

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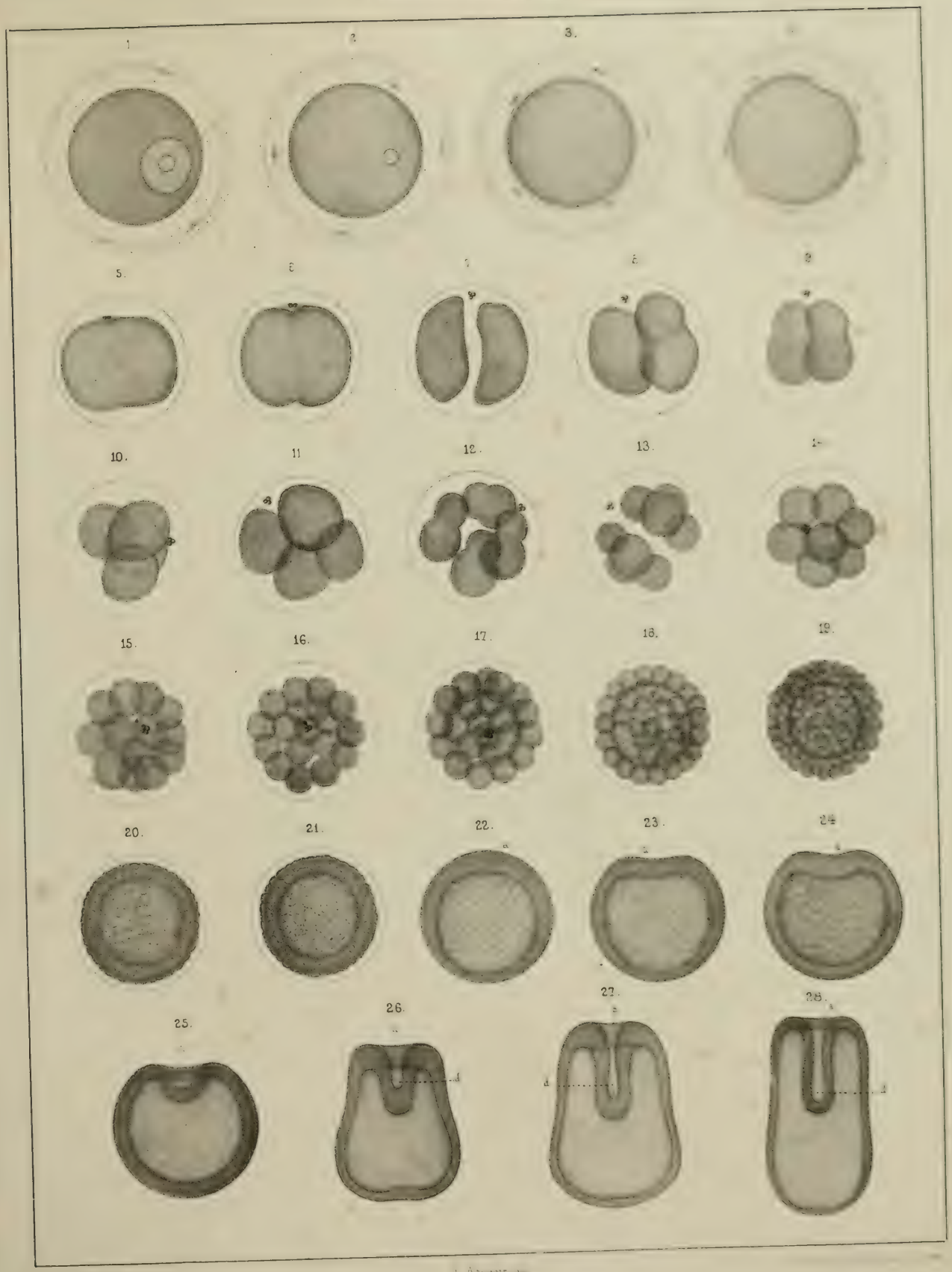
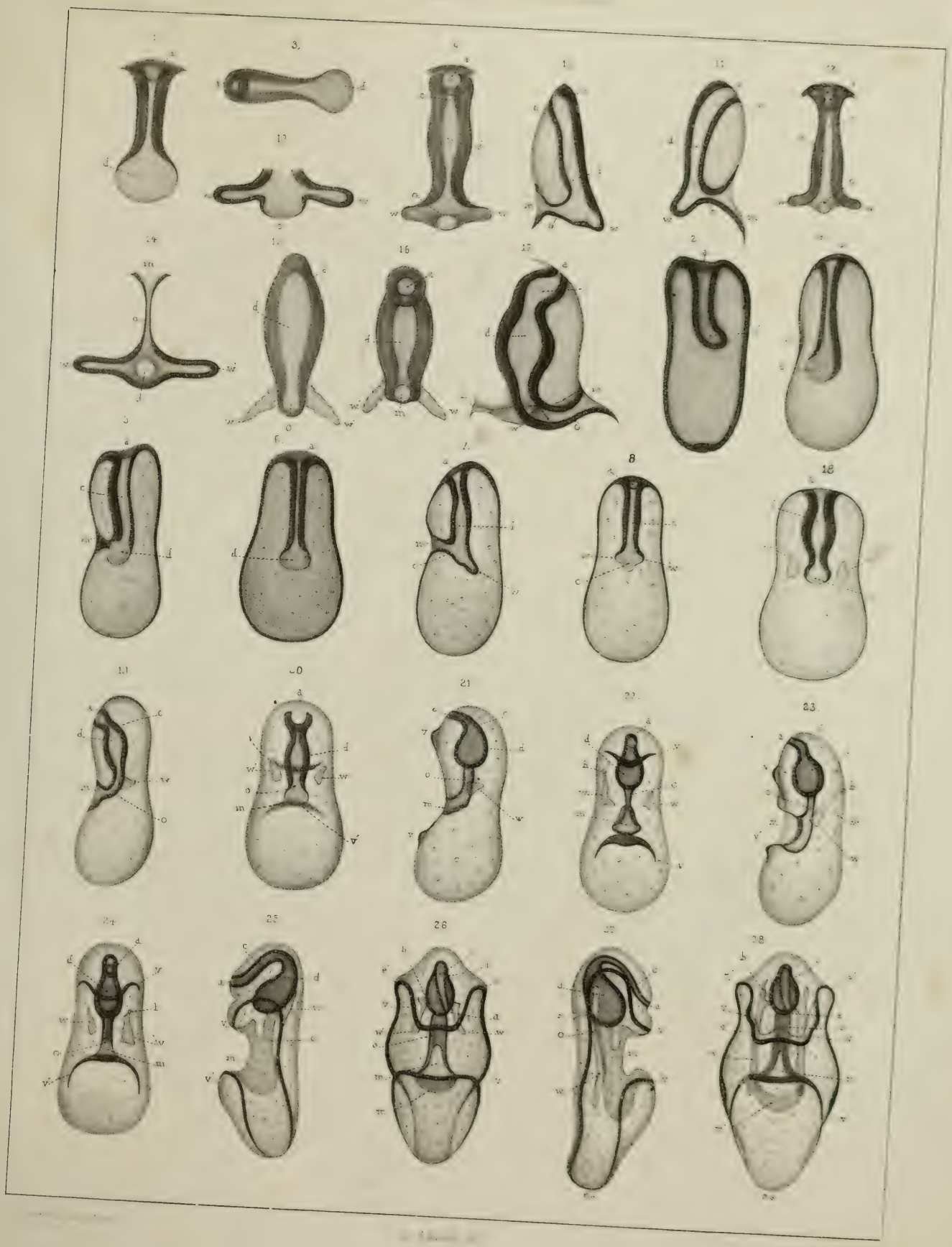
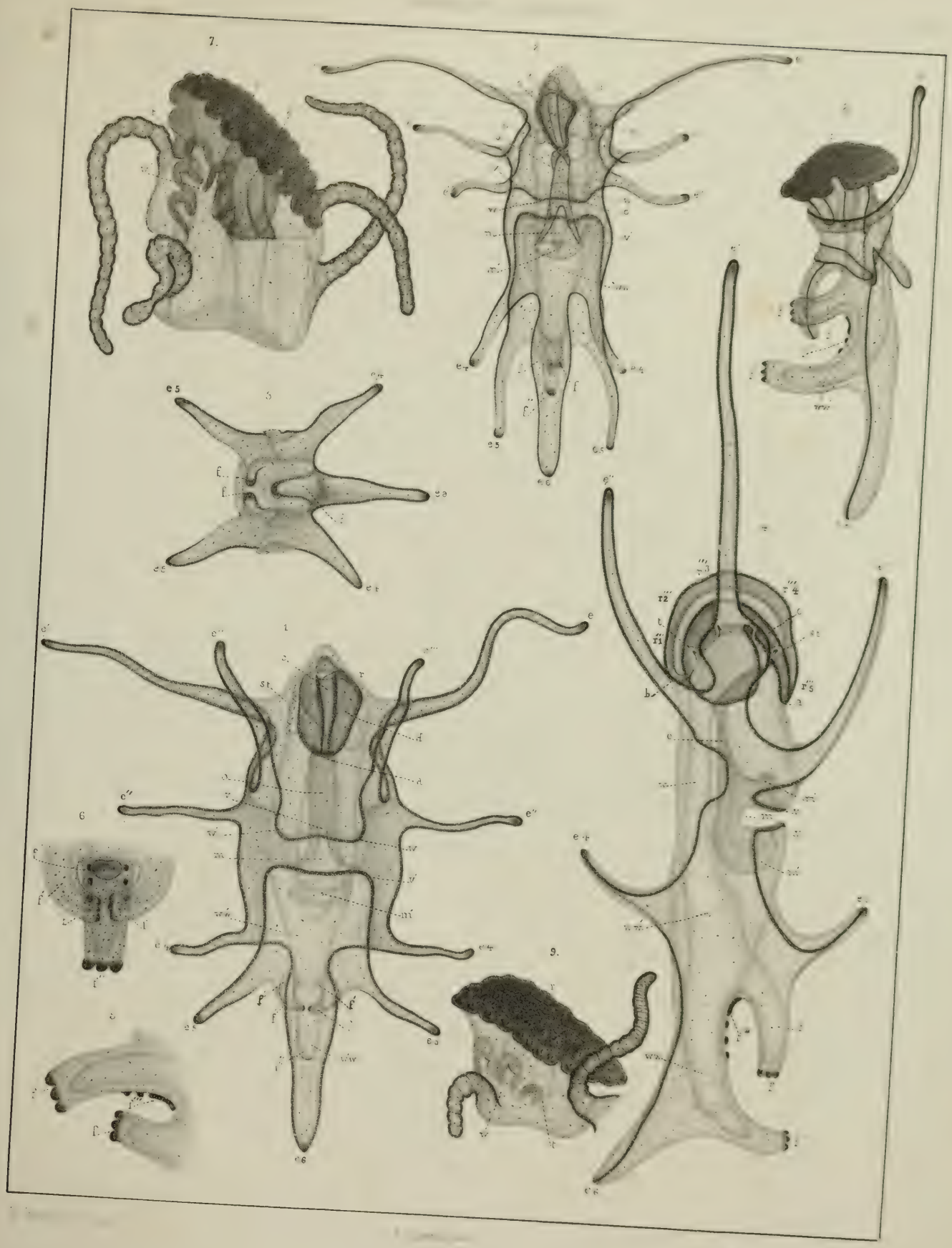


E. Burrill, on stone

A. Agassiz

ASTERACANTHION BERYLINUS A.

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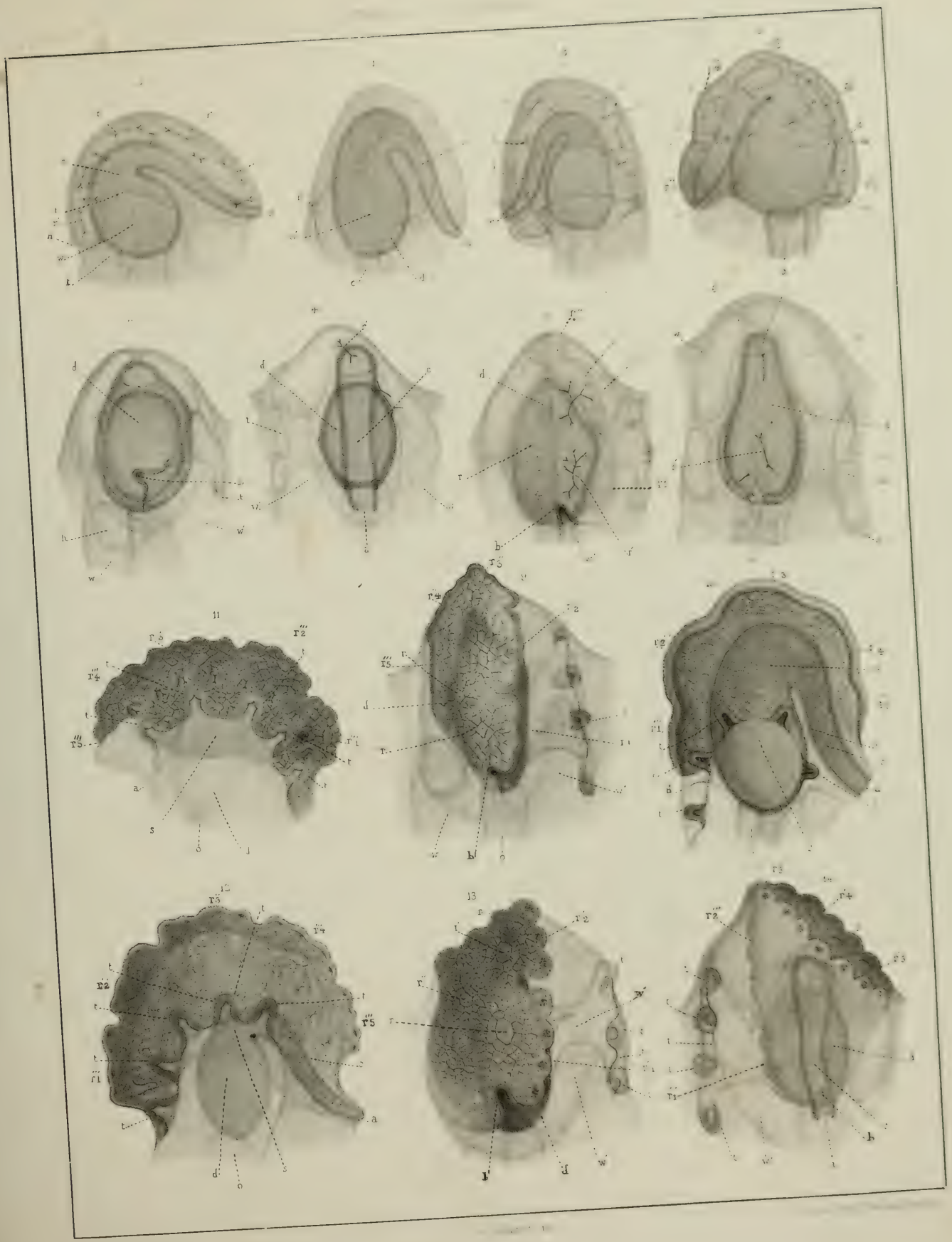
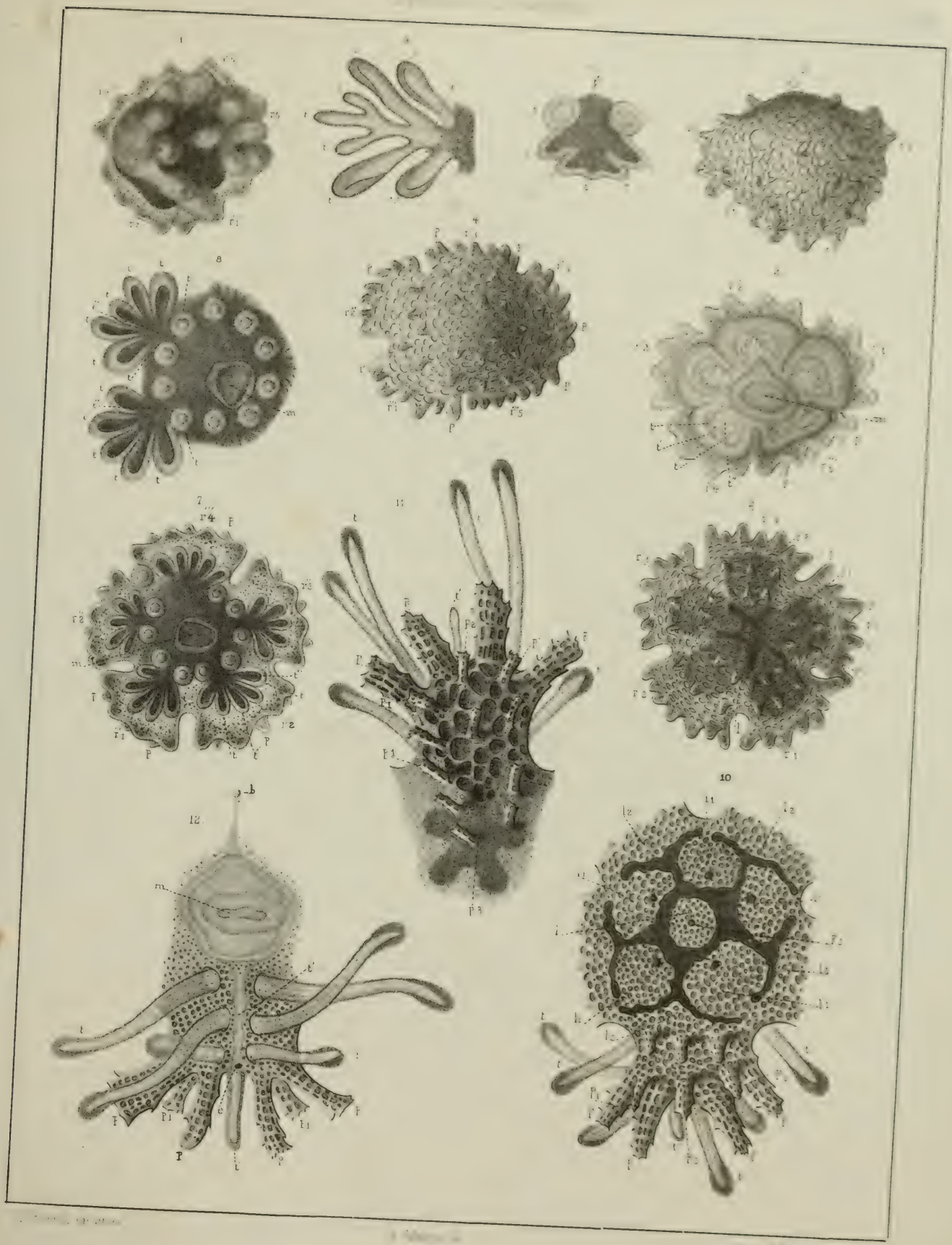
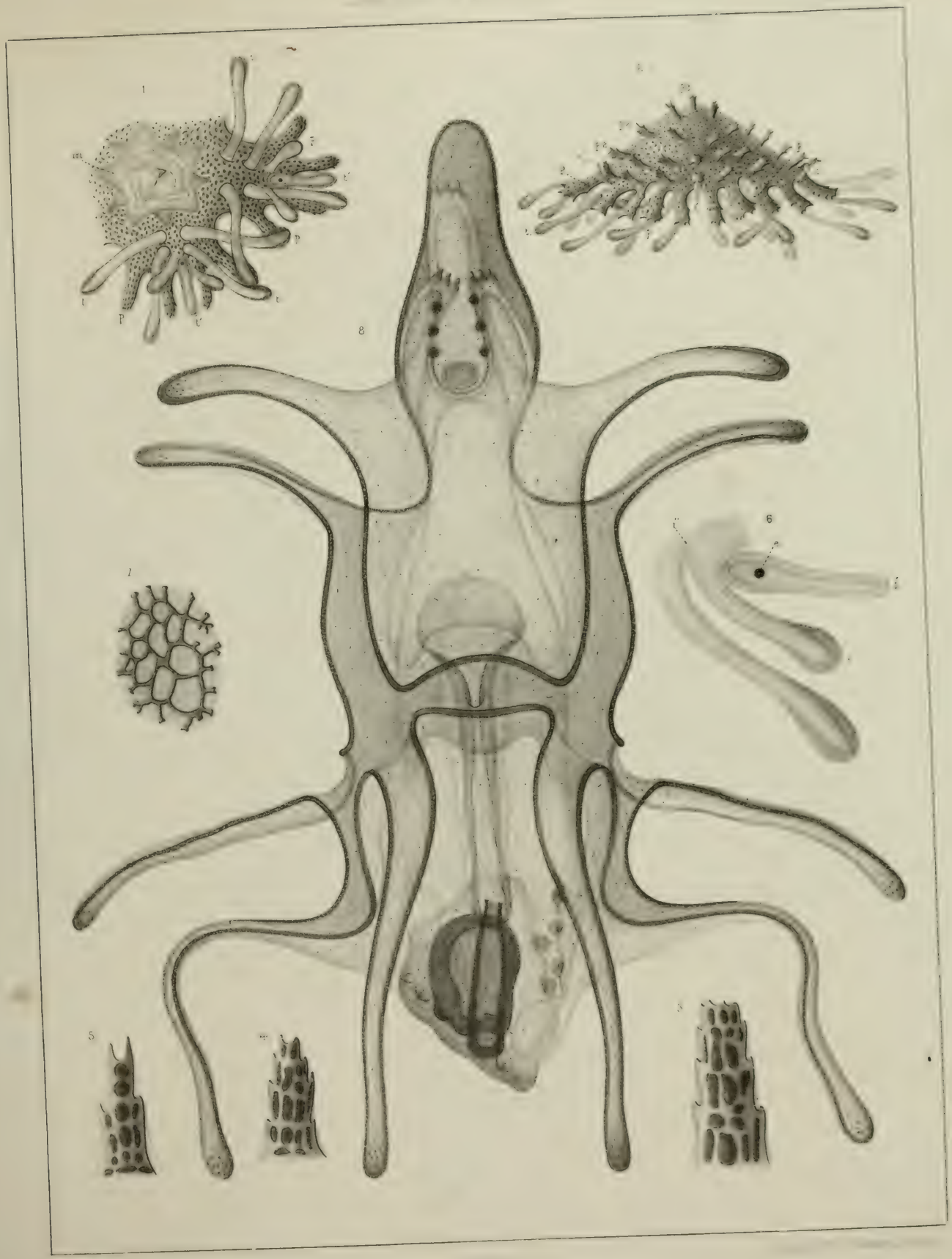


E. Burrill, on stone

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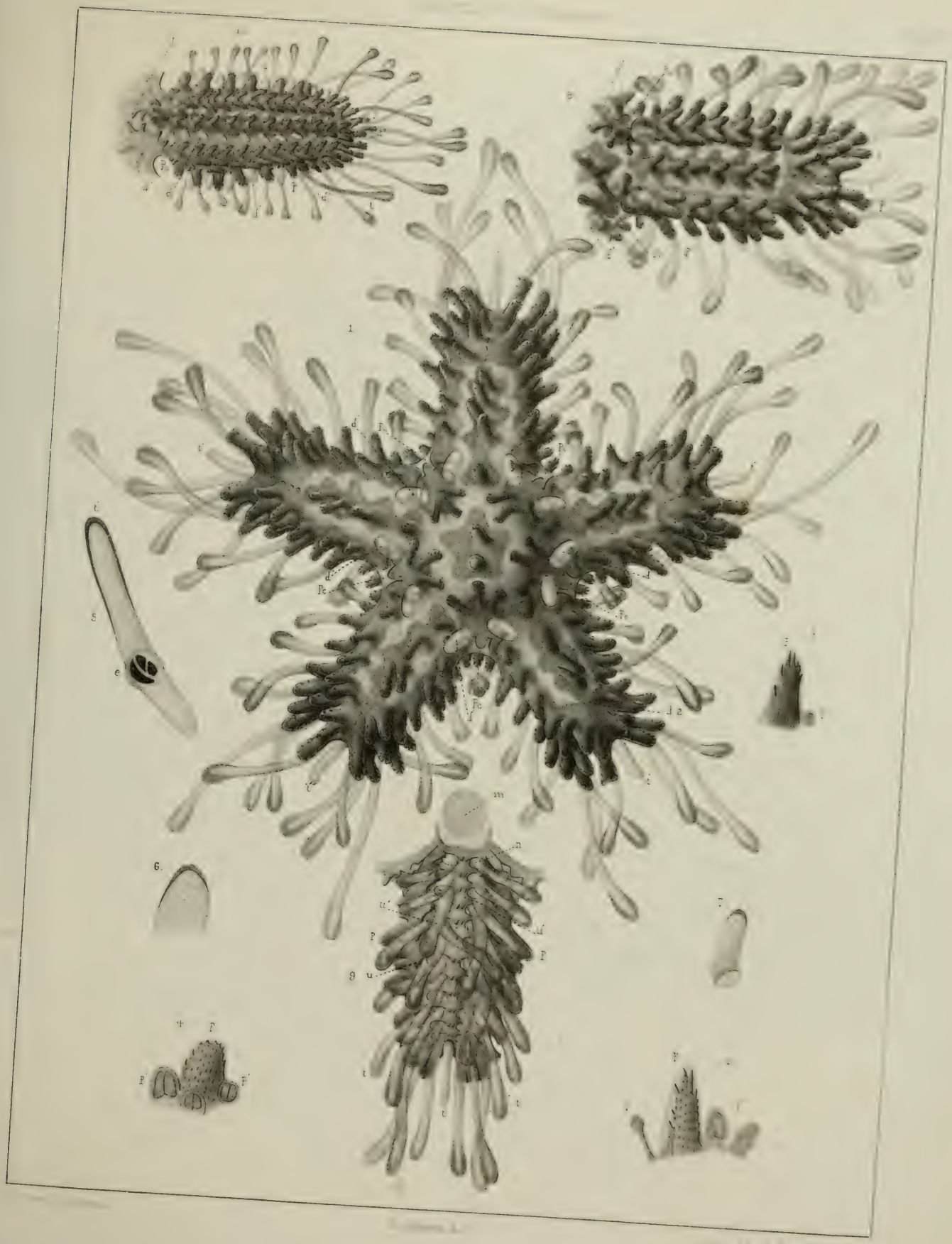
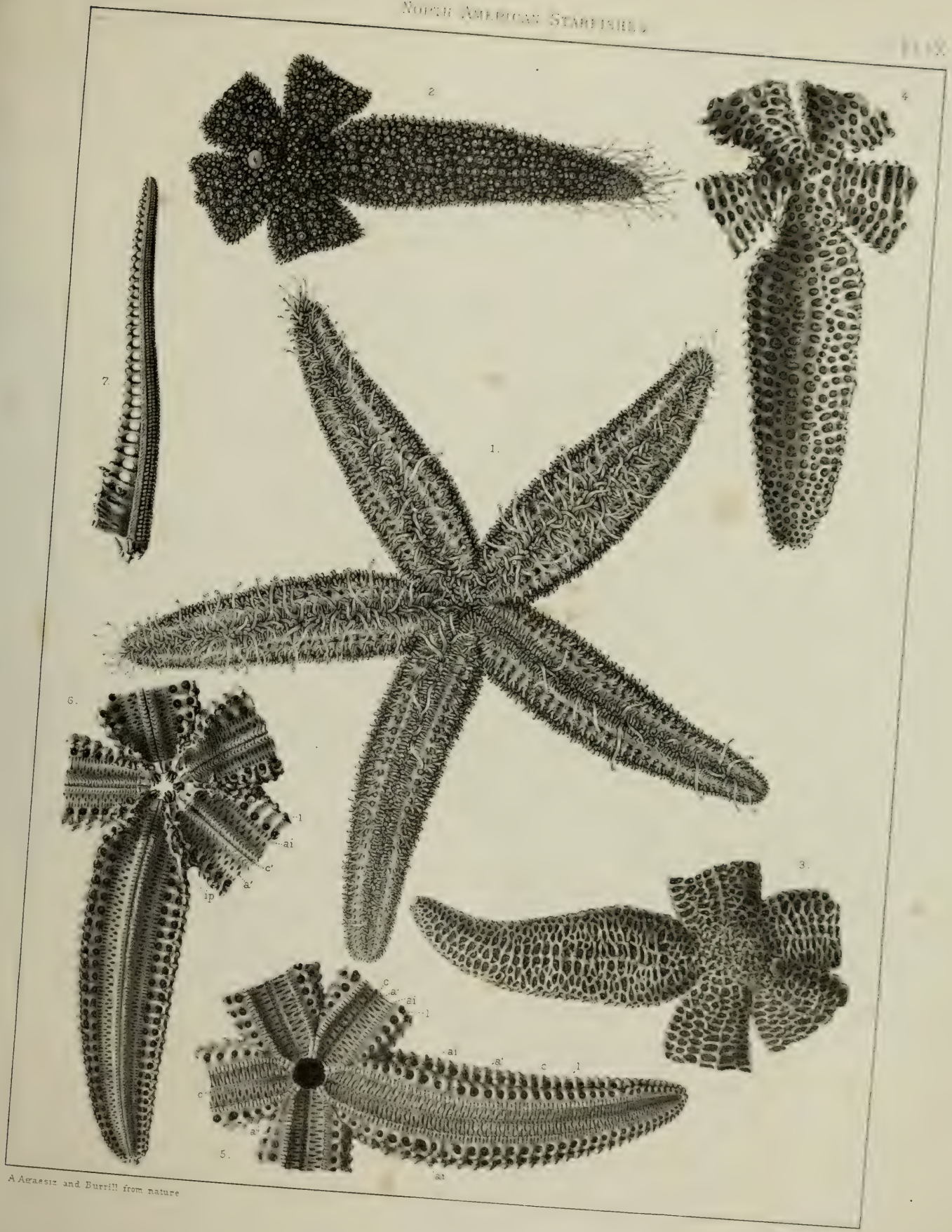
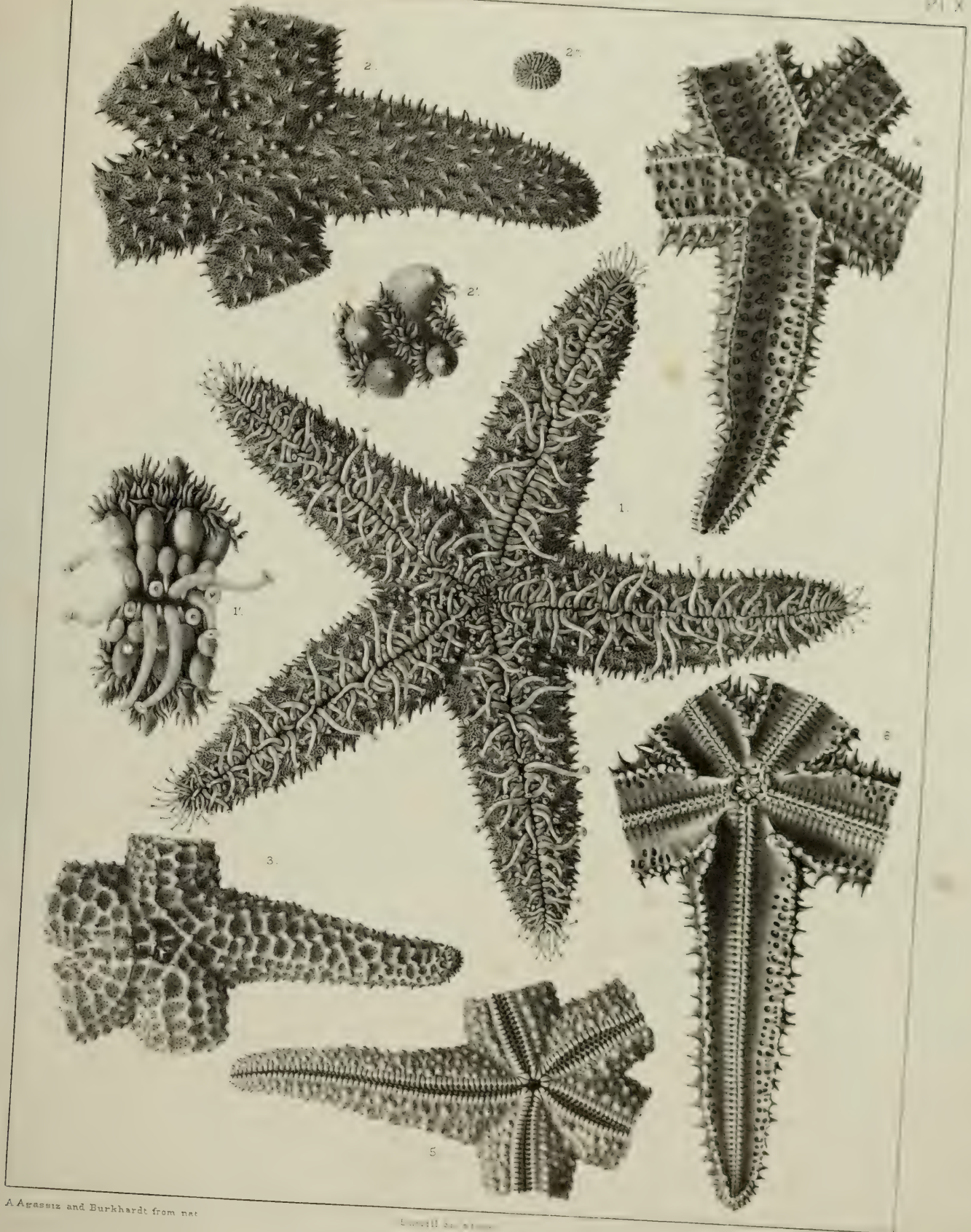




A Agassiz and Burrill from nature

Asteracanthion berylinus Ag

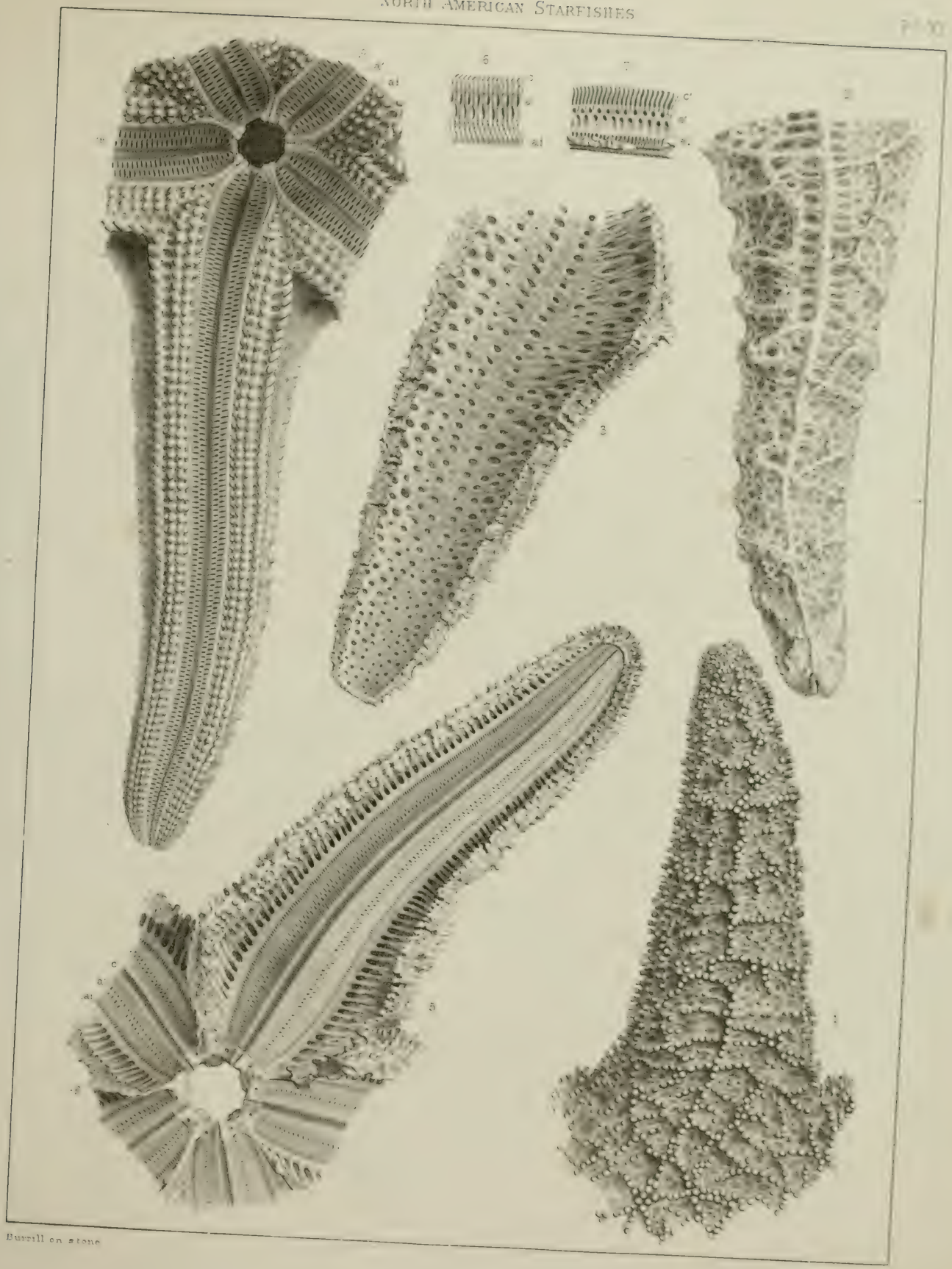


A. Agassiz and Burkhardt from nat.

Lowell lith. Boston

Heliotyped by A. Meisel

Echinaster sentus Verr.



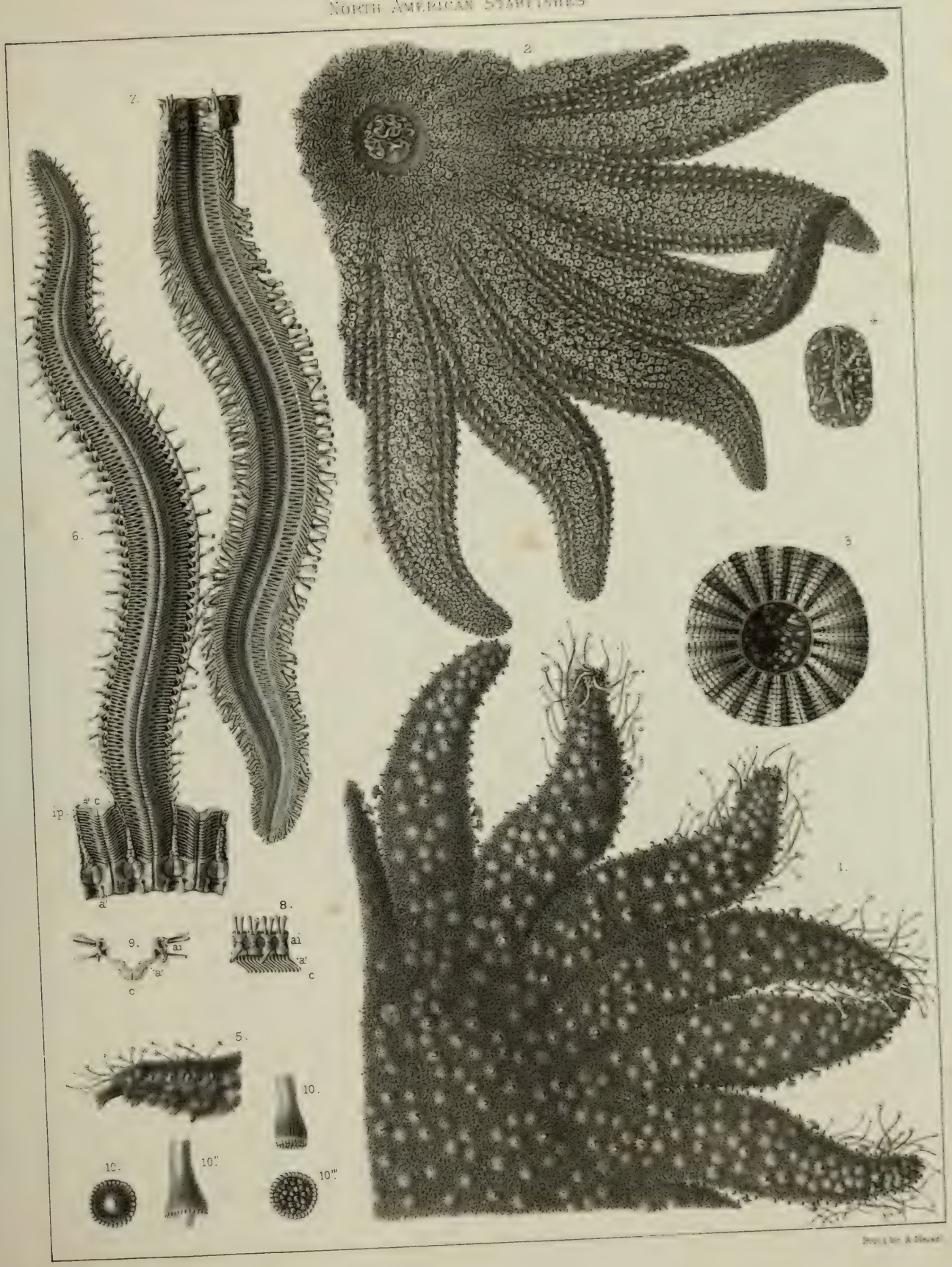
Burrill on stone

Print by A. Meisel

Burrill from nature

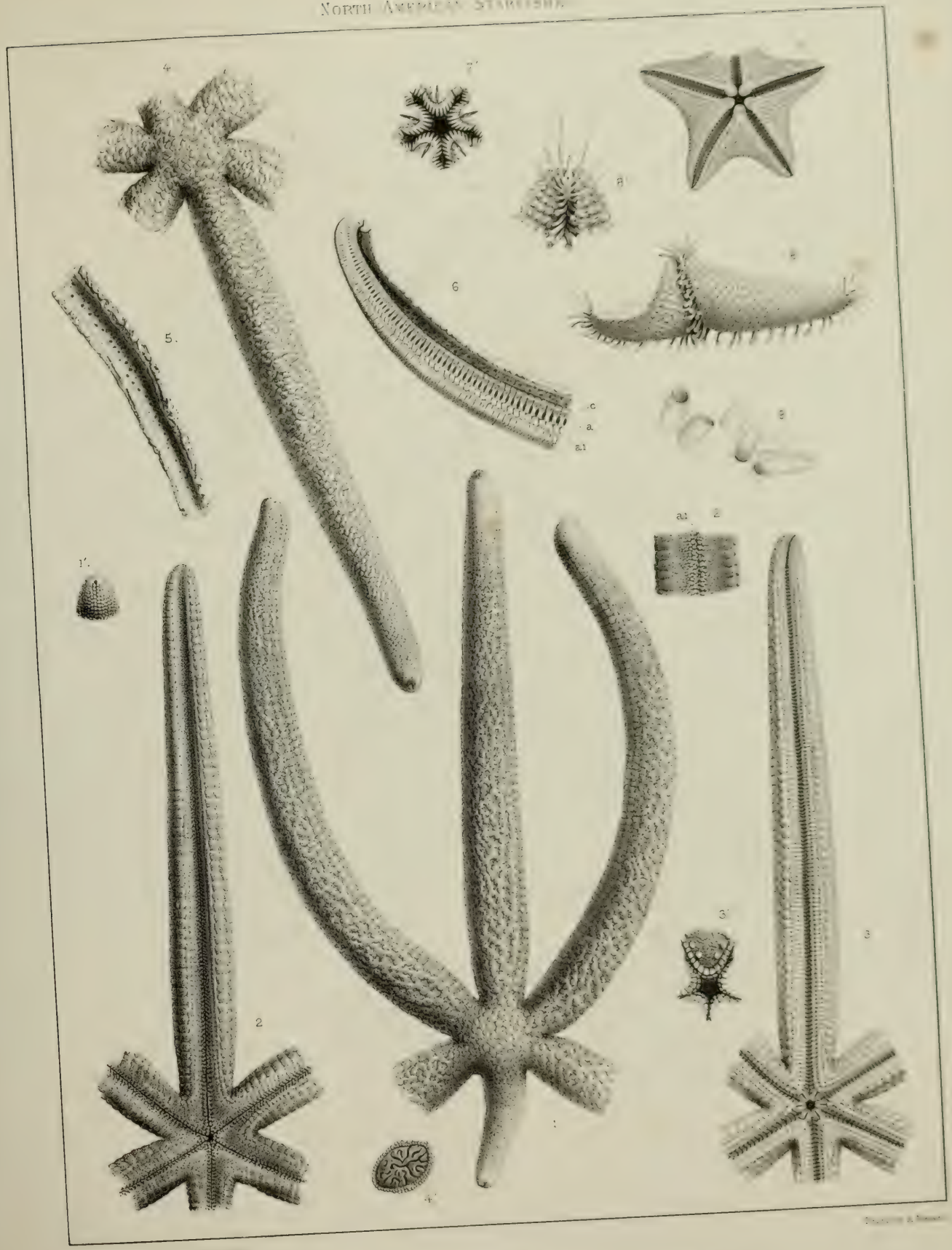
Print by A. Meisel

Crossaster papposus M.T



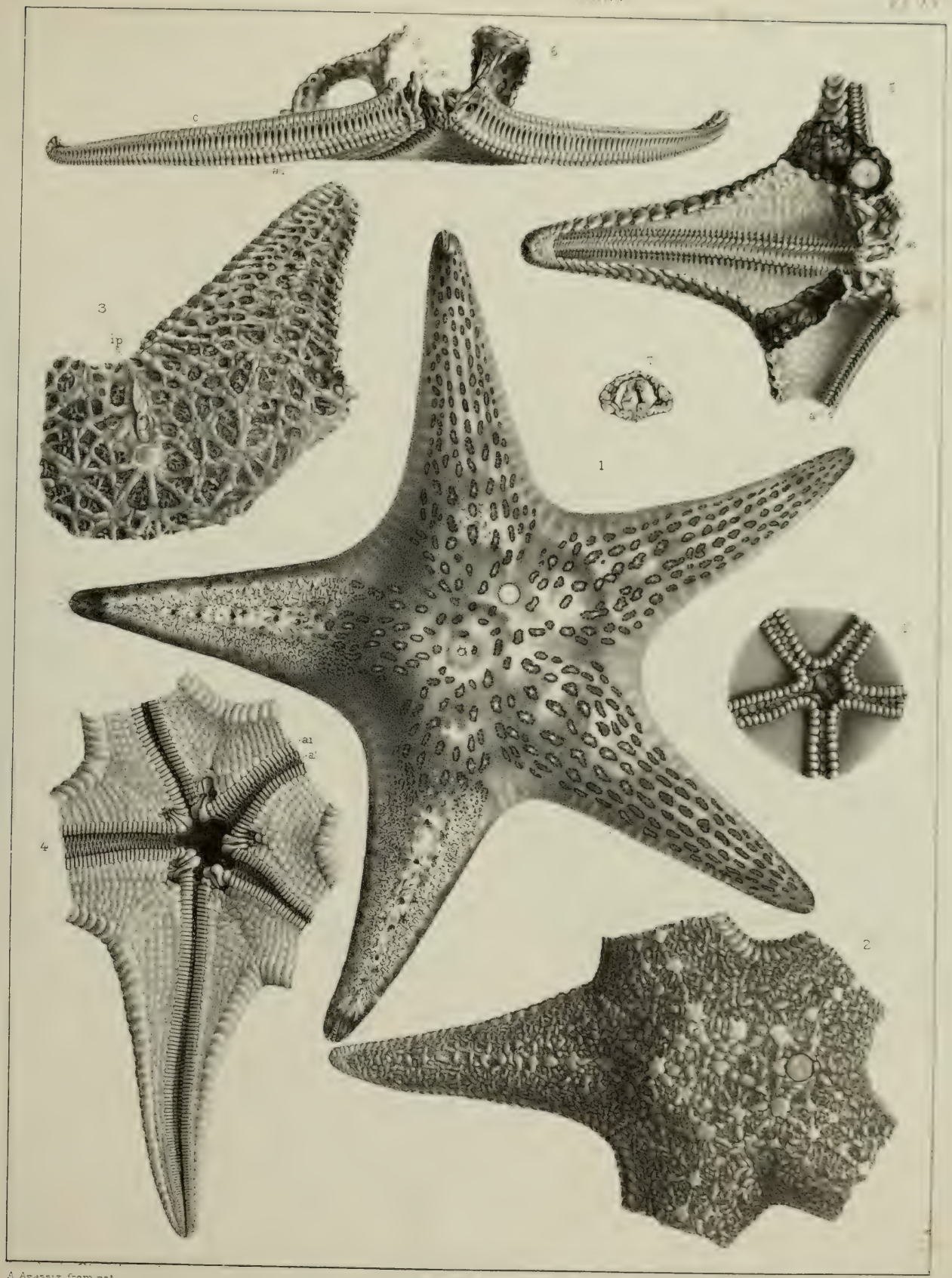
A. Agassiz from nat.

Pycnododia heliantheoides Sumn.



A Agassiz and Burrill from nature

1-6 Linckia Guildingii Gray 7-9 Asterina folium Lütk.



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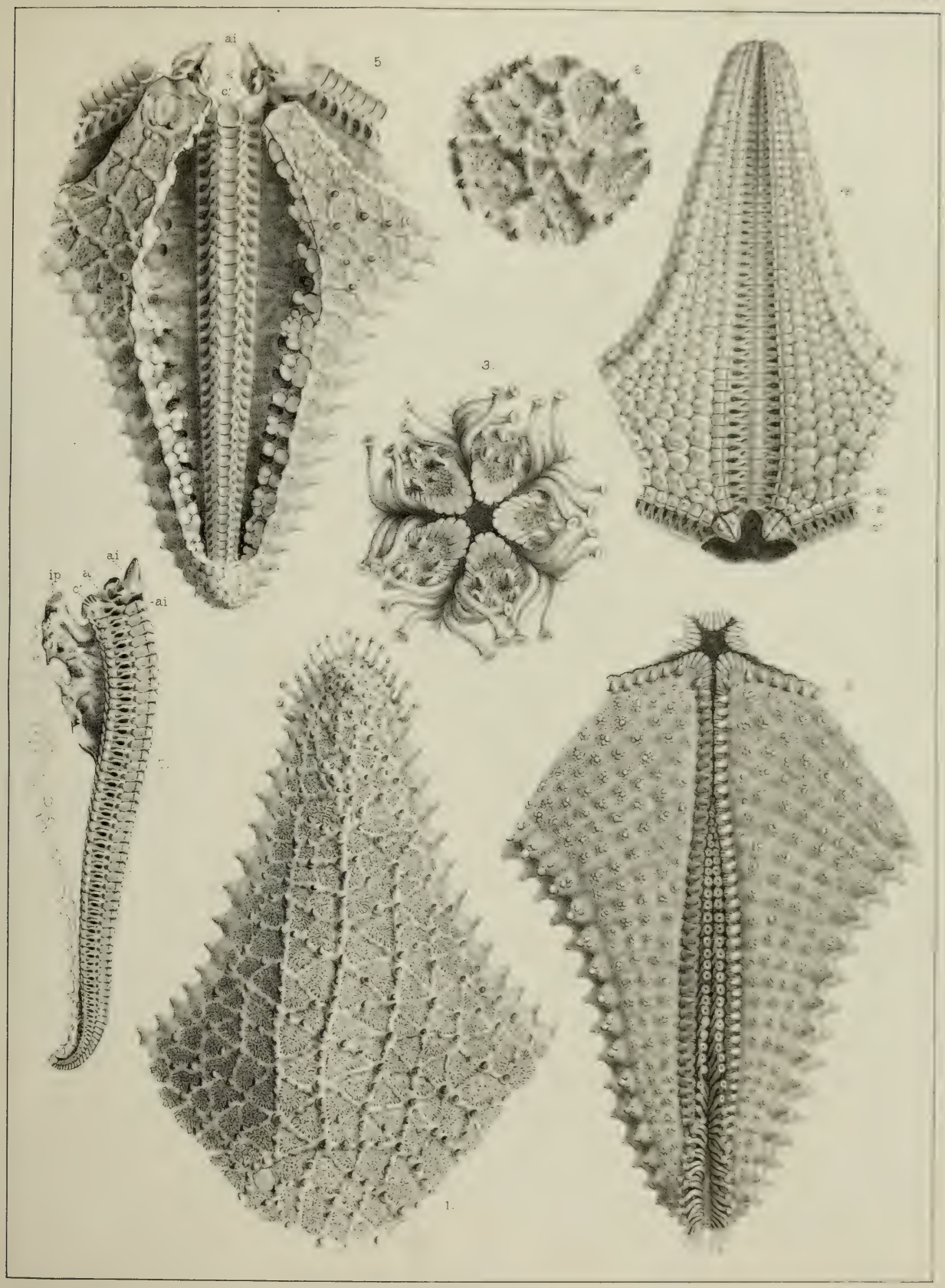
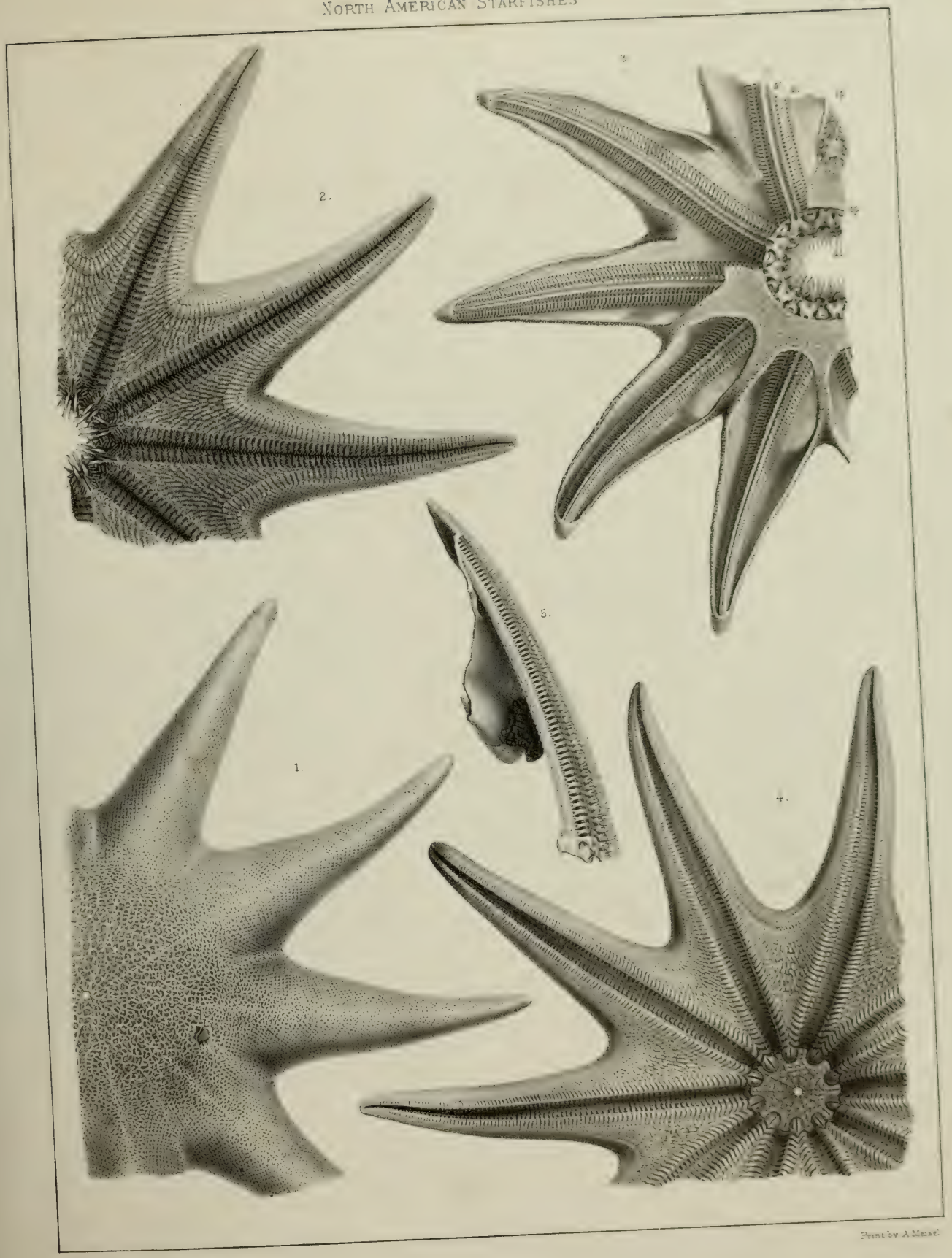
Asteropsis imbricata Grube



A. Agassiz and Burkhardt from nat. Burrill on stone Print by A. Mesel

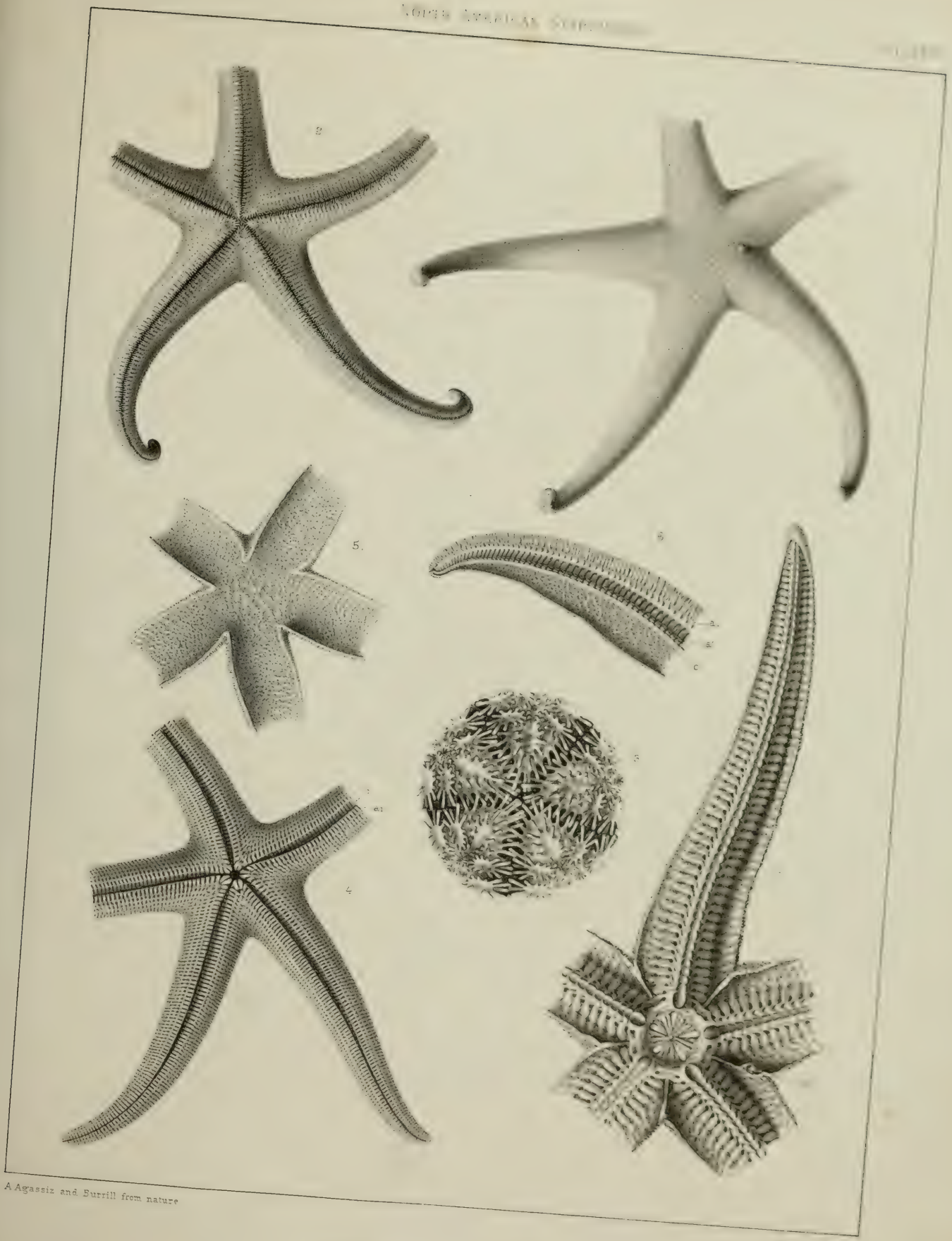
PENTACEROS RETICULATUS Link



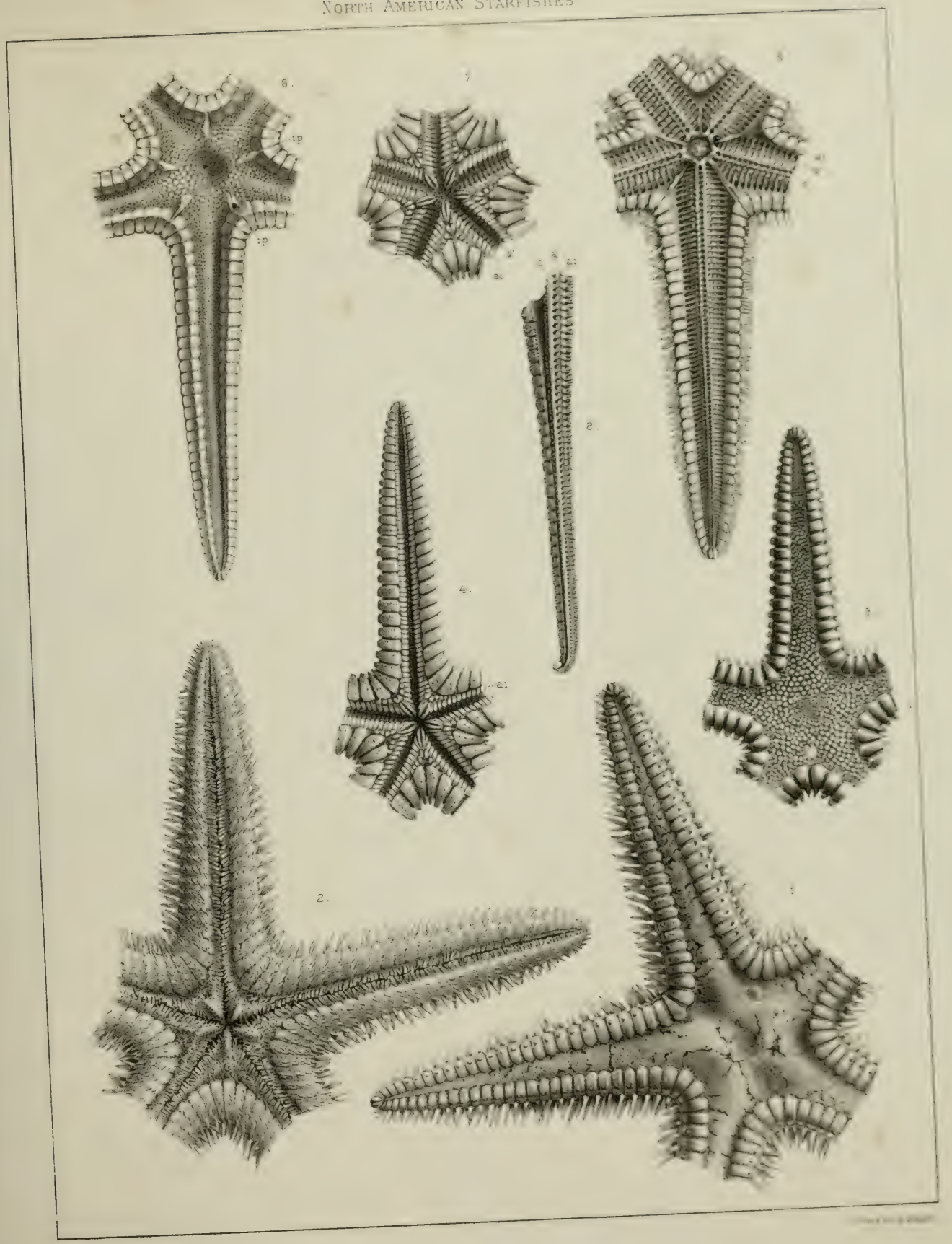
Print by A. Meisel

Burrill from nat on stone.

Solaster endeca Forbes.



A Agassiz and Surrill from nature



Burrill on stone

Astropecten articulatus M.T

A. Agassiz and Burrill from nature

Memoirs of the Museum of Comparative Zoölogy
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Vol. V. No. 2.

REPORT

ON THE

HYDROIDA

COLLECTED DURING THE EXPLORATION OF THE GULF STREAM BY L. F. DE POURTALÈS, ASSISTANT UNITED STATES COAST SURVEY.

[PUBLISHED BY PERMISSION OF PROFESSOR BENJAMIN PEIRCE, SUPERINTENDENT U. S. COAST SURVEY.]

BY

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ETC.

WITH THIRTY-FOUR PLATES.

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INTRODUCTORY.

The collections of Hydroids obtained by Mr. de Pourtalès during the exploration of the Gulf Stream between Florida and Cuba, while assistant of the Coast Survey, were sent to me by Mr. Alexander Agassiz for determination. The collection, which had been put up in spirits and is, for the most part, in an excellent state of preservation, proves to be a very large one, and to contain a great number of undescribed species. The determination of the specimens, and the drawing and description of the new species, have occupied more time than I had anticipated, and with the pressure of other avocations have caused more delay than I could have wished in the publication of the results.

All the enlarged drawings and details of structure have been carefully made by myself, while most of the drawings representing the natural size of the hydroid, as well as the completion of some of my sketches and the drawing of the whole on stone, have been executed by Mr. Hollick; and I must here bear testimony to the truthfulness of his work and the almost photographic actuality with which he has reproduced the natural form of the specimen.

One of the most striking features of the collection consists in the large number of undescribed species, and the small percentage which can, with probability, be referred to forms known to exist on the European side of the Atlantic.

Leaving out of consideration a few specimens whose characters, in consequence of their imperfect preservation, could not be ascertained, the collection consists of seventy-one species. Sixty-four are here figured and described for the first time, and none of these have as yet been known to occur beyond the area to which the exploration was confined. There thus remain only seven species which, so far as their identification is possible,

are already known as European forms. These are *Filellum immersum*, *Halecium muricatum*, *Sertularella polyzonias*, *Sertularella Gayi*, *Antennularia ramosa*, *Plumularia catharina*, and probably *Tubularia indivisa*, whose identification is, in consequence of the absence of all the soft parts, less certain than in the others.

One of the specimens here described, *Halecium capillaris* Pourtalès, has been already examined and named (*Thoa capillaris*) by Mr. de Pourtalès in No. 6, Bull. M. C. Z., Vol. I. Mr. de Pourtalès has also described *Tubularia crinis*, but this has not been received by me in a condition sufficiently perfect to admit of further examination.

The Gymnoblastic genera sufficiently well preserved for satisfactory determination consist of nine species, all new and referable to two genera, Eudendrium and Bimeria. Species of Tubularia would also seem to exist in the collection, and one of these, as just said, is probably the *Tubularia indivisa* of the European seas; but as in none of the specimens of apparent Tubularia does anything remain beyond the tubular perisarc, the characters needed for a reliable determination are entirely wanting.

Several of the specimens referred to Eudendrium have, on the contrary, their soft parts well preserved, and leave no doubt of the correctness of this determination; while others may, with a provisional reservation, be referred without much hesitation to the same genus. In the little hydroid referred to Bimeria the soft parts are well preserved both in the trophosome and the gonosome.

Of species referable to Calyptoblastic genera fifty-six are here described and figured. Of these, fifty-five are now recorded for the first time, while I have figured one form which occurs also on the eastern side of the Atlantic, and has been elsewhere * described by myself as a variety of *Sertularella Gayi*.

Of the fifty-five new Calyptoblastic species forty-five belong to the Sertularinæ and ten to the Campanularinæ.

The collection is especially rich in the Plumularidæ; no less than twenty-eight out of the seventy-one determinable species belong to this beautiful family. Of these, twenty-six species are now described for the first time, the remaining two, so far as it is possible to determine specimens in which no gonosome is present, are identical with the *Antennularia ramosa* and the *Plumularia catharina* of the European shores.

* Reports on the Hydroids collected during the Expeditions of H. M. S. Porcupine, Trans. Zoöl. Soc., London, February, 1873.

It is thus obvious that the region from which the present collection has been obtained, and which includes an area between the Florida Reef on the north and west, and Cuba, the Salt Key, and Bahama Banks on the south and east, is characterized by a very distinct hydroid fauna, and must form part of a special province in the geographical distribution of the Hydroida. How far the same forms will be found to extend beyond the limits of the exploration must remain for future researches to decide.

The European species which was met with in greatest abundance over this area is the *Sertularella Gayi*, which occurred chiefly in the condition of the strong irregularly branched variety already referred to. It was among the most widely distributed species of the area, and was obtained from no less than nineteen different dredgings.

Among the specimens of Gymnoblastea the gonosome is present in a considerable proportion of species. So also a large proportion of the Plumularidæ is provided with the gonosome, and presents some interesting and beautiful modifications of this part of the hydroid colony. From the other Calyptoblastic forms, however, the gonosome is in almost every instance absent. The very rare cases in which it is present are from some of the deepest dredgings made.

Among the new species are many which must be regarded as representatives of new generic groups. Indeed, throughout the whole collection we meet with features many of which are of great interest and significance in their general bearing on hydroid morphology.

Bathymetrical Distribution. — With very few exceptions a careful record had been kept of the depths from which the specimens had been dredged. These depths varied from that of quite shallow water to four hundred and seventy-one fathoms. The following table will show at a glance the relative richness in hydroid life of the various depths explored: —

Species whose depths have been recorded.	Depths from which the species have been dredged.	Species whose depths have been recorded.	Depths from which the species have been dredged.
10	Between 1 and 10 fathoms.	0	Between 200 and 250 fathoms.
2	" 10 " 20 "	6	" 250 " 300 "
5	" 20 " 50 "	2	" 300 " 350 "
13	" 50 " 100 "	0	" 350 " 400 "
10	" 100 " 150 "	2	" 400 " 450 "
6	" 150 " 200 "	2	" 450 " 500 "

DEFINITIONS OF TERMS.

In the descriptions of the genera and species I have adopted the terminology which I have used on other occasions, and these descriptions will perhaps be rendered more intelligible by giving here definitions of the principal terms employed.

Hydrosoma. The entire hydroid colony.

Ectoderm. The more external of the two organized layers of which the body of every hydroid is composed.

Endoderm. The more internal of the two organized layers of which the body of every hydroid is composed.

Perisarc. The unorganized chitinous excretion by which the soft parts are to a greater or less extent invested.

Zooids. The more or less independent products of non-sexual reproduction, forming by their association the hydroid colony.

Trophosome. The entire assemblage of such zooids as are destined for the nutrition of the colony.

Gonosome. The entire assemblage of such zooids as are destined for the sexual reproduction of the colony.

Hydranths. The proper nutritive zooids, or those which carry the mouth and proper digestive cavity, and which are almost always set with tentacles.

Hydrotheca. The cuplike chitinous receptacle which protects the hydranth in the Calyptoblastic genera.

Intrathecal Ridge. An imperfect septum by which in many Plumularidæ the cavity of the hydrotheca is transversely divided into a distal and a proximal portion.

Hydrophyton. The common basis of the hydrosoma by which its zooids are connected into a single colony.

Hydrorhiza. The proximal end of the hydrophyton by which the colony fixes itself to other bodies.

Hydrocaulus. All that portion of the hydrophyton which intervenes between the hydrorhiza and the hydranth. It is *polysiphonic* or fascicled when it is composed of several mutually adherent tubes; *monosiphonic*, when consisting of a single tube. In some species the cavity of its perisarc may be divided by annular ridges or imperfect septa, — *septal ridges*. The *rachis* is that portion of the hydrocaulus along which in the Plumularidæ the hydrothecæ are arranged.

Cœnosarc. The common organized fleshy portion of the hydrophyton; the living bond by which the zooids are organically united to one another.

Nematophores. Peculiar bodies developed in certain genera from definite points of the hydrosoma, and consisting of a chitinous receptacle with sarcode contents in which thread-cells are usually immersed. They are eminently characteristic of the family of the Plumularidæ. They are *supracalycine* when situated one on each side of the orifice of the hydrotheca; *mesial* when situated on the mesial line of the hydrotheca or rachis.

Gonophore. The ultimate generative zooid which gives origin directly to the generative elements, — ova or spermatozoa.

Gonangium. An external chitinous receptacle within which in the Calyptoblastic genera the gonophores are developed.

Acrocyst. An external sac which in certain hydroids is formed on the summit of the gonangium, where it constitutes a receptacle into which the ova are discharged in order to pass within it through some of the earlier stages of their development.

Corbula. A basket-shaped receptacle which encloses groups of gonangia in certain plumularian hydroids.

Phylactogonia. Special branches intended for the protection of the gonangia in certain plumularidans.

Gymnoblastic. The condition of a hydroid when no external protective receptacle (hydrotheca or gonangium) invests either nutritive or generative buds. Gymnoblastea, the name of one of the suborders of Hydroida.

Calyptoblastic. The condition of a hydroid when an external protective receptacle (hydrotheca or gonangium) invests either the nutritive or generative buds. Calyptoblastea, the name of one of the suborders of Hydroida.

DESCRIPTIONS OF NEW GENERA AND SPECIES.

Suborder GYMNOBLASTEA.

Family EUDENDRIDÆ.

Genus EUDENDRIUM Ehrenberg (in part).

Eudendrium eximium.

Pl. I. Figs. 1, 2.

Trophosome. — Hydrocaulus attaining a height of about six inches, much branched, with the main branches and subordinate ramuli alternate and distichous; main stem and origin of the principal branches fascicled; ultimate ramuli with nearly obsolete annulation at their origin. Hydranths with about twenty tentacula.

Gonosome. — Female sporosacs springing irregularly from the body of the hydranth and from its supporting ramulus.

Dredged from a depth of 43 fathoms off the Florida Reef.

This is a fine species, rendered conspicuous by its size and by its profuse ramification. All the branches, both the primary ones and the subordinate ramuli, are in the same plane. The main stem is strongly fascicled, and towards its base acquires a thickness of nearly two lines.

From *E. ramosum* of the European coasts the present species differs in the more extensive fasciculation of its main stem, in the disposition of its ultimate ramuli, which are not, as in *E. ramosum*, confined to one side of their supporting branch, and in the absence of very decided annulation at the origin of the branches.

All the specimens preserved in the collection are female, and the hydranth of the sporosac-bearing ramulus shows no tendency to atrophy.

Eudendrium exiguum.

Pl. I. Figs. 3, 4.

Trophosome. — Hydrocaulus attaining a height of about an inch, irregularly branched, fascicled in main stem; principal branches and ultimate ramuli slender, mostly annulated at their origin. Hydranths with about twenty tentacula.

Gonosome not known.

Dredged from a depth of 98 fathoms off the Florida Reef.

This is a small species; it is strongly fascicled towards the proximal end of the main stem, but the branches are for the most part monosiphonic, very slender, and with very thin perisarc.

Eudendrium fruticosum.

Pl. II. Figs. 1, 2.

Trophosome. — Hydrocaulus attaining a height of about two inches, much and irregularly branched; main stem and base of principal branches fascicled. Hydranths with about twenty tentacles.

Gonosome. — Male gonophores bithalamic, springing in a verticil of about ten from the body of the hydranth. Female gonophores oval, also springing in a verticil from the body of the hydranth.

Dredged off Key West from a depth of 135 fathoms.

This is a strong, confusedly branched form. The annulation of the perisarc is either altogether obsolete or is at most represented by a few obscure rings at the origin of the ultimate branches, or an occasional group of rings near the middle of their length. The stem is thick and strongly fascicled below, where it resolves itself into numerous hydrorhizal filaments.

In the hydranths which carried the gonophores there was no tendency to atrophy in the male, and but little in the female.

The specimen was loaded with small spherical capsules, — probably a molluscan or annelidan nidus, — which adhered to the stem and branches in dense clusters.

Eudendrium attenuatum.

Pl. II. Figs. 3, 4.

Trophosome. — Hydrocaulus attaining a height of about two inches, not fascicled, very slender, alternately branched; ultimate ramuli short, given

off alternately at short and nearly equal intervals along the stem and branches; main branches and ramuli annulated at their origin; stem with a few annulations here and there.

Gonosome not known.

Dredged S. S. W. of Tortugas from a depth of 60 fathoms.

The specimen was destitute of both gonosome and hydranths, but its very slender non-fascicled stem, and short regularly disposed hydranthal ramuli, afford characters sufficiently diagnostic. In the absence, however, of hydranths and gonosome, the species is only provisionally referred to Eudendrium.

Eudendrium laxum.

Pl. III.

Trophosome. — Hydrocaulus attaining a height of about two inches, irregularly branched, not fascicled; ultimate ramuli alternate, rather long, and with a few annulations at their origin.

Gonosome. — Sporosacs (male) bithalamic, springing in a verticil of about ten from the body of the hydranth.

Dredged off Sand Key from a depth of 100 fathoms.

This is a loosely branched, somewhat straggling species, with unusually long, flexile, hydranth-bearing ramuli.

Imbedded in the cœnosarcal walls of the lower end of the hydrocaulus and in those of the hydrorhiza, there occurred in the specimen clear spherical bodies of whose nature I am unable to give any satisfactory account. They showed no trace of a nucleus, but are too regular to be mere lacunæ. Their real nature can scarcely be determined without an examination in the recent hydroid.

Eudendrium gracile.

Pl. IV. Figs. 1, 2.

Trophosome. — Hydrocaulus attaining a height of upwards of an inch, slender, fascicled at extreme base, alternately branched; ultimate ramuli with nearly obsolete annulation at their origin.

Gonosome not known.

Dredged at Double-Headed Shot Key from a depth of from 3 to 4 fathoms.

This is a slender and delicate species. The hydranths were well preserved in the specimen, but no gonosome was present.

Eudendrium tenellum.

Pl. IV. Figs. 3, 4.

Trophosome. — Hydrocaulus attaining a height of about half an inch, very slender, not fascicled, irregularly branched; branches annulated at their origin; main stem and branches with groups of two or three annuli at distant and irregular intervals.

Gonosome not known.

Dredged off Double-Headed Shot Key from a depth of 471 fathoms.

Eudendrium tenellum is a minute and very slender form, perhaps the most slender species as yet referred to the genus Eudendrium. Its reference to this genus is probably correct, but as neither hydranths nor gonophores were present in the specimen, it may possibly have its true place in some other.

The specimens were obtained along with *Sertularella amphorifera* from the deepest dredgings made.

Eudendrium cochleatum.

Pl. V. Figs. 1, 2.

Trophosome. — Hydrocaulus attaining a height of between two and three inches, not fascicled, alternately branched; main branches and ultimate ramuli with very distinct oblique annulation at their origin, and here and there with groups of three or four ordinary transverse annuli.

Gonosome not known.

Dredged off Cape Fear River from a depth of 6 fathoms.

The strongly marked screw-like annulation at the origin of the branches forms a characteristic feature of this species. Some of the hydranths were well preserved in the specimen, but no gonophores were present.

Attached to it were numerous specimens of a little tube-dwelling crustacean.

Family **BIMERIDÆ.**

Genus BIMERIA Str. Wright.

Bimeria humilis.

Pl. V. Figs. 3, 4.

Trophosome. — Hydrocaulus attaining a height of about a line and a half, springing at intervals from a creeping and ramified stolon, sending off

short, alternate hydranth-bearing ramuli which are marked at their origin by spiral corrugations, and which, increasing in thickness towards their distal ends, gradually pass into the piriform body of the hydranth; perisarc very opaque. Hydranths large, assuming for the most part a drooping attitude.

Gonosome. — Gonophores (male?) oviform, supported on short spirally corrugated peduncles, scattered on the hydrocaulus.

Dredged at Tortugas in shallow water.

The massive-looking hydranths and the enlargement of the hydrocaulus towards their base give a peculiar aspect to this little hydroid. The perisarc, which is very opaque, is apparently continued for some distance over the tentacles, as in *B. vestita* Wright, the only species of the genus hitherto described. In the condition of the specimens of *B. humilis*, however, it was not possible to make this out satisfactorily.

The massive hydranths and comparatively slight development of the hydrocaulus distinguish this species from *B. vestita.* In both species the hydranths exhibit a tendency to assume a drooping attitude.

It occurred in considerable profusion, creeping over the surface of a seaweed which it covered with a low but rather dense growth.

Suborder CALYPTOBLASTEA.

Tribe CAMPANULINÆ.

Family CAMPANULARIDÆ.

Genus OBELIA Peron & Lesueur.

Obelia marginata.

Pl. VI. Figs. 1, 2.

Trophosome. — Stem attaining a height of nine inches, monosiphonic, pinnately branched; pinnæ alternate; stem and pinnæ gently zigzag, with a strong short process given off from the salient angle of each geniculation, and with a joint at the distal side of the process. Hydrothecæ supported on short stout peduncles which rest on the processes of the stem and pinnæ, large, nearly cylindrical, slightly oblique at the inner side of the base, and with a circular even orifice which is margined by a narrow, more transparent rim.

Gonosome not known.

Dredged off Logger-Head Key from a depth of 9 fathoms.

This is a very large, strong form, rendered striking by its regularly pinnate hydrocaulus, and its large, nearly cylindrical hydrothecæ, with perfectly even orifice margined by a narrow clear band.

Without a knowledge of the gonosome its reference to Obelia must be regarded as purely provisional.

The beautiful little *Lafoëa venusta* crept over the stem and pinnæ of one of the specimens.

Obelia longicyatha.

Pl. VII. Figs. 4, 5.

Trophosome. — Hydrocaulus attaining a height of nearly an inch, fascicled below, alternately branched; main stem annulated for a short distance above each ramulus; ramuli annulated at their origin; hydrothecal peduncles of moderate length, more or less annulated. Hydrothecæ narrow, deep, nearly cylindrical above, and then tapering towards the base; the orifice cut into about twenty acute, deep, narrow teeth.

Gonosome not known.

Dredged from a depth of 90 fathoms off the Florida Reef.

The specimens were found attached to *Halecium macrocephalum.* It is a delicate species with the hydrothecæ very thin and compressible. No gonosome was present, and its reference to Obelia is therefore only provisional.

THYROSCYPHUS Allman nov. gen.

Generic Character. *Trophosome.* — Hydrocaulus divided into internodes, each internode carrying a hydrotheca. Hydrothecæ pedunculate; orifice closed by an operculum which is formed by four converging valves.

Gonosome not known.

The small and definite number (4) of valve-like segments composing the operculum of the large and strong hydrothecæ, combined with the very definite division of the hydrocaulus into distinct and equal internodes, distinguishes the genus Thyroscyphus from the other operculate genera of the Campanularidæ. It is highly probable that if we were acquainted with the gonosome other and still more important characters would be found.

Thyroscyphus ramosus.

Pl. VI. Figs. 5, 6.

Trophosome. — Hydrocaulus attaining a height of about two inches, much and rather irregularly branched. Hydrothecæ alternate, large and deep, oblique at the inner side of the base, supported each on a short peduncle which consists of two oblique rings and which springs from the summit of a short thick process given off from the distal end of the internode; orifice with a narrow border; opercular valves broadly triangular.

Gonosome not known.

Dredged south of Sand Key from a depth of 10 fathoms.

Thyroscyphus ramosus is a large and strong species, rendered striking by its large valvular and bordered hydrothecæ. It contrasts markedly with the other operculate Campanularinæ, which are all, so far as is known, small and delicate forms.

Genus CAMPANULARIA Lamarck (in part).

Campanularia macroscypha.

Pl. VIII. Figs. 1, 2.

Trophosome. — Peduncles short, rising from a creeping stolon, marked with a few distant annulations, and having a discoid internode just below the hydrotheca. Hydrothecæ large, cylindrical from above downwards for the greater part of their length, and then tapering rapidly to the base; orifice cut into about twelve conspicuous, rather blunt teeth.

Gonosome not known.

Dredged off Sand Key from a depth of 120 fathoms.

This is a simple creeping species, and though of humble growth is remarkable for the large size of its hydrothecæ.

Family **LAFOËIDÆ** Lamouroux.

Genus LAFOËA.*

Lafoëa venusta.

Pl. VI. Figs. 3, 4.

Trophosome. — Hydrophyton minute, creeping. Hydrothecæ borne on moderately long, slightly corrugated peduncles, which spring at short in-

* It is difficult to find characters for the definition of the genus Lafoëa. I regard, however, as an essential character of the genus the absence of any definite floor to the hydrotheca, a character which

tervals from the creeping filament, cylindrical, deep, slightly curved in one aspect, regularly annulated; orifice circular with everted lip.

Gonosome not known.

Dredged along with *Obelia marginata* at Logger-Head Key from a depth of 9 fathoms.

This elegant little campanularian was found creeping over the branches of *Obelia marginata.*

Lafoëa tenellula.

Pl. VIII. Figs. 3, 4.

Trophosome. — Hydrothecæ very minute, slightly curved, contracted below into a short thick peduncle, springing at intervals from a creeping tubular filament.

Gonosome not known.

Dredged south of Marquesas from a depth of 140 fathoms.

This is a very minute species. The form of the hydrothecæ resembles that of the hydrothecæ of *L. dumosa,* but the whole hydroid is more minute and delicate. The hydrothecæ are usually marked by rings of elongation behind the orifice.

Lafoëa convallaria.

Pl. IX.

Trophosome. — Stem attaining a height of about an inch, simple, fascicled below, sending off simple, non-fascicled, alternate pinnæ. Hydrothecæ stalked, alternately disposed along the main stem and pinnæ, tumid towards the base and contracted towards the orifice, which is turned towards one side.

Gonosome not known.

Dredged from a depth of 152 fathoms off the Florida Reef.

Lafoëa convallaria is a beautiful little hydroid. Its cornucopia-like hydrothecæ on their short stalks, with their regular symmetrical disposition along the main stem and pinnæ, give to the entire hydrophyton a remarkable and very elegant aspect.

The form of the hydrotheca appears to change somewhat by age, for while in some the distal end is turned only slightly to one side, in others

it possesses in common with the operculate genus Cuspidella. The cavity of the hydrotheca thus passes uninterruptedly into that of the supporting peduncle, or if the hydrotheca be sessile, into the cavity of the stem or branch which carries it. Admitting the correctness of this view, it appears to me very doubtful whether many of the species referred to Lafoëa are rightly so placed.

the orifice is turned quite downwards by a curving of this part of the hydrotheca. In many of the hydrothecæ annular indications of growth show themselves just behind the orifice. The peduncles are nearly equal in length to that of the hydrothecæ which they support.

The pinnæ of one side are not given off from the middle point of the interval between two pinnæ of the opposite side, but rather nearer to one of these than to the other.

The species is probably correctly referred to the genus Lafoëa, but in the absence of all knowledge of the hydranths this determination must be taken as only provisional.

Lafoëa coalescens.

Pl. X.

Trophosome. — Hydrocaulus attaining a height of about half an inch, alternately branched, fascicled below, springing from a network of tubular filaments. Hydrothecæ borne on the summit of peduncles which are for the most part given off from the sides of a common tube to which they become immediately adnate until within a short distance of their extremities. Hydrothecæ very deep, tubular, tapering towards the base, and again slightly narrowing towards the margin, which is itself slightly everted.

Gonosome not known.

Dredged south of Marquesas from a depth of 140 fathoms.

The adnate condition of the hydrothecal peduncles gives to this elegant little hydroid a remarkable character. This must, however, be regarded as a continuation of the fascicled state of the lower part of the stem. Occasionally hydrothecæ occur which are borne on shorter peduncles springing from the main stem, but free in their entire course, while there are also some which are borne on free peduncles springing from the hydrorhiza.

The hydrothecæ in every case pass gradually into the supporting peduncle without any basal diaphragm.

Genus CUSPIDELLA * Hincks.

Cuspidella pedunculata.

Pl. VIII. Figs. 5, 6.

Trophosome. — Hydrosoma very minute. Hydrothecæ springing by

* The genus Cuspidella was instituted by Hincks for certain minute operculate Campanularinæ which he separated from Calycella (*Campanularia syringia* of authors) on the ground of the sessile condition

rather long peduncles from a creeping filament, very delicate and filmy, deep, tapering toward the base, where they gradually pass into the peduncle without any definite line of demarcation.

Gonosome not known.

Dredged south of Tortugas from a depth of 260 fathoms.

OPLORHIZA Allman nov. gen.

Generic Character. *Trophosome.* — Hydrothecæ tubular, provided with a floor and having the orifice cut into thin collapsible segments; borne by peduncles which spring from a creeping network of tubes. Hydrorhizal network carrying peculiar appendages which are in the form of tubular receptacles with an orifice in the summit, and which enclose a granular, fleshy column, supporting a cluster of thread-cells.

Gonosome not known.

The genus Oplorhiza is nearly allied to Lafoëina Sars. In Lafoëina, however, the hydrothecæ are absolutely sessile on the hydrorhiza, and their cavity passes directly into that of the hydrorhiza without the intervention of an infrathecal diaphragm or floor.

The genus Lafoëina was established by Michael Sars for a little Lafoëa like hydroid (*Lafoëina tenuis*) obtained off the Norwegian coast, and essentially distinguished from Lafoëa by the presence of peculiar urticating appendages which are borne by the hydrorhiza.* These appendages in Lafoëina are long, filiform, and flexuous, while in Oplorhiza they are short and cup-shaped. In both genera they remind us strongly of the nematophores of the Plumularidæ. Like these they consist of a chitinous receptacle with fleshy contents which are probably of a simply sarcodic nature, and in which thread-cells are immersed. In the species on which the genus Oplorhiza is founded, these contents extend through the proximal part of the appendage in the form of a cylindrical column, which towards the summit becomes enlarged into a bulb in which numerous very long, curved thread-cells are imbedded. A very similar condition exists in *Lafoëina tenuis.*

of the hydrothecæ. A more important character, however, will be found in the absence of any definite floor or basal diaphragm in the hydrothecæ. It is the only known operculate form of the Campanulinæ in which the cavity of the hydrotheca thus passes uninterruptedly into that of the supporting tube as in the non-operculate genus Lafoëa. The sessile or pedunculate condition must be regarded as of merely secondary or specific value.

* G. O. Sars, *Bidrag til Kundskaben om Norges Hydroider. Forhandlinger i Videnskabs-selskabet i Christiania*, 1873, p. 119.

Lafoëina and Oplorhiza afford the only known instances in which organs resembling true nematophores occur outside of the family of the Plumularidæ.

Oplorhiza parvula.

Pl. VII. Figs. 1–3.

Trophosome. — Hydrosoma very minute, scarcely attaining a line in height. Hydrothecæ deep, narrowing towards the summit and towards the base; peduncles with about two rings just below the hydrotheca, and several less distinct ones at their origin from the hydrorhiza. Hydrorhizal appendages very minute, clavate, scattered over the upper side of the hydrorhiza.

Gonosome not known.

Dredged south of Marquesas from a depth of 296 fathoms.

Family **HALECIDÆ.**

Genus HALECIUM Oken.

Halecium filicula.

Pl. XI. Figs. 1–4.

Trophosome. — Hydrocaulus attaining a height of about three inches, alternately branched; branches pinnately disposed; internodes rather long; main stem and principal branches fascicled, but becoming monosiphonic toward their distal ends. Hydrophores* with one or more usually oblique and irregular annulations at their base, then gradually widening from the most distal annulation to the summit, where they terminate in a circular and abruptly everted margin.

Gonosome not known.

Dredged south of Marquesas from a depth of 140 fathoms.

This species is rendered striking by the graceful trumpet-shaped form of its hydrophores. Many of these are provided with a double or even triple margin, caused by the hydranth in its growth leaving behind it the old dilated extremity of the hydrophore, and becoming encircled by a new one, — a common occurrence among the various species of Halecium.

* The genus Halecium is destitute of true hydrothecæ, and the term hydrophore is here used for the appendages of the stem which take the place of the hydrothecæ in giving support to the hydranths.

Just within the everted margin of the hydrophore is the circle of minute brilliant points which is scarcely ever absent in any species of Halecium.

Halecium capillare.

Thoa capillaris Pourtalès. Bull. M. C. Z., I. No. 6.

Pl. XI. Figs. 5, 6.

Trophosome. — Hydrocaulus attains a height of about an inch and a half, slender, irregularly branched, fascicled at the origin of the main stem and principal branches; internodes rather long. Hydrophores short, nearly cylindrical.

Gonosome not known.

Dredged five miles S. S. W. of Sand Key from a depth of from 90 to 100 fathoms.

This is a small and delicate species. The circle of brilliant points which in almost every species of Halecium occurs just within the margin of the hydrophore is not here obvious.

This is one of the specimens examined by Mr. de Pourtalès, who has assigned to it the specific name here adopted.

Halecium macrocephalum.

Pl. XII. Figs. 1–5.

Trophosome. — Hydrocaulus attaining a height of about two inches, rigid, stout, and very irregularly branched in all directions; main stem and principal branches fascicled, becoming monosiphonic distally; internodes of moderate length. Hydrophores suppressed. Hydranths very large, supported directly on the fixed lateral processes of the stem.

Gonosome. — Gonangia springing from the sides of the lateral processes which support the hydranths; female slipper-shaped, with the orifice situated near the middle of one side; male smaller than female, cylindrical, with truncated summit.

Dredged off Sand Key from a depth of 120 fathoms.

Halecium macrocephalum is remarkable for the suppression of the hydrophore, whose sole representative is found in the narrow membranous lip, which is here quite sessile on the fixed bracket-like process of the stem.

In some of the specimens the form of the hydranths was well retained. These were very large, reaching when fully extended the height of about two internodes of the stem.

In their slipper-shaped form the female gonangia come very near to those of *H. Beanii.* The orifice, however, in the latter is more exserted than in the present species.

Halecium macrocephalum, in the suppression of its hydrophores, and in the great size of its hydranths, comes very near to *H. sessile* Nordman. It is, however, a much stouter form than *H. sessile*, which, moreover, judging from the figures and descriptions of that species, has a monosiphonic instead of a fascicled stem.

As a rule, the hydranths are relatively large in the various species of Halecium, and this fact, taken in connection with the absence of a true hydrotheca, is not without significance.

Tribe **SERTULARINÆ.**

Family **GRAMMARIDÆ.**

Genus CRYPTOLARIA Busk.

Cryptolaria conferta.

Pl. XII. Figs. 6–10.

Trophosome.—Hydrocaulus attaining a height of about two inches, much and irregularly or subdichotomously branched, fascicled except towards the terminations of the branches. Hydrothecæ adnate for somewhat more than half their height, and in the fascicled portion of their stem deeply immersed, then becoming free and arching outwards; adnate portion slightly narrowing downwards, free portion cylindrical, with circular and entire orifice behind which the walls are marked by several annular striæ.

Gonosome?

Dredged off Cojima, Cuba, from a depth of 450 fathoms.

Cryptolaria conferta forms crowded entangled tufts. The proximal portions are strongly fascicled, but towards the extremities the fascicled condition disappears. Here the whole form of the hydrothecæ is frequently visible, but farther down the greater part of every hydrotheca is immersed and concealed in the fascicled portion.

The hydrotheca where fully seen in the non-fascicled portion of the hydroid is found to have a distinct floor perforated by an offset from the cœno-

sarc of the branch. It is possible that this floor disappears with age, and that the older hydrothecæ, where they are immersed in the fascicled stem, are without it. In *Cryptolaria longitheca*, another species occurring in the present collection, the hydrothecæ appear to pass continuously into the tubes of the hydrocaulus without the intervention of a perforated floor. I have had no opportunity of examining the nearly allied genus Grammaria, but according to Sars the hydrothecæ in this genus form continuous tubes passing uninterruptedly into the tubes of the fascicled stem and allowing of the entire retraction of the hydranth from the hydrothecæ into the tubes of the stem.

On the branches of the specimen here described there occurred here and there certain very remarkable bodies, the real nature of which I have not succeeded in placing beyond doubt. They are of an irregularly fusiform shape, and at the spots where they occur surround the branch like minute sponges. A closer examination shows them to consist of a multitude of flask-shaped, apparently chitinous receptacles (Figs. 9, 10), adnate to one another by their sides, and springing by a narrow base from an irregular network of tubes which encircles the branch. The distal extremity of each is prolonged into a free neck-like extension which terminates in an even circular orifice.

Each receptacle gives exit after a time to a single spherical body, which is retained for a period in an external membranous sac connected by a narrow neck to the orifice of the flask-shaped receptacle (Fig. 9, *a*, *a*).

It is scarcely possible not to recognize in these bodies an assemblage of true hydroid gonangia, each giving origin within it to a single ovum, which is subsequently expelled from its cavity and lodged in an acrocyst in which it continues to be for some time retained.

With the exception, indeed, of there being no apparent hydrothecæ intercalated among the gonangia, the bodies in question resemble in all essential points a colony of Coppinia. For, just as in Coppinia, we have here a colony of mutually adherent gonangia, each containing a sporosac with a single large ovum, which after a time is carried out and retained within an acrocyst. The absence of apparent hydrothecæ, however, will not allow us to make too close a comparison with Coppinia or to regard these enigmatical bodies as constituting a hydroid colony complete in itself.

Another view, however, suggests itself. May they not represent the gonosome of the hydroid with which they are associated? In favor of this interpretation it may be urged that nothing else which can be regarded as a gonosome occurs in the specimen, and that if we look upon them as

merely a parasitic hydroid we should have in these bodies a gonosome without its correlative trophosome. Further, the tubular base from which the gonangia spring forms a close irregular plexus which embraces the fascicled stem of the supporting hydroid, and I believe I have traced a communication between this plexus and the cavities of the outermost tubes of the stem.

If we admit the reasonableness of this view, we may compare the entire hydroid to a Coppinia in which the trophosome, instead of consisting of a number of sessile hydrothecæ intercalated among the gonangia of the gonosome, as in the only known species of Coppinia, is further differentiated, and assumes the form of a branching hydrocaulus with the hydrothecæ distributed along its length.

I do not wish, however, to lay too much stress on this view. I do not feel that I have been able to place beyond all doubt the reality of a communication between the tubular base of the incrusting body and the tubes of the stem, while the fascicled condition of the stem increases the difficulty. Against its constituting the proper gonosome of the supporting hydroid, may also be urged the facts of its irregular form and of its sometimes extending in such a way as to embrace a portion of more than one branch, exactly as a foreign incrusting growth might do. The question, however, of its exact relation to its associated hydroid must await for its solution the examination of recent specimens.

Cryptolaria longitheca.

Pl. XIII Figs. 4, 5.

Trophosome. — Hydrocaulus attaining a height of about two inches, pinnately but not profusely branched; fasciculation disappearing towards the ends of the branches. Hydrothecæ cylindrical, adnate in the non-fascicled portion for about half their height, then becoming free and bending outwards; margin circular and even, surrounded by annular striæ.

Gonosome not known.

Dredged off Double-Headed Shot Key from a depth of 315 fathoms.

Cryptolaria longitheca is a far less profusely branched species than *C. conferta*, and from this species it further differs in the pinnate disposition of its branches and in being a stronger form with larger hydrothecæ. The hydrothecæ, moreover, where a complete view of them can be obtained, as in

the unfascicled portion of the hydrocaulus, are cylindrical throughout, presenting no diminution of their diameter towards the base as in *C. conferta.* They appear also to pass continuously into the tubes of the hydrocaulus, no distinct floor being apparent in the hydrothecæ of any part of the specimen.

The circular striæ which surround the margin of the hydrothecæ are here as in other species most probably indications of successive elongations occurring during the growth of the hydroid.

Cryptolaria abies.

Pl. XIII. Figs. 1–3.

Trophosome. — Hydrocaulus attaining a height of about two inches, irregularly branched, with a pinnate disposition of the ultimate ramuli. Hydrothecæ, where completely visible, near the ends of the branches where the fasciculation ceases, flask-shaped, adnate by somewhat more than half their height, and then bending outwards; margin circular, even, and without obvious annular striation.

Gonosome not known.

The hydrothecæ of this species are considerably smaller than those of either *C. conferta* or *C. longitheca.* They can be seen, too, in the distal, non-fascicled portions of the hydrocaulus, where they are fully exposed, to be of a very different shape from those of the two former species, being here of an elongated flask-shape, tumid below and gradually narrowing towards the orifice. Here also they are plainly provided with a distinct floor, and in all respects resemble a typical sertularian hydrotheca. In the fascicled portion of the stem, where they are in great part immersed and concealed, their form cannot be satisfactorily determined.*

Cryptolaria elegans.

Pl. XIV. Figs. 1, 2.

Trophosome. — Hydrocaulus attaining a height of about an inch, delicate, pinnately and very regularly branched; pinnæ alternate fascicled only at their base or entirely monosiphonic. Hydrothecæ alternate, tubular, nearly cylindrical, narrow, adnate for somewhat more than half their height on the distal portions of the hydrocaulus, with the free part bending outwards

* The label placed with the specimens of this species had become effaced, so that neither their exact station in the area explored nor the depth from which they were dredged could be ascertained.

at nearly a right angle to the adnate part. Margin circular, even, frequently surrounded by annular striæ.

Gonosome not known.

Dredged from a depth of 152 fathoms off the Florida Reef.

This is a much smaller and more delicate form than any of the other species of Cryptolaria in the collection, its hydrothecæ having only about half the diameter of those of *C. abies*, the species which in this respect approaches it most nearly. The fasciculation is not carried to the same extent as in the other species, for it usually disappears from the pinnæ at a short distance from their origin, and those pinnæ which are given off near the summit of the stem are generally quite monosiphonic.

In the monosiphonic portions the hydrothecæ are seen to arise from the sides of a common tube to which they are generally adnate for more than half their height; they are here provided with a distinct floor, and are entirely differentiated from the supporting tube. In the fascicled portion they are, as in all the other species, deeply immersed and in great part concealed.

The pinnæ are so disposed that those of one side do not arise from the middle point of the space opposite to the interval between two pinnæ of the opposite side, but from a point quite near to one end of this space.

Family **SERTULARIDÆ.**

Genus SERTULARELLA Gray.

Sertularella conica.

Pl. XV. Figs. 6, 7.

Trophosome. — Hydrocaulus attaining a height of about an inch and a half, simple or with an occasional short branch, not fascicled. Hydrothecæ distant, each springing from a point close to the distal end of an internode, tumid towards the base, much narrowed towards the orifice, slightly marked with transverse corrugations on its upper side.

Gonosome not known.

Dredged southwest of Tortugas from a depth of 60 fathoms.

Sertularella conica is a rather rigid species. It is distinguished from *S. polyzonias* by its nearly simple habit, by the greater distance of the hydrothecæ from one another, and by their more conical form, resulting from their rapid narrowing towards the orifice.

Sertularella amphorifera.

Pl. XV. Figs. 8–10.

Trophosome. — Hydrocaulus very slender, dichotomously branched; internodes long, attenuated, each carrying a hydrotheca near its distal end. Hydrothecæ nearly cylindrical, deep, adnate to the internode for about their proximal third, then becoming free and bending outwards; margin with three teeth, one internal and two lateral.

Gonosome. — Gonangia springing each from a point near the base of a hydrotheca; obovate, strongly annulated, rapidly narrowing to its point of attachment, and terminating distally in a conical neck, which carries on its summit a small circular orifice with everted margin.

Dredged off Double-Headed Shot Key from a depth of 471 fathoms.

Sertularella amphorifera is very closely allied to the *S. tricuspidata* of Alder. It is destitute, however, of the two or three oblique annulations which at intervals give to the stem in *S. tricuspidata* a twisted appearance, while the disposition of the teeth of the hydrotheca is also different, there being an anterior but no posterior tooth in Alder's species. Further, the gonangia of the present species become much more rapidly narrow towards their point of attachment, a condition which makes them closely resemble in form the old Roman amphora.

The specimens in the collection were mere fragments, so that the full size to which the species grows could not be ascertained. They were obtained from the deepest dredgings of the exploration

Sertularella Gayi var. ROBUSTA.

Pl. XV. Figs. 3–5.

I have assigned to the well-known species *Sertularella Gayi* the hydroid here figured, which I regard as one of the many variations of that species, from the typical form of which it differs in its more irregular ramification and stouter habit. The specimens examined had attained a height of two or three inches, and sprung from a hydrorhiza composed of a dense tow-like mass of fine tubular filaments, formed by the disunion, free extension, and repeated division of the tubes which constitute the fascicled stem.

The valvular apparatus by which the orifice of the hydrotheca is closed was well seen in some of the specimens, and the four bands by which the valves are connected with the body of the hydranth were in some cases visible (Fig. 4).

These bands, so far as I am aware, have not been hitherto described. I have found them in many other Sertularidans, and they are especially obvious in young hydrothecæ. They are destitute of fibrillation, and appear to consist of a cord of protoplasm enclosing nucleus-like bodies, and are plainly intended to close the valves forming the operculum of the hydrotheca during the retreat of the hydranth.

Specimens of the same variety, but in which the strong, robust habit was still better marked, were dredged by the "Porcupine," in the eastern parts of the North Atlantic.*

Genus SERTULARIA Linnæus (in part).

Sertularia marginata.

Pl. XVI. Figs. 1, 2.

Trophosome.—Hydrocaulus attaining a height of about an inch, simple; internodes elongated, attenuated below every pair of hydrothecæ. Hydrothecæ opposite, deep, tubular, free, and divergent above for about three fifths of their height, slightly tumid below; orifice entire, with a broad rim formed by close striæ, which run in a circular direction round the distal end of the hydrotheca.

Gonosome not known.

Dredged from a depth of 324 fathoms, off Florida Reef.

The species is remarkable for its distant pairs of long tubular hydrothecæ, with the orifice surrounded by a band of delicate circular striæ. The specimen is destitute of gonangia; it is possibly immature, and may become ramified before attaining its adult condition.

Sertularia tumida.

Pl. XVI. Figs. 3, 4.

Trophosome.—Hydrocaulus attaining a height of $\frac{3}{4}$ of an inch simple; internodes of moderate length, thinning away for some distance below each pair of hydrothecæ. Hydrothecæ opposite, short, tumid below, adnate to the stem for about half their length, and with the distal half free and diverging at nearly a right angle.

Gonosome not known.

Tortugas, shallow water.

* See Report of the Hydroids collected during the Expeditions of H. M. S. Porcupine, Trans. Zoöl. Soc. London, 1873.

The present species resembles in its general habit *Sertularia pumila*, and might, without examination, be mistaken for it. It is, however, distinguished from that species by its tumid hydrothecæ, and by the wide angle at which their distal portion diverges from the stem; as well as by the greater length of the internodes and consequent separation of the pairs of hydrothecæ.

No gonangia were present, and the specimen may not have attained its full growth. In some of the hydrothecæ the hydranths were fairly preserved, and the opercular bands were recognizable.

Sertularia tubitheca.

Pl. XVI. Figs. 5, 6.

Trophosome.—Hydrocaulus attaining a height of upwards of an inch, branched; branches opposite; internodes of moderate length, thinning away below every pair of hydrothecæ. Hydrothecæ long, tubular, cylindrical, free, and divergent for a little more than their distal half, with the orifice circular, abruptly but slightly everted, and having close behind it an annular ridge resembling the margin of a former orifice.

Gonosome not known.

Dredged from a depth of 16 fathoms at the Tortugas.

Sertularia tubitheca is a small but elegant species. The double-lipped condition of the hydrothecæ was constant in the specimens examined, and seems due to the existence of an earlier orifice, to which the present one has succeeded. It is possible that indications of more than one such earlier orifice would be found in older specimens.

Sertularia exigua.

Pl. XVI. Figs. 7, 8.

Trophosome.—Hydrocaulus minute, simple, attaining the height of about $\frac{1}{4}$ of an inch; internodes very short, not prolonged by an attenuated continuation below the pairs of hydrothecæ. Hydrothecæ opposite, not tumid below; free and divergent on their distal half, and with the opposed sides of each pair parallel to one another.

Gonosome unknown.

Dredged off Cape Fear from a depth of 9 fathoms.

This little Sertularia might be mistaken for *S. pumila*; unless, however,

the specimens are immature, and would have acquired a greater development in their adult state, it is a much smaller form than *S. pumila*. Further, in *S. pumila* the opposed sides of the hydrothecæ composing each pair converge from above downwards, while in *S. exigua* they are parallel.

Sertularia distans.

Pl. XVI. Figs. 9, 10.

Trophosome. — Hydrocaulus attaining a height of about an inch, simple or with an occasional branch; internodes rather long and prolonged by an attenuated extension below each pair of hydrothecæ. Hydrothecæ tubular, with the distal half free and divergent, and the opposed sides of the proximal halves parallel.

Gonosome not known.

Dredged off Tennessee Reef from a depth of 21 fathoms.

This species bears considerable resemblance to *S. pumila*, from which, however, it differs in the much greater length of its internodes and consequent distance of its pairs of hydrothecæ. The orifice of the hydrotheca is cut off obliquely above and below, so as to present two broad lateral teeth, and the intervals between these are closed by two thin membranous valves. Each of these valves is composed of delicate superimposed laminæ, which may be usually seen partially separated from one another, as thin exfoliating films.

The species resembles also *S. gracilis* Hassall in the length of its internodes, but it is a larger form.

In the absence of gonosome it is impossible to approximate it closer to any European form.

DESMOSCYPHUS Allman nov. gen.

Generic Character. *Trophosome.* — Hydrocaulus jointed, each internode corresponding to one or more pairs of hydrothecæ. Hydrothecæ adnate to one another in pairs, each pair adnate to the side of the hydrocaulus.

Gonosome. — Gonangia simple, borne along the front of the hydrocaulus.

The genus Desmoscyphus was originally constituted for a hydroid from the New Zealand shores.* It resembles most of the species of Thuiaria in the extent to which the hydrothecæ are adnate to the hydrocaulus, but it

* Allman on New Genera and Species of Hydroida, Journ. Linn. Soc. Zoölogy, Vol. XII.

differs from this genus in the fact that the hydrothecæ are also adnate to one another in pairs, and thus brought all to one side of the hydrocaulus; while a still further difference is found in the fact that the internodes may in some cases carry each a single pair of hydrothecæ, as in Sertularia.

In the New Zealand species, *Desmoscyphus Buskii*, the main stem is divided into internodes of variable length, carrying each a variable number of pairs of hydrothecæ, while the branches are regularly divided into equal internodes each with one pair of hydrothecæ. In the species here described from the Gulf Stream (*D. longitheca*), the entire hydrocaulus is regularly divided into internodes, each carrying a single pair of hydrothecæ.

Desmoscyphus longitheca.

Pl. XIV. Figs. 3–6.

Trophosome.—Hydrocaulus attaining a height of about an inch, pinnately branched; pinnæ alternate, much contracted at their origin; main stem and pinnæ divided into regular internodes, each internode carrying a single pair of hydrothecæ. Hydrothecæ long, tubular, with semicircular orifice, which is closed by a valve-like lid; along the branches and the greater part of the main stem adnate to one another in pairs for nearly their entire height, but becoming free and diverging from one another close to their distal ends; towards the basal end of the stem the hydrothecæ of each pair receding from one another and ultimately disposed on two diametrically opposite sides of the internode.

Gonosome not known.

Key West, shallow water.

Desmoscyphus longitheca constitutes an interesting transition form by which the genus Desmoscyphus becomes connected with Sertularia. For while in *D. Buskii* the branches alone are divided into equal internodes, each carrying a single pair of hydrothecæ, the main stem being composed of internodes of variable length, each with a variable number of hydrothecæ, in the present species both stem and branches possess the Sertularian character of division into equal internodes, with a single pair of hydrothecæ upon each.

Further, in *D. longitheca* the hydrothecæ composing each pair, where they approach the base of the main stem, begin to recede from one another, the separation gradually increasing, until just above the hydrorhiza they are situated upon opposite sides of their supporting internode exactly as in a

true Sertularia; while the resemblance of this part of the hydroid to a Sertularia is further increased by the occurrence of a deep constriction between each internode.

Genus THUIARIA Fleming.

Thuiaria distans.

Pl. XVII. Figs. 1, 2.

Trophosome. — Stem attaining a height of about four inches, simple, non-fascicled, sending off alternate pinnæ, which extend from its distal end to within a short distance of the base; pinnæ with transverse joints at distant but uncertain intervals; main stem with an oblique joint just above the origin of each pinna. Hydrothecæ distant, alternate, borne upon the stem and pinnæ, to each of which they are adnate for very nearly their entire height; short, tubular, slightly enlarging upwards and bending outward, with a somewhat wavy margin destitute of teeth, and with a narrow, though distinct border.

Gonosome not known.

Tortugas, shallow water.

Thuiaria distans is remarkable for the length of the intervals by which the hydrothecæ of each side are separated from one another. The internodes of the stem are regular in length, and support each three hydrothecæ; those of the pinnæ are irregular in length, and vary in the number of hydrothecæ to which they give support.

The cœnosarc of the stem is canaliculated.

Thuiaria plumulifera.

Pl. XVII. Figs. 3–6.

Trophosome. — Stem attaining a height of about six inches, slender, flexile, emitting numerous pinnate branches which are disposed from distance to distance rather irregularly on all sides of the stem, and which carry the hydrothecæ both upon their axis and pinnæ; pinnæ alternate, much contracted at their origin. Hydrothecæ alternate, deep, adnate for nearly their entire length; orifice with two strong, broad teeth, beyond which the walls of the hydrothecæ are continued as a thin, membranous, collapsible tube.

Gonosome not known.

Dredged off Cape Fear from a depth of 9 fathoms.

Thuiaria plumulifera has a good deal of the habit of *Hydrallmania falcata.* The pinna-bearing branches are regularly divided into equal internodes, each internode carrying three hydrothecæ and giving off a pinna from alternate sides just above its proximal end. The pinnæ are much contracted at their origin, and united to the branch which carries them by a very short, nearly globular internode. The joints of the pinnæ are at distant and uncertain intervals.

The hydrothecæ at their distal ends are thin and collapsible, so that it was very difficult to determine the true form of the orifice. In some cases, however, where the parts were well preserved, it could be seen that the thin collapsible portion was a tubular prolongation of the walls beyond the true orifice, which was provided with two strong, broad lateral teeth.

The gonangia had all fallen, but the indications of their attachment were visible just below many of the hydrothecæ.

Thuiaria pinnata.

Pl. XV. Figs. 1, 2.

Trophosome. — Stem attaining a height of nearly three inches, sparingly branched, fascicled below, alternately pinnate; pinnæ given off at nearly right angles to the stem, jointed at distant and uncertain intervals. Hydrothecæ borne both by stem and pinnæ, deep cylindrical with obscurely 4-toothed margin, adnate to the axis in their whole length.

Gonosome not known.

Double-headed Shot Key from a depth of 3 to 4 fathoms.

Thuiaria pinnata is a strong, rather rigid form, rendered somewhat striking by the very open angle at which the pinnæ are given off from the stem. Some of the hydranths were well preserved in the specimen, and it would appear that they are capable of extending themselves far beyond the orifice of the hydrotheca.

Thuiaria sertularioides.

Pl. XVI. Figs. 11, 12.

Trophosome. — Hydrocaulus attaining a height of three inches, slender cylindrical, sending off short, simple branches which spring from the anterior aspect of the axis. Hydrothecæ opposite, with the distal half free and divergent, gradually narrowing from the base to the orifice,

which is obliquely cut above and below so as to present two broad lateral teeth.

Gonosome not known.

In its opposite hydrothecæ adnate to the axis for only half their height, and disposed in distant pairs, this hydroid has so much of the aspect of a Sertularia that it might at first sight be easily referred to that genus. The fact, however, that the pairs of hydrothecæ are not separated from one another by a joint removes it from Sertularia, and notwithstanding the freedom of the hydrothecæ for so considerable a portion of their height, brings it into the genus Thuiaria.*

It is a slender form, with a somewhat rigid habit which it would seem to owe to the non-jointed condition of the axis.

Family **PLUMULARIDÆ.**

Genus PLUMULARIA, Lamarck (in part).

Plumularia filicula.

Pl. XVIII. Figs. 1, 2.

Trophosome. — Hydrocaulus attaining a height of about two inches, simple or with an occasional branch close to the root, not fascicled; pinnæ alternate, one borne by each internode of the stem, immediately below a joint, where it is supported on a long process of the internode; proximal internode of the pinnæ short and destitute of hydrotheca; following internodes elongate, every alternate one carrying a hydrotheca, the hydrotheca-bearing internodes slightly longer than the intervening ones. Hydrothecæ small, each borne near the middle of its supporting internode. Supracalycine nematophores large; a single mesial nematophore borne by the hydrothecal internode at the proximal side of the hydrotheca, two by each of the intervening internodes, and a single one by the short proximal internode.

Gonosome. — Gonangia elongate, oval, smooth, narrowed below into a

* I regard the presence of a joint at regular intervals between every two or every two pairs of hydrothecæ as an essential character of the true Sertularidans (Sertularia, Sertularella, Diphasia) quite irrespectively of the extent to which the hydrothecæ are adnate to the hydrocaulus. In Thuiaria, on the other hand, the joints occur at distant, and for the most part irregular intervals, thus allowing numerous hydrothecæ to follow one another without any intervening joint. See Journ. Linn. Soc. Zoölogy, Vol. XII. p. 267.

short peduncle, by which they spring from the axils of the pinnæ, opening on the summit by a wide oblique aperture.

Off Alligator Reef, from a depth of 88 fathoms.

This species grows in tufts, numerous undivided stems springing from a common base. It is of a rather rigid habit; the pinnæ are close set; besides the nematophores of the pinnæ we find on each internode of the stem two large, alternately placed, solitary nematophores, and two pairs of nematophores which are borne by the lateral process on which the hydrothecal ramulus is supported.

Plumularia macrotheca.

Pl. XVIII. Figs. 3, 4.

Trophosome. — Hydrocaulus attaining a height of about two inches, simple, fascicled, springing from an entangled mass of fine tubular filaments; pinnæ very slender, alternate, composed each of a succession of long internodes alternating with short ones, each of the long internodes bearing a hydrotheca. Hydrothecæ deep, tubular, with very slightly everted margin. Supracalycine nematophores springing each from a short process which projects from the long internode, just below the margin of the hydrotheca, one mesial nematophore carried by the same internode at the proximal side of the hydrotheca, and another on each of the short internodes.

Gonosome not known.

Off Cojima, Cuba, from a depth of 450 fathoms.

Plumularia macrotheca is remarkable for its long narrow hydrothecæ. Its very slender pinnæ are rather widely set upon the stem, which is fascicled, and, like other fascicled stems, resolves itself below by the separation of its component tubes into a loose plexus of hydrorhizal filaments.

Plumularia attenuata.

Pl. XVIII. Figs. 5, 6.

Trophosome. — Hydrocaulus branched, fascicled below; pinnæ alternate, each arising from a point of the stem close to the distal end of an internode; internodes of pinnæ elongated, becoming abruptly slender in the distal two thirds of their length. Hydrothecæ small, borne by the thicker basal portion.

Supracalycine nematophores springing from tooth-like processes which

flank the hydrotheca on each side; mesial nematophores, one at the distal and one at the proximal side of each hydrotheca.

Gonosome not known.

Off Boca Grande, from a depth of 105 fathoms.

The abruptly attenuated distal portion of the internodes of the pinnæ is sufficient to distinguish this species. The internodes of the stem are short, and the pinnæ are in consequence close set, resembling in this respect those of *P. filicula.* In the stem each internode carries two nematophores which are placed laterally and alternately, and one pair of nematophores which is borne by the lateral process.

Plumularia megalocephala.

Pl. XIX. Figs. 1, 2.

Trophosome. — Hydrocaulus irregularly branched, not fascicled; pinnæ alternate, each borne close to the distal end of an internode of the stem, where it is supported on a long stout process of the internode; proximal internode of pinna short and destitute of hydrotheca; following internodes longer, every alternate one carrying a hydrotheca, and slightly longer than the others. Hydrothecæ small and shallow, each borne near the middle of its internode, and supporting a very large hydranth. Besides the supracalycine pair of nematophores, each hydrotheca-bearing internode carrying a single mesial nematophore at the proximal side of the hydrotheca; intervening internode carrying two mesial nematophores, and short basal internode carrying one.

Gonosome not known.

Off Alligator Reef, from a depth of 14 fathoms.

The specimens from which the description has been written were imperfect, and the height to which they had attained could not be determined with certainty, but it was probably about two inches. The internode intercalated between the hydrotheca-bearing internodes was sometimes present, sometimes absent, and was of variable length. The internodes of the stem carry two nematophores placed laterally and alternately, and one or two pairs on its lateral process.

Some of the hydranths in the specimens were sufficiently well preserved to afford a sketch of their outline. They are of enormous size in comparison with the hydrothecæ, into which they could never have been retracted. The very large pear-shaped body was supported on a slender stalk, the only part which lay within shelter of the hydrotheca.

Plumularia geminata.

Pl. XX. Figs. 1–4.

Trophosome. — Stem attaining a height of about one inch, dichotomously branched; internodes towards the distal extremity of the branch alternately longer and shorter; each shorter internode carrying near its middle a hydrotheca, on each side of which springs an ultimate ramulus, also composed of alternately longer and shorter internodes; each shorter one carrying a hydrotheca. Hydrothecæ campanulate with slightly everted margin, free for about its distal half. Lateral nematophores borne each on a strong tooth-like process of the internode; mesial nematophores carried upon both the hydrothecal and the intervening internodes.

Gonosome. — Gonangia pyriform, borne on short two-jointed peduncles which spring from the mesial line immediately below the hydrotheca, the narrow proximal end of the gonangia carrying a nematophore on each side.

Off Sand Key, from a depth of 120 fathoms.

Plumularia geminata is a very remarkable form; the ultimate ramuli given off in regular pairs from the principal branches confer upon it a very striking aspect. All these pairs of ramuli are directed towards one side of the branch from which they spring. The proximal joint of each hydrotheca-bearing internode in the ultimate ramuli is very oblique, the distal one transverse. This internode carries a single mesial nematophore, which is situated at the proximal side of the hydrotheca, while each intervening internode of the ramulus carries three. In the main branches each hydrotheca-bearing internode carries also a nematophore at the distal side of the hydrotheca, while four nematophores are borne on every intervening internode.*

HALOPTERIS Allman nov. gen.

Generic Character. *Trophosome.* — Hydrosoma pinnate plumose; stem and pinnæ divided into internodes. Hydrothecæ adnate to side of pinnæ, unilateral. A pair of nematophores flanking the hydrotheca, one on each side, and adnate to it. Mesial nematophores two (or more), not adnate to the hydrotheca, fixed, monothalamic, with an oblique aperture continued into a lateral slit.

Gonosome not known.

* See Addenda, p. 56.

The genus Halopteris constitutes an intermediate form between Aglaophenia and Plumularia. To Aglaophenia it shows an affinity by its paired nematophores being adnate to the hydrothecæ, and by its fixed monothalamic mesial nematophores with slit-like aperture. To Plumularia it is connected by having more than one azygous nematophore seated on each internode of the pinnæ, and all at a distance from the hydrotheca, by the wide separation of the hydrothecæ from one another, and by their even margin.

Halopteris carinata.

Pl. XIX. Figs. 3–7.

Trophosome. — Hydrocaulus attaining a height of about two inches, simple, non-fascicled; pinnæ alternate, springing one from each internode of the stem, near its proximal end; internodes of pinnæ separated from one another by oblique joints, each carrying a hydrotheca near its middle. Hydrothecæ very large, adnate to internode for about two thirds of their height, and then becoming free, deep, nearly cylindrical in lateral aspect, infundibuliform in front aspect, margin even, with a slightly prominent cusp in front, from which a slight keel is continued for some distance along the front of the hydrotheca. Lateral nematophores in the form of a long tubular stalk which springs from the internode at a point near its middle, and thence passing obliquely across the side of the hydrotheca, reaches the margin, where it terminates in a cup-like dilatation. Mesial nematophores free, fixed by a narrow base, two on each internode, one being just below the hydrotheca, and one at a little distance above it.

Gonosome not known.

Off Carysfort Reef, from a depth of 35 fathoms.

This is a remarkable hydroid, rendered striking by its long tubular lateral nematophores, and by the peculiar form and large size of its hydrothecæ. The stem carries between the pinnæ longitudinal rows of short fixed nematophores whose oblique aperture is continued into a lateral slit. Though the mesial nematophores of the pinnæ are attached by a narrow base, they are firmly fixed, thus, along with the nematophores of the stem, contrasting with the movable and easily detached nematophores of the true Plumulariæ. In this respect, and in their oblique and slit orifice, they resemble the nematophores of Aglaophenia.

Genus ANTENNULARIA Lamarck.

Antennularia simplex.

Pl. XXI. Figs. 1, 2.

Trophosome. — Hydrocaulus attaining a height of about three inches, simple; verticils closely set, each composed of about five ramuli; ramuli borne each on a stout process from the stem, and composed of long, nearly equal internodes, every internode carrying a hydrotheca near its proximal end. Hydrothecæ small, campanulate, flanked on each side by a short tooth-like process from the internode. Supracalycine nematophores borne on the tooth-like processes; two mesial nematophores on each internode, one at the proximal and another at the distal side of the hydrothecæ; a pair of nematophores borne on the basal process and single nematophores scattered over the common stem.

Gonosome not known.

Off Alligator Reef, from a depth of 86 fathoms.

The present species comes very near to *Antennularia ramosa*, from which, however, it differs in its simple habit, and in the position of the hydrothecæ, which are here situated further towards the proximal end of each internode.

ANTENNOPSIS Allman nov. gen.

Generic Character. *Trophosome.* — Stem jointed, sending off scattered jointed ramuli which carry the hydrothecæ. Hydrothecæ with entire margin, unilateral, associated with a pair of movable supracalycine nematophores and with movable azygous nematophores borne along the hydrothecal side of the ramuli.

Gonosome. — Gonangia not protected by corbulæ or other appendages.

The genus Antennopsis differs from Antennularia, to which it is closely allied, by the scattered disposition of its ramuli, which in Antennularia are verticillate.

In all the species of Antennularia which I have examined, the cœnosarc is canaliculated in the stem, the hydrosomal cavity being there represented by a network of intercommunicating canals. In *Antennopsis hippuris* the hydrosomal cavity is of the ordinary simple type, but we do not yet know enough of the species which may compose the genus Antennopsis to enable us to regard this as a true generic character.

Another feature in which *Antennopsis hippuris* differs from the species of Antennularia consists in the absence of the tow-like mass of filaments which forms the hydrorhiza of the various species hitherto referred to the latter genus, the place of these entangled filaments being here taken by a small knot of free tubular fibres.

Antennopsis hippuris.

Pl. XXI. Figs. 3, 6.

Trophosome. — Hydrocaulus attaining a height of about two inches, springing from a cluster of distinct tubular fibres; stem simple, non-fascicled, divided into rather short internodes; ramuli slender, supported each by a thick process of the rachis which is given off from all sides irregularly, every alternate internode of the ramulus supporting a hydrotheca. Hydrothecæ small, cup-shaped. Hydrothecal internodes carrying besides the supracalycine nematophores two mesial nematophores, one at the proximal and one at the distal side of the hydrothecæ; intervening internodes with two mesial nematophores.

Gonosome. — Gonangia shortly pedunculate, borne singly in the axils of the ramuli; male? elongated oval, with an oblique terminal orifice; female? slipper-shaped with the distal end curved over to one side, and with a sub-terminal orifice.

Off Double-Headed Shot Key, from a depth of 195 fathoms.

Antennopsis hippuris is a small and rather delicate species. Like almost every other hydroid, it is diœcious, and the collection contains specimens of each sex, which differ from one another considerably in the form of the gonangia. The contents of the gonangia were not well enough preserved to enable their nature to be determined, and it is therefore with hesitation that, guided by the analogy of some other forms, I have regarded the long oval gonangia as male, and the shorter slipper-shaped ones as female.

HIPPURELLA Allman nov. gen.

Generic Character. *Trophosome.* — Hydrocaulus branched, ultimate ramuli pinnate on the proximal portion of the branches, but distributed on all sides towards their distal extremities. Hydrothecæ borne on the ultimate ramuli, unilateral, with entire margin, associated with a pair of

supracalycine nematophores, and with azygous nematophores along the hydrothecal side of the ramulus.

Gonosome not known.

The genus Hippurella unites in itself the characters of a Plumularia and of an Antennularia or Antennopsis. Indeed, the genera Plumularia, Antennularia, Antennopsis, and Hippurella differ from one another mainly in the disposition of the ultimate ramuli. The characters thus afforded have long been recognized as of generic value in the separation of Antennularia from Plumularia, and the application of the same principle to other forms necessitates the construction of Antennopsis and Hippurella as legitimate genera.

Hippurella annulata.

Pl. XXI. Figs. 7, 8.

Trophosome. — Hydrocaulus attaining a height of about three inches, springing from a dense bundle of tubular filaments, fascicled throughout the main stem, which sends off numerous non-fascicled branches, which are pinnately disposed below, but given off irregularly towards the distal end of the hydrocaulus; ultimate ramuli alternate and pinnate towards the proximal ends of the branches, but towards the distal ends surrounding the branch on all sides, and here either scattered or regularly verticillate; each composed of alternate long and short internodes with intervening groups of very short ring-like internodes, each of the long internodes carrying a hydrotheca. Hydrothecæ deep, thimble-shaped, with slightly everted margin. Besides the supracalycine pair of nematophores, there are two mesial nematophores, borne by the ramulus, between every two hydrothecæ.

Gonosome not known.

Off Pacific Reef from a depth of 283 fathoms.

The species is rendered striking by the large size and deep thimble-shaped form of its hydrothecæ, and by the annulation, at intervals, of its ultimate ramuli.

MONOSTÆCHAS Allman nov. gen.

Generic Character. *Trophosome.* — Stem branched; hydrothecal ramuli confined to one side of their supporting branches. Hydrothecæ unilateral

with entire margin, associated with a pair of supracalycine nematophores, and with free mesial nematophores.

Gonosome. — Gonangia not contained in corbulæ, or connected with special branches.

The unilateral disposition of the hydrothecal or ultimate ramuli on the main branches is very remarkable, and, being absolutely constant, becomes a character of generic value.

Monostæchas dichotoma.

Pl. XXII. Figs. 1 – 5.

Trophosome. — Hydrocaulus attaining a height of about an inch and a half, pellucid, dichotomously branched ; every alternate internode of the hydrothecal ramuli carrying a hydrotheca and separated from the others by a transverse distal joint, and a very oblique and more strongly marked proximal one. Hydrothecæ rather large cup-shaped, flanked on each side by a prominent tooth-like process of the internode. Supracalycine nematophores borne by the tooth-like processes, one mesial nematophore borne by the hydrotheca-bearing internode at the proximal side of the hydrotheca, and two by the intervening internode ; numerous nematophores borne in a single series along the opposed sides of the bifurcating branches.

Gonosome. — Gonangia pyriform, contracted below into a short stalk, which springs from a slightly prominent process of the internode, just below the base of the hydrotheca, and carries a nematophore on each side of it.

Off Pacific Reef, from a depth of 283 fathoms.

The present species closely resembles, in several important characters, the *Plumularia catharina* of Johnston. In the form and position of the hydrothecæ, in the internodes and nematophores of the ultimate ramuli, and in the form and position of the gonangia, the resemblance is so close, even in minute details, that it is impossible to find in these parts any characters by which the one hydroid can be distinguished from the other.

It is entirely different, however, with the *ramification* of the species for which I have here founded the genus Monostæchas. This ramification is of a very remarkable kind, so much so, indeed, that I regard it as affording a character of generic value. It has not only no resemblance to that of *Plumularia catharina*, but belongs to a type which has no representative in any other known Plumularidan.

ANTENELLA Allman nov. gen.

Generic Character. — *Trophosome.* — Hydrocaulus consisting of simple stems, which spring from a congeries of tubular filaments; stems divided into internodes, destitute of pinnæ, and directly bearing the hydrothecæ. Hydrothecæ with entire margin. Nematophores free and movable.

Gonosome not known.

If in a true Plumularia the rachis had never been developed, and the pinnæ had thus come to stand immediately on the hydrorhiza, we should have a form with the essential characters of Antennella.

Antennella gracilis.

Pl. XXII. Figs. 6, 7.

Trophosome. — Hydrocaulus attaining a height of about an inch, simple or with an occasional division near its base, springing in dense tufts from a mass of creeping, tortuous, inosculating, and entangled filaments, divided into internodes by very oblique joints, and with an intervening obscure horizontal joint, also generally apparent. Hydrothecæ borne along the hydrocaulus from its distal end to within a short distance of its base, rather large, cylindrical, deep, with a circular margin, free for about half their height. Supracalycine nematophores borne each on the extremity of a long hollow process which flanks the hydrotheca on each side; mesial nematophores usually four between every two hydrothecæ.

Gonosome not known.

Dredged off Carysfort Reef from a depth of 60 fathoms.

A form nearly allied to the *Antennella gracilis* of the present Report has been dredged off the British coast by Hincks, who regards it as a variety of *Plumularia catharina* Johnston, and believes it to be identical with the *Antennularia cyathifera* of Dana, and with the *Sertularia secundaria* of Cavolini. That all these belong to the form for which I have constituted the genus Antennella, there can, I think, be little doubt.

Throughout that section of the Plumularidæ which is characterized by its movable nematophores, and of which *Plumularia setacea* may be taken as the type, the modifications of ramification as expressed in the disposition of the hydrothecal or ultimate ramuli admit of being thrown into a series whose members present a definite relation to one another.

Taking as our point of departure such forms as *Plumularia setacea* of

the European shores or *P. filicula*, etc. of the present Report, we find that the hydrothecal ramuli are given off on two opposite sides of the simple or branching stem from which they spring with a regularly alternate arrangement. In *P. catharina* the hydrothecal ramuli, instead of being alternate, are exactly opposite. In *P. geminata*, while the points of origin of these ramuli are opposite to one another, as in *P. catharina*, the ramuli themselves are all directed to one side, and thus lie in unilateral pairs along the supporting branch. In the genus Monostæchas, as represented by the single species *M. dichotoma*, the main stem is dichotomously branched, and every alternate prong of the forks gives off — from one side only — the hydrothecal ramuli. In Antennella the whole of the main stem has disappeared, and the hydrothecal ramuli come to be borne directly on the hydrorhiza.

Again, in Antennularia the hydrothecal ramuli are disposed in regard verticils along the stem. In Antennopsis they also surround the stem, but instead of being disposed in verticils they are scattered. What Antennularia is to *P. catharina* with its opposite distichous ramuli, Antennopsis is to *P. setacea* with its alternate distichous ramuli. Finally, in Hippurella we have a transition between the alternate and distichous ramuli of *P. setacea* and the scattered ramuli of Antennopsis or verticillate ramuli of Antennularia; the proximal parts of the branches having their hydrothecal ramuli disposed as in *P. setacea*, while towards the distal extremity these ramuli become scattered as in Antennopsis or verticillate as in Antennularia.

Each of these modifications is in itself so well marked that it may be justly taken as characterizing a distinct specific form, or, in some cases, even a generic group. Any one of them, however, may be regarded as an easily understood derivation from others, while all may obviously have descended from a single ancestral form

Genus AGLAOPHENIA Lamouroux (in part).

Aglaophenia ramosa.

Pl. XXIII. Figs. 1–4.

Trophosome. — Hydrocaulus attaining a height of about six inches, subdichotomously branched, fascicled in main stem and branches, and becoming monosiphonic only near the distal ends; pinnæ given off at an acute angle from the anterior aspect of the branches; internodes of rachis with a

strongly marked septal ridge on a level with the intrathecal ridge, and with a less distinct one at the base of the supracalycine nematophores. Hydrothecæ deep, with strongly dentate oblique margin, and with the intrathecal ridge extending obliquely upwards across the entire width of the hydrotheca. Supracalycine nematophores strong, overtopping the hydrotheca; mesial nematophore attaining nearly the level of the margin of the hydrotheca, and adnate to it for nearly its entire height; cauline nematophores forming a longitudinal series on front of the stem.

Gonosome not known.

Florida Reef, from a depth of from 2 to 3 fathoms.

This is a tall-growing species, with a loose, somewhat straggling habit.

In the absence of all knowledge of the gonosome, its reference to Aglaophenia is only provisional.

Aglaophenia rhynchocarpa.

Pl. XXIII. Figs. 5 – 8.

Trophosome. — Hydrocaulus attaining a height of about two inches, non-fascicled, simple, springing in dense plumose tufts from a network of tubular fibres; internodes of pinnæ divided transversely by three or four strongly marked imperfect septa. Hydrothecæ incurved in front, margin deeply dentate with the anterior tooth strong and bifid; intrathecal ridge well marked, stretching obliquely upwards across the entire width of the hydrotheca. Supracalycine nematophores slightly overtopping the margin of the hydrotheca; mesial nematophore adnate for nearly its entire length to somewhat less than the proximal half of the hydrotheca.

Gonosome. — Corbulæ closed, with the rachis continued beyond the distal end in the form of a beak; leaflets each with a strong process at its base directed outwards and towards the distal end of the corbula; nematophoral ridges not rising in prominent crests.

Key West, Triangle Shoal, 3 to 4 fathoms.

This is a very beautiful species, and presents several well-marked characters. The hydrothecæ are rendered striking by their rather prominent base giving rise to a sinus-like depression of the anterior wall, and by the bifid anterior tooth of the margin. It is, however, in the corbula that the most marked characters are to be found. The prominent beak-like distal extension of the rachis forms a striking feature, while the processes

which the leaflets of the corbula give off at their base form a series of pinnæ upon each side of the rachis, very obvious when the corbula is viewed either from above or below. These pinnæ-like processes carry nematophores along their upper side, and when viewed from below are seen to send off a somewhat triangular, flat, wing-like expansion from the lower. The beak-like extension of the rachis carries also on its upper surface nematophores which are disposed in two pairs. The peduncle of the corbula carries a single hydrotheca.

Aglaophenia lophocarpa.

Pl. XXIV. Figs. 1–4.

Trophosome. — Hydrocaulus attaining a height of between two and three inches, simple, not fascicled; pinnæ alternate, springing from a point near the distal end of each internode. Hydrothecæ deep, somewhat tumid below, margin slightly everted, with nine equal very distinct teeth; intrathecal ridge transverse. Supracalycine nematophores slightly overtopping the hydrothecæ; mesial nematophore adnate to within a very short distance of its summit, and attaining nearly half the height of the hydrothecæ; cauline nematophores two on each internode of main stem, one close to the axil of the pinna and the other near the proximal end of the internode.

Gonosome. — Corbula with about ten pairs of leaflets; leaflets broad, united into a completely closed corbula, the distal margin of each carrying numerous well-developed denticles, and projecting from the sides of the corbula in the form of a pectinated ridge which is continued as a free serrated crest beyond the roof; a spur-like denticle at the base of each leaflet; peduncle of corbula carrying a single hydrotheca.

Off Tortugas, from a depth of 68 fathoms.

The corbula of this species, with its pectinated ridges and crests, is a very beautiful object, and affords a well-marked specific character.

Aglaophenia apocarpa.

Pl. XXIV. Figs. 5 – 9.

Trophosome. — Hydrocaulus attaining a height of about two inches, simple, not fascicled; pinnæ alternate; internodes of pinnæ somewhat bent backwards at their proximal end so as to give rise to a slight angular bend at the point of junction of every two internodes. Hydrothecæ deep; margin with about nine deeply cut teeth, slightly everted;

intrathecal ridge transverse. Supracalycine nematophores stout, slightly overtopping the hydrotheca; mesial nematophore attaining nearly half the height of the hydrotheca, adnate for nearly its entire length; two cauline nematophores on each internode of stem, one of which is situated close to the axil of the pinna, and the other near the distal end of the internode.

Gonosome. — Corbula with about ten pairs of leaflets; leaflets quite free, narrow, with denticles nearly equally developed on each edge and with a spur-like denticle at its base; peduncle of corbula carrying a single hydrotheca.

Off Sand Key, from a depth of 100 fathoms.

In its trophosome this species comes very near to *Aglaophenia lophocarpa.* It differs from it, however, in the occurrence of a slight angular bend between every two internodes of the pinnæ, and more especially by its open corbulæ.

There can be little doubt that the open condition of the corbulæ is not here the result of an immature state of these bodies. Like a similar condition of the corbulæ of other species, it is of considerable morphological interest as a persistent state of a condition elsewhere transitory.

The nature of the denticles along the edges of the leaflets is very obvious in this species. They are plainly seen to be nematophores of the ordinary Aglaophenian type. Their cavity communicates by an aperture in the base with the interior of the leaflet, and through this aperture their contents become united with the cœnosarc of the leaflet. The cœnosarc does not uniformly fill the leaflet, but is disposed in the form of a loose, irregular network of intercommunicating channels.

Aglaophenia gracilis.

Pl. XXV. Figs. 1–4.

Trophosome. — Hydrocaulus attaining a height of about three inches, sparingly branched, not fascicled; pinnæ alternate, springing from a point near the distal end of each internode; internodes of pinnæ with two strong but short septal ridges, one on a level with the short, strong intrathecal ridge, the other on a level with the base of the supracalycine nematophore. Hydrothecæ deep, slightly widening towards the orifice, with strongly toothed margin; intrathecal ridge strong and short,

situated near the bottom of the hydrotheca. Supracalycine nematophores scarcely overtopping the hydrotheca; mesial nematophore adnate to less than half the height of the hydrotheca, and with a short, free extremity; cauline nematophores two on front of each internode of the stem, one of these close to the axil of the pinna, and the other near to the proximal end of the internode.

Gonosome not known.

Off Carysfort Reef, from a depth of 52 fathoms.

This species comes very near to *Aglaophenia rigida* in the form of its hydrothecæ. The hydrothecal internodes, however, are longer and narrower than in that species. *A. rigida*, moreover, is a much more ramified and a taller form.

Aglaophenia rigida.

Pl. XXV. Figs. 5–9.

Trophosome. — Hydrocaulus attaining a height of about nine inches, springing from a mass of tortuous filaments, non-fascicled, slender, wiry, much branched towards the distal ends of the stems; branches given off from a point on the anterior side of the stem, from which they frequently spring in pairs; pinnæ alternate, springing from a point a little below the distal end of each internode; hydrothecal internodes short, each with two short septal ridges. Hydrothecæ closely set, deep, slightly widening towards the orifice, and with strongly toothed margin. Supracalycine nematophores slightly overtopping the hydrotheca; mesial nematophore adnate to about half the height of the hydrotheca and terminating in a short, free extremity.

Gonosome. — Corbulæ completely closed, long, nearly cylindrical, with about fourteen ridges rising into slightly prominent crests; denticles of ridges cup-shaped, with the basal one in the form of a tubular divergent spur.

Off Cape Fear, from a depth of 9 fathoms.

The pinnæ appear to be easily detached in this species, for most of the specimens were nearly destitute of them, and presented little more than a cluster of long, naked, wiry stems.

The ramification is peculiar, the branches springing from the anterior side of the stem, where each is usually accompanied by a second from

the same point of origin, the twin branches then directing themselves forwards and remaining nearly parallel to one another.

The hydrothecæ are so closely set that the summit of each is on a level with the base of the next above it.

This species closely resembles the preceding, *A. gracilis*, of which it may possibly be regarded as a variety.

Aglaophenia distans.

Pl. XXVI. Figs. 1–8.

Trophosome.— Hydrocaulus attaining a height of about four inches, simple, rooted by an entangled bunch of tubular filaments, fascicled below, becoming non-fascicled above, and here divided into equal internodes, each of which carries a pinna on alternate sides; pinnæ distant, attaining the length of nearly an inch. Hydrothecæ deep, nearly cylindrical above, narrowed below; margin crenate, with a single long tooth-like process in front; intrathecal ridge not conspicuous. Supracalycine nematophores not overtopping the hydrotheca; mesial nematophore attaining about a third of the height of the hydrotheca, to which it is adnate for its entire length.

Gonosome.— Corbulæ composed of numerous pairs of ribs, which are quite free from one another, each carrying a small hydrotheca near its origin, and having numerous tooth-like nematophores along its distal edge; peduncle of corbula rather long, carrying three hydrothecæ.

Dredged off Pacific Reef, from a depth of 283 fathoms.

The present species is rendered very distinct by the long tooth-like process on the front margin of the hydrotheca, and by its remarkable open corbulæ. The form of the hydrotheca is not absolutely constant, and occasionally there may be seen on the same pinna with the ordinary form others in which the narrowing of the hydrotheca towards the base is much less marked. (Fig. 4.)

The corbulæ, which closely resemble those of *Aglaophenia bispinosa*, are in the highest degree instructive, and afford a beautiful example of morphological transformation. Like the corbulæ of other species they are metamorphosed pinnæ, but the change here undergone is of such a character as to bring out very distinctly their true morphology. The pinna (Fig.) 7, which is here to become a corbula, retains nearly its ordi-

nary form for some distance from its origin. It is, however, somewhat more attenuated, while its hydrothecæ are slightly smaller than in the ordinary pinnæ. In the specimens examined these hydrothecæ were three in number, and the first and third internode carried each a small accessory mesial nematophore (not represented in the figure) at the proximal side of the principal one. After the third internode the principal transformation of the pinna suddenly commences and continues to its distal end.

This transformation consists in the hydrothecæ ceasing to be adnate to the rachis of the pinnæ, and becoming elevated on short stalks while they become at the same time approximated and thrown alternately to the right and left, so that the pinna carries now two alternate rows of short processes, each bearing a little cup similar to that of the ordinary hydrotheca except in being somewhat smaller.

With the elevation of the hydrotheca above the level of the rachis the supracalycine and mesial nematophores are carried up with it (Fig. 8). The former (*b*) retain nearly their ordinary shape and size, but the mesial nematophore (*c*) becomes enormously developed, being not only greatly increased in length, but becoming broad, flattened, and somewhat sabre-shaped, while a row of small tubular nematophores is developed along the distal edge of each, as well as along the proximal edge of the stalks (*a*) which carry them.

It is the mesial nematophores thus singularly transformed which mainly constitute the ribs which form the sides of the corbula. Between these and the mesial nematophores of the proximal portion of the pinna, which remains nearly unaltered, there is no gradual transition, but it is interesting to note that the internodes of this part of the pinna differ from those of the ordinary pinnæ in carrying a small accessory mesial nematophore, which is repeated and multiplied on the short stalks which form the bases of the ribs in the corbula.

The joints, which are very distinct in the proximal portion of the pinna, become obsolete in the corbula.

Aglaophenia sigma.

Pl. XXVI. Figs. 9, 10.

Trophosome. — Hydrocaulus attaining a height of about six (?) inches, simple, fascicled almost to the tip; pinnæ alternate, with their origin from the front aspect of the stem. Hydrothecæ deep, nearly cylindrical,

with the margin cut into rather shallow teeth, and with the cavity divided into a distal and proximal portion by a distinct intrathecal ridge of a sigmoid form. Supracalycine nematophores not overtopping the hydrotheca; mesial nematophore adnate to the proximal fourth of the hydrotheca, becoming free only close to its point.

Gonosome not known.

Dredged off Alligator Reef, from a depth of 110 fathoms.

The remarkable sigmoid form of the intrathecal ridge constitutes a very distinctive character of this species. Another striking feature is found in the numerous well-marked septal ridges by which the internodes of the pinnæ have their cavity divided into intercommunicating chambers. It is a strong, rather rigid species, and attains a considerable size; but as the specimen had lost its hydrorhizal extremity, the entire length attained by it could not be determined with certainty.

In the absence of the gonosome its reference to the genus Aglaophenia is of course only provisional.

Aglaophenia bispinosa.

Pls. XXVII. and *XXVIII.*

Trophosome. — Stem attaining a height of eight inches, stout, simple, rising from an entangled mass of branching tubular filaments, fascicled below, and presenting from distance to distance knot-like projections; pinnæ alternate, attaining a length of nearly an inch and a half. Hydrothecæ deep, widening upwards; margin with a single, strong tooth-like process in front, and with short, blunt teeth in the rest of its extent; intrathecal ridge not conspicuous. Supracalycine nematophores stout, not overtopping the hydrotheca; mesial nematophores two in number, the distal one adnate to the hydrotheca, along which it extends for about one third of the height of the hydrotheca, the proximal one forming a short, stout spine-like process just below the distal.

Gonosome. — Corbulæ open, formed by two alternate or sub-opposite series of free, rib-like processes, each of which carries near its base a small hydrothecal cup, and along its distal margin a series of numerous tooth-like nematophores; the rachis of the corbula continued towards the common stem as a long peduncle carrying about five unchanged hydrothecæ.

Dredged off Alligator Reef, from a depth of 156 fathoms, and off Tennessee Reef, from a depth of 200 fathoms.

Aglaophenia bispinosa is a beautiful species, and is surpassed in size by very few hydroids. The proximal part of the stem is composed of a congeries of tubes (Pl. XXVII.), which at rather regular intervals become curiously contorted into knot-like projections, and which, at the extreme proximal end, become separated from one another, and here form a large entangled mass of hydrorhizal filaments. Knot-like projections of quite a similar kind occur in the European *Aglaophenia myriophylla.* Towards its distal extremity the stem loses its polysiphonic or fascicled condition and becomes monosiphonic. In the specimens examined the pinnæ were borne along somewhat less than the distal half of the stem.

The hydrothecæ are remarkable for the long, strong tooth which projects from the front of the margin; but a still more remarkable character is found in the presence of a second mesial nematophore situated on the internode, just behind the normal one and unconnected with the hydrotheca. (Pl. XXVIII.)

The corbulæ (Fig. 3) are very beautiful. They closely resemble those of *A. distans,* present the same elements in their formation, and, like these, afford a most instructive illustration of the essential morphology of the organ. The peduncle which connects them with the common stem, and which consists of the proximal portion of the pinna, which, in its terminal portion, becomes transformed into the corbula, is unusually long (Fig. 4), and consists of five scarcely altered internodes with their hydrothecæ; an additional mesial nematophore, however, is developed near the proximal end of each of these internodes.

Aglaophenia constricta.

Pl. XXIX. Figs. 1–4.

Trophosome. — Stem attaining a height of about eight inches, thick, fascicled, springing from an entangled mass of wiry filaments, and sending off numerous, irregularly disposed, simple branches, which carry alternately disposed pinnæ, three pinnæ springing from every internode. Hydrothecæ with the distal half expanded and separated from the proximal part by a deep constriction; margin with four broad teeth. Supracalycine nematophores slightly overtopping the margin of the hydrotheca; mesial nematophore nearly equalling in length the height of the hydrotheca, to which it is almost entirely adnate; cauline nema-

tophores two on the axil of each pinna, and one immediately below the pinna in front.

Gonosome not known.

Off Conch Reef, from a depth of 30 fathoms.

This is a well-marked species. The expanded summit of the hydrotheca and the deep constriction between this and the proximal portion are striking features. No gonosome was present in the specimen, and it is quite possible that if this were known we should find it necessary to remove the species from Aglaophenia.

Aglaophenia perpusilla.

Pl. XXIX. Figs. 5–7.

Trophosome. — Hydrocaulus attaining a height of about one fourth of an inch; stem simple, non-fascicled; pinnæ alternate, each springing from the anterior aspect of an internode in the axil of a strong tooth-like process, which carries on its proximal side a fixed nematophore, and just below which another strong fixed nematophore also springs from the internode. Hydrothecæ deep, slightly widening upwards; margin with about nine strong and deeply cut teeth, the anterior tooth continued into a narrow keel, which runs down the front of the hydrotheca; intrathecal ridge distinct, horizontal, situated at the junction of the lower and middle third of the hydrotheca. Supracalycine nematophores strong, overtopping the hydrotheca; mesial nematophore scarcely reaching the intrathecal ridge, adnate as far as its oblique terminal orifice.

Gonosome not known.

Dredged off the Quicksands from a depth of 34 fathoms.

Aglaophenia perpusilla is the most minute of all the hitherto described species of Aglaophenia, and is further rendered very distinct by certain special characters. The tooth-like processes given off from the anterior side of each internode of the stem have not been found in any other Aglaophenia. These processes appear bifid from the fact of their carrying in front a strong nematophore, while just below this another similar nematophore is also borne by the internode. A peculiar feature in the mesial nematophore of the hydrotheca consists in the constriction of its cavity by a process which projects transversely into it from its anterior wall.

The species occurred sparingly, growing over a seaweed. No gonosome

had been developed in the specimens obtained, which were possibly examples of young individuals; but though the entire colony might increase in size with age, it is not probable that older specimens would present any important change of form.

In the absence of a gonosome the reference of the species to Aglaophenia is provisional.*

CLADOCARPUS Allman nov. gen.

Generic Character. *Trophosome.* — Hydrosoma pinnate, plumose. Nematophores fixed; supracalycine nematophores one on each side of the orifice of the hydrotheca; mesial nematophores either adnate to the front of the hydrotheca or free.

Gonosome. — Gonangia not included in corbulæ, but borne on the sides or at the base of special protective branches (phylactogonia), which are appendages of the pinnæ.

The genus Cladocarpus was originally defined by me for the reception of a remarkable Plumularidan obtained in the eastern parts of the North Atlantic during one of the expeditions of the "Porcupine." † Its most important character is found in the possession of peculiar branching appendages, which are destined to support the gonangia, or in some other way to afford protection to them. It is convenient to have a special name for these appendages, and that of "phylactogonium" is suggested by the function which devolves upon them.

The phylactogonia differ essentially from the corbulæ, whether open or closed, of the Aglaopheniæ; for they are not, like corbulæ, metamorphosed pinnæ, but appendages superadded to the normal pinnæ.

In Kirchenpauer's subgenus Macrorynchia the gonangia are also borne on special appendages, but the pinnæ which in Cladocarpus retain their normal form, and support the phylactogonia, are here suppressed, and are represented only by short stunted processes destitute of hydrothecæ.

The macrorychial Aglaopheniæ of Kirchenpauer are further distinguished from Cladocarpus by the form of the mesial nematophores, which are very long, usually far surpassing the height of the hydrothecæ, and which, as Kirchenpauer first pointed out, are always provided with a lateral as well as a terminal orifice after they cease to be adnate to the hydrotheca.

* See Note on p. 56.

† Report on the Hydroida collected during the Expeditions of H. M. S Porcupine, Trans. Zoöl. Soc. Lond., Vol. VIII. Part VIII.

To the genus Cladocarpus I must also refer a Plumularidan dredged by Oscar Sars in the North Atlantic, and described by him under the name of *Aglaophenia bicuspis*.*

In the *Cladocarpus paradisea* of the present Report the gonangia are borne exclusively on the sides of the phylactogonia; while in *C. dolichotheca* and in *C. ventricosus* they are borne only on the main stem, the phylactogonia arching over them so as to afford them protection in the manner of the leaflets of a corbula. In *C. formosa* of the Porcupine Report, the gonangia are borne both by the phylactogonia and by the main stem.

Cladocarpus dolichotheca.

Pl. XXX.

Trophosome. — Stem attaining a height of about an inch and a half, carrying alternate pinnæ for a short distance from its distal end, and with three four or very oblique internodes just below the pinnate portion. Hydrothecæ widely separated from each other, deep, tubular, with the margin carrying a single long tooth in front, crenate in the rest of its extent; each hydrotheca overarched by the portion of the pinna which intervenes between it and the next above it; intrathecal ridge obsolete. Supracalycine nematophores tubular, overtopping the hydrotheca; mesial nematophore not adnate to the hydrotheca, but springing from a point just below its base, where it forms a free tubular spine-like process with a long oblique slit-like orifice.

Gonosome. — Gonangia ovate, with a latero-terminal orifice, borne on the front of the stem, each one singly, close to the axil of one of the distal five or six pinnæ, which become here more or less diminished in length, and carry each near its origin a dichotomously divided branch (phylactogonium) which forms three bifurcations, and arches over the front of the stem, and the gonangium there situated.

Dredged off Pacific Reef from a depth of 283 fathoms.

This is a remarkable and beautiful species. It is rendered very striking by its deep and widely separated hydrothecæ, each overarched by that portion of the rachis which intervenes between it and the next above it; the freedom of the mesial nematophore from the hydrotheca is also a well-

* G. Oscar Sars, Bidrag til Kundskaben om Norges Hydroider. Forhandlinger i Videnskabs-Selskabet i Christiania, 1873, p. 98, Tab. II., figs. 7 – 10.

marked character. The parts of the rachis to which the backs of the hydrothecæ are applied are divided, by imperfect septa (septal ridges), into numerous very distinct chambers, while a few similar ridges also project into the cavity of the intervening portion.

Where the stem ceases to give off pinnæ, it becomes divided into three or four internodes by very oblique joints, so as to assume, for some way down, the appearance of being twisted, and then continues towards the hydrorhiza as a simple continuous tube (Fig. 5). Along nearly the whole of its course from the termination of the pinnate portion to the base, the stem carries a longitudinal series of tubular nematophores, which are situated at short and equal intervals from one another, and give to this part of the hydrosoma a close resemblance to certain forms of graptolites.*

The phylactogonia, or protective appendages of the reproductive capsules, resemble in form the antlers of a stag. Their branches are set with large tubular nematophores. They arch over the front of the stem, their branches crossing one another from opposite sides, and forming a cage-like roof over the gonangia. They occur only on some of the pinnæ, which are situated close to the distal end of the stem, one springing from each pinna close to its origin. Though the pinnæ which carry them retain their normal form, they are all more or less shortened, most of them supporting only a single hydrotheca.

It is difficult to form any well-founded opinion as to the exact homology of these appendages. The nature of the changes which have resulted in the formation of a corbula in certain species of Aglaophenia might lead us to suspect that in *Cladocarpus dolichotheca* the phylactogonium represents the mesial nematophore of the proximal hydrotheca of its supporting pinna. The fact, however, that this nematophore is at the same time present in its normal state renders such an explanation untenable. The phylactogonium probably represents, in a greatly modified condition, the mesial nematophore of a hydrotheca, which had itself been totally suppressed.

The sex of the gonophores could not be determined in the specimen.

* I have elsewhere (Gymnoblastic Hydroids, p. 176) endeavored to show the probability that the denticles of graptolites represent the nematophores of the Plumularidæ, the hydrothecæ being entirely suppressed; and I have attempted to support this view on both anatomical and embryological grounds. As the nematophores of the Plumularidæ are filled with sarcode capable of a rich development of pseudopodia, the graptolites would by this comparison be brought into close relation with the Rhizopoda. They would thus represent an ancestral form in which the affinities looked on one side to the Hydroida, and on the other to the Rhizopoda. No hydranths were developed in them, for the hydroid characters had not yet gained that ascendency over the rhizopodal which we see in the existing Plumularidæ, which, according to this hypothesis, have inherited their nematophores from the extinct graptolites.

Cladocarpus ventricosus.

Pl. XXXI.

Trophosome. — Stem attaining a height of about an inch and a half, not fascicled, simple; pinnæ alternate, each springing from a rather long, lateral process of the stem, somewhat waved. Hydrothecæ distant; front wall with a depression just below the margin, then greatly inflated; margin with a long, strong tooth in front, and with shallow crenations in the rest of its extent; intrathecal ridge strong, transverse, springing from a projection of the posterior wall of the hydrotheca near its fundus, and reaching a point about midway between this and the anterior wall. Supracalycine nematophores scarcely overtopping the hydrotheca; mesial nematophore quite detached from the hydrotheca.

Gonosome. — Phylactogonia springing from the proximal internodes of a certain number of the pinnæ, which are situated near the distal end of the stem, twice bifurcating; gonangia springing from the stem in groups, each group close to the axil of a pinna, obovate, with the summit curved over the termino-lateral orifice.

Dredged off Sand Key from a depth of 100 fathoms.

This is a well-marked form; its singular ventricose hydrothecæ, and the complete removal of the mesial nematophore from the hydrotheca, at once distinguish it. In *Cladocarpus dolichotheca* the mesial nematophore, while equally free from the hydrotheca, originates close to its base, but in the present species its point of origin is removed much farther back, and the entire nematophore is adherent to the front of the internode. The septal ridges of the hydrothecal internodes are very distinct.

Where the stem towards its proximal end ceases to carry pinnæ, it is provided with two or three very oblique joints, each of which carries a fixed nematophore, and similar nematophores are continued down the stem in a longitudinal series, at short and equal intervals (Fig. 5); here, again, as in *Cladocarpus dolichotheca*, strongly suggesting the disposition of the denticles in one of the single-sided graptolites. Near the base of the stem the nematophores may become biserial and opposite. Cauline nematophores are also situated, one on the axil of each pinna and one on the stem in the intervals between the pinnæ. The sex of the gonangia could not be determined. The phylactogonium has a single bifurcation close to its origin, and one of its branches again bifurcates.

There are thus two bifurcations in this species, while in *Cladocarpus dolichotheca* there are three. This difference appears constant.

The branches of the phylactogonia are all provided with well-developed tubular nematophores, which are arranged along each branch in a single longitudinal series.

Cladocarpus paradisea.

Pls. XXXII. and *XXXIII.*

Trophosome. — Stem attaining a height of fourteen inches, irregularly branched, fascicled, and thick below, gradually losing its fascicled condition, and becoming monosiphonic towards the distal ends of the main stem and branches; pinnæ alternate, rather distant, attaining a length of about one inch and a quarter. Hydrothecæ large, deep, widening upwards; margin with two strong teeth in front; rest of the margin destitute of teeth; intrathecal ridge faintly marked, forming a waved line which stretches across the middle of the hydrotheca. Supracalycine nematophores bracket-shaped, not overtopping the margin of the hydrotheca; mesial nematophore attaining about one third the height of the hydrotheca, to which it is adnate to within a short distance of its extremity.

Gonosome. — Gonangia-bearing appendages (phylactogonia) in the form of pinnately branched offshoots, which spring each from a pinna of the trophosome close to its origin, and is set with cup-shaped nematophores along its stem and branches; branches of phylactogonia alternate; female phylactogonium larger than male, and carrying a single gonangium in front of the axil of each of its branches; male with a cluster of gonangia at the base of each branch; female gonangia obovate, with a latero-terminal transversely elongated orifice over which the summit of the gonangium bends in the manner of a hood; male gonangia smaller than female, obovate, with a sub-terminal orifice not arched over by the summit.

Dredged off Tennessee Reef, from a depth of 174 fathoms, and off Samboes, from 123 fathoms.

Cladocarpus paradisea is a magnificent species. I take for granted that the difference presented by the gonosomes in the specimens examined is a sexual one, for there is no difference in the trophosomes; but though I believe I am right in regarding the larger gonosome (Pl. XXXIII. Fig. 3.) as the female, I could not from the specimens determine this point with certainty.

The two strong teeth on the front margin of the hydrotheca are so situated, that with the slightly everted intervening portion of the margin they give to this part the appearance of the lip of a jug, and constitute a striking character. The pinnæ arise somewhat from the anterior aspect of the stem, and their internodes exhibit four well-marked septal ridges.

There are usually three or four male gonangia (Fig. 5) in a cluster, and of these one is always placed in front of the axil between the stem of the phylactogonium and its branch; towards the distal end of the phylactogonium the clusters are often reduced to a single gonangium.

The branches of the female phylactogonium carry two longitudinal series of large cup-shaped nematophores. (Figs. 3, 6.) These are situated exactly opposite to one another, one on the front, the other on the back of the branch, each series extending from the base to the apex of the branch, and formed by about three equally distant nematophores. Along the stem of the phylactogonium two series of similarly shaped nematophores also occur. These are confined to the front of the stem, and are disposed alternately. There is farther on the back of the phylactogonium in each axil a somewhat bracket-shaped nematophore. (Fig. 4.)

In the male (Fig. 5) the phylactogonia as well as the gonangia are much smaller than in the female. Both stem and branches carry cup-shaped nematophores as in the female, but in the male these are all confined to the front. A bracket-shaped nematophore is carried on the back of the phylactogonium over the axil of each branch, as in the female.

Genus HALICORNARIA Busk (modified).*

Halicornaria speciosa.

Pl. XXXIV.

Trophosome. — Stem strong, attaining a height of about five inches, simple, monosiphonic pinnate almost to the base; internodes of stem each giving off two pinnæ, which are opposite, or nearly so, towards the base of the stem, but more alternately disposed towards the distal end, where the internodes become longer and more oblique. Hydrothecæ wide;

* The genus Halicornaria founded by Busk, who used it in a wider sense, is here intended to include only those Plumularidæ which, with a trophosome formed on the general type of Aglaophenia, have gonangia which are never included in corbulæ or protected by phylactogonia.

margin with wide, rather shallow crenation; intrathecal ridge springing from the anterior side of the hydrotheca about midway between the margin and base, and extending transversely to about the middle of its lateral walls. Supracalycine nematophores stout, overtopping the margin of the hydrotheca; mesial nematophore reaching the margin of the hydrotheca, and adnate to it in nearly its entire length.

Gonosome. — Gonangia cylindrical, with a broad, truncated summit, contracted below into a short, stout latero-basal peduncle, which springs from the front of the stem close to the origin of a pinna.

Double-Headed Shot Key, from a depth of from 4 to 5 fathoms.

Halicornaria speciosa is a strong, handsome species. The pinnæ are absolutely lateral, showing no disposition to arise from the anterior aspect of the stem. The stem is unusually thick for a monosiphonic or non-fascicled form, and each of its internodes carries four nematophores, one just above and one just below the point of origin of the pinna at each side.

The gonangia in the specimen are small in proportion to the size of the trophosome, and are possibly immature.

ADDENDA.

See Text, Page 32.

Plumularia geminata.

Between the present species and the *Plumularia catharina* Johnston there is a close relation. The form of the hydrotheca, of the gonangia with their basal nematophores, and of the internodes in the ultimate ramuli, is very similar in the two species, while between the same parts in *Plumularia catharina* and *Monostæchas dichotoma* (see p. 37) a corresponding identity of form will be found.

Foot-note to Page 49.

I am indebted to Miss Gatty for an opportunity of examining a second species of the same remarkable form, which may well constitute a subgenus of Aglaophenia. From *Aglaophenia perpusilla* this differs chiefly in the width of the keel which runs down the front of the hydrotheca, and in the presence of a shallow constriction between that portion of the hydrotheca which lies at the proximal side of the strong intrathecal ridge and that which lies at the distal side. A decided bithalamic character is thus given to the hydrotheca. The specimens scarcely surpass *A. perpusilla* in size. They are from the Gulf of Mexico, are attached to Gulf Weed, and are destitute of gonosome. I have assigned to the species the name of *A. late-carinata.*

DESCRIPTION OF THE PLATES.

PLATE I.

Figs. 1, 2. **Eudendrium eximium.**

Fig. 1. Natural size.
Fig. 2. Portion of a colony with female gonophores, magnified.

Figs. 3, 4. **Eudendrium exiguum.**

Fig. 3. Natural size.
Fig. 4. Portion, magnified.

PLATE II.

Figs. 1 – 2ᵃ. **Eudendrium fruticosum.**

Fig. 1. Natural size. A cluster of capsular bodies; probably a molluscan or annelidan nidus has become attached to the stem and branches.
Fig. 2. A portion with hydranths and male gonophores, magnified.
Fig. 2ᵃ. A ramulus with hydranth and female gonophores, magnified.

Figs. 3, 4. **Eudendrium attenuatum.**

Fig. 3. Natural size.
Fig. 4. A portion, magnified.

PLATE III.

Figs. 1 – 4. **Eudendrium laxum.**

Fig. 1. Natural size.
Fig. 2. A portion with hydranths and male gonophores, magnified.
Fig. 3. A portion of the hydrorhiza magnified, showing the clear spherical bodies in the cœnosarc.
Fig. 4. A portion of the stem with similar bodies, still further magnified.

PLATE IV.

Figs. 1, 2. **Eudendrium gracile.**

Fig. 1. Natural size.
Fig. 2. A portion with hydranths, magnified.

Figs, 3, 4. **Eudendrium tenellum.**

Fig. 3. Natural size.
Fig. 4. A portion, magnified.

PLATE V.

Figs. 1, 2. **Eudendrium cochleatum.**

Fig. 1. Natural size. The tubes of a little tubicolous crustacean are seen attached to some of the branches.
Fig. 2. A portion with hydranths, magnified.

Figs. 3, 4. **Bimeria humilis.**

Fig. 3. A colony growing over the surface of a seaweed, natural size.
Fig. 4. A portion magnified, with hydranths and male (?) gonophores.

PLATE VI.

Figs 1, 2. **Obelia marginata.**

Fig. 1. Natural size. Drawn from a small specimen.
Fig. 2. A branch, magnified. Creeping over it is a colony of *Lafoëa venusta.*

Figs. 3, 4. **Lafoëa venusta.**

Fig. 3. Natural size. It is seen creeping over a branch of *Obelia marginata.*
Fig. 4. A portion, magnified, creeping over *Obelia marginata.*

Fig 5, 6. **Thyroscyphus ramosus.**

Fig. 5. Natural size.
Fig. 6. A portion of a branch, magnified.

PLATE VII.

Figs. 1 – 3. **Oplorhiza parvula.**

Fig. 1. Natural size.
Fig. 2. Portion of a colony, magnified.
(*a*, *a*) Hydrorhizal appendages.
Fig. 3. One of the hydrorhizal appendages, still further magnified.

Figs. 4, 5. **Obelia longicyatha.**

Fig. 4. Natural size.
Fig. 5. Portion of a colony, magnified.

PLATE VIII.

Figs. 1, 2. **Campanularia macroscypha.**

Fig. 1. Natural size.
Fig. 2. Portion of a colony, magnified.

Figs. 3, 4. **Lafoëa tenellula.**

Fig. 3. Natural size.
Fig. 4. Portion of a colony, magnified.

Figs. 5, 6. **Cuspidella pedunculata.**

Fig. 5. Natural size.
Fig. 6. Portion of a colony, magnified.

PLATE IX.

Figs. 1, 2. **Lafoëa convallaria.**

Fig. 1. Entire colony, natural size.
Fig. 2. Distal portion of a colony, magnified.

PLATE X.

Figs. 1, 2. **Lafoëa coalescens.**

Fig. 1. Entire colony, natural size.
Fig. 2. The same, magnified.

PLATE XI.

Figs. 1 – 4. **Halecium filicula.**

Fig. 1. Natural size.
Fig. 2. Portion of a pinna with hydranth, magnified.
Fig. 3. Portion of main stem near its distal extremity, carrying hydrophores and a pinna; magnified.
Fig. 4. Distal extremity of a hydrophore with double margin, still further magnified.

Figs. 5, 6. **Halecium capillare.**

Fig. 5. Natural size.
Fig. 6. Portion of a branch, magnified.

PLATE XII.

Figs. 1 – 5. **Halecium macrocephalum.**

Fig. 1. Entire colony, natural size.
Fig. 2. Portion of a branch with hydrophores and hydranths, magnified.
Fig. 3. Portion with two hydrophores, still further enlarged.
Fig. 4. An internode carrying a male gonangium.
Fig. 5. An internode with a female gonangium.

Figs. 6 – 10. **Cryptolaria conferta.**

Fig. 6. An entire colony, natural size.
(*a*) One of the clusters of flask-shaped bodies associated with it.
Fig. 7. A portion taken from a point near the proximal end where the stem is still fascicled; magnified.
Fig. 8. A portion taken from a point near the distal end where the stem is monosiphonic; magnified.
Fig. 9. A portion of one of the associated clusters of flask-shaped bodies as seen in section, parallel to the axis of the cryptolaria stem; magnified.
(*a*, *a*) Acrocysts (?) into which the contents of the capsule have escaped.
Fig. 10. A portion of the same as seen in section transverse to the axis of the stem.
(*a*) Flask-shaped capsules with their contents still included.
(*b*, *b*) The basal tubes seen in tranverse section and surrounding the larger and thicker-walled tubes (*c*, *c*) which form the fascicled stem of the cryptolaria, and are here also seen in transverse section.

PLATE XIII.

Figs. 1 – 3. **Cryptolaria abies.**

Fig. 1. Natural size.
Fig. 2. Portion of a branch taken from a point near its distal end, where it has lost its fascicled condition; magnified.
Fig. 3. Portion of stem with the proximal parts of two branches showing the fascicled condition of the hydrocaulus; magnified.

4, 5. **Cryptolaria longitheca.**

Fig. 4. Natural size.
Fig. 5. Portion of a colony, magnified.

PLATE XIV.

Figs. 1, 2. **Cryptolaria elegans.**

Fig. 1. Entire colony, natural size.
Fig. 2. Portion taken from the distal extremity of the colony, magnified.

Figs. 3 – 6. **Desmoscyphus longitheca.**

Fig. 3. Several stems attached to some foreign body, natural size.
Fig. 4. Front aspect of a portion of a colony from a point near the basal end of the stem; magnified. The lowest hydrothecæ have begun to recede from one another.
Fig. 5. Portion of stem viewed laterally, magnified.
Fig. 6. Proximal extremity of stem, magnified. The hydrothecæ of each pair have receded from one another, and now occupy opposite sides of the stem.

PLATE XV.

Figs. 1, 2. **Thuiaria pinnata.**

Fig. 1. Entire colony, natural size.
Fig. 2. Portion of a pinna with hydranths, magnified.

3 – 5. **Sertularella Gayi** var. **robusta.**

Fig. 3. Natural size.
Fig. 4. Portion of a branch with hydrothecæ and gonangium, magnified. In the uppermost hydrotheca

contractile (?) bands are seen passing from the inner side of the hydrothecal valves to the body of the hydranth.

Fig. 5. Portion of branch with front view of the hydrothecæ; magnified.

Figs. 6, 7. **Sertularella conica.**

Fig. 6. Natural size.
Fig. 7. Portion magnified.

Figs. 8–10. **Sertularella amphorifera.**

Fig. 8. Natural size.
Fig. 9. Portion of a colony with gonangium; magnified.
Fig. 10. Hydrotheca still further enlarged.

PLATE XVI.

Figs. 1, 2. **Sertularia marginata.**

Fig. 1. Natural size.
Fig. 2. Distal end of colony, magnified.

Figs. 3, 4. **Sertularia tumida.**

Fig. 3. Natural size.
Fig. 4. A portion, magnified. In one of the hydrothecæ the hydranth and two opercular bands are still visible.

Figs. 5, 6. **Sertularia tubitheca.**

Fig. 5. Entire colony, natural size.
Fig. 6. A portion, magnified.

Figs. 7, 8. **Sertularia exigua.**

Fig. 7. Colony growing on a seaweed; natural size.
Fig. 8. A portion, magnified.

Figs. 9, 10. **Sertularia distans.**

Fig. 9. Natural size.
Fig. 10. A portion, magnified.

Figs. 11, 12. **Thuiaria sertularioides.**

Fig. 11. Natural size.
Fig. 12. A portion, magnified.

PLATE XVII.

Figs. 1, 2. **Thuiaria distans.**

Fig. 1. Entire colony, natural size.
Fig. 2. A portion, magnified.

Figs. 3–6. **Thuiaria plumulifera.**

Fig. 3. Entire colony, natural size.
Fig. 4. Portion of a branch with pinnæ, magnified.
Fig. 5. Hydrotheca more enlarged, lateral view.
Fig. 6. Same, front view.

PLATE XVIII.

Figs. 1, 2. **Plumularia filicula.**

Fig. 1. Natural size.
Fig. 2. A portion with gonangia, magnified.

Figs. 3, 4. **Plumularia macrotheca.**

Fig. 3. Entire colony, natural size.
Fig. 4. A portion of a pinna, magnified.

Figs. 5, 6. **Plumularia attenuata.**

Fig. 5. Natural size.
Fig. 6. Portion of stem with pinna, magnified.

PLATE XIX.

Figs. 1, 2. **Plumularia megalocephala.**

Fig. 1. Natural size.
Fig. 2. A portion of a branch with pinnæ, magnified.

Figs. 3 – 7. **Halopteris carinata.**

Fig. 3. Entire colony, natural size.
Fig. 4. Portion of stem with pinnæ, magnified.
Fig. 5. Portion of a pinna, still further magnified; lateral view.
Fig. 6. Same, front view.
Fig. 7. Same, back view.

PLATE XX.

Figs. 1 – 4. **Plumularia geminata.**

Fig. 1. Natural size.
Fig. 2. A portion, magnified.
Fig. 3. A portion, still further magnified; front and back view of pinnæ.
Fig. 4. Lateral view of pinna.

PLATE XXI.

Figs. 1, 2. **Antennularia simplex.**

Fig. 1. Natural size.
Fig. 2. A portion, magnified.

Figs. 3 – 6. **Antennopsis hippuris.**

Fig. 3. Natural size.
Fig. 4. A portion, magnified; with male (?) gonangia.
Fig. 5. Portion of a pinna, still further magnified.
Fig. 6. Portion of a colony with female (?) gonangia.

Figs. 7, 8. **Hippurella annulata.**

Fig. 7. Entire colony, natural size.
Fig. 8. Portion of a branch with pinnæ, magnified.

PLATE XXII.

Figs. 1 – 5. **Monostæchas dichotoma.**

Fig. 1. Entire colony, natural size.
Fig. 2. A portion, magnified.
Fig. 3. Portion of a pinna, still further magnified; front view.
Fig. 4. Same, lateral view.
Fig. 5. Young gonangium.

Figs. 6, 7. **Antennella gracilis.**

Fig. 6. Entire colony, natural size.
Fig. 7. One of the pinna-like stems, magnified.

PLATE XXIII.

Figs. 1 – 4. **Aglaophenia ramosa.**

Fig. 1. Natural size.
Fig. 2. Portion of a branch with pinnæ, magnified.
Fig. 3. Hydrotheca, still further magnified; front view.
Fig. 4. Same, lateral view.

Figs. 5 – 8. **Aglaophenia rhynchocarpa.**

Fig. 5. An entire colony, natural size.
Fig. 6. Portion of a pinna, magnified; lateral view.
Fig. 7. Hydrotheca of same; front view.
Fig. 8. Corbula, magnified.

PLATE XXIV.

Figs. 1–4. **Aglaophenia lophocarpa.**

Fig. 1. Natural size.
Fig. 2. Portion of pinna, magnified; lateral view.
Fig. 3. Portion of stem with pinnæ, magnified; front view.
Fig. 4. Corbula, magnified.

Figs. 5–9. **Aglaophenia apocarpa.**

Fig. 5. Natural size.
Fig. 6. Portion of a pinna, magnified; lateral view.
Fig. 7. Portion of stem with pinnæ, magnified; front view.
Fig. 8. Corbula, magnified.
Fig. 9. Part of a leaflet of a corbula showing the lateral nematophores; still further magnified.

PLATE XXV.

Figs. 1–4. **Aglaophenia gracilis.**

Fig. 1. Natural size.
Fig. 2. Portion of a pinna, magnified; lateral view.
Fig. 3. Same, front view.
Fig. 4. Portion of stem with pinna, magnified; oblique view of pinna.

Figs. 5–9. **Aglaophenia rigida.**

Fig. 5. Entire colony, natural size.
Fig. 6. Portion of pinna, magnified; lateral view.
Fig. 7. Same, front view.
Fig. 8. Corbula, magnified.
Fig. 9. Part of one of the ridges of the corbula, still further magnified.

PLATE XXVI.

Figs. 1–8. **Aglaophenia distans.**

Fig. 1. Entire colony, natural size.
Fig. 2. A portion, magnified.
Fig. 3. Portion of the hydrotheca, still further enlarged to show the anterior tooth-like process.
Fig. 4. A hydrotheca differing somewhat in form from the normal hydrothecæ, but associated with these in the same colony; magnified.
Fig. 5. Orifice of hydrotheca viewed from above.
Fig. 6. Portion of a pinna with two hydrothecæ viewed in front; magnified.
Fig. 7. Corbula, magnified.
Fig. 8. One of the leaflets of a corbula, still further magnified.
(*a*) Peduncle of leaflet.
(*b*) Supracalycine nematophores but slightly altered.
(*c*) Mesial nematophore greatly enlarged and altered in form. The slightly altered hydrotheca is seen included between the supracalycine and mesial nematophores.

Figs. 9, 10. **Aglaophenia sigma.**

Fig. 9. Natural size.
Fig. 10. Portion of a pinna, magnified.

PLATE XXVII.

Figs. 1–3. **Aglaophenia bispinosa.**

Fig. 1. An entire colony, natural size; front view.
Fig. 2. The same, lateral view.
Fig. 3. Distal portion of the stem, magnified.

PLATE XXVIII.

Figs. 1 – 5. **Aglaophenia bispinosa.**

Fig. 1. Portion of stem and pinna, magnified; front view.
Fig. 2. Portion of pinna, magnified; lateral view.
Fig. 3. Corbula, magnified; viewed from above.
Fig. 4. Peduncle of corbula, more magnified.
(*a*, *a*) Internodes of peduncle showing the three mesial nematophores borne by each internode.
Fig. 5. Base of proximal rib of corbula, still further magnified.
(*a*) Supracalycine nematophores slightly altered.
(*b*) Base of mesial nematophore which has become transformed into a rib of the corbula. Between *a* and *b* is seen the slightly altered hydrotheca with a hydranth still visible in it.

PLATE XXIX.

Figs. 1 – 4. **Aglaophenia constricta.**

Fig. 1. A specimen, natural size, with some sponges growing over its stem.
Fig. 2. Portion of stem with the proximal ends of the pinnæ; magnified.
Fig. 3. Portion of a pinna, still further magnified; viewed laterally.
Fig. 4. Same, viewed in front.

Figs. 5 – 7. **Aglaophenia perpusilla.**

Fig. 5. Entire colony, natural size.
Fig. 6. Portion of a pinna, viewed laterally; magnified.
Fig. 7. Portion of stem with the proximal ends of two pinnæ, magnified.

PLATE XXX.

Figs. 1 – 5. **Cladocarpus dolichotheca.**

Fig. 1. Entire colony, natural size.
Fig. 2. Distal end of a colony, magnified.
(*a*, *a*) Phylactogonia.
Fig. 3. Portion of a pinna with hydrotheca, magnified; viewed laterally.
Fig. 4. Same, front view.
Fig. 5. Portion of stem near proximal end, showing nematophores disposed like the denticles of a graptolite.

PLATE XXXI.

Figs. 1 – 7. **Cladocarpus ventricosus.**

Fig. 1. A colony, natural size.
Fig. 2. Distal end of a colony, magnified.
(*a*, *a*) Phylactogonia.
Fig. 3. Portion of a pinna, still further magnified; viewed laterally.
Fig. 4. Same, front view.
Fig. 5. Portion of stem near the proximal end, with a longitudinal series of nematophores; magnified.
Fig. 6. Gonangium, magnified; lateral view.
Fig. 7. Same, front view.

PLATE XXXII.

Cladocarpus paradisea; an entire colony, natural size.

PLATE XXXIII.

Figs. 1 – 6. **Cladocarpus paradisea.**

Fig. 1. Portion of a pinna, magnified; lateral view.
Fig. 2. Portion of stem with proximal end of pinna, not so highly magnified; front view.

Fig. 3. Proximal end of a pinna carrying a phylactogonium; magnified.
(*a*) Pinna.
(*b*) Phylactogonium with gonangia; female (?); front view.

Fig. 4. Portion of a phylactogonium from a point near its distal end, carrying a single young gonangium; female (?); back view.

Fig. 5. Portion of a pinna with a phylactogonium, magnified.
(*a*) Pinna.
(*b*) Phylactogonium with gonangia; male (?).

Fig. 6. Portion of one of the branches of a phylactogonium with two of its nematophores; still further magnified.

PLATE XXXIV.

Figs. 1 – 5. **Halicornaria speciosa.**

Fig. 1. Natural size.

Fig. 2. A portion taken from a point towards the proximal end; magnified.

Fig. 3. Same, from a point near the distal end.

Fig. 4. Portion of a pinna, still further magnified; front view.

Fig. 5. Same, lateral view.

ALPHABETICAL INDEX.

Auctor & A F Hollick, ad nat del

M & N Hanhart imp

Auctor & A F Hollick ad nat. del.

M & N Hanhart Imp.

ALLMAN, HYDROIDS OF GULF STREAM.

M.&N. Hanhart imp.

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M&N Auct. lith.

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M & N. Hanhart imp.

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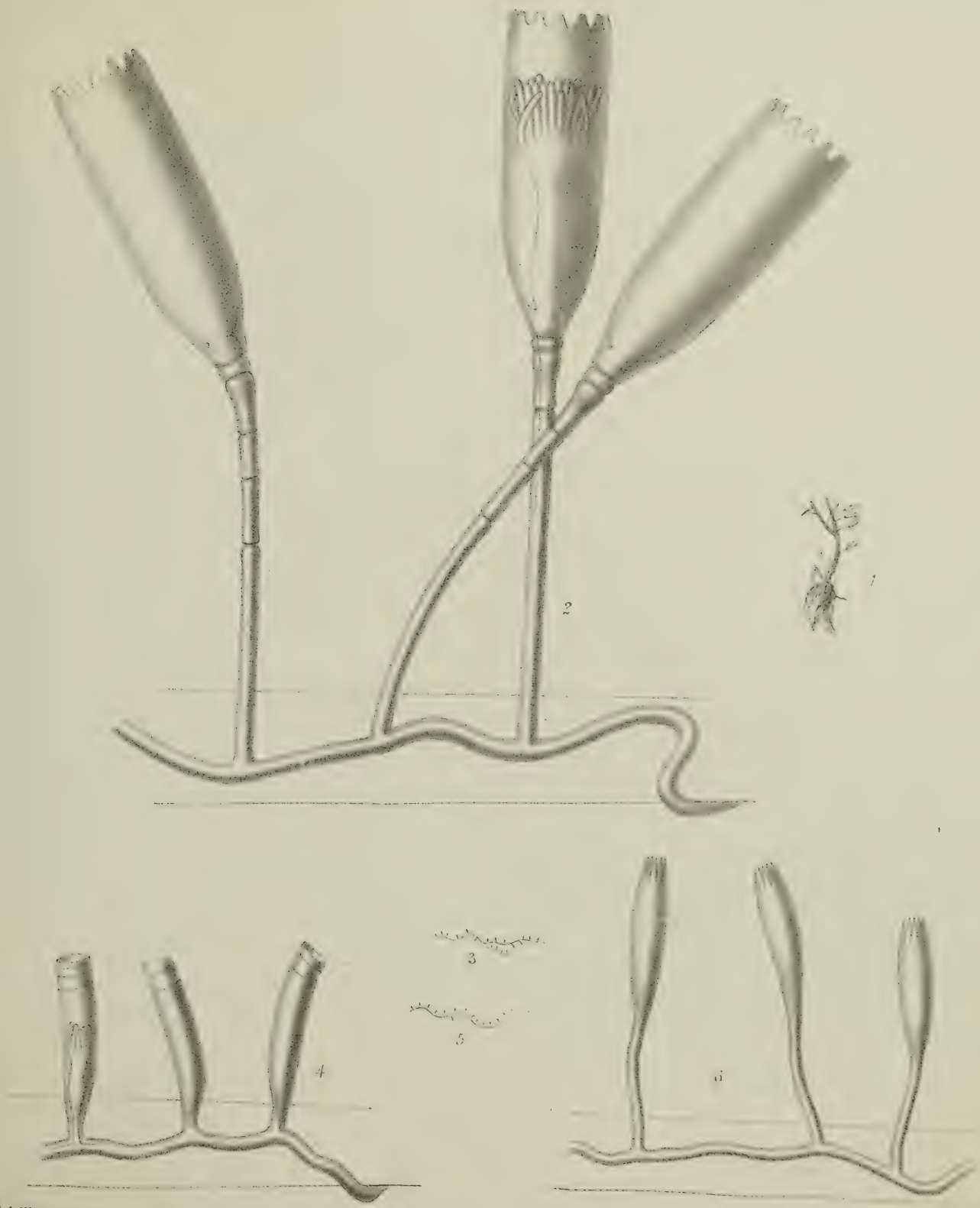
Auctor del. A F Hollick, ad nat. del.

H. N. Hardman imp.



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ALLMAN, HYDROIDS OF GULF STREAM.

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ALLMAN, HYDROIDS OF GULF STREAM.

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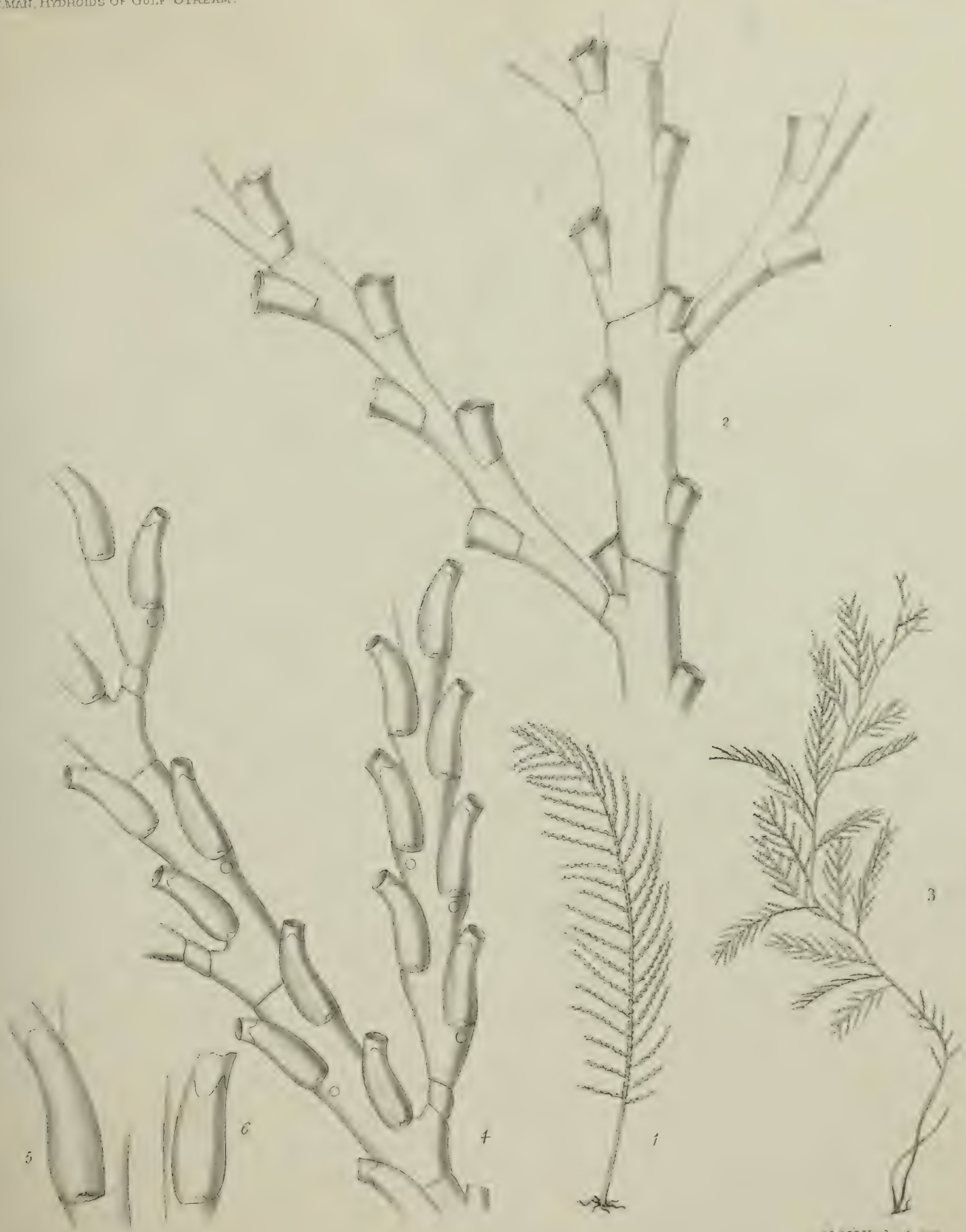

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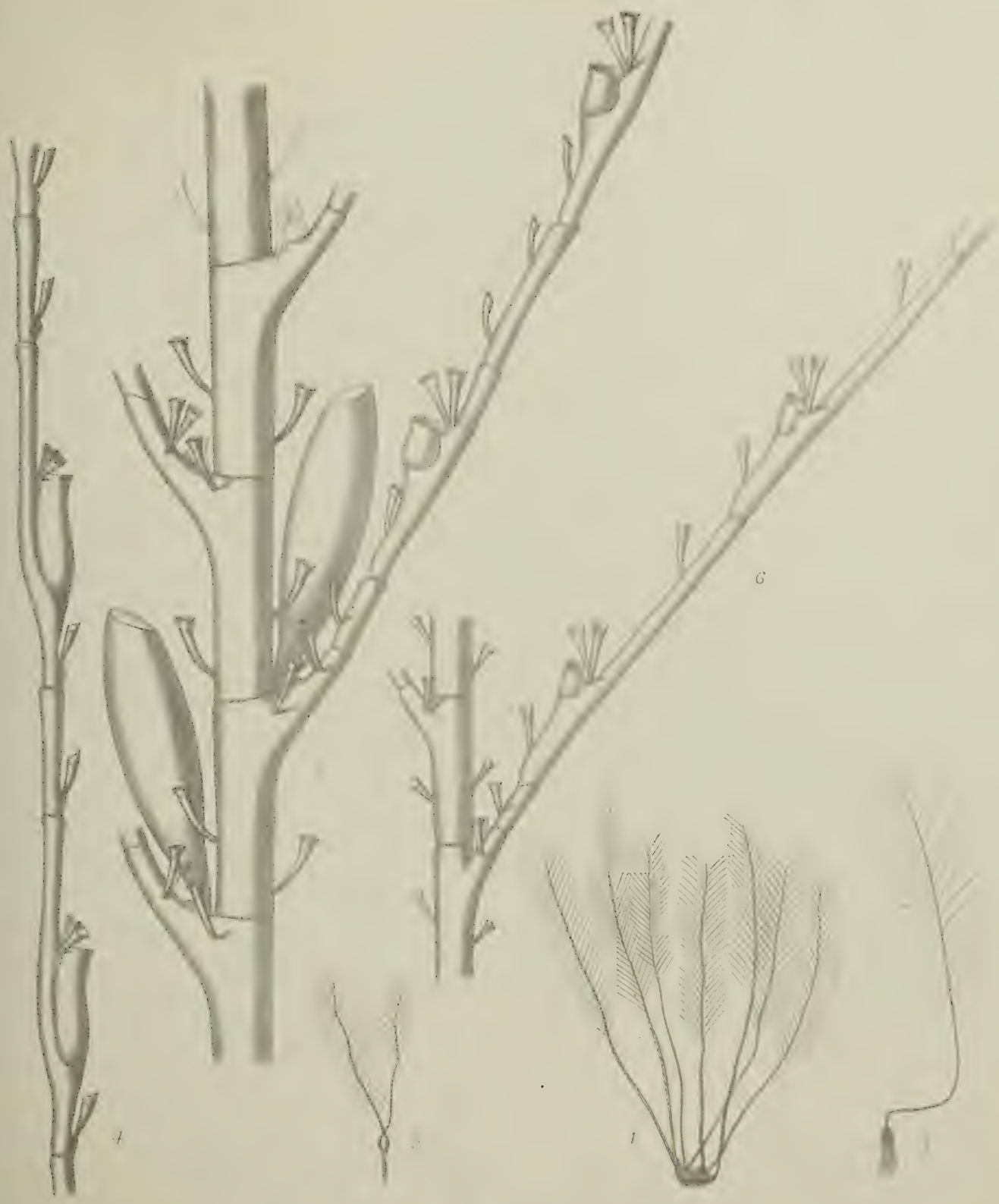

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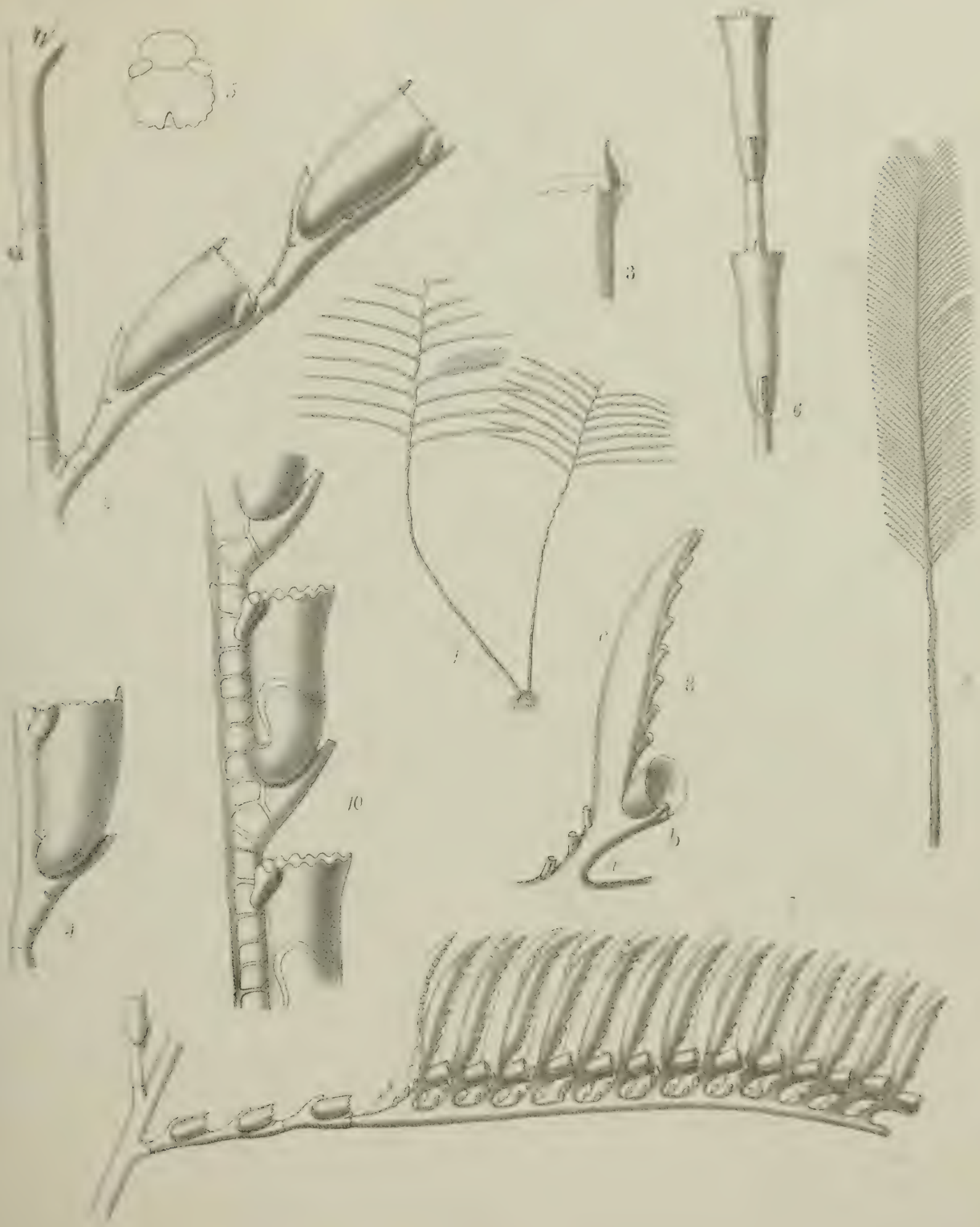
ALLMAN, HYDROIDS OF GULF STREAM.



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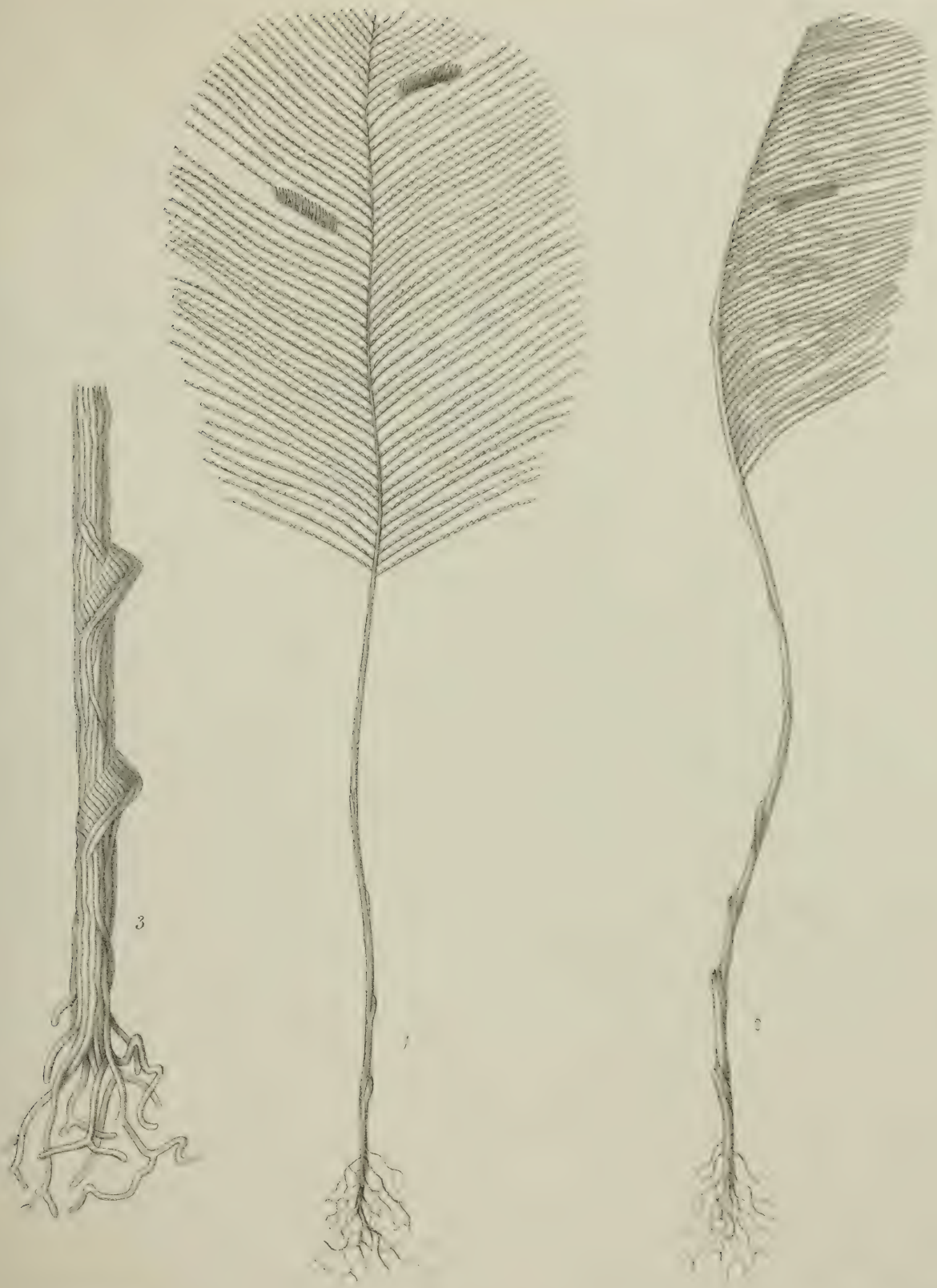

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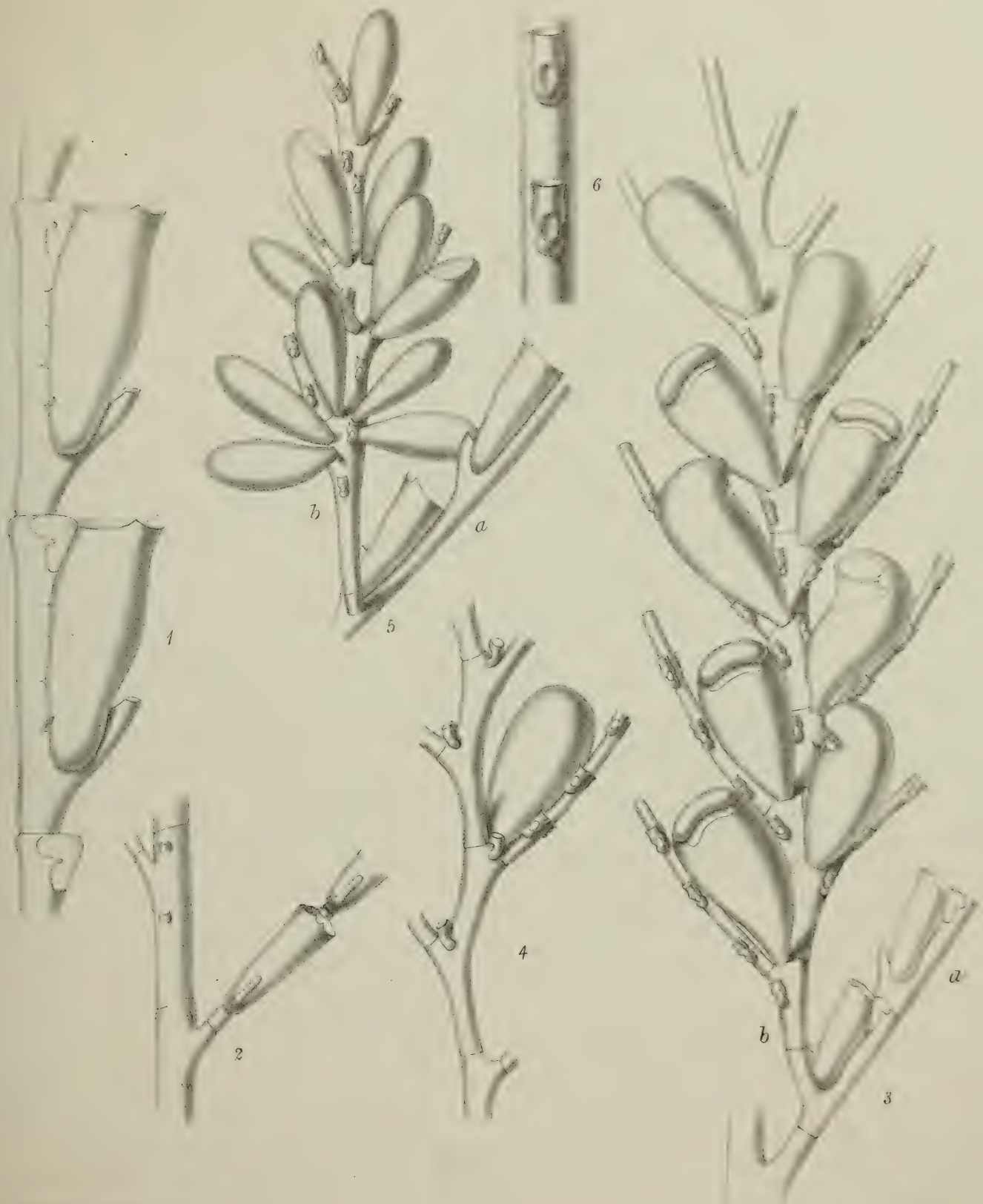

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COMMERCIAL JAPAN

IN

1900.

AREA,
POPULATION,
PRODUCTION,
RAILWAYS,
TELEGRAPHS,
TRANSPORTATION ROUTES,
FOREIGN COMMERCE,

AND

COMMERCE OF THE UNITED STATES WITH JAPAN.

[From the Summary of Commerce and Finance for December, 1901.]

O. P. AUSTIN,
Chief of Bureau.

Treasury Department,
Bureau of Statistics.

CONTENTS.

COMMERCIAL JAPAN.

COMMERCIAL JAPAN IN 1900.

Recent events so much increase the interest which the people of the United States feel, and have for many years felt, in Japan that a brief review of present conditions in that country compared with those of earlier years seems justifiable. Japan has, during the past few years, assumed an important rank in the list of commercial nations, and in doing so has vastly increased her commerce with the United States, the nation instrumental in first opening the doors of that country to commerce with the world. Within the last few years new treaties have been made with the principal countries of the world, by which their citizens are given equal privileges with the citizens of Japan in all parts of the Empire and made subject to the laws of that country, which have been recently revised, new commercial codes established, new currency adopted, new tariffs created, and new ports opened for commercial intercourse with the world. Lastly, by reason of more recent events, Japan and the United States have become near neighbors, physically as well as otherwise, Japan's northern territory, the Kurile Islands, lying within 500 miles of our Aleutian Islands, and her southern extreme, Formosa, lying within 200 miles of the Philippines, thus making a complete chain along the Pacific front of Asia. From Yokohama, her most important port of entry, the distance to Manila as a trade center is practically the same as that to Hongkong, which has proved so important a distributing point for British trade; from Yokohama to Honolulu, a distance of 3,400 miles, Japanese steamships now regularly ply; and from Yokohama to the Pacific coast ports of the United States the distance is far less than to the ports of any other great commercial nation, while the opening of an isthmian canal would greatly lessen the water route between Japan and the Gulf and Atlantic ports of the United States, from which she draws so large and constantly increasing a proportion of her supplies.

EARLIER COMMERCIAL RELATIONS.

The earlier commercial relations of Japan to the world, and the part which the United States has had in developing them, are so well known that they need not be recounted in detail. Portuguese adventurers, who were the first to establish commercial relations in China, soon extended their trade to Japan, the first Portuguese sailors landing on her soil in 1542, and within a few years an active commerce was established. Encouraged by that success, the Dutch East India Company in 1598 dispatched five merchant vessels to Japan, one of which reached it in 1600, and in 1609 other Dutch ships arrived and were well received by the Japanese, who conceded them a port on the island of Hirado and the privilege of establishing a "factory" or trading post and settlement. The hostilities between the Portuguese and Dutch, however, and the extreme demands of the Portuguese, who considered themselves already established in the commerce of Japan, coupled with dissatisfaction with the attitude of foreign missionaries toward the popular religion of Japan, led to the exclusion of all traders except the Dutch, who were permitted to take up their residence on a small island, Deshima, where they remained for more than two centuries in undisturbed monopoly of the entire European trade of Japan. In 1852, serious complaints of mistreatment of American sailors wrecked on the coast of Japan having been made, Commodore M. C. Perry, with a fleet of American vessels, was sent by the United States Government to demand from Japan a treaty by which American vessels should be allowed to enter one or more of its ports to obtain supplies, and, if practicable, that Americans should also be given general trading privileges in these ports. This undertaking was peacefully carried to a successful termination, a treaty being signed March 31, 1854, by which the ports of Shimoda and Hakodate were opened as harbors of refuge, supply, trade, and consular residence to the United States. This action was quickly followed by a successful demand for similar privileges by the British, Russian, and Dutch governments, and by 1860 the ports of Hakodate, Kanagawa, Nagasaki, and Niigata were opened to the commerce of the leading commercial nations of the world.

From this time forward the commercial relations of Japan with the world made rapid progress. In 1860 and 1861 a Japanese embassy visited the United States and Europe. The decade 1860–1870, while largely occupied by dissensions and, in some cases, hostilities between the elements favoring commercial relations with the world and those preferring former methods, saw marked developments within Japan, the beginning of the adoption of the customs and methods of western nations, and laid the foundation of the progress which has since been made. In 1871 an embassy consisting of the embassador and junior prime minister, Iwakura, the vice-embassador, Kido, Count Ito Hirobumi, the three ministers of the cabinet, and several inferior officers and secretaries, numbering 49 in all, sailed from Japan to visit all the nations having treaties with that country. Count Ito, in an address at San Francisco, the first landing place after the embassy had left Japan, said: "Our mission, under special instructions from His Majesty the Emperor, while seeking to protect the rights and interests of our respective nations, will seek to unite them more closely in the future, convinced that we shall appreciate each other more when we know each other better. * * * Held in absolute obedience by despotic sovereigns through many thousand years, our people knew no freedom or liberty of thought. With our material improvement they learned to understand their rightful privileges, which for ages had been denied them. Civil war was but a temporary result. Our 'daimios' magnanimously surrendered their principalities, and their voluntary action was accepted by the General Government. Within a year a feudal system, firmly established many centuries ago, has been completely abolished. By educating our women we hope to insure greater intelligence in future generations. Japan can not claim originality as yet, but will aim to exercise practical wisdom by adopting the advantages and avoiding the errors taught her by the history of those enlightened nations whose experience is their only teacher."

The development of Japan which followed this tour of observation and intercourse with other nations of the world was very rapid. Schools were increased, students were sent abroad to obtain a higher education and study foreign methods; internal highways were made, steamships built, and communication with foreign countries was increased; manufacturing industries were encouraged and

multiplied, and business men from other countries welcomed to participate in the commercial and business development of the country As a consequence the foreign commerce of Japan, which in 1878 amounted to less than 60,000,000 yen, in 1898 was over 484,234,480 yen while the development of railroads, manufactures, and internal industries had been equally great.

The progressive spirit of the Japanese and the rapidity with which they are adapting themselves to modern methods is shown in the increasing proportion in the trade of Japan conducted by Japanese. In 1890 the relative share of the exports from Japan by Japanese and foreigners, respectively, was, Japanese, 6,123,961 yen; foreigners, 48,767,635 yen. In 1900 the relative share was, Japanese, 73,381,634 yen; foreigners, 124,681,912 yen. Of the imports in 1890, the value of 19,521,764 was by Japanese, and 61,033,109 by foreigners; in 1900, the value of 112,737,050 was by Japanese and 173,433,883 by foreigners. Taking the total of imports and exports, the share of the Japanese in 1890 was 25,645,726 yen, or 18.9 per cent of the total; that of foreigners, 109,800,745 yen, or 81.1 per cent of the total; while in 1900 the share of the Japanese was 186,118,684, or 33.4 per cent of the total, and that of foreigners 371,497,429 yen, or 66.6 per cent of the total. Commenting upon this subject, the Austrian consul at Yokohama called attention to the fact that the number of European and American firms established in Japan is decreasing. At Yokohama in 1899, he says, the number was 303, while in 1900 it was but 248. The number of Japanese merchants in China and Korea is increasing, and it is expected that as soon as things in China return to their normal state a large contingent of Japanese merchants will proceed thither to compete with foreigners in that trade. The consul adds that in Korea Japanese merchants have already made competition impossible, and states that Japan is becoming more and more an important commercial factor in Asiatic and generally in international commerce. A table showing the share in the commerce of Japan conducted by Japanese and foreigners, respectively, will be found on another page.

SHARE OF THE UNITED STATES IN THE COMMERCE OF JAPAN.

The United States, which has been constantly and actively associated with the development of Japan, has participated largely in the growth of her commerce. Thousands of young men from Japan have visited the United States as students, and thousands of merchants and business men from the United States have visited Japan as instructors in educational and commercial lines. As teachers and professors in schools and colleges, as editors and publishers, as merchants who engage in both importing and exporting, as manufacturers, as constructors of railways and telegraphs, and in establishing modern electrical aids to commerce, citizens of the United States have been active in Japan. As a consequence, the trade relations between the two countries have grown with greater rapidity than between Japan and any other nation. In 1881 the imports from the United States formed less than 6 per cent of the total importations into Japan, while in 1900 they formed 21.93 per cent of the total importations. Meantime, Great Britain's share in the imports of Japan fell from 52.57 per cent in 1881 to 25.03 per cent in 1900. The United States is also Japan's largest customer, by reason of the fact that the chief export products of Japan are articles required by the manufacturers of the United States, and which can not be produced in this country. The total exports from Japan in 1900 amounted to 198,063,547 yen in value, and of this amount 52,566,395 yen went to the United States; 39,177,455 to Hongkong; 31,871,576 to China; 19,150,423 to France, and 11,262,997 to the United Kingdom.

The exports of Japan to the United States, as already indicated, are chiefly of articles which are not produced in this country, and in a majority of cases are those required by our manufacturers. Of the 52,566,395 yen in value exported to the United States in 1900, the value of 26,710,050 yen consisted of raw silk, 5,972,012 manufactures of silk, 6,930,475 of tea, 3,002,519 mats for floors, 1,011,923 rice, 1,743,671 chemicals, drugs, etc., while manufactures of bamboo, lacquered ware, and other products peculiar to the Japanese have also figured largely in the list. Exports from Japan to the United States have steadily grown, especially since the development of the silk-manufacturing industry in this country. In 1893 the value of her raw-silk exports to the United States was 11,078,748 yen; in 1894, 22,457,348; in 1895, 27,826,245; in 1896, 14,080,981; in 1897, 32,262,900, and in 1900, as already indicated, 26,710,050. The United States is the largest purchaser of raw silk from Japan, whose total exportations of raw silk exceed 50,000,000 yen annually. France is the next largest customer in this line, her purchases of raw silk from Japan in 1900 amounting to 10,861,352 yen in value, against 26,710,050 yen by the United States, while Italy took raw silk to the value 6,092,140 yen; England, 374,927 yen; Russia, 429,304 yen, and other countries 189,256 yen. The total exports from Japan to the United States in 1881 were 11,056,464 yen in value, being 36.5 per cent of the total exports of that year, and in 1900 were 52,566,395 yen, or 26.05 per cent of the total exports of that year.

Japan's imports from the United States have grown with even greater rapidity than her exports to the United States. In 1881 they amounted to but 1,781,108 yen, and in 1900 had reached 62,761,196 yen in value. They have grown with much greater rapidity than the total importations of Japan, our share of her import trade having increased from 5.72 per cent in 1881 to 21.93 per cent in 1900, while the United Kingdom, our principal competitor in that market, which furnished, in 1881, 52.57 per cent of the total imports of Japan, supplied, in 1900, 25.03 per cent. A detailed examination of the supplies furnished by the United States to Japan can perhaps be better made from our own standpoint measured in dollars. In the fiscal year 1892 our total exports of domestic merchandise to Japan amounted to $3,288,282, and in 1901 to $18,656,899. Of this total the largest item of export was illuminating oil, which aggregated $4,784,350; the next largest item being manufactures of iron and steel, with a total of $4,649,287. Third in rank is raw cotton, with a total of $4,086,317; other important items being breadstuffs, $1,107,235; provisions, $399,684; scientific instruments, $376,068; leather and manufactures, $285,551; tobacco and manufactures, $238,890; clocks and watches, $237,381; paper and manufactures thereof, $206,586; lubricating oil, $197,342, and paraffin, $167,118; while many other articles of less importance have found a place in the markets of Japan. Taking up the great class of iron and steel and examining its details, it is found that the exports of locomotive engines in 1901 amounted to $372,162 in value, builders' hardware, $121,697; sewing machines, $30,979; firearms, $42,512; car wheels, $20,773; other machinery, $1,481,796; and miscellaneous manufactures of iron and steel, $2,579,368.

A detailed study of the exports from the United States during the decade is presented on another page, the purpose being to determine the articles most in demand in that country and those in which the export trade has most rapidly grown. It will be found that the exports of raw cotton have grown from but $85,211 in 1890 to $4,086,317 in 1901. Illuminating oil, the exports of which amounted in 1890 to $3,559,395 in value, showed in 1901 a total of $4,784,350, despite the active competition of Russian and Sumatran petroleum, and the further fact that Japan is now herself supplying a part of her consumption of illuminating oil. Exports of flour increased from $127,120 in 1890 to $1,035,893 in 1901. This increase is evidently due to a growing disposition among the Japanese to consume more of this class of food rather than to rely upon rice, as in former years, since the number of foreigners in Japan other than Chinese and Koreans amounts to less than 4,000, and has not materially increased during the period in which our exports of flour to that country have increased sevenfold. In paper and manufactures thereof our export trade with Japan has grown very rapidly, the total exports in this class being, in 1890, $1,606; in 1896, $10,126, and in 1901, $206,586. Instruments for scientific purposes increased

from $9,441 in 1890 to $34,600 in 1894, and $376,068 in 1901. In 1890 the value of the canned beef exported from this country to Japan was but $11,212; in 1901 the total was $140,648; while exports of pickled beef advanced from $638 in 1890 to $72,325 in 1901. Leather and manufactures of leather find a steady demand in Japan, owing to the fact that the number of cattle and other animals whose skins are used for tanning is comparatively small, the total number of cattle in Japan, according to the last census, being but 1,433,583, or 30.24 for each 1,000 inhabitants.

THE COTTON TRADE AND INDUSTRY OF JAPAN.

Exportations of cotton cloths to Japan have fallen by reason of the rapid increase in the manufacture of cotton cloth in that country, the total for 1901 being but $37,891, against $141,264 in 1897. Meantime, however, exportations of raw cotton to Japan have rapidly increased, being, as already indicated, $4,086,317 in 1901, against $85,211 in 1890. This is largely due to the increase in the manufacture of cotton goods in Japan, though American cotton has grown in popularity with the manufacturers there within the past few years. Experience has shown them that cotton from the United States is more satisfactory for use in manufacturing than that which Japan had been accustomed to obtain from India and China, the staple in American cotton being longer, thus giving better results. As a consequence, imports of American cotton now form a much larger percentage of the total importation into Japan than in earlier years, although the raw cottons of China and India have largely the advantage, both in the matter of proximity and cheapness of labor utilized in their production. Japan also produces a considerable amount of cotton of her own, though it can scarcely be expected that this will increase in a manner to at all keep pace with the growth of her cotton-manufacturing industry. The entire area of Japan is but 161,245 square miles, or less than the State of California, while but about 12 per cent of its land is under cultivation, and but a comparatively small proportion cultivable, since mountain ranges and rocky islets and shores occupy a large proportion of its area. It must be remembered that Japan, with her small cultivable area, has a population of 43,760,815, and must therefore devote most of her arable land to the production of food stuffs, while her natural products of silk and tea are so much in demand the world over that they are not likely to be displaced for cotton, which can be so readily brought from other and comparatively adjacent countries. Cotton manufacturing in Japan has, however, grown very rapidly, the total number of spindles in 1899 being 2,074,475, against 5,456 in 1863. It is thus apparent that Japan will continue to purchase from other parts of the world a large proportion of the raw cotton which her rapidly growing cotton mills will consume, and as the cotton from the United States has already made rapid headway against that from the nearer countries of China and India, it is reasonable to assume that the market for American cotton will continue to grow, especially if an isthmian canal gives opportunity for direct water shipments from the cotton-growing section of the United States to the ports of Japan without breaking bulk.

IRON AND STEEL.

In iron and steel there seems no reason to doubt that the demand upon the United States will continue. The importations of manufactures of iron and steel into Japan have grown very rapidly. It is apparent that the demand for manufactures of this class will continue to increase with perhaps greater rapidity. The various manufacturing and mechanical industries are being encouraged by the Government and by Japanese capitalists, as are also the construction of railroads, the building of ships, and other enterprises of this kind, which will require great quantities of iron and steel and their manufactures. While considerable quantities of iron ore are known to exist in various parts of Japan, it is not believed that they will prove sufficient to seriously interfere with or take the place of the supplies now being furnished from other countries, especially since there are few places where iron and coal are found in conjunction. In addition to this, it may be said that while the coal supply is now such as to have become quite an article of export, rivaling that of Australia and other localities in that part of the world, it is believed that it will not be sufficient to meet the great demand upon it for all classes of manufactures for any considerable term. Besides, the large capital required for the construction of establishments for the manufacture of iron and steel, coupled with the extreme cheapness of production in the United States, through proximity of coal and iron mines, also makes it improbable that the market in Japan for manufactures of this class will be seriously impaired by local production and manufacture.

One factor which enters into this question of local manufactures in Japan, as a competitor with those of other countries which have formerly held that market, is that of labor. Upon this subject all recent writers who discuss this feature of conditions in Japan agree that rates of wages in that country have very much increased in the last few years and are likely to continue to increase, and that the fears formerly expressed that a combination of modern manufacturing developments with the cheap labor of the Orient would result in driving the manufacturers of other parts of the world out of the markets do not seem to have been justified by the experiment thus far. A table showing rates of wages in the principal industries for a term of years will be found on another page.

THE DEMAND FOR AGRICULTURAL PRODUCTS.

In products of agriculture other than cotton and tobacco the demand of Japan is up to this time comparatively small. Importations of rice in 1898 were heavy, but this was due to a short crop. As a rule Japan produces rice sufficient for her large population, and as this cereal is the most important food article with the masses the importations of food stuffs are, up to this time, comparatively light. That there is a growing demand for meats, however, is shown by the figures already quoted, which indicate that the exports of meats from the United States to Japan have increased at a reasonably rapid rate in the past few years, and with a growing demand for food stuffs of this class and the extremely small number of animals which can be utilized for this purpose, the prospect for a market for provisions, including meats, butter, cheese, etc., seems fairly satisfactory. Of petroleum, as already indicated, the importations continue heavy, though in this the oil fields of Russia and Sumatra are proving active competitors of those of the United States, resulting both in a reduction of price and something of a reduction in quantity exported.

A STUDY OF JAPANESE IMPORTS.

Those desiring to study the import trade of Japan in its broadest sense and to determine the class of articles for which a market is to be found in that country will find on another page a table showing the importations into that country in the order of their greatest value in 1898, with a comparative statement showing the importations, article by article, beginning with 1892, the year the marked growth of imports into Japan began. Cotton importations, as already indicated, have increased very rapidly, being 11,026,637 yen in 1892 and 51,500,002 yen in 1900. Sugar forms the next article of importation in relative value, being 26,606,528 yen in 1900, against

9,519,612 yen in 1892. Sugar importations up to this time have been largely in the form of the refined material ready for use. The tariff recently adopted, however, makes the rate of duty on refined sugar about three times that on raw sugar, the intention presumably being to encourage the sugar-refining industry in Japan. Cotton yarns show no important gains in the seven years in question, but, on the contrary, a decrease since 1896, this being due to the rapid increase in the cotton-spinning industry of Japan, which has not only proved able to supply the local demand of the cotton mills, but is making a large market for itself in China, and thus increasing the cotton cloth manufactures of that country. Kerosene oil imports from 1892 to 1900 increased from 3,328,398 yen to 14,162,651 yen, thus more than doubling in value, while the exports to Japan from the United States in those years barely kept pace with the general growth.

The growing demand for food products other than rice is illustrated by the fact that importations of beans, pease, and pulse have increased from 2,712,044 yen in 1892 to 8,822,111 yen in 1898, and 4,817,767 yen in 1900. Another article which shows a rapid growth in importations into Japan, and one which the manufacturers of the United States may find worthy of attention, is that of oil cake for fertilizing. The importation of this article in 1892 amounted to 824,651 yen, 3,220,600 yen in 1896, 4,614,967 yen in 1898, and 5,696,453 yen in 1900. The extremely limited cultivable area of Japan, coupled with the large demand from its 45,000,000 population whose wants are rapidly growing with increased earnings and greater activity, calls for the most careful attention to the producing possibilities of the soil, and with the small number of domestic animals from which to obtain supplies of fertilizers there is a growing demand for fertilizers of other classes. This doubtless accounts for the rapid increase in the imports of oil cake for fertilizing, a product of which our own exportations have rapidly grown, while the possibility of introduction of other fertilizers, of which our supply is now so large, may be also worthy of consideration. The United States now supplies a large share of the phosphates of the world used for fertilizing purposes, and this, coupled with the almost unlimited capacity of production of oil cake, makes this rapidly growing Japanese market for fertilizers one worthy of attention.

Another line of imports into Japan which has rapidly grown in the last few years is that of woolen goods, especially those classed as "mousseline de laine." This single line of manufactures has increased from 2,448,899 yen in 1892 to 4,373,988 yen in 1898, and 7,364,991 yen in 1900. Recent writers on Japan indicate a growing disposition on the part of the people of that country to utilize woolen goods for garments, and as wool is not produced in any considerable quantities in that country the demand for woolen cloths is constantly increasing. All efforts to introduce sheep for wool-producing purposes have been unsuccessful, the physical conditions of the soil and climate as well as its grasses being such as to make it improbable that Japan will become a sheep-producing country, so that the growing disposition to utilize woolen cloths will increase the market for raw wool or woolen goods, as is shown by the single item alluded to above. Other classes of woolen cloths have also increased from 640,417 yen in 1892 to 2,969,763 yen in 1900, while wool yarn increased from 427,992 yen in 1892 to 1,798,535 yen in 1900, and cloths made in part of wool from 196,618 yen in 1892 to 2,433,758 yen in 1900.

One curious and interesting feature of the importations of Japan is that which relates to clocks and watches. The opinion was expressed a few years ago that the cleverness of Japanese workmen in reproducing articles of delicate workmanship brought to their attention would soon reduce to a minimum the importation of clocks and watches and other articles of this character. Experience, however, has not justified this belief. The importation of clocks and watches into Japan, according to the official figures of the Japanese Government, has increased from 687,734 yen in 1892 to 3,419,727 yen in 1898, and 1,840,503 yen in 1900.

Other articles in which the increase in importation has been rapid and suggestive to manufacturers and exporters of the United States are rails for railways, which increased from 67,437 yen in 1892 to 4,753,371 yen in 1900; other materials for railways, from 51,865 in 1892 to 2,514,232 in 1898; printing paper, from 217,309 in 1892 to 2,036,844 in 1900; satins of cotton, from 523,459 in 1892 to 3,662,638 in 1900; plate and sheet iron, from 240,583 in 1892 to 4,080,543 in 1900; iron pipe, from 55,814 in 1892 to 2,981,693 in 1900; cotton prints, from 436,544 in 1892 to 2,002,732 in 1900; nails, from 906,422 in 1892 to 2,181,064 in 1900; white shirtings, from 330,558 in 1892 to 1,325,142 yen in 1900, while numerous other articles whose values are stated in smaller sums show equal and even greater relative growth in the importations, the details of which will be shown by the table printed on another page.

AREA, POPULATION, AND PRODUCTION.

The geography of Japan is so well known that details need not be discussed. From the northernmost of its group of Kurile Islands, adjacent to Kamchatka, to the southernmost extremity of Formosa is over 4,000 miles, or more than the distance from the northern boundary of Alaska to the southern extremity of California. Its principal islands of course are Hondo, or Niphon, with a total area of 87,485 square miles, about equal to the State of Kansas, and a population, as shown by the census of December 31, 1898, of 33,327,935, or an average of 381 inhabitants per square mile; Hokkaido, or Yesso, with an area of 36,299 square miles, about equal to that of Indiana, and a population of 610,155, or an average of 16.8 per square mile; Shikoku, lying next south of Hondo, with an area of 7,031 square miles, or a little less than that of Massachusetts, and a population of 3,013,817, or 428 per square mile; and Kiushiu, still farther south, with an area of 16,840 square miles, about the same as the combined area of Vermont and Massachusetts, and a population of 6,808,908, or 404 per square mile, making for these four principal islands a total area of 147,655 square miles, or about the same as that of the State of California, and a population of 43,760,815, or an average of 296.4 per square mile. In addition to this the population of the island of Formosa, ceded to Japan by China after the war between China and Japan, was given on December 31, 1898, as 2,690,096.

The Kurile Islands, stretching northward from Hokkaido to Kamtchatka, which were obtained from Russia in exchange for a part of Saghalin, number about 25, with an area of 3,070 square miles, and a small population, subsisting upon hunting and fishing, the products of which they barter to American, Portuguese, and Dutch traders. The Riu Kiu Islands, which lie between Japan and Formosa, also belong to Japan, and likewise have a small population, subsisting chiefly by fishing and barter. Hokkaido or Yesso, the most northerly of the islands, has but a comparatively small population, the climate being severe and large portions of the surface unsuited to agriculture. Indeed, the fact that the large proportion of the Empire of Japan is volcanic and that lines of mountains, some of them active volcanoes, run through the center of the islands with merely a frontage of low lands on each side and valleys between these mountains, renders the cultivable area relatively small, the land now under cultivation being estimated at but about 12 per cent of the total area. This is, however, very carefully tilled, mostly by hand, with spades, hoes, and implements of this character, plows and other agricultural implements being but comparatively little used. Rice is the largest and most important crop agriculturally, supplying, as it does, the principal food of a large part of the population, though wheat, corn, barley, and millet are grown in certain localities in quantities bearing but a small relative proportion to that of rice. As to natural products for exportation, silk is by far the most important, the exports of raw silk in 1900 amounting to 48,818,347 yen. Tea is the next in importance among the natural products, the exports of 1900 being 9,035,819 yen in value; rice, 3,576,569 yen; cuttle-fish, 1,158,794 yen; camphor, 3,070,701 yen. Of the minerals,

coal is the most important in export value, the exportation of 1900 being 13,703,655 yen; those of copper, refined, 12,660,185 yen, while the chief of the manufactured articles exported were cotton yarn, 20,589,263 yen; silk goods, 23,512,116 yen; cotton tissues, 6,000,201 yen; mats, 3,310,042 yen; porcelain and earthenware, 2,660,478 yen. Of the cereals, rice occupied in 1899 6,958,885 acres, against 1,105,000 in wheat, 1,605,000 in barley, and 1,677,000 in rye, the number of bushels of rice being, according to the Statesman's Year-Book for 1901, 196,367,997, as compared with 20,126,043 bushels of wheat, 41,690,025 of barley, and 32,767,134 bushels of rye. The production of tea for 1899 is given at 7,543,997 kwan, or 62,454 pounds avoirdupois, the kwan being equal to 8.28 pounds; sugar, 14,615,473 kwan (in 1898); raw silk, 3,277,404 kwan; silk cocoons, 2,512,562 koku, the koku being equal to 4.96 bushels.

THE COAL SUPPLY.

Coal, the most important of the minerals of Japan, is found in the northernmost island, Hokkaido, and in the northern part of the island of Hondo, and in large quantities in the most southerly island of the group, Kiushiu. Coal has been mined systematically during the last thirty years, formerly by the Government, but more recently the management has been transferred to a prominent financial firm of private citizens, who promptly established trading stations, not only in Japan but in China, Straits Settlements, Burmah, and the Philippine Islands, their product rapidly taking the place of Australian coal, upon which steamships in that part of the world were formerly compelled largely to rely. Locomotive engines from the United States and electric power have been introduced into the mines to take the place of horses, and branch railways convey the coal to ports 50 miles distant, where steamships can have constant access to the docks and depots of supply. The coal veins at the most important of these mines range from 8 to 20 feet in thickness, and the area is believed to be such as to justify the expectation that Japan will, for many years at least, prove an important coal producer and distributor in the East, while the fact that enormous coal deposits, easily worked, are in China, simply awaiting transportation methods to render them available, shows that the coal supply of the Orient can from this time forward be relied upon as sufficient for ordinary requirements. And when it is remembered that the supply of natural water power in the mountains of Japan must necessarily be very great and that this may now be conveyed in the form of electricity to accessible points for use in manufacturing, the manufacturing possibilities of Japan, with its large industries and skillful population, will be apparent.

TRANSPORTATION METHODS.

Methods of communication and transportation, which play such an important part in the productive possibilities of any country, have so rapidly improved in Japan during the past few years as to add greatly to its industrial prospects, whether agricultural, mining, or manufacturing. Railway lines now stretch along the coast on either side of the principal islands, the total length of railroads being over 3,000 miles, with a large additional mileage proposed and in many cases under construction; telegraph lines form a network over the entire group of islands, while large sums of money have recently been expended by the Government in the construction of highways for transportation connecting the railways, the chief lack, however, being in horses, of which, as already indicated, the number is but a little over 1,000,000 for the 45,000,000 population of the Empire.

Of the 11,684 foreigners residing in Japan in 1900, 11,561 were classed as "merchants and other professions," while of the 1,296 from the United States 1,282 were classed as "merchants and other professions." Of the 2,113 British subjects 1,994 were thus classed, and of the 532 Germans 518 were so classified. The number of foreigners residing in Japan is only about one-ninth as great as the number of Japanese residing in foreign countries. The Japanese census of December 31, 1899—and it is interesting to observe that the Japanese take a census each year—showed 99,039 Japanese residing in other countries. Of this number 71,315 were in the United States, so that 62 per cent of the Japanese now residing abroad are subject to the jurisdiction of the United States. Of the remaining 27,724 Japanese residing abroad 15,068 were in Korea, 5,681 in England and English colonies, 4,021 in Russia and Russian colonies, and 2,442 in China. Of the 71,315 residing in the United States 282 were students and 1,983 merchants. It is interesting to observe that the disposition of the Japanese is apparently to look almost exclusively to the United States in educational matters, as the total number of Japanese students residing abroad, as shown by the census figures, was 605, and of this number 282 were in the United States, 147 in Germany, 37 in Russia and Russian colonies, 35 in England and English colonies, 49 in China, 15 in Korea, and 17 in France.

The new relation in which the foreigners in Japan stand to its citizens, laws, and Government is especially important because of the unusual relation they hold to its foreign commerce. Both the import and export business of Japan are conducted largely by foreigners residing in that country. About 63 per cent of the exportations from Japan and more than 61 per cent of its importations are conducted by foreigners. Of the total exports from Japan in 1900 over 124,000,000 yen were sent abroad by foreign merchants doing business in that country and 73,000,000 by Japanese merchants, while of the total imports of the year 173,000,000 yen in value were imported by foreigners and 112,000,000 yen in value by Japanese merchants. That the Japanese have proved apt pupils in the study of foreign commerce as an art is shown by an examination of the record of Japan's foreign trade during the past few years. In 1883 only 4.85 per cent of the imports into Japan and 14.4 per cent of the exports were made by Japanese merchants. By 1888 the percentage of importations made by Japanese merchants had increased to 17.8 per cent; by 1894 they had reached 29.2 per cent, and in 1900 39.4 per cent of the total imports were made by Japanese merchants. Meantime their share in the exportation business has also increased, reaching 18.4 per cent in 1894, 25.8 per cent in 1896, and 37.05 per cent in 1900. The total value of imports by Japanese merchants in 1883 was 1,383,101 yen, and in 1900, 112,737,050 yen, while the total value of the exports by Japanese merchants, which in 1883 was 5,149,078 yen, was in 1900 73,381,634 yen. The fact that three-fifths of the exports of Japan still find a market through foreigners residing in that country, and that a like proportion of the imports is brought in and distributed by foreign merchants doing business in Japan, adds greatly to the importance of the new relations which now exist between the Japanese Government and foreigners residing and doing business in that country.

CURRENCY.

Naturally the banking and currency of a country which is so rapidly increasing its commercial relations with the United States is a matter of especial interest. The gold standard, as is well known, was established in Japan in 1897, and its general banking facilities, as well as its currency, are considered stable and satisfactory. The total coinage issued from the mint from its foundation in 1870 up to March 31, 1900, exclusive of recoinage, was, according to the Stateman's Year-Book of 1899, 431,246,052 yen. The paper money, according to the same authority, consists of Nippon Ginko, or Bank of Japan notes, exchangeable for gold on presentation, and the amount in circulation on April 1, 1900, 217,809,333 yen. In 1899 the Nippon Ginko, or Bank of Japan, had a paid-up capital of

30,000,000 yen; notes in circulation, 217,809-333 yen; loans, 786,117,640 yen; deposits, 1,725,404,724 yen. In 1898 there were 1,414 private banks, with a paid-up capital of 190,292,740 yen; loans, 1,576,200,337 yen; deposits, 3,393,044,548 yen. In 189[illegible]-99, 1,565,498 persons deposited 37,921,508 yen and withdrew 15,430,590 yen from the post-offices, which act as savings banks. In the same year there were 413 savings banks, with a paid-up capital of 14,966,242 yen, and deposits aggregating 93,659,013 yen.

The following table shows the amount of coinage issued in the fiscal years ending March 31, 1896 to 1900:

COINAGE.	1895-96	1896-97	1897-98	1898-99	1899-1900
	Yen.	*Yen.*	*Yen.*	*Yen.*	*Yen.*
Gold coins	1,423,750	952,433	76,824,311	21,385,797	16,[illegible],270
Silver coins	20,007,377	12,927,034	10,298,085	17,090,000	5,[illegible]
Nickel coins	51,500	650,000	600,000	750,000	[illegible]
Bronze coins	.....	.....	.....	100,000	[illegible]
Total	21,482,627	14,529,467	87,722,396	39,235,797	22,[illegible],270

The following table shows the condition of banks in Japan in 1898:

BANKS.	Head offices.	Branch offices.	Paid-up capital.	Deposits.	Loans.
			Yen.	*Yen.*	*Yen.*
Nippon Ginko	1	8	30,000,000	1,725,404,724	786,117,640
Nippon Industrial Bank	1	.....	2,500,000	.....	6,776,609
Yokohama Specie Bank	1	2	10,500,000	842,014,234	209,777,971
National banks	4	1	390,000	6,682,266	2,981,879
Agricultural-Industrial	41	.....	8,798,020	962,686	4,356,337
Private	1,414	904	190,292,740	3,393,044,548	1,576,200,337
Savings	413	453	14,966,242	93,659,013	72,854,056
Total	1,875	1,368	257,447,002	6,061,768,165	2,659,064,829

In January, 1899, there were 4,481 miles of State roads and 15,362 miles of prefectural roads.

Railways are of two classes: (1) State railways; (2) railways owned by private companies, 42 in number, two of them supported in a certain way by the Government.

The following table gives the railway statistics for 1898-99:

	State railways, 1898-99.	Railways owned by private companies, 1898-99.
Length in miles	820	2,652
Gross income ..... yen	11,143,742	21,841,458
Expenditure ..... do	6,343,030	12,059,674
Goods carried ..... tons	1,887,227	8,141,315
Passengers ..... number	31,720,787	66,816,330

The following are postal and telegraphic statistics for four fiscal years:

	1896-97	1897-98	1898-99	1899-1900
Letters and post cards	403,818,612	454,052,108	505,002,412	501,960,680
Newspapers and periodicals	86,801,875	88,750,347	91,519,154	110,064,813
Books	6,617,114	7,363,932	7,663,751	8,079,462
Samples, etc	898,190	1,053,116	1,164,327	1,341,151
Registered packets	5,223,891	6,498,199	7,409,388	8,424,703
Parcels	2,737,138	4,213,849	5,076,648	6,016,011
Total	506,096,820	561,931,551	617,835,680	635,886,810
Post-offices	4,270	4,285	4,337	4,464
Telegrams delivered	10,978,153	14,126,012	15,[illegible]	14,[illegible]
Telegraphic line ..... miles	11,517	12,[illegible]	12,924	[illegible]
Telegraphic wire ..... do	37,654	44,801	50,177	[illegible]
Submarine cable ..... do	387	1,[illegible]	1,763	1,[illegible]
Submarine wire ..... do	481	1,691	1,988	2,[illegible]
Telegraph officers	1,114	1,255	1,[illegible]	1,[illegible]
Post and telegraph officers	17,050	18,464	19,[illegible]	21,[illegible]
Post and telegraph income ..... yen	9,221,833	10,797,093	11,844,767	.....
Post and telegraph expenditure ..... do	6,625,725	7,954,087	.....	.....

In March, 1899, there were 1,562 miles of telephone (31,273 miles of wire), with 13 exchange offices, 40 calling offices, and 8,083 subscribers.

EDUCATION IN JAPAN.

Educational conditions in Japan are the subject of very favorable comment by those who have had opportunity for thorough investigation, while the official reports of the Japanese Government show that the number of schools, teachers, and pupils has rapidly increased during the past few years. The number of primary schools on January 1, 1899, as shown by the official reports of the Japanese Government, was 26,824, with a total attendance of 4,062,418, of which number 2,582,277 were boys and 1,480,141 girls. Special technical schools also number 268; ordinary normal schools, 47; and these, with others of various designations, brought the total number of public

schools and educational institutions up to 28,479, against 25,611 in 1893; while the total attendance was 4,183,507, against 3,459,446 in 1893, 3,055,380 in 1888, and 2,833,350 in 1887. In addition to these the universities and institutions of higher grade founded by the State include the Imperial University of Tokyo, with 2,696 students, while there are also superior schools with an attendance of over 5,000, schools of music, schools of art, schools for the blind and dumb, and schools for instruction in military and naval matters. Mr. Stafford Ransome, C. E., whose views regarding the effect of the new treaties are quoted elsewhere, discussing the educational conditions in Japan, estimates that 61 per cent of the Japanese of school-going age were, according to the latest available information, receiving at all events an elementary education based on modern principles, and adds that his investigations showed that so far as the masses are concerned education is making its most effectual progress in the quiet and outlying districts which are undisturbed by foreigners and modern methods. "Roughly speaking," he says, "we may estimate that there are in Japan at the present day 30,000 schools of all sorts, 100,000 teachers, 500,000 graduates, 5,000,000 pupils of both sexes, and that the annual outlay in one way and another to maintain them has reached about £1,500,000," or $7,500,000.

PORTS AND TRADING CENTERS.

Naturally the principal trading centers of Japan are the treaty ports where commerce has flowed in and out and where foreign vessels have been permitted to land and foreign merchants to do business. Especially this is true in view of the fact that the large proportion of the foreign commerce of Japan is conducted by citizens of other countries residing in that Empire, and necessarily residing only at the treaty ports. A table published on another page shows the amount of imports into each of the principal ports of Japan in 1900. It will be seen that the largest imports of 1900 were at Kobe and Yokohama, those at Kobe being 137,484,281 yen and those at Yokohama 109,775,317 yen; Nagasaki being next with 15,427,338 yen, followed by Osaka with 9,741,437 yen. Of the 62,761,196 yen imports from the United States in 1900, the value of 37,553,855 yen entered at the port of Kobe, 19,022,004 yen at Yokohama, 3,610,307 yen at Nagasaki, 368,342 yen at Hakodate, and 2,214 yen at Osaka. Yokohama still continues to be the favorite port with imports from Great Britain, as 35,108,611 yen of the imports from Great Britain in 1900 entered at the port of Yokohama, 28,404,815 yen at Kobe, 6,582,257 yen at Nagasaki, and 578,946 yen at Osaka. Yokohama still continues to hold the largest percentage of the German import trade also, the imports at that port from Germany in 1900 being 15,409,225 yen; at Kobe, 12,240,284 yen; at Nagasaki, 211,323 yen, and at Osaka, 156,084 yen.

SHIPPING.

Of the 6,630 vessels entering Japanese ports in 1900, 2,685 were foreign steamships, 2,645 Japanese steamships, 1,172 Japanese sailing ships and junks, and 128 foreign sailing ships. Of the 9,825,622 tonnage of the vessels so entering, 6,243,095 tons were foreign steamships. Of the total foreign ships entering the ports in 1900, 1,590 ships, of 3,819,804 tons, were British; 411, of 1,068,914 tons, German; 163, of 340,032 tons, American, and 137, of 297,801 tons, French. Of the total shipping in 1900, 1,075 vessels, of 1,974,428 tons, entered Nagasaki; 766 vessels, of 1,850,043 tons, entered Yokohama, and 1,361 vessels, of 2,816,949 tons, entered Kobe. In 1898 the merchant navy of Japan consisted of 1,130 steamers of European type, having a total tonnage of 447,430 tons; 1,914 sailing vessels of European type, of 170,894 tons, and 19,097 Japanese craft above—"koku" each, of 3,320,284 koku (koku equals 180.4 liters).

CHANGES IN VALUE OF THE STANDARD OF THE CURRENCY.

In closing this discussion it is proper to call attention to the fact that the value of the yen, in which all statements of the value of imports and exports of Japan are made, has fluctuated with the value of silver during the years under discussion, prior to the date at which the gold standard was adopted, and that this fact should be borne in mind in considering the statements of imports and exports. The following gives the value of the yen in United States money on January 1 of each year from 1885 to 1899, as shown by the Annual Report of the Director of the Mint:

Value of yen on January 1, 1885, in United States money, 85.8 cents; 1890, 75.2 cents; 1891, 83.1 cents; 1892, 74.5 cents; 1893, 66.1 cents; 1894, 55.6 cents; 1895, 49.1 cents; 1896, 52.9 cents; 1897, 51.1 cents; since 1898, 49.8 cents.

Monme=27.0067 grains troy. Picul=133⅓ pounds avoirdupois, catty=1⅓ pounds, tael=1⅓ ounces.

THE DEVELOPMENT OF COMMERCE IN JAPAN, AND ITS EFFECT ON CIVILIZATION IN THAT COUNTRY.

By Chohei Shirasu, A. M.

(A native of Japan).

INTRODUCTORY.

The first glance we cast upon the history of nations enables us to perceive an incontestable fact, that civilization representing the highest degree of culture attained by man at different periods does not continue in the same places, but passes from one country to another, from one continent to another, following a certain order. Man can not struggle at once against human oppression and the hindering and destructive forces of inorganic nature. It would hence seem that the physical adaptation of different portions of the earth to the use and enjoyment of man is a matter so strictly belonging to mightier than human powers that we must accept geographical nature as we find her, and be content with such soils and such skies as she spontaneously offers. Nature and history, the earth and man, stand in the closest relations to each other, and form only one grand harmony. Thus it is apparent that civilization arose in fertile lands and then spread abroad. But it is certain that man has reacted upon organic and inorganic nature, and thereby modified, if not determined, the material structure of his earthly home. That early civilization in which the food question played so important a part was wonderful. There must always be some commerce, some intercourse, means are continually to be sought. Valleys and islands had every condition favorable to the growth of civilization. Egypt had, by the aid of nature, a rich soil on which the overflowing river spread every year a fruitful loam, where the plow is almost useless; an equable, warm climate, securing to the inhabitants of these fortunate regions plentiful harvests in return for light labor—the most favored spot for early civilization. Being completely protected from enemies, by her isolation, she produced wonderfully, and was well situated to maintain a high civilization. Phœnicia formed an early civilization of the races of two continents mingled, and also by the aid of nature, with the facility of coast line, she became the great commercial nation of the world. Her sails dotted the entire Mediterranean Sea, her colonies were on its coast, and from her trading posts radiated long routes of land travel, by which articles were conveyed from the interior of the continents to the seaboard. She was the common carrier of the world. The civilization of the above two countries, the one a fertile valley, the other a favorable coast line, influenced the entire Mediterranean region, Carthage and Greece, and Rome and Spain. Greece was once quite densely populated and most highly civilized. Her islands were closely connected to the mainland and had safe harbors within them. She extended her civilization by colonies and conquest. Greece drove the Phœnician from the seas and succeeded to their commerce. Europe is complicated in its geographical structure, linking together various natural features, a vast number of valleys, rivers, harbors, and islands, terminating in peninsulas. The Roman Empire, succeeding Greece, spread its power into further territory. Then civilization passed to Spain and Gaul, and even Britain. Each of these early civilizations was in turn either overthrown by enemies and surrendered to hopeless desolation, or was at least greatly reduced in its material productiveness and population, especially in commerce. Civilization flowed into the interior of the European continent by way of the Danube, through Bavaria and Bohemia to the Carpathian Mountains, and over a plain of thousands of square miles, including Hungary, Bosnia, and Servia, to the "Iron Gate." The decay of these once flourishing countries is partly due to that class of geographical causes whose action we can neither resist nor guide, and partly also to the direct violence of hostile human force. But it is, in a far greater degree, either the result of man's ignorant disregard of the laws of nature, or an incidental consequence of civil war and ecclesiastical tyranny and misrule. Thus, for an early civilization, there must be protection against natural forces and barbarians. Agriculture is the basis of civilization, cultivation of soil permits a dense population. But just as no civilization comes without food, so it does not come without commerce. Forests and mountains prevent invasion of enemies, by hindering their approach. Early civilization was an exchange of products between forest countries and those having a dry climate, as in the western part of Asia; between those with fertile region, where food could be derived and the more distant and inhospitable regions. In all cases variety of products and available water courses were a necessity. The polar region can never hope to be occupied by man. The Eskimos live in little rooms with no considerable property; in such conditions there is no hope of civilization. Even in the United States there was not suitable food for a large population and for domestic animals, and no advanced civilization till after the soil had been cleared and several crops had been produced; then came the foundation—sufficient food for a civilization. Wherever population has not grown it is because of the food question and of domestic animals. But when railroads were built and gave facilities for supplying food, civilization suddenly developed. In the earliest ages of the world Asia shone alone. She was at once the cradle of civilization, and of those nations which were the only representatives of culture, and which carried it, in their day, to the extremities of the world. Asia, its gigantic proportions, the almost infinite diversity of its soil, and its central situation rendered it suitable to be the continent of the germ and the root of the immense tree which afterwards bore such beautiful fruit. But Asia has yielded to Europe the scepter of civilization for two thousand years. At the present day, Europe is still unquestionably the first of the civilized continents. North America has also entered the list and is advancing with geometrical ratio; for it has not to recommence the work of civilization; civilization was transported thither ready-made. The three continents of the southern hemisphere, Africa (except Egypt), Australasia, and South America, have not been the birthplaces of any of the great civilizations which have exercised an influence on the progress of the race. Japan has just been added to high modern civilization of the European sense and is preparing herself to play a part of the first importance. The natural advantages of the Japan Islands are immense. These islands consist of four large mountainous islands, and comprise many small ones distinguished by their physical condition. This country has a healthy and moderate climate, fertile soil, variety of vegetable and mineral products, and natural facilities for the transportation and distribution of exchangeable commodities, advantages which are not possessed in an equal degree by any other country in the Orient. Its productions are rice, tea, cotton, and silk, and are the great staples, furnishing the principal food, drink, and clothing of its people. Manufactures, having the benefit of the competition of different countries in supplying raw materials, are the chief features of the present commerce and wealth. These manifold blessings, the temperature of the air, the distribution of the rains, relative disposition of land and water, the plenty of coast lines, the composition of soil, and the raw materials of the manufacturing arts are wholly gratuitous gifts. The native products of China and Korea were naturalized in these islands, and gradually improved by the art of man, while centuries of persevering labor was expelling the wild vegetation and fitting the earth for the production of a more

generous growth. Early civilization was introduced from China, but now the Japanese surpass the Chinese in advancement and mercantile skill, as the world has abundantly seen. Thirty years ago the Japanese themselves thought they were far behind the Chinese. The late victory and success of Japan over China, it goes without saying, was because she has a better geographical position. The question may arise, "How such small islands escaped the invasion of the Chinese?" The answer is, Because no ancient scientist left any accurate maps of the coast lines and the course of voyage; and also there was a lack of ships to cross with, although the islands were well known to the Chinese; and also on account of their jealousies and their perpetual wars in their own country. But the intention of invasion by both countries was clear enough. The history of Japan tells us that the ancient Empress Jingo, in 200 A. D., and again Taiko, the famous warrior and ruler in the seventeenth century, sent their armies and subjugated Korea; the latter with the hope of going into China. The great Mongol conquerer, Ho-oe-li, in 1281, invaded and sought to overwhelm Japan, to make a descent upon the south-western island, with forces numbering 100,000 men; but, fortunately for Japan, a storm dispersed his fleets.

Interesting parallels may be drawn between the relative positions of the United Kingdom and Japan to the continents which they respectively adjoin; and the resemblance of the geographical situation of the British Isles on the fringe of Europe to that of the islands of Japan on the extreme eastern edge of Asia is so striking as to have attracted universal attention. But Japan has a far greater range of temperature and climatic variation than prevails in the British Isles. The great ocean currents exert their beneficial influence upon both groups of islands, so they enjoy this most excellent gift of nature, and the greatest facility for transportation. The Japanese islands are particularly rich in harbors, having 56 large ones; and the development of a trade in coal and silk must inevitably bring more of them into prominence, but the number already in constant use, as shipping ports for local produce, has grown to be very considerable. Some ports are already well known to the Europeans, and, when the country is all opened to foreign trade, it is more than likely that they may become ports of call for the mercantile fleets of the world.

Thus Asia, Europe, and North America are the three grand stages in the life of humanity in its march through the ages. Asia is the cradle where man passed his infancy; Europe is the school where his youth was trained, where he waxed in strength and knowledge, grew to manhood, and learned at once his liberty and his moral responsibility; North America is the theater of his activity during the period of manhood, the land where he applies and practices all he has learned, brings into action all the forces he has acquired, and where he is still to gain the complete development of his being and his happiness. England in Europe, the United States in North America, and Japan in Asia are preparing to act the parts of three sisters of the twentieth century in the development of the commerce of the world. The recent war in China showed that Japan has a most excellent army and navy, and she has shown herself to be one of the strong countries in the world. She has shown those forces which accompany the development of commerce, and whose civilization increases with the increase in population and wealth. Hence, as society advances it is absolutely necessary that the facilities of transportation and communication be also developed. Japan, in every view, has all natural advantages, and recently has been rapidly improving in her industrial products, and can compete with the world. In order to act with credit her part with her other two sisters in the twentieth century, she must improve more and more of her facilities of transportation, her industry, and her commerce.

Now, let us go back and trace her history and see how she has grown, and then look upon her present condition, which shows her prosperity, and, lastly, discuss her future and how to improve it.

Chapter I.

THE HISTORY OF THE COMMERCE.

ARTICLE I. PRIMITIVE AGE TO 800 A. D.

Ancient history is never trustworthy, and it is difficult to trace with accuracy the record and get results worth much. Japan, like England, is a country surrounded by water, the coast abounds in capacious harbors, and she had navigation facilities early in her unknown history. According to the law of geographical progress, in places where there are good facilities for navigation and an abundant food supply, an increase of population and rapid improvement in every way and in commerce will occur. The general feature of the country is long; there is one great range of mountains running through the middle, with rivers making their ways on both sides to the sea. Population occupies the country, first along the seacoast, and thence spreads along the navigable rivers, although many of them obstruct easy passage by their shortness and rapidity. Then it extends along the line of the highways, which were long ago necessarily opened and improved into the interior to make transportation easier and more rapid. Pack horses and oxen were then used for transporting goods and for traveling purposes. Stations were established at the distance of a days' journey apart. In 313 A. D., rivers were bridged. Not only was attention paid to improvements in inland transportation but their eyes were opened to the advantages of water transportation. The subjugation of Korea in 200 A. D., by the Empress Jingo, is the important fact that shows their advancement in maritime power, and it is wonderful that they crossed the sea with many thousands of warriors and with ships, and returned successfully. Trade, or the exchange of commodities, was by barter, as is seen in other countries; a bearskin was exchanged for 60 pounds of cotton in a trade with Korea in 650 A. D. They employed only things made by themselves, and each group or neighborhood was closely confined to its own resources. Consequently, chiefly physical strength was needed. Their dwellings were simple, built of wood; sharpened and burnt posts were put into the earth, and the joints of the building were fastened with twine. From earliest times they used iron utensils for various purposes, after a short stage of using stone. People were industrious, and though without scientific knowledge, knew how to clean off the dust and perspiration of their bodies after their work by taking hot-water baths, allowing good circulation of blood. Then continental civilization came into the country and with it its religion. With increase of population in the country they began to exchange their surplus products. Silk was known early in this period and was highly valued. Dyeing and needle work were also known and practiced. Oil was made from the seeds of a plant and was used for lighting purposes. Their food was limited pretty much to rice, barley, and wheat. Birds and wild animals were food only in the hunting districts, and fish on the sea-shore and river sides. Wines made from rice were highly appreciated by the people. Such was the state of living, and people were quite contented with their situation. This simple and direct condition of life could not last long, and was followed by an increase of population and a struggle for means of subsistence and a better style of living.

When communities became sufficiently advanced a different state of things developed the necessity of means of exchange, division of labor and of regulation of peace and order, and the idea of carrying on commerce. They began to produce more than they needed for their own requirements. The necessity of exchanging the surplus with others taught them to travel to other communities and to seek better terms. So the peddler was known as early as 457 A. D. In 701 A. D. the systematized market was established, giving the idea of value to things. The bill of sale was signed and sealed, either by marking with the thumb or with a stamp. Loan and borrowing, even interest-bearing at not over one-eighth of the principal in sixty days, and not twice in four hundred and eighty days, began to prevail in the eighth century. Officers and priests were prohibted from lending at interest, by which they were prevented from spending the money of the official treasury. The loan on crops was limited to one year for redemption. The borrower needed a guarantor, who was responsible to compensate the creditor if the borrower failed to return the loan, as is the case at this present time. A law of measurement and the ratio of prices to commodities was enacted in 701 A. D. It regulated, by a central office, the prices of the whole country, except the large cities, where the municipal governments were already independent and separated from the central office, and sanctioned themselves.

Exchange of commodities with China and Korea began in 697, but was not very active, and was only in luxurious things. Korea produced gold and silver long before Christ, but did not know how to mint or use either for ornament or means of exchange. In 200

A. D. China and Korea made a present of gold and silver to Japan, which they continued annually for a long while. Both metals were highly valued and used for ornament. The first production of silver in the country was in 675, and of gold in 749. Copper was produced in antiquity and used for mirrors, then iron was used for the same purpose, by polishing a side of a plate of the metal. The joke was that people thought that these metals had some spirit in them, as rats frighten at their own reflection, and so they [illegible] only for ornament. Since 724 bronze has been used a great deal for making immense statues of stupid Buddha. The first appearance of metallic money was in 485, said to have been brought from either China or Korea. Prior to this, crude [illegible] and pieces of cloth were used for the medium of exchange. The goods in general use and the food supply were made by their own [illegible] consequently exchangeable goods were not in great quantity, and the transaction of business was so small and of so little value that the use of silver was abolished in 684, and copper, coined in China or Korea, of smaller value, took its place. In [illegible] a copper mint was established, and from this time on people began to use the money made in the country, which was coined in a [illegible] Korea. The law of 701 also regulated the monetary system. In 760 the ratio of gold, silver, and copper was fixed—at the rate of ten for silver to one of gold, and a hundred for copper to one of silver. The unit of measurement for length was fixed from tip of thumb to tip of little finger, and for quantity a handful, and for broadness the width of shoulders of a man. As early as 250 A. D., lineal measure was applied, for they paid great attention to building, which necessitated a fixed measurement. In 690 the Government sent a messenger to China and learned the method of measuring quantity by the decimal system, and in 697 and then in 701 a great art was [illegible] the establishment of measurements.

The development of the mechanical industry of the country largely depended upon religious believers and upon the wars of the country. Engraving was encouraged by the making of idols of Buddha, and fine fighting weapons of iron were in great demand by the warriors. These arts gave the people great skill in hand work, although their scope of working was very small and they used rude and simple instruments pertaining to individual hand work. Skill in work was considered the treasury of the family or house, and was inherited by the descendants. Most of the industries of the country originated in China and Korea—there were very few original ones. Silk-spinning instruments (not machine at this time) were introduced from China in about 215. In 540 Korea presented a gift of leather clothing to our country, and since then people have used it for general wear.

Earthenware was used already in 29 B. C., said to have been introduced from Korea. Black japan ware was used in 71 A. D., and in 673 red ware was added. Glass plate and balls existed in 697. Engraving was the wonder of those ages, and, under the influence of Buddhism, the making of idols for worship, and they paid special attention to making fine ones. In those times communication with China was only for the purpose of getting their manners and customs, or rather continental civilization, and trade was not in view, although they did trade in luxuries and a few other things. Chinese literature was brought in and influenced many officials, as no one could get official position unless he knew something of this literature.

ARTICLE II. 800-1540.

In 805 the Emperor made his permanent residence in Kioto, which continued, reign after reign, until the present Emperor removed to Tokyo, in 1868. As Kioto became the capital of Japan everything concentrated there, and it became the center of the commerce and finance of the country. Prior to this there was no fixed place for commerce; but only those ports where transportation facilities existed were doing business gathered from neighboring places. The country was not well settled; fighting occurred among the lords, and battles took place almost everywhere in the country in order to extend their own territories by defeating the weak and striving for power; disorder and conflict prevailed everywhere. Thus commerce and trade were neglected. But those ports to which neighboring towns brought their products which they could not take into the interior, and which were deposited with the wholesale merchants to be protected by guards, made great profits. Then the bill of exchange began to exist for the benefit of producers.

In a few reigns after the removal of the Emperor's seat to Kioto the central government lost its power; it went into the hands of the normally appointed yet actually self-imposed ruler, who was the most famous warrior of that time, having defeated all others. He issued laws as he pleased, but for the benefit of the people at this time. In transacting business the price of goods was fixed in order to prevent unjust dealing and the cheating of the people; and where there was scarcity of money, rice was used as a medium of exchange. The transfer of real estate was licensed and guaranteed and needed the agreement of both parties. In 960 lead was minted for money. While the country was in disorder and war prevailed, minting operations were neglected, and Chinese money was found in circulation. The roads were opened and improved merely for facility in transporting troops, and this was a great benefit to foot travelers; and the planting of trees on both sides of the road gave shelter. But the inconveniences can be easily imagined, for it is said that they made bundles of grass for their pillows and passed the night under the trees. Interstate communication was almost undeveloped, goods being carried on the shoulders of man. Communication with China and Korea was also destroyed, with the exception of some private transactions. Many pirates along the coasts were very powerful, and boarded the ships and robbed them of their cargoes. Therefore transportation on water almost ceased. Only the officers of the ruler were very luxurious after great victories, and so some ornamental articles were brought into trade. All industries for a long time were almost annihilated by internal troubles, except the art of making armor, especially swords, and this produced many noted armorers. Lacquer and japan ware were used for their ornaments and the arts were improved. Engraving and painting, on the other hand, were improved by the influence of Buddhism. The paper industry, which was introduced from Korea, was considerably improved for the use of painting and printing. Printing originated in 1171 and gave great benefit to the people, and the constitution of the country was for the first time printed in this reign.

In 1170 the Government collected money or compulsory labor for the purpose of building dikes, which should protect from high waves and also from the invasion of enemies. This somewhat improved the ports and facilitated water transportation. In 1200, for the purpose of repairing a temple, priests and their believers collected money by borrowing, with a certain payment of interest. This is the origin of the bond. In 1250 loaning without pledge was prohibited, and the result was that burglars brought stolen things to loan offices for pledges, and lawsuits occurred occasionally in this case, consequently they began to write the name and residence of the pledger for the contract. Real estate can not be pledged for more than twenty years. The ruler established his own court, separate from the Emperor's court, in the best naturally fortified place, which made a second large concentrated place, and communication with the capital began. The road between the Emperor's court and the ruler's was improved, and towns sprung up and prospered. The country was in good order and peace under this ruler, and people sang for joy, being tired of massacre and robbery for awhile. In May, 1281, a great invasion of 100,000 armed troops, with 4,000 war vessels from China, was reported. They landed on a small island, but the people fought well, and a storm broke the enemy's ships into pieces. This great event was a good lesson to the Japanese, and they began to pay attention to shipbuilding. Japan now became a power on the sea; still the people were afraid of the revenge of China, and prepared for it. Since then trade with China was entirely checked until 1342, though many private vessels sailed to China and acted as pirates. They all feared our pirates so much that the seacoast of China was deserted. Meanwhile they sent an embassy demanding the opening of intercourse, but as internal war was again raging in Japan it was not complied with. But trade with Korea was considerably active, and in 1466 there was more than 120 vessels floating on this route, and more than 45 houses and 1,650 Japanese immigrants were found in Korea. From these the improvement of our navigation and our earnestness in business can be judged.

At about 1470 the ruler's power was weakened, naturally resulting from his luxury and extravagance, while the empire was divided up, and several lords were governing their own small provinces, overpowering the weak, issuing their own laws, and charging tolls on travelers for their revenue. These lords prohibited their subjects from selling their tenancies, and persecuted both parties if they violated the law. The law was so strict that subjects also began to leave off trading. This leaving off of trade became a custom for a long time to the subjects; thus the economic idea was neglected. During these times there was no fixed price of goods; transactions in generally useful things were made by mutual exchange. But the wholesale merchant in the ports and cities, where the powerful lords had their residences, made a good deal of profit. Trade-marks or store marks began to exist by this time for giving sign to the guards by which these houses were protected. The great inconvenience of travel made it necessary to set up milestones in every 2½ miles, and the lords gave warning not to travel after dark. During this period of disorder of the country people could not produce enough supplies, consequently Chinese goods were brought in by messengers, sent by the lords, for their own use. Drugs, dyeing

materials, brocade, embroideries, and other articles of clothing were imported, and exchanged for sealskin, sulphur, lacquered ware, gold, and copper. The prices were enormous, and the profits were accordingly great. But international trade was still unopened. By the end of this period people again began to give attention to literature, but the priests were the only instructors. Chinese and Korean bronze money were in circulation again, and smuggling and counterfeiting prevailed all over the country. Interest on loans ran from 5 to 7 per cent, limiting their redemption to twenty years, doubling the amount in ten and three times in twenty years. If overdue, after notifying borrower, three times the pledge would be forfeited by the action of law. A son was responsible for his father's debt. At about 1521 the first silver mines in the country were opened, and many utensils were made of silver, and coins were minted afterwards. Iron and brass were minted for a one-tenth of a sen (perhaps this was the unit of value at this time, 1535); but on account of their inconvenience and because they were not made of good metal for circulation their use ceased.

ARTICLE III. 1540–1636. BEGINNING OF FOREIGN TRADE.

After the long war panic of the country was over trade with China and Korea was reopened. With the reaction of the long interruption the trade was enormous, as one can never imagine. Of course there was no statistics taken, but it is said that more than 2,000 Chinese merchant vessels came yearly to Japan, and mostly silk was brought. Prior to this the Japan Islands were made known to European nations by an Italian, who lived long years in China, and was doing business in trade at about 1280. The first navigation line from Europe to Japan was established in 1541 by three Portuguese merchants, who sailed for China from Siam, whose vessel was wrecked and was saved by two Japanese vessels, which met them on their way to China. In August, 1543, more than a hundred Portugese merchants came to Japan, a Chinese acting as their interpreter by writing on the sands, and opened intercourse with our country. They traded in woolen goods, leather, and silk clothing, with gold, silver, and copper. Rifles were first introduced into the country at this time. This trade with Portugal was the first of our trade with European countries. In 1549, a young Japanese murdered his friend, and ran away to Portugal, and told them about the prosperity of Japan and the possibility of spreading Christianity. Next year many Catholic priests arrived in Japan. In 1548 Spain came next to the Portuguese, en route from the Philippines to Mexico, and stopped to secure a food supply. The country allowed them to trade only at Nagasaki, a southern port of the country. The field gun was introduced by the Portuguese in 1570. In 1592 cotton cloths were imported from China and took the place of silk, which was imported by the Portuguese merchants, but people never used it, so it remained useless in store.

Prior to this, Buddhism spread all over the country, and was powerful, consequently the ruler allowed Christianity to counteract the power of Buddhism; but afterwards he regretted this, because the new religious believers got the same power as Buddhists, and a few years later he persecuted thousands of Catholic believers. By this time the navigation of the country was considerably improved, and many vessels were sent to other countries for commercial purposes. As the Catholics got power, one of the lords earnestly believed and sent messengers to Rome to pay his respects to the Pope in 1583, being the first message to European countries. They sailed through the Indian Ocean, rounding the Cape of Good Hope, along the western coast of Africa, arriving at Lisbon, Portugal; Madrid, Spain; then crossing the Mediterranean Sea they arrived at Rome, having sailed 7,000 miles in nearly three years. They came back in 1591. They were entertained and welcomed wherever they stopped, and brought back some knowledge of European civilization. Other lords followed him in 1585, 1587, 1591, respectively. Of course, these voyages were made in consequence of their earnestness of religious belief, but one can easily imagine how hard it was, how brave they were, and how they were interested in the improvements of navigation, sailing in such small, imperfect, and unscientific sailing boats, without full-knowledge of the ocean route. This great experience helped the knowledge of navigation in Japan.

In 1601 the Holland Dutch came, and from 1609 they began their trade by the name of the Dutch East India Company, which gave itself out as an agent of the King of Holland, on behalf of commerce.

Tobacco was brought in 1605, and the Government considered it luxurious and useless, and prohibited its imports in 1609; but the people planted it in their own gardens, and used it secretly, so the Government was obliged to change the law. Then the product was greatly increased. In 1596 printed books were introduced from China, and soon afterward, about 1610, people used copper for printing. After prohibiting the circulation of Chinese copper money in 1604, the country minted gold in large plate, and silver and copper for fractional coin. Lead was once coined, but the people suffered by counterfeiting.

The communication with the Philippine Islands, Annam, Siam, and India began before 1500, and there were more than five hundred Japanese emigrants living near about Manila and thousands in Siam. But the natives were afraid of the Japanese, and never had close communication with them. For a short while the Philippine Islands were under the control of Japan. Japan advanced the trade with those southern islands, and encouraged the building of ships large enough to carry crews of 300 men, having guns and weapons against pirates. Their trade was copper, lacquered wares, umbrellas, fans, screens, sulphur, camphor, cloths, and wheat, with which they purchased from these islands onions, silk, rugs, sugar, and woods.

In 1600 William Adams, of England, was wrecked in the Pacific Ocean and arrived at Japan. He became naturalized afterwards, being the first naturalization of a foreigner in the country. In April, 1611, Capt. John Davis was sent by King James I, arriving in Japan in 1613. He consulted Adams about trade, and began the English trade; but there were Spanish and Portuguese already in active business and the English could not compete with them, and finally left the country in 1623. In September, 1611, the world atlas was first introduced into the country, and people learned that there were three other large continents beside Asia, and they resolved to open communication and trade on a grand scale. Two schooners of foreign styles, of 80 and 120 tons, respectively, were built by the design and assistance of William Adams, and were sent to Mexico to trade. This route has been kept open ever since. This is the first opening of the Pacific Ocean to North America, being only eighty years after Columbus discovered America. This progress in navigation was the pride of the country. There were 198 trading ships licensed during 1605–1618, trading with 20 different countries. There were over 1,000,000 emigrants found in Annam, Siam, and Philippine Islands, establishing villages there, and they brought back some useful things. While European trade excited such great interest in the people, that with China was somewhat neglected, or rather prohibited. But the people, who gained profit in trade with China would not give it up, and over 50 were persecuted to death and 500 intermarried persons were driven out of the country for violating the laws. In these days the quotation of gold and silver was 1 to 10 or about so, while in Europe it was 1 to 15 or 16, and European trade gained a large premium in exchanging goods for gold. It is no wonder that many foreign merchants came to the country to trade, even though transportation was conducted under great difficulties. During this period the "Refined Bohemianism" prevailed in the country, and the "tea ceremony" was one of their fashions. For this reason planting of tea began in many places. The colored porcelain which was introduced from China for the use of the ceremony began to be useful, and soon afterwards it was exported to China.

The difference of the characters of foreigners necessitated their having different ports for their trading places; consequently the country opened several ports along the southern coast, which naturally improved, according to their business activity, and some of them remain very important ports of the country. The first navigation law had regard to the captain and the consignor of goods, and was issued because the art of the building of ships had so progressed and navigation was so improved that such a law was needed.

As Christianity spread over the country and gained influence over citizens, the officers in the Government began to suspect the action of the Christians. A suspicion of their motives was aroused by the remarks of the captain of a Spanish vessel, who said "We got Mexico and Peru by sending Catholic priests first, and letting them report the manners and customs of the people, and then we sent an army and took them by force." Consequently, in 1636, the Government prohibited this religion, together with traders, to come to the country. The communication and trade with Spain and Portugal, which were very active, were absolutely abolished. England was also included in this list, for she had an intimate intercourse with Spain. But Holland, who was jealous of Spanish and Portuguese merchants, and never mixed religion and trade, alone took their places. The trade with China became very active again. By this religious prohibition the interest in navigation suddenly collapsed. The Government being yet afraid of foreign religious influence over the people, and on account of the enormous exports of gold, issued the most conservative law of "the closed door," shutting up the ports, confiscating all ships large enough to cross the sea, and prohibiting shipbuilding. Even Holland and China were allowed to trade in

only one port, and the Government levied a tax on all imported commodities; 60 per cent on Chinese, and 15 per cent on the Dutch Company, and 65 per cent on individual trade; this at one time raised $500,000 yearly revenue. This is the origin of our customs duties.

During this period of communication with foreign countries the industry of the country improved wonderfully, and produced many noted men in all lines. Japanese products were exported to the continent of Europe for ornamental purposes, as Oriental curiosities, but not for general use. The art of engraving alone lagged behind because of the spread of Christianity, which was opposed to Buddhistic ornamentation. During this period the commerce of the country developed the most that the country had ever seen, and foreign trade was carried on with all parts of the world.

ARTICLE IV. A. 1636–1868; FROM THE "CLOSED DOOR" TO THE REVOLUTION.

While Japan was in restriction of communication with foreign countries she improved her facilities of land transportation. The origin of the mail system began by a private messenger between Osaka and Yedo, to which latter place the ruler removed in 1606, and the concentration of people there made everything improve. At this time the people were advocating what was really the Physiocrat doctrine, and rice was considered the source of the wealth of the country, and prosperity depended upon the production of it. Prior to this period literature, art, jurisprudence, and religion had greatly improved, but the economic idea was not yet aroused. As the ruler of this time was fond of reading books, his subjects followed him, and they began to pay attention to economic views, and economic subjects were greatly discussed among learned men. But they were never interested in navigation, and they thought it ridiculous to discuss foreign trade and communication. This wealth-producing rice was brought from all parts of the country into Osaka, where the water facility for transportation was developed, being near to the capital. The lords also sent their products to this city, building storehouses, selling in the market, preventing the monopoly of the wholesalers and giving the benefit to the consumers. The quotation of rice was reported by flags, and torches in night, to distant places. People concentrated at Osaka, improved the streets, facilitated commerce by building canals, so commerce became prosperous. In consequence of the increase of population in this city, the muncipality now developed into full power. For convenience of market, almost all products were sent to this city and then distributed to other parts of the country. In payment they brought back useful things, and for any balance they received credit in the market on which they could draw drafts in case of necessity. The Government also helped the circulation of money by lending in the market without interest. Osaka became the center of commerce and finance of the country. There was a money exchange market and drafts could be easily cashed. In 1637 the Government enacted a law for bills and notes, which were in private use before this time. They were made by farmers. On these they wrote the measure of silver that was equivalent to the goods exchanged. These were signed by a rich neighbor, made payable to bearer, and indorsed by the last payee only; because of the danger of carrying bulky money. People appreciated this convenience. Drafts, notes payable on demand or on sight, depository notes, bills of exchange, notes of the exchange office, bills of storage of sugar and rice, etc., were in circulation, limited for three years. The house tax began in 1636, levied according to the width of the front of the house, for the purpose of improvement of the streets and roads.

After the prohibition law of 1636 and the Christian riot in 1637, trade with Holland and China became less active than before. The Government limited their trade, reducing their number of trading ships year after year, until only one ship for Holland and ten ships for China yearly, were allowed in 1790. Their trading goods were silk, woolen cloths, lumber, buffalo bone, leather, candle, sugar, camphor, coral, musk, perfume, glass, and dyeing materials from Holland; sugar, matches, ivory, buttons, lead, mercury, wood, porcelain, camphor, rugs, medicine, calico, turtle shell, silk, brocade, crepon, wool, brushes, fans, umbrellas, ink paintings, coral, playthings, cloths, leather, matting, etc., from China; and in payment, copper, porcelain, embroidery, lacquer wares, umbrellas, screens, dried fish, oil papers, rice wine, sauce, tobacco, tea, etc., to Holland; and dried fish, copper, rice, etc., to China, were exported. The export of silk, cotton, hemp, silver, and weapons to other countries were prohibited.

It is worth while to study the development of the mail system of this time. At first private messengers of the lords reported to their produce dealers in Osaka after the ruler had removed to Tokyo (Yedo); afterwards the merchants began to send their private messengers between the two cities. In 1663 only one person served as a messenger for public purposes, and he made the round trip only three times every month. In 1672 money was sent by the messenger's company, six members being incorporated for this business. As commerce increased between the two cities, people began to urge the importance of faster communication, then horses came into use and the number of messengers was increased, and a great improvement was made in 1740. In the same year communication by public messenger was made with other important places. Then parcels were also sent by the messengers, and in 1747 bills of lading, bills of exchange, and insurance for transferred goods began to be used. By doing this the corporation made considerable profit and the Government levied a tax of 50 yen a year since 1781. The charge of the messages differed according to the speed. The distance between Osaka and Tokyo is 356 miles; the charges were as follows:

	In six days (pounds of silver).	In twenty days (pounds of silver).	Three and one-half days.
A letter	1/60	1/400	By special agreement.
A parcel per 8 pounds	1/6	1/12	
Gold coin per 100 pieces	55/120	11/120	

Thus, transportation facilities were opened to all parts of the country and the rate reduced year after year. But there was no regular system until the Government established the post-office in 1871, when necessitated to do so by the importance of communication.

In 1688 a gold coin was minted, having its fineness 86 per cent of gold and 14 per cent of silver, weighing 15.39 grains, and sold at 40 shillings. It was amended to 9 grains of 57 per cent of gold in the nineteenth century. Schools and libraries were established in 1697, and were greatly encouraged by the ruler, who was much interested in reading. A series of books of 635 volumes was published at this time.

As the Shogun made his permanent residence in Tokyo, this obliged all lords to live there at least three months in the year. The streets were improved, a great many people concentrated in that city, and it soon surpassed Osaka. The commerce of the country divided among three cities—Osaka, representing the center of commerce; Kioto, representing the capital; Tokyo, the largest city in the country. A market for rice and other products was opened also in Tokyo, and it gathered all the products of the north, and competition with the southern products arose.

During 1764–1805, the silk industry was revived and enough was produced in sixteen different provinces to meet the internal demand, and therefore the importation was naturally decreased. In 1764 colors were added to printing papers and used for the illustration on novels; this colored printing is at present highly valued in Europe and America.

In 1842 the harvest was comparatively small and prices rose, so the Government issued a law that wholesale and retail trade must be carried on at the former wholesale stores, and its ratio was given; rice being limited as to price other necessary things were equalized thereto. Commission sale and bailment were known at this time. The interest on loans was fixed at 15 per cent in 1848, but this hindered business and it was obliged to be given up. The idea of saving was advised by the Government. The former common market was changed, and a rice and stock exchange system took its place.

England, having lost America, began to pay attention to Oriental countries, and tried often to open communication with Japan, but in vain, spending over $200,000. In August, 1803, she sent a squadron to Japan, asking, or rather, demanding the opening of the country. In September of the same year, Russia sent her messenger for the same purpose. From this time on the people began to discuss the question of foreign communication. European countries were much interested in Japan, and began their race to conclude treaties of peace and friendship, and to open communication; the Dutch in 1845, the United States in June, 1852; Russia the same year; the Dutch

again in 1853 sent their squadrons and messengers. Their actions were haughty, the officers and crews showed very disgraceful manners, stealing cattle and food, and firing houses, as they did in China recently. The people feared subjugation by an alliance with these foreigners, and the Government, the people, and the country as a whole, were busy in preparing to fight against them, and they guarded all their ports. Prices of food and weapons of war went very high, while other goods were driven off from the market, the stock and rice exchange was closed, and the country lost its internal commerce. In 1854 the United States sent General Perry urging the opening of friendly intercourse. These Americans were, unlike the others, very kind and friendly, so people respected them and treated them very nicely. Thereupon in September, the Government ceased its conservative policy, and awoke from a long dream of two hundred years. This policy had restricted foreign trade by narrow legislation, and was inclined to look upon the foreign merchant as an enemy, and to forbid the export of money and to prohibit the import of manufactured commodities. While European countries were improving by the invention of labor-saving machines and utilities in everything, Japan lagged behind. Now, people began to pay attention to navigation, and light-houses were erected and gave great benefit to commerce. In 1853 tea was for the first time sent abroad, to Europe and the United States by samples, then exported on an order from England. The exportation of tea increased year after year, and became one of the most important articles of export of the country. Lead was used for the first time for printing in 1854. Then books, newspapers, and pictures were printed and gave great help to the public.

In July, 1858, the Government concluded a temporary treaty with the United States—then with Russia, England, France, and Holland—to open five ports, one in the south, two at the middle part facing on the Pacific Ocean, one facing the Japan Sea, and one in the north, of which the ports of Nagasaki, Yokohama, and Hakodate opened in October, 1865, and Kobe, in May, 1868. Then amendment and addition were made in the treaty, and it was concluded with other countries. Thereby the commerce of the country was rapidly increased and developed, and raw silk and other articles were exported to Europe and America. At this time the mercantile doctrine began to prevail in the country. The attention of the people was turned to foreign communication; European science and arts began to be diffused. In July, 1861, Holland made a present of a man-of-war to Japan and advised a naval system, which advice the country followed two years later and employed Holland professors and officers to teach in the navy. Many large vessels were built and the Government owned 44 and the lords owned 94 vessels at the close of the feudal system. But there were still many high officials and people who believed a short-sighted policy would be better for the country, and in 1863 the English legation was attacked by mobs and two officials were killed. Trouble between the people of Japan and the people of European countries happened oftentimes.

The first embassy to foreign countries was sent to the United States in January, 1860, and then to other countries. In 1864 the Government built a dock, iron factory, and shipyard, spending $2,400,000. This was the first time that many laborers were employed in a large factory using labor-saving machines. The dock remains one of the best in the Orient. Industries, manufactures, and everything were improved. In 1864 an embassy was sent to France, which was shown many things of European civilization, and brought home new knowledge of their manners and customs, science and arts, which gave great satisfaction to the people.

As a natural result of the opening of ports and of free trade, European civilization came into the country and gained many admirers of mathematics, the new calendar, the use of guns, and photography; and later on people began to read and to translate books and to study medicine, physiology, electricity, printing, etc.

Mining during this period was very active and prosperous. Copper was produced in all parts of the country, 200,000 pounds every year, even as early as 1700. Gold was produced much in 1711, but the ratio of gold to silver varied from 1 to 4 to 1 to 12, while European countries varied from 1 to 14.83 to 1 to 16.17 during 1687–1874. Then, of course, Gresham's law acted most vigorously, and exportation of gold took place:

1644–1738, gold was exported more than 300,000 pounds; 1709–1858, $17,000,000; 1858–1872, $14,000,000.

Note.—Aggregate amount of export of gold in three hundred and thirty years, between 1532–1872 was $642,000,000, and if accurate calculation was made until the present day there must have been over $1,000,000,000 worth of gold taken out of the country, while its production was in two hundred and seventy-six years, between 1592–1865, 1,230,348 ounces, or $62,000,000; total coinage issued 284,782,821 yen during 1870–1897.

Thus, silver coin alone was left in circulation. A French atlas of 1700 figured out that "Japan was the most fertile and gold producing country in the world." Coal was said to have been mined and known as a "burning stone," and used for fuel, but it was not generally used till after the American vessels visited the country. Since 1854 the Government has encouraged the production of this most useful fuel. With the introduction of dynamite in 1861 mining made a great advancement, by using it for breaking rocks and stones.

B. 1868 TO PRESENT TIME.

In 1868 occurred the greatest event in the history of Japan. The lords magnanimously surrendered their principalities to the Emperor, and their voluntary action was accepted, and the administrative power returned to the Emperor, having been in the hands of rulers for about seven hundred years. Then the feudal system was completely abolished. All kinds of monopolies and business privileges which the lords held ceased to exist. This revolution was the victory of European civilization over conservative feudalism, and the admirers of the Western civilization gained the majority in the Government. They sent messengers and scholars to those countries for the purpose of observing and examining their social, political, and industrial systems, with a view to transplanting to their own country whatever seemed most applicable. The first thing done was to issue full credit paper money, as a natural result of the scarcity of coin; this helped the credit of the Government. The germs of many new things were introduced and civilization began to shine all through the country. Cotton spinning machines were imported from France, and astonished thousands who were spinning with small insignificant machines worked by hands.

The Imperial Court removed from Kioto to Tokyo, for His Majesty's permanent residence. Then Tokyo became the commercial center of the country, while Osaka took long strides in industrial developments. Here was located the Government mint in 1868; brush, paper napkin, cotton spinning, and several other manufacturing enterprises, and a brewery conducted on a large scale; and Osaka has become a manufacturing city of great importance. It has ample transportation facilities either by river, canal, sea, or railroad, which have done great work in developing the city.

In 1869 light-houses of foreign styles were built and greatly helped navigation. Next year the Government adopted the German army system and compulsory recruiting took place. Horse carriages and coolie carriages began to run on the streets, giving quick and easy street passage. In 1871 the American monetary decimal system was adopted. On account of the growth of wealth and population, resulting from active trade and transportation facilities, round gold coin had to be minted for convenience of circulation. This coin being the latest improvement for foreign exchange, the yen was made standard or unit; its fineness and weight were fixed. The post-office and the telegraph office were established. The people admired these new establishments and new things, and a craze for civilization arose. The first proposal to compile a commercial code was made in 1870. The Government issued a law that people should not wear swords, which it had been the custom to do from time immemorial. My late father once petitioned the Government, years ago, to do away with this custom, but his request was rejected and he was laughed at. By this law the disputacious character of the people was softened to friendship. In 1872 a large printing press for newspapers was introduced and the people began to learn of the world's enterprises; this was a great benefit and help to the progress of the country in civilization.

The American national-bank system was introduced, but with no success, because notes were issued only on 60 per cent of the capital, with Government bonds for security. In 1876 this act was amended and the bank note was made a legal tender for all payments, except for the payment of custom duty and interest on Government bonds. It was convertible into Government money, and an issue of 80 per cent of the capital was allowed to be issued. Under this favorable condition 153 banks were organized during 1876–1879, with a capital of 48,816,100 yen. The first steam-railroad construction was completed in February, 1872, between Tokyo and Yokohama, about 18 miles, and began its operation in September in the same year, under the Government control. This was a sudden break of the people's dream of ages, and their admiration of foreign civilization became greater and greater, although day laborers feared to lose their work, as other countries had done, with the invention of labor-saving machines. Gaslight now put away the dark, dim light of crude kerosene and seed oil, and the terrible fires caused by the upsetting of lamps decreased. The European calendar began to be used

from this time. A stamp tax on the license permitting the transfer of property, etc., began to be used, bringing a good revenue and yet reducing the expense of the Government by leaving out revenue officers. The world's fair took place at Vienna in 1873, and the Government sent delegates. After the exposition European goods became more and more welcomed, and imitations of those European articles were manufactured in all parts of the country. This gave great advancement to the industry of the country. In 1874 the Government entered into the Universal Postal and Telegraph Convention. In 1877 the internal exposition took place and gave encouragement and improvement for both export and import articles. In 1881 the Specie Bank, with a capital of 6,000,000 yen, was chartered for the purpose of foreign exchange, to afford facilities to foreign trade in the direct exportation of several exporting firms. It was the prevalent desire to improve, develop, and protect the home manufactures and products and to check importation. By this time communication with western countries was very intimate and trade became very prosperous. In 1882 the Bank of Japan was established with a paid-up capital of 10,000,000 yen (one-half of its capital), having the privilege of a legal limit to issue 75,000,000 yen on Government bonds, treasury notes, and other reliable bonds for security. When the bank deems it necessary to increase the amount it may issue notes binding itself to pay a tax of not less than 5 per cent on the issue, according to the condition of the money market, with the consent of the secretary of treasury, thus giving a monetary elasticity as in Germany. This legal limit was amended and increased to 85,000,000 yen, and in 1897 increased again to 120,000,000 yen, with the increase of paid-up capital to 30,000,000 yen in 1897. The Bank of Japan, as the central bank of the country, is the organ of financial administration; it displaces the inflated currency that was in use. It gives a smooth circulation, increases capital available for trade and industry, discounts bills, and transfers Government bonds, as the Bank of England does. Its issue department is separated from its business department. Since 1889 treasury notes have been handed over to the bank, and the national banking system was so amended that only the Bank of Japan could issue notes.

Prior to 1872 there was no incorporated navigation company in the country, though in January, 1870, an express company ran its business by steamships, but failed in a year. Hence, in September, 1875, the Mitsubishi Navigation Company was founded, receiving a subsidy of 250,000 yen a year from the Government for mail service and general transportation. Later on it became the most powerful company on the water, having contracted to help in case of an emergency of the country, and it greatly assisted in the transporting of troops and their supplies in 1874, 1877, etc., when the rebellions took place. About 1882 many worshipers of Western ideas advocated the parliamentary system of government for the better development of the country, and in 1883 the first political party was organized. In 1884 a telegraph line was laid on the bottom of the sea between Korea and Japan. In 1885 a patent law was enacted, and gave privileges and advantages to inventors. In 1885 the Mitsubishi Navigation Company was consolidated with a rival company, which was established in 1884 with the same privilege and subsidy from the Government, and named The Japan Mail Steamship Company, with 12,200,000 yen of capital. Seventy-six vessels, of 39,870 tons, belonged to this company, and its navigation (over a course of 2,949 miles) extended from Yokohama to Shanghai, Jinsen, and Vladivostok. Since then great improvement has been made, and 607 steamships, of 95,588 tons, and 835 sailing ships, of 50,000 tons, were afloat in the country in 1892. In later years the Government contracted to give 880,000 yen subsidy yearly to this organized company.

In 1889 Dr. Roesler, a German jurist, who was one of the counselors of the department of justice, compiled a commercial code under the supervision of the minister to the department, but this code did not take effect owing to the deficiency of its provisions. In February, 1890, the constitution of Japan was issued to be the motive power of all the laws of the country, and in November Parliament was opened. A great step has been taken in adopting Western civilization. In the annual session of the Imperial Diet, in 1893, a proposal to organize a committee for the revision of the commercial code was made to the Government. According to this proposal a committee was organized, consisting of members of the Imperial Diet, professors of the law department of the Imperial University, higher civil officials, eminent judges, and learned barristers. The committee worked vigorously under the direct control of the minister president at the time. To revise the former code which had been compiled by Dr. Roesler was the original intention of the committee, but in the course of the work so many changes had to be made that the result was what is substantially a new code, in which the German system is followed even more closely than in the former ones. In the extra session of the Imperial Diet in 1898, this new commercial code passed the Diet by a large majority, and took effect at the end of the year. This commercial code is divided into five books, according to systematic, scientific, and logical principles. The first treats of commerce in general; that is, of the application of the code, trade, commercial registration, trade names, trade books, and trade assistants and agents. The second is entirely devoted to commercial companies, prescribing general provisions, ordinary partnerships, limited partnerships, joint stock companies, joint stock limited partnerships, and foreign commercial companies and penal provisions. The third treats of commercial transactions; that is, of general provisions as to sale, current account, anonymous association, brokerage, commission agency, forwarding agency, carriage, deposit, and insurance. The fourth covers bills; that is, general provisions as to bills of exchange, promissory notes, and checks. The fifth treats of commerce by sea; that is, of ships and shipowners, mariners, carriage, sea damage, insurance, and ship's creditors.

The rapid improvement and development of the transportation facilities on land and water aided the rapid increase in population and production and enabled the Government to raise the enormous revenue which it spent in the development of the country, and also on its defensive and offensive power, increasing and improving the army and the navy to face the European powers. This preparation was unexpectedly shown, to the great surprise of the world, by the victory over China in 1894–95. Enormous sums were paid in that war for the transportation of troops and their supplies, and this was a great aid to the navigation and railroad companies. But these sums were paid back to the Government by the enormous indemnity exacted of China. By the vast importation of this indemnity from London a great distribution of money was made in the interior of the country, which naturally resulted in extravagance among the people and caused the importation of luxuries from western countries. However, this great achievement over China gave a new era to the country. A new treaty, on equal footing with the first powers of the world, was signed with the United States and all European countries, to take effect after July 17, 1899. By this new treaty foreigners living in Japan are made subject to the laws of the country. It amended the customs tariff, by which Japan before this could not levy a duty greater than 5 per cent ad valorem. Its policy was toward regular free trade.

With the advantage of the Chinese indemnity in gold, Japan became a gold-standard country in 1897, by which stability of currency was gained, as well as international banking facilities. The effect of this change was great. It has been most beneficial to the steady and natural development of both imports and exports by causing a feeling of security on the part of shippers owing to the stability of exchange, except in silver-standard countries. As Hon. O. P. Austin has written, "Now that the capitalists of the gold-standard countries have become assured that they will no longer be in constant danger of suffering unexpected losses from investment made in the country on account of fluctuations in the price of silver, they seem to show a growing tendency to make such investments at low rates of interest. This tendency, if encouraged, will doubtless bring about a closer connection between Japan and the central money markets of the world."

Another effect of the war was an educational development. During the war the newspaper reports and telegrams were of very great interest to the whole people of the country. Every man, woman, and child talked about the war, and newspaper sales were more than ten times larger than in former years. Even farmers, peasants, hunters, and fishermen, who never before had any interest in the world's affairs, being satisfied with their small incomes, enough to support their families in a most humble way, began to learn to read. This was shown in the statistics of recruits, which show that only 25 per cent of the recruits before the war above 21 years of age could read and write their names, while the percentage went up to 60 or 70 per cent a few years later, and still is increasing year by year, aided by compulsory education adopted in the country.

During this period, especially right after the war, manufacturing industry made rapid progress. Several factories and industrial firms were founded one after another. Foreign trade wonderfully increased, both in business done by foreigners and by our people with their increased facilities for transportation, especially in navigation. During the first ten years after the restoration, the principal items of export of the country consisted of natural products and raw materials, while manufactured goods were imported from the western countries; but now the fact is quite the reverse.

The food of the natives was comparatively simple, being rice, wheat, fish, and vegetables; now beef, mutton, pork, and chicken are the principle courses of the meals, although hunters enjoyed meats of deer, bear, rabbit, and partridge from time immemorial. This eating of simple food was only because of the abundant production of rice and wheat and the economical doctrines of the Buddhist

priests. Wearing apparel, such as silk and cotton clothes, has greatly improved since the restoration, both in arts of manufacture and quantity of production in all parts of the country. Now it meets the demand of home consumers, and also is becoming one of the staple commodities of export; while engraving and sword-smithing, which at one time were highly developed, when Buddhism and war were popular, have fallen away.

ARTICLE V. CONCLUSION.

Commerce in Japan was not thought of for a long time, and facilities of transportation were only for armies to invade the territories of neighboring lords. After communication with China and Korea had been established many things were brought in, especially Chinese literature; but there was no active exchange, because when our people were strong they thought that China and Korea belonged to them, and so made them give yearly compulsory presents, and those countries, in turn, when they were strong wanted our country under their command, and often they made invasions, but in vain. When our country was prosperous, those countries were in the trouble of rebellions. Then only luxurious goods were exchanged. Even up to the sixteenth century people were satisfied with self-produced food supplies. They spun for themselves, made their own clothing, and all fuel was gathered in near forests; consequently there was little exchange. In fact, the country was only semicivilized islands. After communication with America and European countries had been established rapid progress was made. Transportation facilities and increased income from their products and increase of manufacturing industries gave our people the idea of exchange. But an antiforeign spirit arose with the treacherous motives of the Spanish and Portuguese merchants mixed with their Christianity, and the Government persecuted the believers and drove those merchants and priests out of the country. This was exactly like the present condition of China, but the European countries were not very strong, for lack of transportation, and could not disturb our affairs. But this shows that our people were very strong in fighting ability and, at least, not barbarians. The physical geography of the country is advantageous to transportation by water. Its fertile land along the seacoast and the water supply for irrigating their lands furnished by the vast number of rivers gives a large food production and a rapid growth of population. Prosperity, followed by wealth and peace, sometimes flourished, then declined, disappeared, and again arose, and each new era brought better results.

After China lost its last opportunity for invading Japan, our sea merchants discovered that it would be far more profitable to become pirates than to make money in general bargaining. This made a great improvement in the art of shipbuilding, and the navigation power over Asiatic seas fell into the hands of our country.

Looking at the history of the fifteenth century of Europe, one sees that great changes were made in navigation and trade. The discovery of America and navigation from Europe to the Orient by the Cape of Good Hope brought great profit to the Europeans. If the Japanese pirates had had a far-sighted view of the world's commerce in place of practicing piracy, and had continued their maritime power, they would now, in my opinion, hold the place which England has in the commerce, and all commercial power would have fallen into the hands of our country. Moreover, the prohibition of Christianity in itself was not bad administration, but it was foolish for the majority to close the doors against foreigners, which act prohibited the people for over two hundred years from crossing the ocean or building large ships, and destroyed all the art of shipbuilding. This, of course, had the indirect result of checking the development of home industry, as well as foreign trade. It is sad to think that the great power on water which the country early developed went into the hands of foreigners. Notwithstanding this the country might be a large maritime power in the Orient, parallel with England's, because the location is advantageous, and hundreds of vessels were floating in the Japan seas, going sometimes as far as the Philippine Islands, and sometimes even to Mexico, in the early history, but for this policy of the "closed door."

Immediately after the country opened its doors to Europeans, new knowledge of civilization poured in. The old civilization has advanced, and with intellectual effort and influence has reconstructed civil society and promoted material wealth, and has raised the people from ignorance. Railway, navigation, and banking systems were most beneficial to the development of our commerce and were the warp of the fabric of our civilization. Every decade finds it more full and comprehensive. The railroads and navigation gave facilities of transportation by land and sea, and naturally caused the increase of products and population, and brought great benefit to the people. Country places came into cultivation, mines were opened, and advancement in commerce was very great. All heavy and bulky articles which are very troublesome to transport, such as lumber, mining products, etc., were handled more readily, and they became the staple products of the country. The banking system developed the idea of saving, and those accumulations of deposits from which the people got a safe income created a financial reserve. The banking system directs and sustains the commercial enterprises and industrial activities, and serves as the medium by which the business of the country is carried on, just as the Bank of England furnished the necessary funds in her war with France and as the Bank of North America loaned money to the Government in its financial troubles in the Revolutionary war.

The war and triumph over China gave a most interesting experience to our people. The Japanese once believed in the tradition of betterment by defensive and offensive alliances, but this war destroyed this fancy in our people, for at the first of this war England opposed Japan and then changed her mind entirely at the end, when Japan had accomplished this great achievement. Russia, Germany, and France paid great respect to our country at first, but reversed their action after we had gained our victory. The only permanent and beneficial policy for our people is to improve our industry and develop our trade, and make our own country wealthy and powerful. The United States and England are the strongest countries because of their much improved industry and trade and their wealth. So the Government encourages commerce and trade by sending officials to study Western civilization, giving subsidies to the necessary business firms, giving the right of eminent domain to railroad companies, establishing chambers of commerce, mercantile museums,* commercial clubs, banks, exchanges, markets, commercial corporations, and commercial schools. And our people have followed in the same track in recent years, and the progress of our country is so rapid as to be without parallel.

Chapter II.

PRESENT CONDITION.

One of the most striking features of modern times is the growth of international relations of ever increasing complexity and influence. Means of communication and transportation have so rapidly improved as to add greatly to industrial prospects, whether of agriculture, mining, or manufacturing. Facilities of communication have produced competition of the different countries in Japan. The United Kingdom held a monopoly on machinery, locomotives, and railroad materials for a long time, but now the United States is coming rapidly to compete with or rather surpass the former, and European and American articles are found in Japan, giving great advantage to our consumers.

Before the war with China, in 1894–95, Japan's economic condition was fair, both in commerce and finance, and even during the war things went very smoothly, the enormous sum of 150,000,000 yen being borrowed in the country without much trouble. The victory over China gave the people great encouragement as to the future prosperity of the country. And as part of the war expense

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*Mercantile museums, exhibiting (1) home products, staple commodities of export, articles capable of future exportation, and articles to compete with imported commodities; (2) foreign products of articles serving as models for home manufactures, articles competing with home products in foreign markets, articles apprehended as future competition with home export commodities, articles commanding large sales in foreign markets, imported through some other countries and capable of being manufactured in the country, staple commodities of imports, articles promising future importation, and new materials of industry.

went back and was distributed to the soldiers, laborers, merchants, and pensioners, business excitement ran high. New factories, banks, and corporations arose, one after another, and new navigation lines were opened, extending to London, Seattle, South America, and Australasia. These figures show the increase of capital of several corporations in yens:

YEARS.	CAPITAL INVESTED IN—						Percentage of increase in capital.
	Agriculture: Raising of silk worms, pasturing, fishery, etc.	Commerce: Dry goods, raw cotton, exchange, warehouses, foreign trade, insurance, etc.	Manufacturing, including coal and petroleum.	Railroads.	Banks.	Total.	
—	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*	
1887	2,924,102	37,474,305	20,010,513	12,129,500	90,734,911	163,273,331	160
1890[a]	8,229,582	61,881,332	77,529,926	47,390,000	190,215,837	385,246,977	181
1895[b]	1,884,475	57,168,500	74,585,457	91,028,000	165,061,079	392,721,411	212
1899	3,941,288	141,995,680	175,689,956	[c] 238,095,000	[c] 361,399,124	.....	[d] 500

[a] Expectation of the opening of the Parliament next year. [b] During the war. [c] 1898. [d] About.

PAID-UP CAPITAL.

YEARS.	Agriculture.	Industrial.	Commercial.	Transportation.
	Yen.	*Yen.*	*Yen.*	*Yen.*
1894	1,188,203	44,589,762	20,014,874	82,560,279
1895	1,526,409	58,728,656	23,835,358	89,969,825
1898	2,336,720	122,066,653	360,039,664	197,233,421

An increase of fivefold in a decade.

Thus the country suddenly became a strong power, and made a jump from agriculture to the industrial arts. Altogether it has been most successful. The new treaty resulting in the increase of customs reflected accurately the expansion of trade. The people's purchasing power increased, general price of commodities and wages went up;[a] in fact, the standard of living of the people was rapidly raised. Average increase in price of commodities and wages in two largest cities are as follows, taking the year 1892 as 100:

COMMODITIES.	OSAKA AND TOKYO.			TOKYO.
	1892	1895	1897	1899
Rice	100	120	159	192
Barley	100	117	155	187
Wheat	100	99	141	155
Pease	100	118	154	164
Salt	100	72	178	198
Japanese sauce	100	102	152	104
Sake	100	182	199	234
Tea	100	73	84	122
Leaf tobacco	100	170	205	271
Cut tobacco	100	158	142	181
Bonitos	100	163	215	295
Sugar:				
Japanese white	100	107	152	212
Japanese brown	100	133	191	125
Foreign white	100	127	120	126
Foreign brown	100	103	123	136
Cotton:				
Japanese raw	100	112	125	111
Japanese spun	100	120	121	101
Foreign raw	100	120	126	114
Foreign spun	100	151	152	118
Bleached	100	130	178	100
Textile	100	138	137	114

COMMODITIES.	OSAKA AND TOKYO.			TOKYO.
	1892	1895	1897	1899
Silk:				
Raw silk	100	97	112	.....
Textile	100	140	151	156
Taffeta	100	122	159	178
Flax	100	185	188	111
Indigo	100	87	97	96
Iron:				
Japanese	100	237	215	130
Foreign	100	98	115	122
Oil	100	145	161	168
Petroleum	100	135	128	124
Wood fuel	100	112	140	122
Charcoal	100	208	305	218
Manure:				
Dried sardines	100	102	138	200
Refuse of herrings	100	121	148	165
Coal	100	140	170	215
Average	100	[b] 143–[c] 128	[b] 169–[c] 155	.....

WAGES.	OSAKA AND TOKYO.		
	1892	1895	1897
Carpenters	100	164	145
Stonecutters	100	164	191
Sawyers	100	125	161
Tilers	100	139	144
Bricklayers	100	153	153
Cabinetmakers	100	127	158
Tailors:			
Japanese dress	100	167	150
Foreign dress	100	136	114
Dyers	100	130	140
Blacksmiths	100	159	164
Varnishers	100	170	139
Tobacco workers	100	148	164
Compositors	100	167	128

WAGES.	OSAKA AND TOKYO.		
	1892	1895	1897
Printers	100	178	173
Shipwrights	100	115	192
Agricultural laborers:			
Male	100	163	185
Female	100	118	153
Silkworm raisers:			
Male	100	119	167
Female	100	122	183
Silk spinners	100	83	143
Weavers, female	100	88	135
Tea workers	100	240	220
Average	100	[b] 165–[c] 117	[b] 192–[c] 118

[a] See pp. 606–615 and 523–532, the Nineteenth Annual Census of Japan, and pp. 29 and 47, Resume Statistique de l'Empire du Japon, 1900.
[b] Osaka.
[c] Tokyo.

The wages generally paid do not compare favorably with those in the United States and Europe, and the standard of living is also not so high as in those countries, the labor market being for the most part supplied by those who are satisfied to live under conditions which Americans would not accept. The wages are very low—there is not much margin left for the ordinary laborer—yet there is something left for wine, clothing, and other comforts.

Great amounts of rails, machinery, useful materials, sugar, liquors, tobacco, watches, and woolen goods were imported into the country to the excess of 113,334,222 yen over export in 1899; 53,831,714 yen in 1897, against the excess of export over import of 6,831,714 yen in 1895. At the same time the total foreign trade was increased enormously; 265,372,756 yen in 1895 was increased to 2[illegible],517,235 yen in 1896, and in 1899 was rapidly increased to 440,558,820 yen, against only 96,711,[illegible] yen in 1887, or an increase of 292 per cent in export and 294 per cent in import in 1895, and 418 per cent in export and 628 per cent in import in 1899, compared with 1887. But the indemnity of 300,000,000 yen from China, which the people thought was to be spent in increasing the productive facilities of the country, the Government used for the improvement of the army and the navy (the estimate for this purpose was increased to 60,000,000 yen in 1897, against 16,000,000 yen before the war), the telegraphs, harbors, a subsidy for navigation, and the expenses of the new territory of 65,000,000 yen annually. The extravagance which almost inevitably follows a successful war has led to a lavish expenditure of the public money, partly due to the increase in price of commodities and labor. In consequence of the increase of national expenditure, the budget always finds an excess of expenditure over receipts, which necessitates an appropriate increase in revenue, and the question of raising the land tax was discussed in the Imperial Diet. The budget of the country, only 80,000,000 yen before the war, was raised to more than four times that sum. The Government expenditure and revenue for the last fiscal year (1899–1900) were substantially as follows:

	Yen.
Expenditure	253,662,841
Ordinary	137,314,631
Extraordinary	116,348,210
Interest on debt	34,278,956
War department	35,422,674
	16,876,231
Navy department	14,572,638
	47,066,796
Communication department	14,931,751
	21,688,812
Revenue	253,682,356
Ordinary	176,749,819
Extraordinary	76,932,537
All taxes	125,504,331
Stamp taxes	11,935,531
Quasi private	34,709,059
Bonds	35,172,362
Indemnity	32,638,630

This increase of public expenditure caused a stringency of money, hindering new enterprises and stopping the free flow of capital into promising ventures. Business began to suffer from a shortage of funds. The reaction from a too-rapid growth of the country came as early as 1897, when prices of stocks began to decline. In 1898 the dispute about the return of the indemnity to the people who contributed to the war in the form of loans arose, and the Government redeemed 35,000,000 yen of the loan. Still the Government was necessitated to sell war bonds of 43,000,000 yen in London. The income tax, the tax on sake, the customs dues, tonnage tax on ships at ports, charges for postal and telegraph service, on railroads, freight and passenger traffic, and on tobacco were increased. The burden on the people was, per capita:

YEARS.	Country.	Local.	City.	Borough.	Total.
	Yen.	*Yen.*	*Yen.*	*Yen.*	*Yen.*
1890	1.47	0.36	0.36	0.40	2.58
1896	1.68	.43	.52	.48	3.11

Germany took in direct taxes in 1896 7.50 yen per capita, more than double ours.

The Government tried to rescue the people from the business trouble, which reached a climax in 1898, and in 1899 borrowed 100,000,000 yen in the London money market and loaned it to the business men. The public debt had also increased suddenly since the war. In 1893 it was 283,519,624 yen. It had increased to 419,380,217 yen at the end of 1896, and still increased at the end of 1899 to 505,166,702 yen, most of it bearing interest at 5 per cent. Then the present Chinese trouble blocked the export of cotton goods, porcelain, etc., and added more disaster to business. Of course, it could not be called a panic—it was merely tightness of money—for work was plenty, factories were going at full blast, and wages were as high as they had ever been, if not higher. As was well said by Count Matsugata, ex-premier and secretary of the treasury, "The present condition of the country's economics is just like a young boy who has eaten too much and is troubled with indigestion, but nevertheless growing day by day, finds himself weak after his sickness. He will be all right when he takes a dose of industrial and trade development." Such enormous expenditures of the country show the improved economic condition, and the people's power to meet those expenditures, as they become wealthier and the desire for a higher standard of living develops.

However, the great achievement over China advanced the transportation facilities and other important matters necessary to the improvement of the commerce as a whole. Mechanical appliances supplanted slow processes of production, and the railroad, navigation, and mail services were great helps to the development. Now Baldwin locomotives are on our tracks, trolley cars, telephones, electric power, machinery; in fact, all the best and latest appliances are coming more and more into use. The banking system is one which can easily be adapted to the demands of business. Statistics show the following figures of banks and loan offices:

YEARS.	Number.	Capital.	Reserved funds.	Net profit.	Dividends.	PERCENTAGE TO CAPITAL.	
						Net profit.	Dividends.
		Yen.	*Yen.*	*Yen.*	*Yen.*	*Per cent.*	*Per cent.*
1891	862	101,409,881	30,231,153	38,777,336	20,[illegible]	[illegible]	[illegible]
1896	1,019	127,[illegible],715	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1898	1,875	257,447,002	40,705,138	17,433,796	10,[illegible]	[illegible]	10.37

PAPER MONEY IN CIRCULATION.

FISCAL YEARS.	Treasury notes.	National-bank notes.	Convertible to gold and silver.	Total.
	Yen.	*Yen.*	*Yen.*	*Yen.*
1895	13,020,517	21,300,375	124,524,590	158,845,482
1896	10,679,236	20,293,887	149,035,640	180,008,763
1899	5,112,265	1,632,818	179,769,782	186,514,865

METALLIC MONEY ISSUED FOR CIRCULATION.

YEARS.	Gold.	Silver.	Nickel.	Copper.	Total.
	Yen.	*Yen.*	*Yen.*	*Yen.*	*Yen.*
1870-1894	66,146,237	138,786,085	5,487,349	12,418,051	222,837,722
1894-95	1,583,088	28,539,445	350,000	.....	30,472,533
1895-96	1,422,750	20,007,377	51,500	.....	21,482,627
1896-97	952,433	12,927,034	650,000	.....	14,529,467
1897-98	76,824,311	10,298,085	600,000	.....	87,722,396
1898-99	21,385,797	17,000,000	750,000	100,000	39,235,797

TOTAL CIRCULATION AND ITS PER CAPITA.

YEARS.	Circulation.	Per capita.	Population.
	Yen.	*Yen.*	
1871	72,712,817	2.196	33,110,825
1875	153,831,028	4.48	34,338,404
1880	203,994,169	5.61	36,358,994
1885	181,131,029	4.748	38,151,217
1890	205,483,263	5.08	40,453,461
1896	293,168,224	6.893	42,682,560

The amount of checks and bills cleared at the clearing houses, one in Osaka and one in Tokyo, has remarkably increased to 1,000,000,000 yen in 1897, notwithstanding the business stagnation everywhere; so that one may conclude that business transactions on credit have come to prevail more widely and freely than before. The raising of the general intellectual standard of the country by improving the village schools in necessary features is an encouraging point of view in the present educational outlook. Municipal government is now in full operation. The mayors are elected by the common votes. The care of parks, drainage, education, and the fire system are all under municipal direction. The police is under direct control of the department of the interior. City improvements are made, water pipes run as far as 14 miles from river into large cities, streets are widened and trees are planted. The commerce of the country is keenly watched by all the nations of the world, and the United States is publishing yearly "The Commerce of Japan," containing its area, population, production, railways, telegraph lines, transportation routes, its foreign trade, and the trade of the United States with Japan, and is studying these constantly by means of consul-general's reports. Laboriously worked out statistics,[a] the "Résumé Statistique de l'Empire du Japon," and "The General View of Commerce and Industry in the Empire of Japan" are published yearly in Japan, and supply abundant data for a full and careful estimate, not simply of the facts of extended trade, but also of its amount compared with previous years, and fully illustrate the present condition, and so give approximately a correct idea of the quantity and relative proportion of the national growth of wealth. Consequently, it is not necessary to repeat them here, but for the convenience of understanding its chief items let us look at the subject, dividing it into transportation, industry, and trade of the country:

ARTICLE I. TRANSPORTATION.

Professor Mayo-Smith states: "In early times the coasting ship was the cheapest means of transportation, and the most effective one. Railroads have reached an enormous development for inland transportation, but the extension of the world's trade has kept shipping of equal importance with railroads. In fact, the two now supplement each other; railroads bring the commodities to the sea-shore, and ships carry them to other countries. Even in direct competition with railroads, shipping still plays an important part on account of its superior cheapness. Transportation facilities enable individuals to command commodities of distant lands; it makes labor most productive by carrying it to the place where it can best be employed; it encourages capital to invest itself in new undertakings; for the products can find an outlet. The history of civilization shows constant advance in the efficiency of the means and methods of transportation. Postal service was also improved by the improvement of transportation facilities. Telephone and telegraph service are equally important in the development of the country. Highways, bridges, and canals are also a great help to the development of a country, and are of special local importance." Unfortunately our statistics have not yet reached a sufficient proficiency, so we observe only those subjects of greatest importance. As transportation facilities are an important feature of the country the establishment of these increased as follows:

	1898		1895	
	Number of companies.	Paid-up capital.	Number of companies.	Paid-up capital.
		Yen.		*Yen.*
Navigation	196	38,985,588	97	13,695,009
Railroad	64	155,881,965	30	73,252,797
Others	276	2,952,868	110	3,013,029
Total	536	197,233,421	237	89,960,835

[a] I am very sorry to say that the latest statistics did not reach my hand before the time required for this thesis.

I. NAVIGATION.

Our natural facilities for navigation are unsurpassed. Among the many directions in which the country has been pushing its economic expansion in recent years, none is more remarkable than the development of the maritime interests, which include shipbuilding, carrying power, and harbor improvements, together with its protection from foreign attack. Sea interests and sea powers are the natural corollaries of trade interests and industrial power, and they to-day take a leading place in the country.

(A) VESSELS.

All countries have discovered that if they are to find a market for their growing surplus, they must have their own ships. Within the past years our Government has been increasing directly its subsidies, to encourage the enlargement of the shipyards and the construction and operation of steamships. Independently, however, of this artificial stimulus shipbuilding is yearly progressing, encouraged by the daily increase and improvement in methods of production and by the gradually increasing facilities of carriage, the natural results of the industrial and trade prosperity. About the middle of the last century Europe and America began to give attention to gaining the controlling power over the Pacific Ocean, and with the increase of traffic, an increase of vessels, both foreign and domestic, entered and cleared the Japanese ports. According to the statistics showing the increased number of the vessels entering and clearing our ports Japan improved very rapidly in later years.

VESSELS WHICH CLEARED THE PORTS OF JAPAN.

YEARS.	DOMESTIC.				FOREIGN.			
	Steamers.		Sailing.		Steamers.		Sailing.	
	Vessels.	Tonnage.	Vessels.	Tonnage.	Vessels.	Tonnage.	Vessels.	Tonnage.
1893	743	854,544	1,254	38,262	1,409	2,407,896	129	172,764
1894	418	455,347	845	22,827	1,540	2,483,911	165	129,672
1895[a]	144	169,748	953	22,187	1,462	1,855,362	164	[illegible]
1896	386	327,818	664	24,264	1,656	1,552,356	145	87,165

VESSELS ENTERED THE PORTS OF JAPAN.

YEARS.	DOMESTIC.				FOREIGN.			
	Steamers.		Sailing.		Steamers.		Sailing.	
	Vessels.	Tonnage.	Vessels.	Tonnage.	Vessels.	Tonnage.	Vessels.	Tonnage.
1893	791	845,458	1,213	36,379	1,534	2,329,658	126	170,668
1894	415	93,505	834	22,634	1,857	3,021,090	164	[illegible]
1895[a]	126	277,385	837	20,921	1,787	2,658,534	168	97,148
1896	386	318,163	616	23,757	1,274	1,826,357	154	[illegible]

[a] 1895 shows the effect of Chino-Japanese war, while sailing vessels of the country and foreign steam and sailing vessels are not affected by it, yet there is the steady substitution of steamers for sailing vessels. The sailing vessels of the country are increasing as well as the steamers, while foreign sailing vessels are decreasing more rapidly than foreign steamers.

Shipping, since 1891, shows an enormous development in its total capacity; showing relative growth as follows:

STEAMERS.

YEARS.	UNDER 100 TONS.		100 TO 500 TONS.		OVER 500 TONS.		TOTAL.	
	Vessels.	Tons.	Vessels.	Tons.	Vessels.	Tons.	Vessels.	Tons.
1890	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1,221	510,[illegible]
1891	633	19,[illegible]	302	66,118	126	391,446	1,160	477,[illegible]
1892	598	20,337	166	49,209	135	173,996	899	[illegible]
1893	563	18,987	154	37,217	120	137,017	827	[illegible]
1894	469	15,392	131	24,649	60	62,194	660	[illegible]
1895	441	14,644	113	27,429	52	53,305	607	[illegible]
1896	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	459	[illegible]

SAILING VESSELS.

1890	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1891	1,254	67,064	673	98,168	7	5,672	1,934	[illegible]
1892	579	24,263	68	19,318	2	1,924	644	[illegible]
1893	631	22,376	67	16,112	4	2,583	702	[illegible]
1894	656	24,649	69	17,323	4	3,095	729	[illegible]
1895	751	28,513	82	24,200	2	1,234	[illegible]	[illegible]
1896	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	688	[illegible]

While the number of ships is increasing, the size is also increasing, especially of steamers. In 1891 the average size of steamers was 157 tons; in 1895 became 258, and in 1898 increased to 422 tons. During the same period sailing vessels increased only from 60 to 89 tons. Thus the country is utilizing immensely the facilities of navigation.

The standing of Japan's merchant marine in comparison to that of the world was given by Professor Mayo-Smith:

World's Vessels Over 50 Tons of Capacity in 1893.

COUNTRIES.	STEAMERS.		SAILING.		TOTAL.	
	Number.	1,000 tons.	Number.	1,000 tons.	Number.	1,000 tons.
2. United States	2,372	825.7	4,853	1,573.7	7,225	2,399.4
1. Great Britain and Ireland	5,931	6,183.3	7,749	2,891.1	13,680	9,074.4
3. Norway	542	246.1	3,559	1,420.5	4,101	1,666.6
4. Germany	867	783.3	1,427	686.9	2,294	1,479.2
5. France	599	621.5	1,634	288.4	2,233	909.9
7. Italy	224	223.6	1,738	529.7	1,962	753.3
8. Sweden	429	145.6	1,506	325.0	1,935	470.6
9. Spain	367	302.4	733	138.5	1,100	440.9
11. Russia	201	108.3	1,649	213.2	1,850	321.5
12. Holland	150	177.6	447	121.4	597	299.0
13. Denmark	240	122.6	885	158.1	1,125	280.7
14. Greece	118	80.1	852	192.9	970	273.0
15. Austria-Hungary	132	118.1	241	96.7	373	214.8
17. Turkey	63	39.5	650	125.2	713	164.7
20. Portugal	51	42.6	211	44.6	262	87.2
21. Belgium	47	69.4	6	1.0	53	70.4
All Europe	10,049	9,290.0	24,126	7,436.9	34,175	16,726.9
6. Canada	300	80.9	3,416	761.9	3,716	842.8
10. Australasia	533	181.5	751	169.5	1,284	351
16. Japan	307	108.3	1,077	96.4	1,384	204.7
18. Brazil	176	81.1	282	65.2	458	146.3
19. Chile	36	28.7	149	76.5	185	105.2
World	14,251	10,783.3	56,264	10,450.9	50,518	21,234.2

In this table Japan stands next to Austria-Hungary, in the sixteenth position, having only 22.2 per cent of the average tonnage of the total, which average is 92,300 tons, and only 8 per cent of the average tonnage of 2,488,100 tons of the six great nations, England, United States, Germany, France, Italy, and Russia, and only 2.2 per cent when compared with Great Britain and Ireland. But since 1893 Japan has made her most rapid improvement; in 1899 she had increased her tonnage to three times as much as in 1893, and her comparative standing to-day would be as high as Sweden, or perhaps as Italy.

(B) CREWS AND OFFICERS.

No accurate statistics have been taken since 1892 which will give an idea of this matter.

	Japanese.	Foreign.	Total.
Licensed for abroad	752	652	1,404
Licensed for coast	1,802	52	1,854
Licensed for small vessels	1,061	.....	1,061
Total	3,555	704	4,259

In 1891 there were 1,442 vessels in the country, which shows that only three men were employed to one vessel. This fact is due to the less demand for crews, smallness of compensation for their rough work, and less comfort in voyages, which naturally causes dislike for the work. The majority of these men were employed in the coast lines, and only one-third were employed for vessels abroad, and only one-sixth of all that go abroad are Japanese, foreigners being employed in the more important voyages. Of the officers licensed the division was as follows:

	Captains.	Mates.	Engineers.	Special pilots.
Japanese	93	150	175	4
Foreign	51	22	65	16

These figures plainly show the poorness of marine interest at that date.

(C) NAVIGATION LINES.

Recently the Japanese navigation lines to different countries have made remarkable progress, and at present the Japanese flag is floating over all waters. Hitherto all shipments to foreign countries were made in foreign vessels, which enjoyed this privilege for a long time.

(1) Vladivostock line.

(2) Korea lines, two companies.

(3) Tientsin, Manila, Niuchwang, Singapore, Sidney, and Bombay line.

(4) Shanghai, Hongkong, London line, to consist of 12 steamers of over 6,000 tons, with minimum speed of 14 knots an hour, running fortnightly, with a subsidy of 1,331,600 yen.

(5) Australasia line.

(6) South America, irregular.

(7) North America: (*a*) San Francisco line, 3 steamers, 6,000 tons each, 17 knots; (*b*) Seattle line, 3 steamers, 6,000 tons each, 13 knots.

The above lines are controlled by Japanese companies. Beside these there are—

(1) England: (*a*) Canadian Pacific Railway Company, every four weeks; (*b*) Peninsular and Oriental, running between London and Japan via Oriental ports; (*c*) Castle Company, running between London and Japan via Oriental ports; (*d*) Glen Company, running between London and Japan via Oriental ports; (*e*) Ocean Company, running between London and colonial China, with annex to Japan.

(2) The United States: (*a*) Occidental and Oriental, running between Hongkong and United States via Japan and Hawaii; (*b*) Pacific Mail, running between Hongkong and United States via Japan and Hawaii; (*c*) Northern Pacific, running between Tacoma and Japan, and to Shanghai if necessary; (*d*) Great Northern, running between Portland and Japan, irregular.

(3) France: Compagnie des Messageries Maritimes, running between Marseilles and Japan via Oriental ports, with aggregate tonnage of 192,600, annex to London.

(4) Germany: Norddeutcher Lloyd, running between Hongkong and Japan, annex to Germany, with 199,000 tons aggregate.

(5) Austria Lloyd Company, between Port Said and Japan via Oriental ports.

(6) Peninsular and Oriental Steam Navigation Company, Hongkong and Japan.

Thus, facilities on the ocean are increasing most favorably, and by their competition improving their accommodations, speed, and all other details.

(D) TRAFFIC POWER.

Before the war (1894) the carrying trade was almost entirely in foreign hands, but after the war, with the improvement of shipbuilding, the traffic power increased and came into Japan's vessels, and the traffic that passed through Japanese ports in 1898 was the largest in her history. Its relative power was as follows:

	1894	1895	1896	1897	1898
IMPORTS.	*Yen.*	*Yen.*			*Yen.*
Steam	10,353,694	2,971,196	.....	.....	63,819,992
Sailing	422,064	884,694	.....	.....	2,448,747
Total	10,775,758	3,855,890	.....	.....	66,268,739
Total traffic carried	109,278,986	124,518,573	.....	.....	269,985,739
Percentage of Japan's power to foreign	9.75	3.1	12.2	21.2	20.8
EXPORTS.					
Steam	5,746,869	3,453,299	.....	.....	39,574,417
Sailing	307,870	477,121	.....	.....	788,868
Total	6,054,739	3,930,420	.....	.....	40,363,285
Total traffic carried	111,284,986	133,513,036	.....	.....	162,741,902
Percentage of Japan's power to foreign	5.4	3.9	12.3	15.1	21.1
Percentage of Japan's power to foreign, both exports and imports	7.6	3.5	12.2	18.1	21

Thus the traffic power is on a steady increase.

(E) SHIPBUILDING.

The shipbuilding of the country has made considerable progress, 5 large steamers, of 15,650 tons gross capacity, and 177 steamers and sailing vessels, of 16,822 tons gross, were built during the year 1898. The Mitsubishi, the largest of the shipyards, made 2 steamers, of 6,000 tons each, although the materials were imported from abroad. There are at present 160 shipyards, both state and private establishments, but their constructing power is only about 40,000 to 50,000 tons yearly.

(F) DOCKS.

There are now about 20 docks in the country, all under private management, and all very prosperous.

(G) TONNAGE DUES.

For the charges of ports and light-houses the custom-houses collect 5 sen per registered ton upon a ship's entry into a port.

(H) COAST CONVEYANCE, LIGHT-HOUSES, AND BUOYS.

The coast line of the country is about 15,185 miles, excluding Formosa, and the survey of it is all completed. The light-houses and buoys were placed by the Government, the Government and private persons together, and by private persons. The figures show:

YEARS.	LIGHT-HOUSES.				DAY.		
	Number.	Light reaches under 10 miles.	Light reaches 10 to 20 miles.	Light reaches over 20 miles.	Buoys.	Indications.	Other.
1898	137	67	57	13	24	29	22
1896	131	67	54	10	22	21	22
1895	149	91	51	7	26	21	22
1893	138	87	44	7	21	30	25

One light-house in every 111 miles, most of their lights reaching only 10 to 20 miles, shows, roughly speaking, that coast steamers and sailing vessels were running every 90 miles without any directing light. It is not comparable with European countries as can be seen by the following table:

COUNTRIES.	Coast line.	Light-houses.	Per mile.
England	12,850	927	14
France	3,825	448	8.5
Germany	1,986	310	6.1
Italy	4,770	298	1.6

(I) INSTITUTIONS.

Many institutions were built for the encouragement and improvement of maritime interests. They are a feature of the country, and there are 927 students in these institutions.

Before closing the subject of navigation I would like to add a few lines concerning the business of navigation. Just recently the Japan Mail Steamship Company published its semiannual report for 1900, from which is summarized the following:

(*a*) *Coast lines.*—The economic condition of the country was not very active, but, as usual, in the latter half of the year the traffic movement was great. The business was fairly done, as the company ran five extra vessels for the transportation of crops. Suddenly the outbreak of the Chinese trouble compelled the company to hire thirteen vessels to the Government, and consequently the company was forced to hire five vessels from other companies, and a decrease of the traffic was unavoidable. But the company did the best it could for transportation, running extra vessels to the necessary places.

(*b*) *Oriental lines.*—All were affected by the Chinese trouble and stopped all direct lines to northern China or decreased the number of trips. But the passenger traffic was great, and rather more prosperous than in previous years.

(*c*) *European lines.*—For the outward trip the freight from the country does not yet exceed one-fifth of the capacity, but is on the increase. And to the Straits Settlements, which are the most important export places of this line, a great decrease has followed since the Transvaal trouble. But by reducing their prices, and giving some advantages, they have found some increase of traffic since last August. On return trips only iron and the remainders of old orders were brought home. On account of the reaction in Japan against the great excess of imports new orders were almost stopped. Only 8 per cent of the whole capacity of the ships, including the goods brought to the Straits Settlements and elsewhere, was occupied. After July the traffic was fair in coal and other supplies to China, and the passenger traffic was prosperous.

(*d*) *American line.*—On the outward trips the competition of different companies reduced the price lower and lower, but at the end of April a committee was selected for the arrangement of charges, and the recovery of prices was made. But the ships now building are not ready to use, and the ships which are in use are slow compared with other competing lines, therefore valuable goods which need prompt delivery all go to other companies. On the return trips large shipments of flour to Oriental countries made a heavy traffic. The passengers were almost all emigrants.

(*e*) *Australasia line.*—Both trips generally increase their traffic, and the improvement is going on. Passengers increased about 30 per cent in first and second classes and 16 per cent in third class compared with previous year. Competition was expected with Norddeutscher Lloyd Company.

(*f*) *Bombay line.*—The important feature of this line is in the raw cotton traffic. As the Chinese trouble has affected the cotton trade, the demand for raw cotton has almost disappeared, therefore the business was very poor, and naturally the trips decreased.

(*g*) *Revenue and expense of the company.*—The Chinese trouble and the great need of public service caused vessels which had been in the Oriental and Bombay lines to be utilized in places where they were needed.

	Yen.		Yen.
Revenue in transportation	7,762,471	Reserved fund by commercial code	147,986
Total revenue	11,370,591	Fund reserved for dividend	940,000
Total expenditure	7,372,382	Compensation to directors	94,711
Net revenue	3,998,009	Extra reward for employees	125,000
Surplus fund	11,025,601	Dividends, 10 per cent a year	1,100,000
Sinking fund for building	12,870	Extra dividends, 2 per cent a year	220,000

II. RAILWAYS.

The most important means of inland transportation is the railroad. The success attained of late years in industry and trade in Japan is due to the measures taken for the extension and regulation of the railway system, because it gave great facilities for transportation of surplus products, and also brought progressive ideas among peasants. The railroads of the country were started in 1872, with only 18 miles, between Yokohama and Tokyo, under Government control. Progress was rapid, and in March, 1900, there were 3,635 miles, of which 833 miles belonged to the Government and 2,802 miles were managed by fifty-eight private companies. Only five companies have more than 100 miles in operation. Railroad capitalization in March, 1899, was 234,567,634 yen; that is, 67,354.50 yen per mile. The longest mileage under one company was 857.07 miles, and the shortest 3.06 miles. There is a uniform, stable, and reasonable railway tariff, which is fixed in accordance with the general national interests in industry and trade. The passenger tariff is cheaper than in other countries. Railroads are built largely for the passenger traffic, running along the coast lines, where many densely inhabited cities are located, and many railroads have their destinations at the famous temples. The natural effect is that this business is eminently satisfactory. The growth of railroads is wonderful, as is shown by the following tables:

CONSTRUCTION OF EACH YEAR, 1873–1896.

[Report of Bureau of Railroad Communication Department.]

	1873–1877	1888	1889	1890	1891	1892	1893	1894	1895	1896
Government:										
Miles	224.40	200.59	105.30	.....	.....	.....	7	23.20	12.33	38.40
Capital (yen)	22,447,622	7,349,811	1,820,915	1,142,493	1,480,663	1,177,493	684,255	4,288,202	3,311,552	5,363,077
Private:										
Miles	293.24	113.14	118.64	262.60	283.18	17.28	47.51	169.36	142.42	120.14
Capital (yen)	6,702,924	5,130,641	8,532,175	12,021,880	7,359,667	2,558,697	4,408,195	8,640,118	10,130,063	15,619,811

YEARS.		Mileage.	Per cent of increase.	Proposed.	Stations.	Railroad miles per 100 square miles.
				Miles.		
1899	Government	828.77	18	4,412.01	913	2.86
	Private	2,652.13				
1897		2,944.33	16	3,691.32	746	1.98
1896		2,501.47	10	3,034.51	582	1.69
1895		2,273.17	7	2,794.34	525	1.54
1894		2,118.24	10	2,580.69	462	1.45
1893		1,925.46	3	2,236.69	394	1.34
1892		1,870	1,000	.....	.....	.....
1882		170	844	.....	.....	.....
1872		18	.....	.....	.....	.....

(A) RAILWAY EQUIPMENT.

The carrying capacity of railroads is partly indicated by the total number of locomotives and cars. This table shows the condition on March 31, 1899:

FISCAL YEARS.	Locomotives.	Passenger cars.	Freight cars.
1899	1,168	3,911	14,6[illegible]
1898	[a]957	[b]3,720	[c]1[illegible],[illegible]1
1897	8[illegible]	2,[illegible]17	10,[illegible]
1896	612	2,[illegible]	[illegible]
1895	522	1,948	7,[illegible]
1894	440	1,646	6,413
1893	351	1,[illegible]	5,378

[a]32 every 100 miles. [b]112 every 100 miles. [c]413 every 100 miles.

The total capacity is sufficient to accommodate 145,139 passengers and 94,350 tons of freight.

(B) RAILWAY TRAFFIC FOR THE GENERAL AND PUBLIC SERVICE.

FISCAL YEARS.	Number of passengers.	Tons of freight.	Total mileage.
1898	98,[illegible]2,117	10,018,542	22,977,499
1897	84,453,362	8,[illegible]	18,[illegible]
1896	65,107,[illegible]	6,[illegible],671	14,748,[illegible]
1895	48,271,[illegible]	5,223,840	12,[illegible],976
1894	98,584,269	4,170,153	11,241,117
1893	82,494,772	3,[illegible],594	9,904,[illegible]

Compared with other countries:

COUNTRIES.	Number of passengers.	Tons of freight.
England (1897)	1,031,706,709	374,382,266
United States (1900)	337,977,301	975,789,947
France (1896)	363,000,000	101,000,000
Germany (1891)	464,012,850	228,906,758
Austria	205,200,000	----------
Russia (1895)	49,342,000	100,000,365
Italy (1887)	45,342,000	90,115,000
Canada (1897)	16,171,[illegible]	25,[illegible],361
Argentina (1895)	14,551,257	9,614,041

Compared with the United States in 1897:

	Japan.	United States.
Passengers	84,453,362	489,445,198
Passengers carried 1 mile	1,443,317,956	12,256,939,647
Passengers carried 1 mile per mile of line	2,426	66,874
Tons carried	8,688,388	741,705,946
Tons carried 1 mile	396,798,680	95,139,022,225
Tons carried 1 mile per mile of line	249.5	519,079
Average number of passengers in train	[a]39.5	37
Average journey per passenger (miles)	10.09	25.04
Average number of tons in train	[b]6.8	204.62
Average haul per ton (miles)	45.67	123.27
Total train mileage	18,788,437	799,980,847
Average passengers per mile per day	1,596.5	(c)
Average tons per mile per day	395.9	(c)

[a]28 per cent. [b]46 per cent.
[c]Train mileage of passengers and freight is not taken separately.

The following shows the movement of cars in 1897:

Total mileage of the year	17,727,009
Average trip to terminals	9.8
Average number of cars per trip	13.6
Average weight of engine (tons)	38.6
Average use of engine (per cent)	92

(C) EMPLOYEES.

March 31, 1899, of eleven leading companies and the Government railroad the following were employed:

Station masters	639	Firemen	1,321
Assistant station masters	588	Assistant firemen	103
Extras	48	Yardmen	457
Conductors	1,253	Signalmen	87
Assistant conductors	93	Switchmen	259
Foremen of engines	28	Signal and switch men	1,278
Enginemen	1,165		
Assistant enginemen	73	Total	7,[illegible]

(D) COST OF SERVICE.

REVENUE.

YEARS.	Passengers.	Freight.	Other.	Total.	Per cent of passenger revenue to total revenue.	Per cent of freight.
	Yen.	*Yen.*	*Yen.*	*Yen.*		
1899	24,460,000	12,690,000	1,050,000	38,210,000	65	33
1898	20,523,757	10,299,038	2,162,405	32,985,200	62	36
1896	13,727,172	5,937,368	1,482,544	21,147,084	65	28
1895	11,796,653	5,820,512	1,169,630	18,786,795	63	31
1893	7,394,773	3,576,470	621,670	11,594,474	64	31

Passenger revenue includes revenue from postal service and charge of excess of weight on baggage, and freight includes cattle and carriages. Total income shows an increase of 6,500,000 yen compared with 1898, due to the raise of fares and better traffic.

EXPENSE.

YEARS.	Maintenance of ways.	Train.	Transportation.	Other.	Total.	Net revenue.
	Yen.	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*
1898	3,941,509	8,239,306	4,172,344	2,049,545	18,402,704	14,582,496
1896	2,582,311	3,669,625	2,122,987	1,006,192	9,381,115	11,765,969
1895	1,899,656	3,040,918	1,635,644	1,087,348	7,663,566	11,123,229
1893	1,384,943	1,593,750	1,002,170	996,480	4,977,343	6,617,131

The percentage of net revenue to the total revenue is: 1898, 44.21; 1896, 55.64; 1895, 55.27; 1893, 57.06.

	1898	United States.	
		1890	1896
Revenue per passenger per mile (cents)	1.1	2.16	2.06
Revenue per ton per mile (cents)	4.1	.94	.8
Revenue per train mile, all trains	175	144	138
Average cost of running a train 1 mile, all trains (cents)	81	96	93
Percentage of operating expenses to operating income	44.21	65.80	67.06
Revenue per mile, passenger (yen)	5,895.76	= 9,475.51 yen.	
Revenue per mile, freight (yen)	2,958.42		
Revenue per day per mile, passenger (yen)	16.23	= 24.70 yen.	
Revenue per day per mile, freight (yen)	8.47		
Expense per mile (yen)	5,286.48		
Net revenue per mile (yen)	4,189.03		
Net revenue per mile per day (yen)	11.48		

No statistics of traffic according to commodities have been taken. The comparison of the cost of service with that of other countries was made.

	Revenue.	Expense.
England, 1898 ..... pounds sterling	91,066,038	55,960,543
France, 1896 ..... 1,000 francs	2,595,300	1,373,200
Germany, 1896 ..... 1,000 marks	1,504,375	856,722
Austria, 1896 ..... 1,000 florins	263,955	153,896
Italy, 1891 ..... 1,000 lire	257,072	178,460
Russia, 1891 ..... 1,000 rubles	398,628	232,787
Japan, 1899 ..... yen	38,219,000	18,230,000

The percentage of net revenue of Japanese railroads is the largest in the world.

Government roads show a good income but heavy expenses. The cost of construction of railroads is largely increased, the average of 1897–98 being 54,472 yen per mile; that of 1898–99, 62,007, an increase of 7,535 yen per mile.

In comparison with other countries, Japan shows one of the cheapest costs of construction, the cost for 1897 being:

England	$226,119	Belgium	$108,921	France	$133,833
Germany	98,706	Austria	96,520	Italy	82,217
Holland	90,355	Canada	54,910	United States	61,409
Switzerland	95,011	Japan	27,236		

All roads of Japan are under public administration. As construction of competing lines is forbidden, unreasonable discrimination and cut-throat competition are avoided. This gives great favor to the railroad business. The tendency to railroad consolidation has been very apparent, but this is not due to competition but to the attempt to get better economy with better management, or, in short, better efficiency.

Besides steam railroads there are horse cars, trolley cars, and other vehicles for inland transportation.

YEARS.	Number of companies.	Capital.	Mileage.	Number of cars.	Horses.	Passengers.	Car mileage.	Revenue.	Expense.	Net income.
		Yen.						*Yen.*	*Yen.*	*Yen.*
1898	10	2,035,532	31.52	442	1,620	36,872,845	1,899,229	1,080,584	724,381	426,276
1895	9	1,245,260	33.77	321	901	18,448,835	992,296	475,197	262,486	212,711
1893	8	786,375	26.08	250	699	9,283,343	667,015	273,401	170,967	102,434

YEARS.	Carriages.	Wagons.	Jinrikisha.	Man wagon.	Ox wagon.	Others.	Total.
1898	4,653	77,897	204,419	1,259,865	40,268	25,982	1,613,084
1895	3,225	51,592	206,848	1,042,925	18,544	.....	1,323,135
1893	2,630	40,788	199,411	914,830	14,127	.....	1,171,786

III. MAIL, TELEGRAPH, AND TELEPHONE SERVICE.

All three are under Government ownership and control, adding their revenue to its budget. Although they are supplementary to transportation, they indicate the business condition of the country and the development of those relations which are indicated by correspondence, by the transmission of money orders, and by the use of the post-office as a receptacle of private deposits. In consequence of the increase of population, growth of cities, transportation facility, and advancement of industry and trade the mail, telegraph, and telephone systems are also improved.

NUMBER OF POST-OFFICES AND EMPLOYEES.

YEARS.	POST AND TELEGRAPH OFFICES COMBINED.			POST-OFFICES.				TELEGRAPH OFFICES.				Letter boxes.
	Number.	Carriers.	Employees.	Number.	Branches.	Carriers.	Employees.	Number.	Branches.	Carriers.	Employees.	
1898	1,144	10,611	14,175	2,668	596	6,292	7,532	27	132	100	179	39,295
1895	648	6,591	8,389	3,076	523	6,910	8,573	41	96	110	147	35,026
1893	590	6,116	7,393	3,128	563	6,908	8,225	46	80	118	154	33,300

These figures show the increase of combined offices and decrease of single offices. This means the Government is improving the business with comparatively less expenses.

DOMESTIC AND INTERNATIONAL MAIL MATTER.

YEARS.	Number of letters.	Number of cards.	Printed matter.	Books.	Samples.	Number of foreign letters.	Registered.	Parcels.	Total.	Per capita.
1898	157,514,549	329,933,823	91,519,154	7,663,751	1,164,327	17,554,040	7,409,388	5,076,648	617,825,[illegible]	11.83
1895	109,401,244	228,502,113	78,962,299	5,917,775	683,923	18,237,885	4,679,471	1,686,977	448,071,[illegible]	10.43
1892	72,122,576	133,260,175	50,829,700	5,087,360	325,064	12,929,437	3,514,310	40,682	277,8[illegible]	6.66

FOREIGN MAIL SERVICE—TOTAL MAIL MATTER SENT ABROAD.

YEARS.	Sent.	Increase.	Received.	Increase.
1898	2,922,663	323	2,749,784	185
1895	2,082,092	230	2,459,841	166
1892	904,406	100	1,486,331	100

The rapid enlargement of the mails shows the increase in the number of people who are utilizing the system. The estimated number of letters sent through the post-office increased 217 per cent from 1892 to 1898; postal cards, 248 per cent; parcel, 12,479 per cent; books, 151 per cent; samples, 358 per cent; registered mail, 228 per cent; pamphlets, 180 per cent, and the total, 222 per cent. In the foreign mail service letters sent increased 297 per cent in 1898 compared with 1892; cards, 769 per cent; pamphlets, 337 per cent; samples, 139 per cent; registered mail, 236 per cent; parcels, 6,271 per cent, and total, 323 per cent; and letters received, 195 per cent; cards, 279 per cent; printed matter, 159 per cent; samples, 358 per cent; registered mail, 216 per cent; parcels, 4,254 per cent; total, 185 per cent.

Statistics were taken of the percentage of our mail service in relation to other countries, 1898:

	Corea.	China.	British Asia.	Whole Asia.	England.	Germany.	France.	Whole Europe.	United States.	Whole America.	Other.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Sent	28.8	21.9	5.2	46.4	9.7	5.2	3.6	22	19.8	22.2	9.4
Received	21.9	8.4	4.5	33.9	15.1	6.8	4.1	30.1	23.6	24.9	11.1

This shows the communication of the country is largely with Asia, its neighbor, but the United States is in very intimate condition both in commercial and social affairs.

The number of letters unmailable, stolen, and burned varies according to the circumstances, as—

YEARS.	Undeliverable.	Stolen and burnt.
1898	94,703	7,489
1893	59,143	3,263

Money orders and deposits are rather in the nature of social correspondence, with small amounts, and they are not of very much help to transportation.

LENGTH OF TELEGRAPH ROUTES.

YEARS.	Length of lines.	Length of wires.	Number of messages.	Number per 100 of population.
1898	12,923	50,171	15,342,535	32.75
1895	9,449	29,798	9,097,102	21.13
1892	8,432	22,255	5,360,452	12.86

International, taking the year 1892 as a standard as 100, the increase is as follows:

YEARS.	Sent.	Increase.	Received.	Increase.
1898	161,165	314	166,622	306
1896	120,500	235	120,997	222
1895 [a]	148,071	288	165,053	303
1892	51,300	100	54,343	100

[a] The war effected a considerable change in 1895.

REVENUE AND EXPENSE OF POST-OFFICE AND TELEGRAPH.

YEARS.	REVENUE.			EXPENSE.		
	Post-office.	Telegraph and telephone.	Total.	Operating.	Other.	Total.
	Yen.	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*
1897	7,689,312	3,336,180	11,025,492	6,340,019	1,793,680	8,133,699
1895	5,820,680	2,520,362	8,341,042	4,080,996	1,352,829	5,433,825
1892	3,835,839	1,683,074	5,518,913	3,358,935	1,140,092	4,499,027

The net revenue of the department in 1897 was 2,891,793 yen, an increase over 1892 of 1,871,907 yen, equal to about 174 per cent. The telephone system is being constantly extended throughout the country.

YEARS.	Stations.	Branches.	Employees.	Length of lines.	Length of wires.	Cost of construction.	Subscribers.	Revenue.	Expense.
				Miles.	*Miles.*	*Yen.*		*Yen.*	*Yen.*
1898	13	40	778	1,562	31,273	1,896,119	8,083	574,332	324,038
1895	4	24	201	433	5,261	40,897	2,858	142,431	90,117
1892	2	18	51	224	1,573	64,283	821	30,121	21,840

The net revenue of the department in 1898 was 250,294 yen, an increase over 1892 of 241,013 yen, about 269 per cent.

ARTICLE II. INDUSTRY.

After the war the industry of Japan made wonderful improvement in all lines, especially in manufacturing, being helped somewhat by the amendment of the customs tariff. A near approach was made to the English principle of levying customs merely for revenue, and not for protection. Hitherto treaty conventions restricted the levy to not more than 5 per cent. The actual state of industry is best explained by statistics.

A. AGRICULTURAL, FOREST, AND ANIMAL.

Maintaining that the broad foundation of the wealth of the country rests upon its honest farmers and its skilled agriculturists, farming was the principal source of industry for a long time, having quite a variety of products such as rice, wheat, pease, corn, radishes, ginger, onions, teas, potatoes, indigo leaves, cocoons, rape seed, cotton, tobacco leaves, hemp, flax, all kinds of papyrus plants, sugar cane, mushrooms, bamboo, fuel, charcoal, timber, persimmons, sweet oranges, grapes, and other fruits, cattle, horses, other domestic animals, etc., many of which are of benefit to the manufacturers for their supply of raw materials. Rice for home use, cocoons for silk, and tea for export are the most important and staple products of the country, and many areas are cultivated in all parts of the country.

CROPS.	ESTIMATED AREA DEVOTED TO AGRICULTURE.			PRODUCTS.		
	1898	1895	1892	1898	1895	1892
	Acres.	*Acres.*	*Acres.*	*Bushels.*	*Bushels.*	*Bushels.*
Rice	6,903,179	6,809,106	6,749,999	236,925,000	199,600,000	206,890,000
Barley	1,616,253	1,603,351	1,600,199	44,565,000	42,680,000	34,045,000
Rye	1,679,342	1,645,890	1,592,145	36,859,000	35,075,000	30,285,000
Wheat	1,140,849	1,094,231	1,063,915	20,907,000	19,865,000	15,370,000
Potatoes	706,488	.....	.....	[a] 720,920,000	.....	.....
Other crops	3,009,261	.....	.....	45,910,000	.....	.....
Cotton	108,888	.....	.....	[b] 7,314,253	.....	.....
Hemp	54,757	.....	.....	[b] 3,569,159	.....	.....
Tobacco	77,120	.....	.....	[b] 8,871,370	.....	.....
Indigo	124,245	.....	.....	[b] 19,415,593	.....	.....
Total	15,463,783	.....	.....	.....	.....	.....

[a] Kwan. [b] Kwan, 1891.

AVERAGE YIELD PER ACRE.

CROPS.	1898	1895	1892	1897	
				United States.	United Kingdom.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Rice	34.3	29.3	30.6	.....	.....
Barley	27.6	26.6	21.3	24.5	32.9
Rye	21.9	21.3	19	16.1	.....
Wheat	18.3	18.1	14.4	13.4	29.1

The cultivated area and products look stationary, but average yield per acre is increasing slightly.

YEARS.	Field plantation of mulberry trees.	Production of cocoons.	Tea.
	Acres.	*Koku.*	*Acres.*
1897	.....	2,124,238	.....
1898	749,348	.....	.....
1895	674,720	2,258,173	143,709
1893	596,229	1,480,705	124,522

No statistics are taken showing the classification of population. If accurately estimated a great percentage would be found to be agricultural.

All forests of the country are under public administration, of which 33,072,380 acres were directly under Government control, with but 17,903,965 acres under the lease of private citizens, in 1897.

YEARS.	Government.	Private.	Plains distinct from forests.
	Acres.	*Acres.*	*Acres.*
1895	33,117,512	17,974,891	14,066,141
1893	29,029,039	17,334,746	14,113,976

A census was taken on December 31, 1898, of cattle and horses.

YEARS.	Cows.	Oxen.	Total.	Proportion per 1,000 population.	Mares.	Horses.	Total.	Per 1,000 population.	Butchers.	ANIMALS SLAUGHTERED.					PER CENT OF SLAUGHTERED.	
										Beeves.	Calves.	Horses.	Sheep.	Hogs.	Beeves.	Horses.
1898	742,412	488,054	1,230,466	28.12	873,617	714,080	1,587,697	36.21	1,315	157,866	.....	41,478	.....	108,217	.....	.....
1897	813,245	593,739	1,406,984	32.65	874,663	718,208	1,592,871	36.85	1,163	151,227	7,277	41,049	68.65	107,034	18.6	2.6
1896	582,206	454,072	1,136,278	27.16	852,567	678,036	1,530,603	36.59	988	154,815	5,771	36,026	46.64	11,419	22.7	2.35
1892	643,292	451,507	1,094,799	26.64	837,984	716,668	1,554,652	37.84	.....	100,629	.....	26,817	.....	.....	15.6	1.7

B. FISHERIES.

The marine products are important for both food and fertilizers. There is quite a variety, such as trout, tunny fish, cuttlefish, agi, turbot, shellfish, bechedemer, dried sardine, herring, bonito, shrimps, gomame, salmon, mackerel, dried tunny fish, kainohashira, agematti, konbu, funori, tsunomata, nori, wakame, hijiki, colle vegetable, sardine, fish oil, and shark's fins.

YEARS.	Number of companies engaged in fisheries.	Paid-up capital.	PRODUCTION.							
			Fresh fish.	Dried fish.	Salted fish.	Seaweed.	Vegetable glue and candles manufactured of fish oil.	Manure.	Fish oil.	Other.
		Yen.	Yen.	Yen.	Yen.	Yen.	Yen.	Yen.	Yen.	Yen.
1897	29	614,225	31,103,631	8,997,336	2,257,887	1,748,449	658,705	10,515,196	239,746	5,555,609
1896	19	600,678	.....	.....	.....	.....	.....	.....	.....	.....
1895	15	177,765	14,489,146	6,164,778	1,450,860	1,340,279	337,236	7,413,519	237,242	2,870,632
1892	.....	.....	.....	6,785,527	2,541,067	1,723,113	626,940	4,529,766	145,358	.....

C. MINING.

Coal and iron are the most important minerals. The more widespread the material prosperity the greater the need of these two minerals in all the processes of production and transportation—coal as a motive power, iron as a fundamental metal for all industrial purposes. Statistics show the steady increase of the iron output year by year. The coal mines are very prosperous and produce all the country requires for consumption. But most of the raw irons which are needed in the manufacturing industries of the country are not produced in the country. Gold and silver are also important for the substantial wealth of the country, but their production is not very great, although it is yearly increasing. Copper is found in great abundance.

YEARS.	Gold.	Silver.	Copper.	Iron.	Lead.	Antimony.	Tin.	Manganese.	Arsenic.	Copperas.	Mercury.	Sulphated iron.	Coal.	NONMETALLIC.		
														Petroleum.	Sulphur.	Graphite.
	Ounces.	Ounces.	Kwan.	Kwan.	Kwan.	Kwan.	Kwan.	Kwan.	Kwan.	Kwan.			Tons.	Kwan.	Kwan.	Kwan.
1897	33,385	1,748,609	5,437,155	7,464,364	205,577	312,171	12,692	4,112,239	3,477	1,120	714	2,033,716	5,188,157	9,248,840	3,621,899	103,984
1895	29,101	2,326,699	5,098,085	6,879,356	519,133	448,916	12,833	4,563,209	1,955	222,343	128	1,686,519	4,766,670	5,979,880	4,141,480	20,442
1892	21,540	1,916,549	5,536,061	5,182,427	236,859	368,869	11,011	1,338,200	1,434	.....	3,955	.....	3,176,840	537,640	5,462,818	160,074

The increase of the production of petroleum is something wonderful. There are (April, 1900) over thirty companies in the oil districts; some of them possess a capital of over 1,000,000 yen, and the aggregate capital amounts to 12,000,000 yen.

The total production of coal in the world in 1900 was estimated in round numbers at 700,000,000 gross tons, of which the United States had 255,000,000 tons, or 32 per cent, and England comes next, after a large home consumption, she exported 45,000,000 tons in 1900. A few years ago Japan entered the list of coal-producing nations, the production of which has been wonderfully increased, and she not only drove away the imports from Great Britain, but even exported to the western shore of the United States and oriental ports, where vigorous competition with Indian and Australasian coal began. Being superior in its quality, with the advantage of facility of transportation and cheapness of cost of production, it defied competition.[a] Its production amounted to 6,000,000 tons in 1900, of which 45 per cent was exported to India, China, Korea, Hawaii, Hongkong, the Philippines, Siberia, United States, and Australasia. The ships on the Indian Ocean began to use Japanese coal instead of Welsh and Northumberland coal. Coal is abundant in Formosa and will be a great addition to the supply in the country.

The construction of railroads, the building of ships, and the manufacturing industries need great quantities of iron and steel. A considerable quantity of iron is known to exist in various places, but not in conjunction with coal, and therefore its local production and manufacture is seriously impaired.

The copper market continues to present a very brisk aspect, owing to an active demand for export for electrical uses in other countries.

D. THE MANUFACTURING INDUSTRIES.

Innumerable variety and species, and enormous quantities of these form the principal resources of the country; such as all kinds of wares of gold, silver, copper, bronze, and other metals, porcelain, earthen, glass, bamboo, wood, cloisoné, lacquerware, and leather; mattings of all kinds, thread, and fabrics of silk, cotton, hemp, and other fibers; many kinds of paper works; writing, and painting brushes of all kinds; implements of carpenters, smiths, and other mechanics; manufactures of straw, hides, bones, tortoise shells, conch shells, and tusks; many kinds of dyeing materials; all kinds of oil, camphor, sulphuric acid, sugar, white wax, soap, rouge, face powder, and other toilet materials; matches, cloths, knitting, toys, tobacco, shoyu, and many kinds of liquors.

The new era, since the restoration and peace after the war with China, resulted in immense gains to our manufacturers in the demand for goods of various descriptions which our people are preeminently fitted to provide. The various manufacturing and mechanical industries are being encouraged by the Government and by capitalists, and recently a strong disposition has been shown to seek for investments in manufacturing undertakings. Heretofore native capitalists have, with some rare exceptions, invested their money almost exclusively in lands. Many forms of industry that were in their infancy twenty years ago are now flourishing and not only increase in quantity but also improve in quality. Articles that used to be exclusively imported are now manufactured at home. The total exports of industrial products have increased from 66 per cent in 1888, to 78 per cent in 1897, and total imports have decreased from 92 to 60 per cent during the same period. The capital used by the manufacturing companies in 1897 is twice that in 1894; the amount of paid up capital $18,000,000 in 1894 became $37,000,000 in 1897.

The development of manufacturing industries depend greatly upon the invention of machines, which is due to the progress of science, and also to the encouragement and protection of patents. The patent system began in 1871, when the Government issued a patent law, but it was inapplicable and was abolished the next year. In 1885 a law was issued again; but being too crude it was

[a] COST OF COAL PRODUCTION.

	s.	d.		s.	d.		s.	d.
England	5	10	Hungary	8	7	New Zealand	10	
Germany	6	2	United States	4	9	Canada	8	9
Belgium	7	7	India	8	8	Chile	10	
Austria	5	2	Victoria	10		Japan	5	
France	8	3	New South Wales	5	9			
Spain	6	1	Queensland	8	4			

amended in February 1889, taking the form of the United States law, and the system was then complete. Statistics show the number of licenses of various patents since 1885:

YEARS.	Number.	YEARS.	Number.	YEARS.	Number.
1885	99	1891	367	1897	188
1886	216	1892	379	1898	293
1887	112	1893	318	1899	577
1888	186	1894	326	1900	584
1889	209	1895	223		
1890	240	1896	189	Total	4,597

In 1896 an estimate was made of patents on machinery. Of 73 patents on silk, 10 were made in a silk district; of 30 on tea refining, 11 were made in a tea district; of 41 on matting, 27 were made in a matting district; of 8 on matches, 6 were made in a match district.

IMPORTANCE OF MANUFACTURING INDUSTRY: 1897.

	Number of establishments.	Capital.	Number of households engaged.	Product.	Employees.
		Yen.			
Silk spinning	274	3,292,877			17,291
Tea			777,944	[a] 8,470,182	
Pottery			5,157	[b] 5,163,070	25,667
Lacquer			5,191	[b] 4,116,088	18,708
Bronze ware			1,240	[b] 1,130,642	5,277
Liquors	125	3,901,196	14,470	[c] 4,778,053	
Sauce			10,177	1,[illegible]	
Textile	187	9,171,895	665,356	[b] 105,984,922	1,041,229
Paper	31	4,685,025	66,363	[b] 15,234,910	
Matting and mats			109,100	[b] 5,[illegible],270	
Rugs			2,000	[d] 3,000,000	18,000
Matches	269			[b] 6,548,492	47,724
Grain oil			8,247	[b] 6,919,603	
Vegetable wax			2,619	[b] 2,604,299	
Cement	16	2,704,800			
Pharmacy	33	2,641,750			
Salt	9	236,300		[b] 10,101,771	
Electric light	42	5,610,714		[b] 1,444,917	
Cotton spinning	85	34,106,083			
Sugar	5	1,667,570	91,167		

[a] Kwan. [b] Yen. [c] Koku. [d] Square yards.

Industries for which materials are locally produced.—They are the manufacture of silk, tea refining, pottery, clay pipes, matches, iron and other metal, etc. The iron and steel industry has now attained great proficiency in every kind of production, and is advancing daily. The iron industry, under Government control, was established in 1896 with 4,090,000 yen, and it improved its investment to 6,470,000 yen in 1898. The inconveniences of material transportation caused the Government to give a bounty in opening a port to facilitate the transportation of coal, iron, and machinery. The capital was increased again to 8,620,000 yen in 1899. Match factories are kept very busy. There were 278 factories, with 19,229 employees, in 1899. They produced 5,871,506 gross, and 58,906,665 gross were exported in 1899. Our pottery and clay pipes are favorites in the world, and imitations of our porcelain is seen in the Netherlands. In 1899 tea was produced to the amount of 33,451,528 yen, of which 8,387,598 yen was exported. In the silk factories having more than ten employees in 1896:

	Production.	Machinery.	Hand work.
Cocoon used ....kokus..	1,036,849	887,098	149,751
Silk produced ....pounds..	6,031,738	5,140,627	891,111
Silk produced in 1893 ....do....		3,381,008	422,413
Worsted silk ....do....	1,522,383	1,302,912	219,471
Employees ....number..	172,901	12,444	48,460

This table shows that the producing power and efficiency are great in machine work and machines are going to be used more and more. The factories of silk manufacture are getting larger and the number of employees is increasing.

FACTORY EMPLOYING—	NUMBER OF FACTORIES.		Increase (+) or decrease (−).
	1896	1893	
More than 10 persons:			
On machines	1,480	2,129	−649
By hand	474	542	− 68
More than 50 persons:			
On machines	509	349	+161
By hand	41	39	+ 2
More than 100 persons:			
On machines	273	121	+152
By hand	87	17	+ 70
More than 500 persons:			
On machines	21	3	+ 18
By hand	15	3	+ 12
Total:			
On machines	2,283	2,602	−319
By hand	617	601	+ 16

SHOPS WHERE MACHINERY IS USED.

	NUMBER OF FACTORIES.		Decrease (—) or increase (+).
	1896	1893	
By steam	829	513	+316
By water	1,077	1,151	— 74
By men	994	1,539	—545

Steam power is going to take the place of water power and men.

EMPLOYEES IN FACTORIES USING—

	1896	1893	Per cent increase or decrease.
Machine boiler	130,753	85,988	+52
Hand-work boiler	47,514	19,169	—74

EXPENSE FOR EVERY 100 POUNDS SILK.

	1897	1893
	Yen.	*Yen.*
Machine	126	110
Hand	108	82

Silk, flax, and ramie machines have been mostly supplied from England, although a small number of them have come from Germany and France.

Industries for which materials are imported from abroad.—A few materials are partly supplied at home, such as cotton, wool, sugar, etc. The manufacture of woolen goods is yet in an infant condition, not more than 2,000 spindles being at work.

The manufacture of textiles has become one of the most important industries of the country. Its product:

YEARS.	Silk.	Mixture cotton and silk.	Cotton.	Hemp and others.	Total.
	Yen.	*Yen.*	*Yen.*	*Yen.*	*Yen.*
1898	73,936,028	17,240,317	48,728,404	3,834,449	143,739,198
1895	4,647,401	10,281,272	37,083,757	2,350,805	96,187,235
1892	19,347,885	7,807,364	19,113,409	2,671,978	48,940,536

There are many companies for cotton spinning located at various places in the country. The supply of raw materials is great, and there is active competition between the United States and India in furnishing them. The manufactured goods are mostly exported to the Orient. More than $14,000,000 worth of yarns was exported in 1900. The growth of this industry was very rapid, the total number of spindles in 1899 being 1,353,125 against 5,456 in 1863. The quantity of raw materials worked up during the year 1898 totaled 27,343,000 pounds, and the output of yarns was 23,773,000 pounds.

The following shows the cotton-spinning condition in September, 1898:

Spindles		910,441
Average consumption of coal per month	pounds	53,219,168
Product of yarn per month	kwan	2,728,695
Employees—		
Male		14,811
Female		49,608
Horse power		28,367

Other statistics:

	First half of 1898.	Second half of 1897.	Increase.	Decrease.
Number of companies	67	63	4	.....
Net revenue	1,701,163	1,274,660	426,503	.....
Surplus fund	613,249	249,683	363,566	.....
Dividend	815,650	852,551	.....	40,986
Per cent	26.5	31.64	.....	5.14
Net revenue per company	25,391	20,232	5,159	.....
Surplus fund per company	9,153	3,963	5,190	.....
Dividend per company	12,113	13,533	.....	1,420
Per cent per company	4	5	.....	1

The best systematized manufacturing business in the country is cotton spinning. To understand the condition of the factories, employees, etc., it is best to study this industry.

After the war this industry made wonderful progress and the demand for laborers increased enormously. Consequently, where machinery was used and many laborers were employed it began to feel a lack of labor supply, and had to meet the demand by getting

them from a distance at great expense and much loss of time. Many companies sent agents over 200 miles to get employees. As to the efficiency of the work of those brought from a distance, few are found to quit the company, although they need a few days' careful drilling, while those who come from neighboring towns are found to need no practice, for they have seen and heard in their surroundings. But they very readily quit work, for they come just to get money; therefore, if they are told of better wages, they are easily influenced to quit the place. The defects of the former are that when they return to their homes for festivals, funerals, and so forth, they stay a long time; the latter, having their homes in the near neighborhood quickly quit in case of slight sickness and other circumstances. Very few children come by their own desire; most come by their parents' financial trouble, i. e., parents send them for work and get their wages. People who can support themselves hate to send their children, because the associations are not good, and nothing can be learned except to do that particular work. The employees, especially the females, are children of very poor people, as of peasants, fishermen, and coolies. They have no idea of sanitation or the health of their bodies, and have no proper education; therefore they have no patience in their work and no ideas of saving; they spend all they earn for insignificant things. Employees from the city or town, where there are facilities of communication, are smart in work, but these facilities give them opportunities to return to their homes, and they never stay long for work. On the other hand, those who come from a distance remain comparatively longer, but take a longer time to become acquainted with the work. The reason of their quitting is very simple—change of their customs. They have not grown up under strict rules of conduct, and the factory system makes them as uncomfortable as if they were working in imprisonment. Employers want to have as many employees from a distance as possible, but there is considerable expense to this, as for sending agents, commission for recommenders, outfit of clothing and traveling expenses given to employees, and advance payments which often are never returned. Another defect is the competition of employers to get these employees, which gives the latter some favorable considerations. Still another is that employees are cheated by the commissioner, and often complain to the company for breach of contract.

The contract is written, the time is from three to five years, and their ages from 10 to 60 years, because the older employees demand generally that their young children be employed with them.

In October, 1897, in seventy cotton-spinning companies there were 71,301 employees, as follows:

YEARS.	Male.	Female.	YEARS.	Male.	Female.
Under 11	254	814	Under 30	6,166	14,414
Under 12	228	1,875	Under 40	2,481	3,656
Under 14	857	7,684	Under 50	911	1,420
Under 15	736	6,071	Under 60	302	327
Under 20	3,354	19,734	Over 60	10	9

Thus, female children under 12 years of age form only 3.8 per cent of the total and 4.8 per cent of total female employees, and male children under 14 years of age only 1.8 per cent of total and 8.7 per cent of total male employees.

Their length of employment, October, 1897, in the seventy firms was as follows:

YEARS.	Male.	Female.
Under 1	6,486	26,470
Under 2	3,755	12,872
Under 3	2,024	7,462
Under 4	1,165	4,297
Unner 5	829	2,489
Under 7	579	1,826
Under 10	374	512
Over 10	87	76
Total	15,299	56,004

HOURS OF LABOR.

Generally speaking, they change their work from day to night every other week or every ten days, although changes are made according to weather and season. They work ten to eleven hours, having recess one to one and one-half hours every three or four hours. The hours are never different with male, female, old or young, but the kind of work differs. A discussion took place about the question of night work. Some say it is too hard.

To discuss this question intelligently, the first thing is to observe the custom and degree of civilization, and also the benefit of the country; therefore, all European and American methods can not be taken into consideration. Eleven hours of work are short compared with the hours of clerks and salesmen, who sit in stores from twelve to eighteen hours. Of course, the work on the machines is not very easy, needing constant watching of the movements under fixed arrangements, and of careful study. As to the night work, they rather prefer it in winter, because they are largely poor people and lack bedclothing and fuel at home; so they prefer to come to work and save expenses, and also on account of the larger wages in night work. In summer the factory is cooler than their little houses.

WAGES, PIECEWORK AND SALARY TOGETHER, OCTOBER, 1897.

PER DAY.	Male.	Female.	PER DAY.	Male.	Female.
	Sen.	*Sen.*		*Sen.*	*Sen.*
Under 5	52	418	Under 25	3,369	5,571
Under 7	222	2,103	Under 30	1,795	2,676
Under 10	577	8,059	Under 35	954	623
Under 12	736	8,772	Under 40	716	145
Under 15	1,536	10,515	Under 50	302	20
Under 17	1,718	8,924	Under 60	279	5
Under 20	2,689	6,904	Over 60	131	.....

The average of wages per day is 23½ sen for males and 14½ sen for females. Customarily, females under 14 years of age begin under 7 sen a day, and over 14 years, 8 or 9 sen are paid. Males under 16 get 11 to 12 sen, and over 16, 12 to 14 sen are paid.

The increase in wages runs from 1 to 3 sen per day. The payments are made according to the condition of employees and the custom of the place, but always with regard to the wish of laborers (daily, every ten days, or monthly). Boarding expenses, if they live in tenements; the charges, if they live at the company boarding houses; rent, if requested by the house owner, and the compulsory savings are deducted from payments. Wages rose very high after the war. The average rise for males was 45 per cent; for females, 83 per cent in October, 1897, in some places rising as high as 200 per cent on female labor.

SANITARY CONDITION OF FACTORIES.

All companies pay attention to the health of their employees, but the laborers, as said before, have no ideas in this regard. When they get their wages they spend them for eating and drinking, spoil themselves, and the attention of the employers to sanitation is in vain. They furnish doctors and examine the patients, but if the examination is too strict the latter dislike it and run away. The expense to which 62 large companies went for sanitary improvements for three summer months was 12,405 yen in 1897, with average of 200 yen per company. But there is a hopeful decrease in the amount of sickness among the laborers.

Sickness in thirty-five factories, from October, 1896, to October, 1897, is shown as follows:

	Aggregate.	Deaths.
Contagious diseases	908	42
Developmental and exhaustive	735	5
Skin and muscle	2,807	3
Bones and joints	3,015	6
Blood vessels	235	12
Internal organs	6,220	2
Breathing, throat	10,220	104
Diet	14,115	39
Nerves	872	17
Kidney and reproductive organs	1,547	11
Wounds	2,375	2
Miscellaneous	1,220	6
Total	44,270	249

The above table shows the greatest number in the diet list, and the next is in throat disease, caused by drinking.

BUILDINGS.

Recently great improvement has been made in factory buildings, which are now erected under the supervision of technical architects, who have studied the European and American factories. Most of them are of brick or stone, but on account of earthquakes most are of one story and very seldom of three stories. They pay attention to light, ventilation, and especially to the prevention of fire. To keep the factory clean they sweep it all over three or four times a year, besides the daily sweeping. Dormitories are not in the foreign style at all; they are made for the convenience of our laborers, which the foreign style of dormitory would not be.

EDUCATION.

First of all, labor and education can not run parallel; the employees work all day and come home almost worn out, and it is impossible to pour learning into such dull heads. Moreover, they had not proper education when they came, and if they are compelled to attend lectures they dislike it and run away. But on account of the improvement of machinery and the division of labor, they need more education. Some companies give lectures by priests, and inculcate morals; some use shadow pictures and explain the redress of wrong and try to improve their personality; others give lessons in sewing to female laborers, and this last is the only successful method.

In thirty-seven large factories, October, 1897, there were 6,041 males and 21,463 females who could read, and 1,211 males and 17,471 females who could not read; there were 521 males and 3,124 females under 14 years of age who could read, and 405 males and 3,808 females who could not read.

SAVINGS.

Three to 6 per cent of the wages are reduced compulsory for savings, on which the company gives 5 to 10 per cent interest, and this they never allow to be drawn out during the employment, unless it is needed. But, as stated before, the laborers are ignorant and never understand the principle, and think that the sum taken away has gone as a contribution or commission to the officers of the company, although as time passes they begin to know the value of the idea. The result was:

(1) Some idea of savings for need was given and at the same time their extravagance was stopped.
(2) When sickness occurred in their families it gave great help.
(3) When expiration of employment came they had some capital.
(4) As the amount of savings increased they became more and more studious to save.
(5) If they violate the by-laws those saved amounts are forfeited, thus insuring their good behavior.
(6) Naturally they change their customs and tendencies and become good employees and get more wages.

Thus the system is of great benefit to the company as well as the employees themselves. Besides these savings the company takes their deposit on voluntary savings and gives interest a little higher than the market rate. The company also sends their remittances of money to their homes without any charge.

PENSION.

For long service the company gives pensions according to the length of employment and rate of wages.

FACTORIES OF ALL KINDS EMPLOYING MORE THAN 30 MEN IN JAPAN DECEMBER 31, 1897.

ARTICLES.	BY MACHINE POWER.			HAND POWER.		
	Number of factories.	Number of machines.	Horse-power.	Employees.	Number of factories.	Employees.
Silk thread	1,939	2,721	19,796	161,345	153	13,671
Cotton thread	150	278	18,526	130,133	5	776
Silk textiles	16	34	1,035	3,771	120	7,1[illegible]
Cotton textiles	15	19	2,792	5,793	187	18,4[illegible]
Machine and instrument for vessels	144	192	64,373	30,737	44	2,[illegible]
Mining	328	1,074	48,462	124,027	115	9,812
Tobacco	42	72	1,193	5,809	143	27,742
Matches	4	4	18	1,026	259	52,2[illegible]
Refine rice	29	40	798	1,425	1	[illegible]
Printing	52	63	650	5,962	41	1,[illegible]
Brick and tile	13	13	391	1,453	99	[illegible]
Dyeing	11	13	85	804	19	[illegible]
Saki	10	16	400	1,144	138	9,7[illegible]
Glass	9	11	156	1,238	28	2,27[illegible]
Paper	47	125	5,693	6,403	47	2,[illegible]
Pottery	5	5	38	407	53	2,7[illegible]
Match sticks	14	81	128	1,519	28	1,7[illegible]
Hemp textiles	6	14	1,030	2,762	4	27[illegible]
Hemp thread	13	13	394	3,606	.....	.....
Thread	11	15	553	3,400	.....	.....
Clocks	29	38	252	3,482	[illegible]	[illegible]
Straw braid	.....	.....	.....	.....	[illegible]	4,[illegible]
Matting	.....	.....	.....	.....	106	5,[illegible]
Cement	22	41	2,660	4,015	4	[illegible]
Cotton	14	15	429	1,691	6	[illegible]
Wire	5	5	36	188	.....	.....
Electricity	4	26	1,732	324	.....	.....
Rugs	.....	.....	.....	.....	36	1,392
Cans	1	1	75	30	3	166
Cotton flannel	5	5	460	805	42	736
Springs	.....	.....	.....	.....	4	216
Needles	2	2	60	140	.....	.....
Brushes	4	4	76	1,004	.....	.....
Wooden tubes	7	7	71	[illegible]	.....	.....
Nets	7	31	202	257	.....	.....
Hats	8	16	238	908	.....	.....
Oil	8	10	[illegible]	[illegible]	.....	.....
"Kanten"	.....	.....	.....	.....	5	[illegible]
Powder	5	5	73	191	.....	.....
Measures	2	2	9	160	11	[illegible]
Leather goods	8	11	80	2,594	11	1,[illegible]
Toothpicks	.....	.....	.....	.....	4	1,[illegible]
Lanterns	.....	.....	.....	.....	4	[illegible]
Lumber	3	3	58	104	3	[illegible]
Hand organs	2	104	20	192	.....	.....
Lime	.....	.....	.....	.....	[illegible]	[illegible]
Fans	.....	.....	.....	.....	[illegible]	2,[illegible]
Earthen ware	.....	.....	.....	.....	7	[illegible]
Sauces	2	2	36	116	11	[illegible]
Wooden boxes	2	2	29	73	2	60
Salt	.....	.....	.....	.....	4	[illegible]
Fez	.....	.....	.....	.....	9	1,[illegible]
Marine products	2	4	194	106	.....	.....
Chemical	6	22	310	842	.....	.....
Medicine	3	3	47	158	[illegible]	[illegible]
Stone chalk	4	4	30	240	5	[illegible]
Lacquer	.....	.....	.....	.....	[illegible]	[illegible]
Wool	6	10	1,084	2,680	2	[illegible]
Wicks	2	2	16	120	2	[illegible]
Instruments for lamps	4	4	40	730	.....	.....
Bat[illegible]	.....	.....	.....	.....	6	[illegible]
Parasols, bone	2	2	50	116	4	[illegible]
"Motoyui"	1	1	8	47	.....	.....
Manure	4	12	144	300	.....	.....
Mineral water	1	1	5	32	.....	.....
Sugar	2	8	400	130	2	[illegible]
Gas	2	4	12	234	.....	.....
Rubber	2	4	216	118	.....	.....

ARTICLE III. TRADE.

That the amount of foreign trade is the sole and sufficient measure of material progress is stated as a mercantile principle. Internal trade is likewise important, especially in a country like the United States, but this indicates only a part of economic improvement and is commonly free and unimpeded. Therefore let us observe the foreign trade here.

The restoration in 1868 abolished all unsuitable features and developed all the favorable systems and regulations of trade, industry, laws, transportation, etc., and trade became yearly more prosperous. The development of our foreign trade in the past few years has been simply wonderful, and within that period it has expanded to the western countries, where it has been very great. These western countries have offered us great competition for the trade of China; the excellence and uniform cheapness of our products defy competition. For instance, as Professor Mayo-Smith stated, "Down to the beginning of the seventies China was almost the only source of tea supply for the Western World; then Japan came in as a competitor and now exports more than $4,000,000 worth." The increase of manufactures, the application of steam on land and sea, the growth of population, and a more liberal commercial policy developed the country's trade with marvelous rapidity. The movement of trade is accurately measured by the statistics of imports and exports, if all invoice values are true.

Total Value of Imports and Exports.

[In round numbers, yen.]

EXPORTS.

YEARS.	Japanese produce.	Foreign produce.	Total.	Export per capita.
1868			15,553,500	
1873			21,635,400	
1878			25,988,000	
1883			36,268,000	
1888			65,705,500	
1893	88,950,000	762,900	89,712,900	2.18
1895	134,991,000	1,121,100	136,112,200	3.26
1898	162,903,200	2,850,500	165,753,800	3.83
1899	212,952,100	1,977,800	214,929,900	4.92
1900			203,943,800	

IMPORTS.

1868			10,693,600	
1873			28,107,400	
1878			32,874,800	
1883			28,441,800	
1888			65,455,200	
1893	69,500	88,187,600	88,257,200	2.15
1895	177,300	129,083,300	129,260,600	3.09
1898	231,427	277,270,700	277,502,200	6.42
1899	350,900	220,051,000	220,401,900	5.04
1900			287,169,600	

TOTAL EXPORTS AND IMPORTS.

YEARS.		EXCESS.	
		Imports.	Exports.
1868	2,624,500		4,860,400
1873	49,142,800	6,471,900	
1878	58,863,100	6,886,700	
1883	64,712,900		7,823,200
1888	131,160,700		250,300
1893	177,970,000		1,455,700
1895	265,372,800		6,851,600
1898	443,255,900	111,748,400	
1899	435,330,800	5,472,000	
1900	491,113,300	83,225,800	

The foreign trade of the country has increased more than fourfold in the last twenty years and its rapidity far exceeds the rate of the world's progress, while England, Germany, and France increased only 10 to 30 per cent. Even in later years the progress is wonderful. The total value of the whole trade of 1900 shows an increase of 108,677,483 yen over 1897 and 201,596,097 yen over 1896, or over 28 and 52 per cent, respectively. The corresponding figures of 1890 show an increase of over 300 per cent in a decade. Total trade per capita was also increased from 3.45 yen in 1890 to 9.96 yen in 1899.

Statistics of Gold and Silver.

YEARS.	Export.	Import.	EXCESS.	
			Export.	Import.
	Yen.	*Yen.*	*Yen.*	*Yen.*
1890	13,778,500	1,200,600	12,577,900	
1893	12,289,200	11,186,500	1,102,700	
1895	27,301,700	5,874,200	21,427,500	
1896	11,598,900	39,142,200		27,543,300
1897	19,219,200	81,466,700		62,247,500
1898	86,987,500	42,563,800	44,423,700	
1899	11,178,200	20,163,500		8,985,200

Though the development of foreign trade is very great, when we compare it with the trade of European and American countries we see at once that the country is still in the kindergarten state.

COUNTRIES.	1891	1899	COUNTRIES.	1891	1899
	Million yen.	*Million yen.*		*Million yen.*	*Million yen.*
United Kingdom	5,212	7,297	Switzerland	508	[a] 712
France	3,200	3,133	Sweden and Norway	408	[a] 674
Germany	3,130	[a] 4,572	Brazil	400	[b] 470
United States	2,570	[a] 4,149	China	330	[a] 530
Holland	1,500	[a] 2,649	Turkey	251	[c] 325
Netherlands		2,649	Argentina	246	608
Belgium	1,423	1,498	Denmark	233	[a] 418
Russia	1,100	1,335	Chile	202	[a] 197
Austria-Hungary	1,050	1,440	Mexico	180	222
Italy	630	1,134	British India		1,183
Spain	582	[a] 582	Japan	142	485

[a] 1898. [b] 1897. [c] 1896.

The above figures show that the total trade of Japan was only 5.5 per cent compared with the United Kingdom, and only 11.6 per cent compared with the average amount, 3,754 million yen, of the six strong countries—the United Kingdom, the United States, Germany, France, Belgium, and Austria.

The following is the share of trade conducted by foreign and Japanese merchants, respectively, in yens:

IMPORTS.

YEARS.	Japanese.	Per cent.	Foreigners.	Per cent.
1883	1,383,000	4.8	2,704,900	95.2
1888	11,635,000	17.8	53,820,000	82.2
1893	16,694,000	19	70,903,193	81
1898	90,472,259	32.6	104,127,000	67.4

EXPORTS.

1883	5,149,000	14.4	30,557,000	85.6
1888	7,081,500	11.1	56,599,000	88.9
1893	13,655,000	15.5	74,486,000	84.5
1898	55,060,500	33.7	107,736,000	66.3

TOTAL PER CENT.

YEARS.	Japanese.	Foreigners.
1883	9.6	90.4
1888	14.4	85.5
1893	17.2	82.8
1898	33.2	66.8

This shows that Japanese merchants are invading the domain formerly monopolized by foreigners, for in 1898 the direct exports by Japanese merchants represented only 11.1 per cent out of the total exports, whereas in 1898 they rose to 33.7 per cent. In imports a decade ago only 17.8 per cent was conducted by Japanese merchants, whereas in 1898 they rose to 32.6 per cent. Japanese merchants have labored to get rid of the foreign middlemen, and they have somewhat succeeded.

CLASSIFICATION OF COUNTRIES WITH THE TRADE, IN YEN.

COUNTRIES.	1899			1894		
	Exports.	Imports.	Total.	Exports.	Imports.	Total.
United States	63,919,270	38,215,894	102,235,164	43,323,557	10,982,558	53,406,115
England	11,270,771	44,836,994	56.107,765	5,950,198	42,189,874	48,140,072
China	40,257,034	28,687,731	68,944,765	8,813,987	17,511,507	26,325,494
British India	6,062,049	43,883,886	49,945,935	3,688,159	10,560,448	14,248,607
Hongkong	34,291,308	7,338,455	41,629,763	16,199,481	8,999,718	15,192,199
Germany	3,796,927	17,613,191	21,410,115	1,517,549	7,909,542	9,427,091
France	29,247,837	5,768,180	35,016,017	19,498,776	4,348,048	23,846,824
French India	161,048	4,489,326	4,650,374	24,523	6,204,147	62,286,670
Korea	6,995,931	4,976,167	11,672,098	2,365,112	2,183,313	4,548,425
Belgium	331,415	5,415,810	5,747,225	19,480	1,201,121	1,220,601
Asiatic Russia	2,556,003	4,524,120	7,090,123	992,755	1,165,306	2,158,061
Siam	26,614	757,030	783,644	2,953	618,859	621,812
Switzerland	111,518	1,676,669	1,788,187	103,021	629,208	1,332,209
Italy	3,581,709	236,988	3,818,697	2,900,390	170,340	3,070,730
Philippines	286,772	2,383,874	2,670,646	220,587	1,698,819	1,919,406
Australasia	2,169,921	1,708,670	3,878,591	1,098,066	534,763	1,632,829
Canada	2,358,099	182,018	2,540,107	2,211,687	45,395	2,257,082
Austria	674,527	1,250,218	1,924,745	465,186	19,820	485,006
Hawaii	1,351,950	5,623	1,357,573	313,908	6,148	320,056
Holland	322,155	914,406	1,236,561	136,871	30,174	167,045
Russia	616,802	49,123	665,925	27,594	8,468	36,062
Spain	57,732	101,718	159,450	52,307	43,463	95,770
Sweden and Norway	12,043	120,664	132,707	576	18,623	19,199
Turkey	92,651	26,053	118,704	16,741	3,446	20,290
Other countries	943,189	5,196,013	6,139,202	754,223	398,847	1,152,070
Sold to ships in ports	3,434,560	.....	.....	1,948,396	.....	.....

The trade with the United States is at the head of the list, having the greatest number of cargoes and price, as over one-fifth of the total trade of the country was with that country, and also the United States is the field of the most promising trade in the future. China and Hongkong trade are next important for the export trade. All oriental countries and Australasia are favorable to our export trade.

	1899		1890	
	Export.	Import.	Export.	Import.
	Yen.	*Yen.*	*Yen.*	*Yen.*
Asia	90,349,987	94,666,715	16,456,701	27,848,858
Europe	50,137,945	78,046,222	18,713,468	40,285,811
North America	66,286,923	38,397,940	20,844,281	6,999,190
Australasia	2,169,921	1,708,670	726,044	334,209
Other continents and islands	2,550,559	7,582,379	1,083,149	6,362,003
Sold to ships in ports	3,434,560	.....	1,711,989	.....
Total	214,929,895	220,401,926	[illegible]	81,728,581

Our largest trade is with Asia, and Japan has recovered her balance of trade there which she lost long ago. Europe is always furnishing supplies to Japan. The United States is very favorable to our country, and the excess of our exports to that country is great.

The chief trade relations with important countries in important articles are:

UNITED STATES, 1899.

	Yen.
Exports to:	
Rice	1,571,408
Camphor	399,227
Silk handkerchiefs	1,329,191
Habutai	3,700,097
Kaiki	1,254,195
Matting	3,473,344
Tea	6,326,806
Sulphur	363,879
Silks	39,931,057
Straw braid	743,641
Pottery	685,811
Imports from:	
Flour	1,333,676
Oil, petroleum	5,436,622
Raw cotton	16,476,899
Locomotives	883,597
Iron nails	1,497,560
Tobacco	4,839,923
Cigarettes	407,922

ENGLAND.

Exports to:	
Rice	2,226,042
Habutai	1,771,263
Silk handkerchiefs	674,772
Straw braid	1,507,918
Crude and sheet copper	1,323,048
Imports from:	
Soda	515,999
Cotton	4,935,667
Calico	3,575,191
Cloth	489,463
Wool	494,993
Cotton, printed	1,369,230
Cotton satin	944,754
Satin	1,102,627
Iron ores	684,959
Iron plate	893,509
Iron bar	781,310
Wire	818,115
Coal	936,653
Vessels	3,070,701
Cotton-spinning machines	680,276
Locomotives	973,957

CHINA.

Exports to:	
Koubu	909,191
Coal	5,406,894
Cotton, spun	22,911,535
Lumber	779,960
Matches	2,020,056
Umbrellas	479,418
Imports from:	
Pease and other beans	6,666,098
Residual product of oil	6,047,238
Eggs	823,088
Raw cotton	4,350,148
Hemp	611,024
Crude sugar	2,880,267
Wool	810,617

BRITISH INDIA.

Exports to:	
Habutai	1,077,523
Matches	807,642
Coal	1,686,539
Imports from:	
Dry indigo	796,762
Raw cotton	39,165,995

HONGKONG.

	Yen.
Exports to:	
Rice	2,387,027
Cotton yarn	3,469,524
Matches	2,872,230
Leches	1,168,660
Habutai	2,273,505
Coal	4,618,615
Camphor	939,219
Crude and sheet copper	7,944,607
Imports from:	
Sugar	6,203,444
Crude sugar	852,224

GERMANY.

Exports to:	
Rice	803,360
Crude and sheet copper	1,190,017
Fish oil	314,273
Imports from:	
Sugar	1,863,453
Wool cloth	616,592
Aniline dyes	783,411
Iron nails	657,318
Wool	1,065,850
Liquors	1,768,857

FRANCE.

Exports to:	
Silks	19,183,785
Habutai	5,925,106
Silk "noshi"	829,372
Worsted silk	1,202,341
Imports from:	
Mousseline de laine	2,832,664
Wool thread	172,064

KOREA.

Exports to:	
Cotton yarns	2,137,913
White cotton cloth	984,959
Calico	453,967
Imports from:	
Rice	1,689,909
Pease and other beans	2,110,847
Cow skins	408,200

FRENCH INDIA.

Imports from:	
Rice	3,354,096

BELGIUM.

Imports from:	
Plate iron	515,017
Bar iron	1,564,710
Glass	1,165,480

ITALY.

Exports to:	
Silks	2,851,108

AUSTRALASIA.

Exports to:	
Rice	867,888
Habutai	316,312
Imports from:	
Wool	941,117

CANADA.

Exports to:	
Tea	1,293,963

ASIATIC RUSSIA.

Imports from:	
Petroleum	2,429,456

The United States and England have a variety of important articles to trade.

GENERAL ARTICLES, IMPORT AND EXPORT, 1898.

	1898	1896
IMPORT.	*Yen.*	*Yen.*
Arms, clocks, watches, instruments, apparatus, tools, and machinery	20,526,973	12,674,506
Beverages and comestibles	4,820,339	2,473,740
Clothing and accessories	1,054,177	947,126
Drugs, chemicals, and medicines	7,919,373	4,273,145
Dyes, colors, and paints	5,160,594	3,710,893
Glass and glass manufactures	917,237	774,710
Grains and seeds	56,205,492	9,669,437
Horns, ivory, skins, hair, shells, etc	3,077,509	2,902,854
Metals and metal manufactures—iron and steel	20,281,049	14,815,622
Metals and metal manufactures—others	3,365,110	2,737,921
Oil and wax	8,553,570	7,105,694
Paper and stationery	4,009,476	1,937,330
Sugar	28,619,563	13,858,844
Tissues, yarns, threads, and raw materials thereof:		
Cotton	65,624,587	55,788,354
Wool	13,069,870	18,268,460
Silk	1,920,492	1,543,520
Hemp, flax, and jute	1,086,914	1,463,266
Other	1,803,577	3,200,842
Tobacco	6,628,210	843,340
Wines, liquors, and spirits	1,398,338	790,112
Miscellaneous	21,228,278	11,684,877
	217,270,729	171,459,556
Reimported	231,428	214,918
Total imports	277,502,157	171,674,474
EXPORT.		
Beverages and comestibles:		
Tea	8,215,665	6,372,329
Grains	6,039,229	8,118,081
Marine productions	4,280,121	3,864,899
Others	2,234,963	1,920,268
Clothing and accessories	1,162,697	913,674
Drugs, medicines, chemicals, dyes, and paints	2,865,275	2,978,086
Metals and metal manufactures	8,845,087	6,673,950
Oil and wax	1,090,461	754,658
Paper and paper manufactures	1,871,121	1,020,712
Skin, hair, shells, horns, etc	799,319	582,765
Tissues, yarns, etc.:		
Silk	61,617,157	44,236,111
Cotton	23,403,120	6,736,202
Others	1,144,464	1,165,830
Tobacco	184,725	245,383
Miscellaneous	39,649,809	30,973,631
	162,908,212	116,575,579
Reexport	2,850,541	1,267,182
Total export	165,753,753	117,842,761

ARTICLES.	1899		1897	
	Export.	Import.	Export.	Import.
	Yen.	*Yen.*	*Yen.*	*Yen.*
Agricultural products	21,074,230	17,300,922	15,088,000	29,748,747
Animal products	20,759,063	47,446	.....	78,[illegible]
Fishery or marine products	4,094,858	.....	4,194,892	.....
Manure	.....	7,934,189	.....	4,[illegible]
Mining and oil products	16,249,281	11,999,036	12,002,416	1[illegible]
Chemicals, dyes, and medicines	3,960,345	12,749,717	2,985,986	8,[illegible]
Food and drink	1,774,417	8,952,897	1,081,079	2,[illegible]
Raw materials	2,129,363	68,992,298	1,[illegible]	47,[illegible]
Manufactured goods	163,220,376	96,850,234	122,671,624	11[illegible]
Total	212,962,136	220,[illegible]	161,[illegible]	2[illegible]

	Exports.	Imports.
Agricultural products	Grain, vegetables, tea Tobacco leaf	Grain, vegetables, tea. Coffee.
Animals		Cattle, horses, etc.
Fisheries	Seaweed, fish.	
Manure	All kinds.	
Mining and oil	Coal, metal, and petroleum.[a]	
Food and drink	Food, other than grain, such as salt, sauce, etc	Wine and mineral water.
Raw materials	Cotton, feathers, bamboo, and timber	Feathers, leather, bone, shell, ivory, cotton, wool, hair, stone.
Manufactured products	Cotton, silk, textiles, clothing, several kinds of wares, soap, wax, pottery, glass, boots and shoes, fans and other ornamental goods, books, paper, matches, and miscellaneous.	Cotton, silk, wool mixture of three textiles, wearing things, many kinds of wares, pottery, metal, paper, [illegible], soap, wax, [illegible] and [illegible], [illegible] and vessels, scientific machines and apparatus, and miscellaneous.

[a] Iron and steel are mixed up with raw and manufactured products, and in this figure include in the latter, amounting to [illegible] in [illegible] and [illegible] in 1893 on items of import.

IMPORTANT ARTICLES CLASSIFIED.

ARTICLES.	EXPORT.		IMPORT.	
	1899	1893	1899	1893
Agricultural:	*Yen.*	*Yen.*	*Yen.*	*Yen.*
Rice	10,282,012	5,001,158	5,960,166	3,254,842
Tea	8,498,783	7,420,371		
Flour			1,383,540	641,920
Peas			8,822,111	3,446,636
Marine:				
Algæ	780,009	939,419		
Leeches	1,362,068	1,426,782		
Manure:				
Residual product of oil			6,791,813	599,893
Mining:				
Coal	15,164,867	[illegible]		
Copper	11,383,358	2,033,820		
Chemical:				
Camphor	1,754,496	1,308,611		
Alcohol			[illegible]	[illegible]
Raw materials:				
Silk, raw	62,627,721	28,167,411		
Silk, noshi and waste	4,074,085	2,792,764		
Cotton			62,210,717	15,294,898
Wool			4,324,427	425,120
Iron ores			965,544	743,553
Tobacco leaves			[illegible]	
Iron, bar			2,603,677	975,787
Iron, sheet			3,139,141	330,09[illegible]
Total raw materials			73,231,510	17,769,456
Manufactured articles:[a]				
Silk fabrics	15,799,014	3,553,694		
Silk handkerchiefs	3,461,572	3,899,646		
Cotton, spun	28,521,438	59,176	[illegible]	[illegible]
Straw braid	2,770,178	378,349		
Mats and matting	3,717,489	1,723,383		
Matches	5,890,666	3,587,974		
Umbrellas	933,547	589,273		
Porcelain and earthenware	2,181,336	1,577,191		
Sugar			17,645,230	10,452,026
Indigo, dry			2,903,829	444,268
Aniline dyes			904,013	405,047
Calicoes			3,575,191	2,315,124
Printed cotton			1,438,245	635,903
Satin			949,750	855,998
Wool cloth			2,004,198	891,408
Mousseline de laine			4,350,934	2,305,505
Flannels			374,959	1,389,714
Satin			1,132,575	1,489,305
Rails			435,054	607,108
Iron nails			2,223,432	887,7[illegible]
Iron pipes			933,436	484,086
Watches			237,716	2,960,211
Machines for spinning			3,088,762	1,912,013
Locomotives			1,968,374	1,580,273
Steamers			3,620,982	8,202,549
Cigarettes			760,594	232,344
Paper for printing			748,414	257,857
Petroleum			7,918,149	4,401,041

[a] Raw silk and other threads and straw braid may both be counted as raw material and manufactured articles, for there are many factories manufacturing raw silk from cocoons.

Trade movements show that the country is becoming more and more a manufacturing one, increasing in her imports of raw materials and machinery and decreasing in imports of manufactured goods, except sugar and petroleum, which are necessarily imported to a larger and larger extent with the increase of population, transportation, industry, trade, and the wealth of the nation. The imports of raw cotton are enormous, but at the same time the export of the goods manufactured from it is equally great.

The whole trade shows a general increase and is very prosperous.

ARTICLE IV. CONCLUSION.

The invention of the steam engines, and application of electricity, and the adaptation of mail facilities gave the world quick and easy communication, and western civilization is due very much to them. These facilities, especially in transportation, were the greatest phenomena of the nineteenth century, giving opportunity for domestic industry and for transporting the products to market. The United States has grown in the midst of this exciting era, being born in the latter part of the eighteenth century, and has gradually developed, till at the present time she is the star of the world. Unfortunately these facilities reached Japan only at the middle of the century, and only now is she beginning to get into the partnership of civilization. Gradually the country has been adopting every means of cheapening production and transportation, making the most intelligent use of her workmen instead of treating them as mere machines, evolving plans and schemes of labor saving, discarding worn-out methods, adopting tools and machines suitable for special purposes, giving close study to the best and most economical forms of power applicable to the particular business, adopting the most effective means of advertising her productions, and generally keeping in the march of progress. Thus transportation, industry, and trade have flourished the passed few years in an extraordinary and perhaps unprecedented manner, and a continuance of this prosperity is anticipated with the utmost confidence, especially the development of the manufacturing industry, which, having a number of immense firms, is becoming more prominent. The increase of the wealth of the country is shown by the enormous increase of the budget of the country, which the people can stand for the payment of immense amounts of taxes, to feed the great standing army and to maintain the magnificent men-of-war.

NUMERICAL STRENGTH OF THE ARMY AND NAVY.

	Standing army (December 31, 1898).	Navy (December 31, 1899).
Active service	125,345	24,575
Reserved service	115,666	2,512
Territorial service	74,797	1,623
Total	315,808	[a]28,710

[a] And 226,170 tonnage of fleet.

The constantly decreasing number of paupers, the increased deposits in savings banks and post-offices, the increased utility of the bank system are evidences of the generally improved condition of the mass of the people. The figures show a great decrease in the number of convicts sentenced for negligence in paying their land taxes:

YEARS.	Persons.	Amount.	Number of bankrupt peasants.
		Yen.	
1882	1,179	1,402	.....
1887	10,095	2,655	4,962
1892	899	613	1,203

The source of this increase of wealth is the development of commerce and the consolidation of small scattered sums of money into incorporated enterprises.

Just lately the tightness of the money market and the Chinese trouble had a mischievous effect on the industry of our country. But this should not be regarded as a symptom of economic retrogression, for new industries are being founded, improved on the old ones, which diminish our consumption of foreign merchandise. The economic movement is most actively reflected in the table of exports which shows a steady increase. There is no doubt that the productive power of the country is increasing, and therefore there is no basis for the pessimistic conclusion that the country is in a stagnant condition. To illustrate more forcibly this expansion of forces, silk and manufactured goods will be named. The export of silk has more than doubled both in quantity and value, and the increase of imports of raw materials demonstrate the fact that the country has achieved real economic progress, both in consumption and production. The immense and yearly increasing imports of raw materials, such as cotton, wool, hides, iron, steel, etc., absolutely necessary for manufacturing industries, which they could not possibly do without, show the great development of the industry of the country. Though the country is very dependent on foreign countries for her supplies of raw materials, yet they are her markets for her industrial productions. The tendency is for the country to become a manufacturing one, toward which it is progressing favorably. The rise of the price of coal and iron shows its development, whereas agriculture seems less promising and will doubtless for many reasons remain comparatively stationary, as it is in England, although the country has mighty forests, large rivers, great lakes, mountain ranges, broad, high prairies, fertile valleys, and inexhaustible mines and fisheries.

It is difficult to state accurately the progress of the commerce of the country, but if it be compared with that of the world I am sorry to say the country is still in its infancy. The supply of coal; which is the motive power of manufacturing, though small compared with European countries, yet exceeds the home demand, and this shows the need of more manufacturing industry, although the home demand for coal is greatly increasing.

The entire State expenditure, though in fact not more than the expenditure of the city of Paris, is still a little too heavy a burden upon the people, and caused the recent economic troubles. The mines of gold, silver, copper, nickel, iron, and coal are only beginning to be developed.

Chapter III.

FURTHER OBSERVATIONS.

As I have stated in previous chapters on the history and the present condition of commerce, Japan is still in need of economic study in regard to future development—the necessity, possibility, and consideration of the interchange of articles whose production is thus so enormously increased. Geographical location, natural facility of transportation, etc., are worthless unless they are utilized.

ARTICLE I. TRANSPORTATION.

The subject of transportation is one of the most important in the whole field of economic investigation.

With the improvement of home navigation the movements of trade have also improved. In 1898, 21 per cent of total trade of the country was carried by Japanese vessels, against 7.6 per cent in 1894 and 0.02 per cent about twenty years ago. The improvement is wonderful; but on the other hand this fact plainly shows not only that navigation is not fully developed, but that it is insufficient to serve the country. The improvement of navigation is the most urgent demand of the country.

At the time of the civil war the United States lost her power in navigation, having stopped her subsidy policy, but lately she has regretted her loss, and in March, 1891, Congress revived the policy, and the country has recovered most rapidly her trade and power on water. Japan has taken up the subsidy policy, having paid 2,673,894 yen on her European lines; 654,030 yen on the Seattle line, and 1,013,880 yen on the San Francisco line. The most important form of subsidy is by postal contracts for mail service by quick steamers, though it is frankly acknowledged that other important objects are kept in view throughout, such as the indirect advantages that would accrue to trade, the coveted means of favoring home industries, and the privilege of using the ships as cruisers in time of war. The charters of navigation companies speak accurately on the latter subject, but in fact only one steamer was used as a cruiser in the Chino-Japanese war, and this one caused undeniable hindrance to action in the battle on account of its lack of speed and other defects. So far, the facilities of navigation are increasing sufficiently fast, but there is no encouragement given to the subject of auxiliary cruisers by which steamers are used for transportation service in peace and for cruisers in war, as seen in the Canadian Pacific, the French Mail, the German Lloyd, and lines of all other strong companies. A navy is to encourage commerce in time of peace and protect it in time of war. Japan has improved her naval power wonderfully since the war, but yet it is necessary to continue its progress to secure the balance of power as well as her commercial interests. A system of auxiliary cruisers would be beneficial and economical to the country; it would decrease the expense of the navy and at the same time give great facilities and improvements in navigation, and also encourage the marine interests.

For the advantage of navigation the improving of ports is also demanded. Breakwaters or dikes for safety of anchorage to protect against gales, piers constructed of iron and steel at which vessels may receive and discharge their passengers and cargoes, abolishing the tardy movement of goods in lighters, and docks for repairs must all be provided. The iron and steel industry must be established and encouraged. These are the most important matters to consider. If these are not in complete shape natural facilities will never give permanent benefit. Owing to the lack of good docks in the country, all vessels hurry to Shanghai for repairs.

As the means of communication develop, bringing nearer the relations of countries, competition in trade becomes more active, and prompt shipments are a great advantage to trade. The reason of the supreme power of England on water is her farsighted improvement in shipbuilding, using steel instead of wood, employing steam engines instead of sails, thus paying regard to speed. The improvement of ocean transportation lies in the direction of larger vessels of rapid movement; competition is always to the advantage of the vessel of large capacity and speed. Japan's trade is increasing by strides unparalleled in her history, and her lines of steamships are running to all

important parts of the world, but the improvement in transportation is not equal to that of trade. Merchants are paying an enormous percentage of their profits to alien vessels for carrying their cargoes, and other nations are making every effort to keep our vessels out of this lucrative field. This fact is due to our small number of large ships, their slow speed and small number of trips. To have our own freight service is essential to the proper increase of our trade. Of course it seems ridiculous to build large vessels of great speed when the cargoes are not sufficient, but, as stated above, the tendency of the world is to build large vessels with sufficient speed, for it is penny wise and pound foolish to try to compete with small capacity and less speed, although it would be cheaper.

No nation can be prosperous without good inland transportation. The general advantage of railroads to our country is well shown in the development of the interior and the increase of freight carried. In the last twenty years there has been an increase of railroads of 4,822 per cent in mileage, due mainly to the growing prosperity of the country, but also in part to the individual efforts of those concerned in the management of the railways. Railroads, it goes without saying, as a means of defense, finance, and economics, are the most important media of the progress of a country. The way to utilize these media is to build them all over the country with the latest improvements, cheapening the cost of transportation and giving quick delivery of products in the markets. Comparing Japan's with the railroads of the United States and Europe per capita, per mile, and also with traffic, I am sorry to say the fact is our railways do not compare favorably with the railroads of those countries.

Suggestion as to the improvement of railways is very hard to make without a knowledge of civil engineering. The social, political, and economical significance of this subject will be greater in the future than now, and the country feels it. Railway councils have been appointed, composed not only of representatives of the various government departments, and the army and navy, but also of prominent representatives of commercial interests, of the learned and practical men of the country, and their earnest effort and efficiency, no doubt, will improve the system. Let me mention some things here:

1. The removal of the law of maximum price, which is fixed the same all over the country, is needed. It would be extremely difficult to make a general law for large and small towns, since the development of business varies radically in different districts. The manager of each company wants to have the largest amount of net income by the increase and decrease of the fare. The formula is $(x-c)\,dy-y\,dx=0$ (Hadley). Let the companies decide what is best to be done under proper control by the Government, allowing them a reasonable rate of profit and preventing them from injustice to the people.

2. Rails ought to be improved, together with the improvement of engines, their speed, and also increase of traffic. Improvement has been made; steel rails have been substituted for iron, but the 60-pounds-per-yard rail was used from the beginning and is still used, while the weight of engines increased from 22 tons to 80 or 85 tons and the speed from 14 (in Government) to sometimes 50 miles per hour. With the improvement of rails the roadbed and ballast ought to be studied by specialists. The rock ballast is used in the United States railroads, and the drainage of the road is well provided for, which is very important to keep the tracks in good order.

3. Tracks: The single-track system is almost inadequate to meet the growing demands. Double tracks, or quadruple tracks, should be more generally used for quick delivery of goods and also for safety from collision and other accidents.

4. Water supply: The country has an immense number of rivers and abundant water, and therefore the method of getting water supply from the track while the train is running should be used, which will certainly save time and also work of the manager. Often it is the case that trains stop for a long time to fill their tanks.

5. Scarcity of locomotives and cars: The number of locomotives and cars per 100 square miles is very small compared with the United States and England, as follows, in 1896:

	Engines.	Passenger cars.	Freight cars.
Japan	26.3	100	366.4
United States	19.8	184	718
England	87	275	2,907

While the hauling power of mileage per one year is:

	Engines.	Passenger cars.	Freight cars.
Japan	21,621	29,783	770
United States	20,348	16,375	529
England	18,170	15,826	533

So more cars should be used, although in the passenger traffic the character is entirely different, as one small car carries 80 third-class passengers, while in the United States such a car carries about 30.

6. Much has been said about the improvement of stations—lack of storerooms; but I may say that the improvement of yards should be preferred, in order to shift the freight cars according to distance and importance.

7. It is advisable to abolish the uniform classification of freight by the Government, because where there is competition by water, lines handling heavy and bulky goods should be classified differently from those lines where there is no competition. The kind and location of goods to be carried should also be considered; therefore the classification on freight ought to be fixed by each different line.

8. Division of labor: The road should be divided into parts, and superintendents should be appointed for the divisions, to whom supreme power should be given over the tributaries to it, and under whom the engineer, the supervisor, etc., would each have his own share of work.

9. There should be established a society or club of employees in order to improve themselves as in the Young Men's Christian Association of the Pennsylvania Railroad, instead of continuing to employ unprogressive but cheaper men. Of course the standard gauge might be preferable from the point of efficiency, but the expense would not allow it at present. But I hope that when a new construction of railroad is undertaken there shall be some preparation for wide gauge when needed.

The subject of State purchase of railways was the most exciting question in 1899. The twelfth Congress of the country thoroughly discussed the matter and finally decided to let it remain as it was. But this question can not be said to have disappeared entirely, for the railroad history recalls that the subject was repeated three times in 1881, when the first private railway corporation came into existence. There was great agitation for State ownership, not only among those who are interested in railways, but in every quarter of the country, but private ownership won. In 1890, when the industrial disturbances occasioned by the great earthquakes made the railroads unprosperous, their purchase by the Government was urged to rescue them from the panic. The Government refused and won its struggle. In 1893, when the railroads were very prosperous, everybody began to talk about improving the means of transportation, and complaint arose of the management of the State road, which was about 376 miles long. The insufficiency of the funds of the Government was the cause of this agitation in favor of transferring all railways to private corporations. The railroad association opposed. The popular reasons of the advocates of State ownership were:

1. As a part of one consistent scheme of national defense; by army officers.

2. Simplification of freights, together with greater uniformity and cheapness, preventing unreasonable discrimination; by merchants.

3. To develop the whole country's resources, so that those places which would otherwise be left without means of transportation should be helped by the paying portion of the lines and the public should be generally benefited; by country gentlemen.

4. Feared that foreigners might come into possession of the railways, unless Government secures them; by short-sighted non-economists.

5. Good fiscal policy; by treasury officers.

6. Large combinations of industry under one management are beneficial to the community; by nonstockholders.

7. Remedy of scarcity of business capital or tightness of money market; secured by foreign loan; by self-interested money wanter.

8. Competition of private railways favor large towns; by country gentlemen.

I am sorry to state that it has been suspected from the outset that many of the so-called advocates of State ownership were the motive power in the movement, and published stories for the purpose of "rigging" the market. The failure of the party of State ownership in 1899 was due to the insufficiency of their method of purchase, and in consequence of the lack of funds in the Government. I am of the opinion that the railroads should be kept in their present state and am glad of the decision of the Congress. I may oppose it if in the future the case occurs again:

1. In Germany and France, whose boundary lines are contiguous, the State ownership of railroads is entirely necessary, but in Japan, being well protected from invasion, as I have said in the introduction, it would be better to leave the matter to private corporations.

2. Of course cheap rates would give increased commercial activity, but often governments utilize the railroad revenues for the deficit of the public finance; therefore the cheapening of the rates may never come.

3. If the country had plenty of revenue, it would be possible; otherwise it would increase the burden of the people; better give some special privileges to private companies.

4. If the Government has proper control or regulation over them, there is no fear of their going into the possession of foreigners; if not, it is desirable that they should, if improvements would result from their better management.

5. A merely fiscal policy is in conflict with Nos. 2 and 3, and also it is doubtful whether the Government is wise enough to manage as well as private business men.

6. Large combinations of industrial organization are good for any business, but private companies could combine most effectively under circumstances where the locality is favorable.

7. I am in favor of the purchase of private railroads by the Government if a foreign loan can be secured low enough, but to buy up all private railroads at a fair and just figure is impossible. The only way is to buy them in the daily market, fixing the maximum price on the Government side. As to the importation of foreign money, it is desirable not only to improve railroads, but also industry and trade, but when it comes to this question the country must show to lenders prosperity and safe security, which is now lacking in the country; the only way is to improve industry and make the country prosperous, and this will naturally cause an inflow of foreign money.

8. Competition among private railroads, etc.: The most striking influences of the growth of railroads are seen in the concentration of people in cities. The cities are growing larger and larger, although the small town is growing year by year, especially fast where the factories are. Competition is a good thing for the community if it is not "cutthroat."

The best enterprises have been constructed entirely by individuals. This gives mental education, a mode of strengthening their active faculties, of exercising the judgment, and better improvements of the road because of self-interest and of competition. This would avoid the great evil of adding unnecessarily to the power of the government. Mill says: "To avoid class feeling, which is the great evil of society, and to give equal opportunity to all fellow-citizens who are fit to use it, and to avoid increasing the burden of government obligations is the wisest plan." President Hadley says: "Government management involves corruption unless the civil service is improved. Therefore let us have private railroads."

Postal, telegraph, and telephone systems are in a sufficiently good condition, although many complain of misdeliveries. It can not be stated here as to the utility of telegrams in trade, for the statistics do not distinguish the number of public, private, and merchants' dispatches and receipts. An enormous amount was collected in the telegraph office, but the fact is that almost all of it was for political and diplomatic uses and very little for trade purposes. I hope that the country merchants will utilize this facility more and more, and with quick communication take advantage on their sales.

ARTICLE II. INDUSTRY.

The nation as a whole has held the physiocratic doctrine and has thought the only proper way is to cultivate the land in rice and other agricultural products. Different conditions in different districts, as weather favorable to one crop and unfavorable to others, produce a variety of crops, but rice is generally a good crop everywhere. The food of the people is mainly rice, and this rice crop was thought the only source of growth of the country. The majority (about 70 per cent of the people) is classed as farmers or peasants, as compared with 40 per cent in the United States and 15 per cent in England. This great amount of agricultural products is of great importance to the workmen, whose comfort and family happiness are largely due to the price of rice. On account of the lack of funds among the agriculturists, the method of cultivation, the implements used, and the manures are not sufficiently studied, although great improvements have been made. These agricultural products have only one harvest in a year, and they depend on escaping the annual storm, which usually occurs at the change of the season from summer to autumn, when rice is blooming. This storm often destroys considerable products, and the labor which they spend with a hope of a good harvest return is gone without compensation. So our agriculturists should study all the scientific appliances in use in western countries, as manures, latest implements for labor saving, and should utilize the machinery for obtaining a water supply instead of depending on the water afforded by rivers about which they struggle when dry weather comes; and they should also give attention to controlling the river flood. The recent rise of prices gave prosperity to farmers, but the total production for years has remained almost stationary, and the area under cultivation also has not changed, showing that the stage of increasing returns has already reached its maximum, and almost all cultivatable places have been touched with the plow and are getting into the stage of diminishing returns. But the increase of population is enormous, about 400,000 being added yearly, and therefore most of the arable land must be devoted to the production of food stuffs; the country must strive to establish manufactures and endeavor to export largely and receive raw materials and food stuffs in exchange. Even now the country has to import a part of its food supply, and the physiocratic doctrine has gone out of existence for us. But the maintenance of home agriculture is, from a military point of view, most necessary in order not to be entirely dependent on a foreign food supply, although a blockade of the whole country is inconceivable. Economically, also, agriculture, especially of the mulberry tree and the tea plant, should be studied and improved. The great factor of our safety is an improved method of transportation which would enable us to produce rice and other crops where they can be raised to greatest advantage, creating new areas of cultivation which no application of capital and labor can otherwise overcome. Prof. Mayo Smith says: "The grand fact indicated by the statistics of agriculture and of agricultural production is that Europe is depending more and more upon new countries for its bread, meat, and the raw materials of manufactures. In 1890 41 per cent of the imports of Great Britain consisted of articles of food and drink; 30 per cent of raw materials of manufactures. England is supplied with food and raw material by new countries, while it employs its labor in turning out manufactured goods which it exchanges for them. From 1852 to 1859 Great Britain produced three-fourths of the wheat it consumed. In 1889–90 it produced only 31 per cent of what it consumed and imported the remainder. England gets two-thirds of its wheat supply from abroad, all its cotton, most of its wool, and a great deal of its iron ores." The great fertile plains of North America, South America, Australasia, and Russia have become the world's producers of grain and provisions and are increasing their demand for textiles, while Japan stands ready with her silk and tea. Africa tenders its gold, diamonds, ivory, and native tropical products, all of which are required by the great manufacturing centers of the United States and Europe, which can give in exchange their manufactures of cotton, wool, silk, iron, and steel. Thus commerce is constantly increasing its volume by its own activity. The advantages of industry and trade depend upon the principle of division of labor. Each locality in general produces that which it can produce to the best advantage cheaper than others, and each country should prefer what is most profitable to it. Japan can be turned from rice growing to an industrial country and the production of silk and tea, which are so much in demand the world over. This would be advantageous to Japan because she would make a greater profit by this exchange,

and all sorts of labor would be more productive and would command more real wealth. Owing to natural advantage of situation and to facilities for obtaining abundant supplies of raw materials, both at home and from abroad, the policy of manufacturing is by far the most advantageous to the country. Moreover, rice is not the general food of Europe and the United States, and their supplies of rice in Europe come from Calcutta, 45,700 tons; Siam, 37,401 tons, and French Indo-China, Burma, 716,000 tons; Saigon, 160,619 tons in 1896, which countries have an advantage over Japan in the cost of transportation and in quick delivery. The only place for export is to China, but there are immense rice fields in China, producing immeasurable crops and promising to export all their surplus when the present trouble is over. British India, French India, and Java are also great rice-producing countries, and the United States would come to produce it if other countries demanded it by an increase of consumption which would warrant an increase of production. Still more, the agriculture of the country is unlike that of the United States, where large amounts of capital are invested and the most improved machines are used and the fields are cultivated by many laborers, by which the division of labor is utilized as in factories. In Japan agriculture is conducted on a very small scale, most of the farmers cultivating by themselves, getting just enough products to support their families. Again, the country has a supply of natural water power in the mountains and rivers which can be easily conveyed in the form of electricity to accessible points for use in manufacturing, affording opportunity for the skillful and energetic workmen using the latest machinery. In every point of view the profits of manufacturing are steadier than the cultivation of rice, which largely depends on rain and wind. Then, is not manufacturing preferable and most suitable for the permanent development of the country's economy? Let us observe the relative importance.

I. The silk industry will naturally come first. The difference of food for the silk worm, land, and climate produces different kinds of cocoons. Mr. Fukazawa, one of the most experienced authorities, states:

"(*a*) From the leaves of either very young or very old trees: Lands distant from the ocean, having a dry hot climate with few fogs, when a chlorate fertilizer is used will produce easily good, elastic, bright cocoons, but in small quantities.

"(*b*) From the leaves of young trees on newly cultivated land: Lands near the ocean, having a moist, cold climate with heavy fogs, where a carbonate fertilizer is used, will produce hardy, fat cocoons, in good quantity, but not good quality.

"It is impossible to get perfect cocoons. The manufacturer ought to select that kind most suitable for his own business." Japan as a whole, in its climate and location, is suitable for the production of the latter kind, although it produces different kinds in summer and spring. Thus Japan has its peculiarity in the cheaper qualities, which the United States and European continents are not able to produce, and the consumption of silk in the world has a tendency toward cheaper quality; that is, the people of the United States and Europe are beginning to use silk dresses for general wear, and the use of goods of high quality has begun to decrease. The only competing countries are France, Italy, Switzerland, and China, but Japan's cheapness of production defies all competition, so in France the manufacturers can not continue their work unless the Government gives enormous subsidies or bounties, amounting to $2,000,000 a year, or $100 per 100 pounds. This cheapness was not due to competition, but to the depreciation of prices, which was caused by our Japanese merchants selling silk goods without a knowledge of the quotations of gold and silver. When gold appreciated the nominal price in silver was larger in our market, while the New York price remained the same, and in fact our merchants sold goods under value. Thus, the price of silk was lowered, while the consumers of silk are increasing year by year. This is in contrast to the law of demand and supply. Nevertheless, this is the actual condition; yet it is not too late to cure this evil by better management among silk dealers.

II. Heretofore raw silk was exported and thought to be the most stable manufactured commodity. Silk clothing or spun silk was exported to the amount of only several thousand dollars in 1887, but in 1899 the export was—

	1899	1896
	Yen.	*Yen.*
Silk fabrics	15,799,014	7,052,217
Silk "kaiki"	1,451,952	233,803
Silk handkerchiefs	3,461,572	4,617,720
Total	20,712,538	11,903,746

24 per cent of the total silk export of 86,116,096 yen in 1899. This comes next to spun cotton, and is about three times as large as the export of tea, 7,699,625 yen. This would be the most important export article in a few years if proper improvement were made, because the country has plenty of raw materials near at hand. It has skillful laborers, and also the people have an intelligent idea of design. In fact, all the conditions are advantageous to this industry, it having no large competing fields in Europe and America.

III. The future of cotton yarn, matches, straw braid, matting, the porcelain and pottery industries looks most promising, as is evident from the increasing amount of yearly production and the growth of exports.

ARTICLES.	1887	1895	1898	1899
	Yen.	*Yen.*	*Yen.*	*Yen.*
Cotton yarn	.....	.....	1,034,479	28,521,438
Matches	941,577	1,843,637	4,672,811	5,890,666
Straw braids	350,450	193,776	1,387,643	2,770,178
Floor mats	36,296	656,123	3,461,370	3,717,489
Pottery	1,311,901	1,287,026	1,955,060	2,181,336
Paper	226,742	418,549	964,690	1,357,626
Green tea	5,761,175	5,526,051	.....	7,699,625

The demand for cotton yarn, matches, and pottery will be greater when peace with China is declared, since these industries are supplied to that country with raw materials most advantageously. Recently the exportation of porcelain and earthenwares to all parts of the world, especially to the United States and China, has increased, not only those of original styles, but of all kinds. Imitated styles for parlor ornaments can be seen in almost every house in the United States. The merchants are trying to produce lighter colors, which would be appreciated, being much cheaper than American and European made, although its frailty would lessen its general use. If it could be made lighter in color and more substantial it would be more profitable to the merchants as well as to the consumers. The number of paper factories will be very large, because there is future promise for their growth.

IV. Besides industries for export, there are many important industries which would meet domestic demands; such as brushes, soap, woolen goods, clocks and watches, and would diminish imports, especially in woolen goods. In 1897 the import of wool was 1,062,398 yen, but increased to 4,324,427 yen in 1899, while the importation of manufactured goods decreased from 9,479,719 yen in 1897 to 8,252,750 yen in 1899. The importation of clocks and watches has increased from 687,734 yen in 1892 to 3,298,295 in 1898, and decreased to 455,559 yen in 1899. The cleverness of workmen in reproducing articles is promising for the future of exports to China and other Oriental countries.

It would be too tedious to enumerate the various other branches of industry.

However, the future of manufacturing is assured, though it is still in its infancy, as can be seen in the small demand for coal in the country and the retrogression of lacquer ware manufacturing, which goods were once exported to Europe and America to the amount of more than a million yen. But the heat on the voyage melted the glue in the ware, and when used with hot water the whole thing was spoiled, and now the export is only to Oriental countries. This subject is not one for pen and ink discussion, but for practical improve-

ments. Manufacturing needs complicated machinery, and the more the industry improves with the increase of invention of labor-saving machinery the more is there need of highly skilled laborers, who know, at least, the movements of machinery and its processes. Our day laborers at present are personally good for little, but labor is the greatest and most important factor of the wealth of a country. It is worth while to study how to improve the condition of the laborers, to increase the standard of intelligence among them, and to give them industrial education and make them fully acquainted with the work, and thus increase their usefulness; otherwise the factory would become a place where the ignorant and the lower class would be gathered and industry would retrograde; pauperism would increase and finally destroy all the resources of the country.

As to the betterment of industrial conditions, industrial improvement, and the elevation of workingmen, Mr. Victor H. Olmsted gives some very interesting summaries in the United States:

"1. Club organizations, in which employees are banded together for social, educational, recreative, and other purposes incident to such associations.

"2. The encouragement of physical culture by means of gymnasiums, calisthenics, base ball, bicycle, and similar exercises.

"3. The improvement of intellectual conditions by means of free lectures, libraries, kindergartens, and educational classes.

"4. The increasing of industrial efficiency through industrial schools and manual-training classes.

"5. The advancement of spiritual life by means of Sunday schools and general religious work—making people moral and creating intellectual aspiration.

"6. The cultivation of musical taste and ability by means of concerts and musical entertainments for employees, and the encouragement of musical clubs and organizations among them.

"7. Promotion of improved social conditions by means of social gatherings, summer outings, meeting places, and game rooms for employees, banquets, dances, etc.

"8. Profit sharing with employees.

"9 The promotion of the personal interest of employees in the successful conduct of the business by encouraging and assisting them to purchase shares in it, thus, in effect, taking them into partnership.

"10. The improvement of domestic conditions by means of improved dwellings, instruction in sewing, cooking, and housekeeping, and in landscape and kitchen gardening, and the exterior and interior decoration of homes.

"11. The care for employees' health and comfort by means of bathing facilities, dining and lunch rooms, the furnishing of hot lunches to female employees, and by improved sanitary construction and appliances.

"12. The care of sick and disabled employees and their families by means of free insurance, free medical attendance or hospital facilities, and by the encouragement of beneficial organizations.

"13. The cultivation of thrift through savings-bank facilities, building associations, or provident organizations, and by the giving of prizes for valuable suggestions of employees and rewards for faithful service or the manifestation of zealous interest in their employment.

"14. The rendering of financial aid to employees in case of hardship or distress.

"15. The manifestation of interest in the personal affairs of individual employees, the cultivation of cordial and even confidential relations with them, and the promotion of their welfare in all possible ways."

These are worthy of general adoption.

As to the improvement of industry, this would naturally follow from competition with other strong countries. Then the great economical subjects to be studied are the effect on wages, profits, and improvement of laborers.

The defects in the manufacturing industry of our country at present are—

1. Factory: (*a*) Insufficiency of ventilation, as in our printing, tobacco, textile, rug, match, and iron factories; (*b*) lack of space, as in factories of large employment, as in matches, bookbinding, tobacco factories, etc.; (*c*) too small entrances, often resulting in blockades in cases of panics; (*d*) narrowness and disorder of gateways in factories; (*e*) uncleanness of dining, resting, bathing, and toilet rooms.

2. Machinery: (*a*) Leaking of poisonous gas; (*b*) the insufficient care of dangerous chemicals; (*c*) imperfect arrangement in regard to dust; (*d*) carelessness in handling machines; (*e*) lack of protection or remedy against accidents by machinery; (*f*) imperfect methods of fireproofing; (*g*) unsafe lanterns or light.

3. Laborers: (*a*) Difference in hours of labor; (*b*) difference in wages on extra work; (*c*) lack of uniformity in recess hours; (*d*) work in recess hour; (*e*) no limit as to age; (*f*) no limit on hours for child laborers; (*g*) no system of instruction for child laborers; (*h*) depending too much on foreman as to the laborers, employment, discharge, and wages; (*i*) no by-law on compensation for damages when discharged; (*j*) food and goods given as payment; (*k*) imperfect system for the care of the sick and the injured among laborers; (*l*) no regulation as to assistance on the death of laborer while at work; (*m*) mixture of male and female workers; (*n*) no supervision over apprentices; (*o*) no regulation about the running away of employees; (*p*) many defects in the method of securing employees by commission; (*q*) no penalties for damage of machinery or other things by the bad intention of employees.

4. The articles produced: (*a*) The variety of quality, caused by the lack of large factories and by small capital; (*b*) cheap quality, lack of capital investment, which does not allow the factory to buy machinery with the latest improvements; (*c*) uncertainty of time of contract. This is also caused by the lack of large factories. All factories which exist to-day are on a small scale, except a few in cotton spinning and a few others, and they buy their raw materials with the money just got from the sale of goods, and never look forward to improvements, but seek merely the present small profit, and can not even repair machinery. When a large order comes the merchants can not meet it because there is no factory large enough. The only thing for the merchant to do in this case is to go round to several other small factories and get their help, which from the difficulties in finance or other economical circumstances often can not fill their orders at the proper time. Nor do they care very much about their promises; therefore there is no confidence, for if there comes any higher bidder for the ordered goods they are easily tempted to sell. (*d*) In finished goods they can not follow the fashions. All sorts of luxurious things have usually a fashion. Without a cultivated taste the manufacturer can not anticipate the coming fashions abroad, and therefore can not make any new design, but must weave just according to the foreign order. So to meet this the managers or designers ought to read art magazines and newspapers, and go often to the countries with which they deal and study for themselves.

Generally the mode of remedying the above four defects is to establish large factories, put in the latest machinery, employ good managers, keep the firm in good order, contract for sufficient raw materials, and produce the best possible quality, which then can be sold by samples. The economic principle of the relation between production and consumption is: The more we produce, the cheaper we can sell; the larger, therefore, the consumption. An increase in the demand provides more hands with work, at higher wages, and consequently results in a further increase in the consuming capacity of the nation; and this again leads to a further opportunity for extension of production. The tendency to concentrate business organization finds expression in our country. The Government holds an absolute monopoly in the sale of camphor and tobacco in all its forms. The word "trust" has not become hateful, and the subject is popularly discussed. Thus the concentration of capital and production on a large scale will be the system of our future. As it is, very many of the smaller units have disappeared and are all in favor of further amalgamation. The result of the organization of trusts and the establishment of the syndicate system has been to cheapen production, to control and maintain profitable prices of the output, to give advantage to laborers with the greatest possible saving of materials, to apply newest machinery and newest technical improvements, and to improve the quality of the product in order to get more consumers; for competition allures by the prospect of gains, gives confidence to the producers. Large organizations of capital enable better managers to be obtained by giving better salaries, and this enables these organizations to offer strong inducements to commerce and to increase the future greatness of industry and trade. But for the good order of the community there is need of public supervision and control.

There are many agricultural institutions for study and investigation, but there are no institutions for the investigation of industry. The establishment of an institution of this kind, which would undoubtedly be of great benefit to manufacturers, is expected. Germany, for instance, has spent considerable money for this purpose, shows great improvement.

The exports of minerals are increasing very rapidly, as coal, copper, etc.; they are important products of the country, and their laborers would be improved by the better system which I have described. Combinations would also be expected in this line.

Fertilizers were imported to the amount of 7,934,189 yen in 1899. If improvements were made in our marine interests these enormous imports would be superseded by our own country, as the country is located most advantageously for securing fertilizers, and it has good customers for them in its near neighbors. This industry would be great in the future, and would have a great influence on the wealth of the country, for the natural field is very great and the product is exhaustless. The only thing needed is encouragement from the Government.

ARTICLE III. TRADE.

Trade is the result of differences in comparative cost of producing the articles traded in, though this law is limited by the natural hindrances to trade and the competition of different countries. A country derives great advantages from foreign trade, which is in one point of view a development of the division of employments, and is at once a cause and an index of civilization. Questions of trade are every day becoming more prominent in Japan as well as political questions, of Oriental diplomacy, and they occasionally even overshadow political ones. Competition for the world's markets must necessarily become keener as the struggle for existence becomes more severe. The means to secure this trade must be carefully considered by the state and individuals, and are already being carried out with method and zeal on all sides.

Not only are almost all commodities of our country transported in foreign vessels, but the trade of the country is also carried on by foreign merchants. More than 67 per cent of our exports and imports in 1898 were by foreign merchants. Why, having the best location, in the center of the Oriental trade, with the best facilities, can not we conduct our own merchandising? Of course trade never exists without the development of internal and external transportation and industry. Now, it is the chief duty of our people and the Government to investigate this matter; for the country has already many customers in the United States and Europe, and it ought to control the Oriental trade. Let us observe the trading power of the Orient and of other countries with which our trade is not yet very active.

1. China in a few years, whether division of that country takes place or Russia controls it or the country stands independent, will be a great customer for our copper, marine products, pottery, matches, cotton goods, and silk; and in payment we can get food and other supplies. The demand which China will make upon us will be the greatest she makes on the world, because she has over 400,000,000 population. Many lines of railway are going to be built, giving facilities for transportation, and the present trouble will surely result in the introduction of modern civilization. The more she develops, the more will be the demand for our products. The relation between China and Japan is very similar to that between the United States and England, or perhaps we have a greater advantage because of nearness and the larger population in China.

2. Trade with eastern Russia will also become great in the future. Our imports of her abundant crops and meats and her general demands on Japan for manufactured goods in payment will be very great.

3. The trade of Korea is already in our hands, but needs more development.

4. With the Philippines, Sumatra, Annam, Siam, and the neighboring islands trade will be great in exchanging silk goods, fans, pottery, copper, and coal, for which we will get sugar, hemp, etc., for these countries usually exceed in exports; so there is opportunity to increase our exports of manufactured goods.

5. British Australasia is still in process of development, having about 3,000,000 square miles, with near 4,973,900 population, and is going to be very prosperous. Japan will be able to exchange her tea, silk and other manufactured goods with that country for wool and other luxuries. Great attention must be paid to Australasian trade, for it has great promise.

YEARS.	Exports.	Imports.
	Yen.	*Yen.*
1883	438,000,000	91,000,000
1887	535,000,000	32,000,000
1891	575,000,000	228,000,000
1898	765,000,000	668,000,000

6. India: England controls everything; but India needs our cotton goods, pottery, wood ware, and copper in exchange for raw cotton, salt, and pine and oak lumber.

7. New York and Boston trade: The Nicaragua Canal would reduce the cost of transportation from Japan to New York and Boston by about 30 per cent; for the charge by railroad is five times greater than ship transportation, though the latter takes a longer time.

8. The southern United States cotton and wheat would come to China and other Oriental countries, and on their return trips the ships could carry our silk, tea, and other manufactured commodities at reduced rates to American markets. Also the vessels from Europe to the Orient would take the route by way of the United States, and Japan would become their Oriental terminus; and if our country should have good docks and shipyards she would be the place for repairs, coaling, etc., and thus our trade would become more prosperous and our coal trade would be great.

Owing to the great attraction of Oriental commerce, competition for that trade will become greater, and commerce will concentrate in the most convenient places. As the greatest market is in the East, the East will attract the merchant fleets of all nations. Its favorable situation at the starting point of an important line of transport will undoubtedly cause Japan to flourish. It is a proud and high duty to bring our country to the center of this great Oriental trade of the whole world.

I would like to add two more suggestions before the conclusion. The important thing in foreign trade is to gain intimate acquaintance with the customers; to know their tastes and discover the articles which they can not produce, or the high cost of production of which forbid them to compete. If nothing better offers, let our consular officers go into business circles and endeavor to find in foreign ports new outlets for the products of our country, and seek to develop the trade already existing. For instance, Japan can make handsome bonnets, but does not know how to meet the requirements of fashion in the United States and Europe. Therefore the bright and active consul abroad, with a perfect knowledge of foreign wants, tastes, and methods, is necessary. Another very important and necessary thing is to give the people technical and business education. Through lack of this education merchants are not trustworthy, delaying the date of orders, changing contracts, selling things ordered to other and higher bidders, and often furnishing goods of lower quality. Hence our merchants can not sell goods by samples. England made great progress in business by her sales by samples. So sales by samples ought to be made in our foreign trade, and we should transact business in foreign markets with the prices fixed on the samples.

ARTICLE IV. CONCLUSION.

The world's statistics show that where there are great facilities of transportation industry and trade flourish. Where industry is prosperous transportation and trade are very active, and where trade is steady the other two improve; the three are always supplementary to one another. One feature is not prosperous without the others. The better the improvement of transportation the easier the communication, the more benefit to industry and trade. The more improvement in industry the more production, the more increase of trade the less will be the cost of transportation. The opening of the Suez Canal brought European civilization fully to the Orient. The great chain of railway through Siberia, and the Nicaragua Canal, which will be completed within the next few years, will bring more commercial prosperity to the Orient. Japan will become the great battlefield for the world's commerce, both for the termini of foreign trade routes from Europe to the United States and for the trade itself. The importance of internal and external transportation will become still greater, and it will be necessary to have a great surplus of manufactured products in the commodity fight to win the game.

The abundance of water in rivers running down in such narrow channels, and the enormous fields of coal, with railroad facilities,

will enable us to produce electric power to run our manufactories. The country is making considerable progress in finance, transportation, and trade. However, progress in these three merely does not make internal prosperity, but a nation's financial condition depends on the material prosperity of its people, the bulk of which in Japan is in the manufacturing industries. These have the advantages of near-by customers, motive power of electricity, and great opportunities for procuring raw materials and cheap wages, thus being the best-fitted country for manufacturing. And a proper combination of labor and capital in the superior organization of industry will yield a much greater return and will contribute largely to the total wealth of the country.

The people participate in every effort which promises them a cheaper market, or one in which they can purchase superior goods at equal prices. It is gratifying to be able to state that the commerce of the country shows a marked increase in the practical intelligence of the manufacturers and exporters in promoting trade, and presents a mass of evidence as to the steady growth in popularity in foreign markets of our goods, as well as of our raw materials and minerals. The danger is in a falling off in the standard either through carelessness or the mistaken desire to obtain large present profits by lowering the quality. The foreign trade represents the foreign policy of the nation, its relation with other countries, the extension of its influence abroad; its position in the world and its prosperity at home. To make a joint effort toward securing regular and economical means of transportation the Government and people have to inaugurate a policy of vigorous internal development, and to concentrate their efforts on enlarging the export trade. The free-trade policy of Japan is of great importance, for retaliation is a dangerous weapon, costly at the best, and in case of failure hurtful to sound commercial relations with other countries; and a protective policy is suitable only to new, large, and influential countries, like the United States.

Our country is young in commerce, and has a great opportunity to adopt the best methods and improvements, which other older civilized countries got after many years of discussion and experience. If, as I stated in a previous chapter, to give laborers better education, to improve manufacturing industries, with better facilities of transportation, and to give a larger field for foreign trade will not disturb the trade balance, why, then commerce will develop and bring wealth to the country. Thus by prudently and gradually developing the resources of the country the large expenditure of the Government, which now hinders the industry and burdens the people, will be most willingly contributed by the people, although the maintenance of constant watchfulness to prevent waste and a further reduction of fiscal burthens are to be hoped for soon.

In the recent trouble in China in the international alliance Japan held a most important place. This shows that she has made most rapid improvement since a few years ago, and it displays the power of a nation acknowledged to stand parallel with European and American civilization. Now is the time for Japan to show her ability and her progress; and the twentieth century will show the greatest measure of her commerce, with the United States and England as "the three sisters of the century."

THE ADOPTION OF THE GOLD STANDARD IN JAPAN.

The statements which follow regarding the adoption of the gold standard in Japan are from an official report upon this subject issued by the Japanese Government in 1899, entitled Report on the Adoption of the Gold Standard in Japan, by Count Matsukata Masayoshi, His Imperial Japanese Majesty's minister of state for finance. The report occupies more than 400 printed pages, and its complete reproduction is therefore impracticable. The statements which follow are, however, as far as practicable, verbatim extracts, with only such necessary condensations of the less important features as are required to render the statement a continuous and fairly complete history of the transaction.

The detailed statement is prefaced by an official letter from Count Matsukata Masayoshi, minister of finance, addressed to the minister president of state, which gives in outline the history of the conditions leading up to the change in the standard of currency in Japan and the methods by which the change was accomplished. In subsequent pages of the volume a brief statement is given of the effect of the newly adopted system so far as tested at the date of the report (May 1899), and these statements are in this presentation placed in immediate conjunction with the outline history of the event itself, thus presenting in continuous form a condensed statement of the cause, the action, and the effect, for the convenience of those who do not desire to study in detail the more elaborate statements of facts which are presented in subsequent pages.

The complete volume from which these extracts and condensations are taken is on file in the library of the Bureau of Statistics of the Treasury Department, and may be consulted by those desiring additional details.

OFFICIAL STATEMENT OF THE JAPANESE MINISTER OF FINANCE ACCOMPANYING THE REPORT UPON THE ADOPTION OF THE GOLD STANDARD.

DEPARTMENT OF FINANCE, *May 13, 32d Year of Meiji (1899).*

To His Excellency Marquis YAMAGATA ARITOMO,
His Imperial Japanese Majesty's Minister President of State.

YOUR EXCELLENCY: I have the honor to present to your excellency herewith a report on the particulars relating to the accomplishment of the monetary reform recently undertaken by the Government. To establish gold monometallism in place of a de facto silver standard is indeed a thoroughgoing change, and the influence of that change on the future economy and finance of the country will doubtless be great and far-reaching. The coinage law (Law No. XVI of the 30th year of Meiji) which brought about this great change went into operation on the 1st day of October, 1897, while at the same time the Government began the process of exchanging and withdrawing from circulation 1-yen silver coins, which process was closed on July 31, of 1898. The disposal of the silver yen thus withdrawn from circulation was also completed in December of the latter year.

The coinage system in vogue at the time of the restoration (1868) was based on the system that was first established in the 6th year of Keicho (1600 A. D.), and since that time, for more than two hundred and sixty years, no change had ever been introduced into the system. Yet, owing to the growing financial distress, the Shogunate Government frequently resorted to recoinage as its invariable relief measure, which in every case, excepting the solitary case of Kioho time (1715 A. D.–1734 A. D.), brought out coins of lighter weight and poorer quality. The coinage system was thus, though nominally kept intact, practically destroyed in the end through successive debasement. Besides, some of the Daimios (feudal princes) often took the liberty of secretly coining money, while the practice of issuing paper money for circulation within their separate jurisdictions had become well-nigh universal. In a word, the currency system of the country at the end of the Shogunate period was in a most disordered condition.

Soon after the restoration the Imperial Government saw the necessity of reorganizing the existing system of coinage on a sound basis, and in May, 1871 (fourth year of Meiji), the new coinage law was promulgated, which opened the way for the final establishment of the gold-standard system. This is a fact that must be particularly noted in order to clearly understand the monetary system of modern Japan. However, the gold standard could not yet thus be at once established. In those days the universal medium of exchange in the trade of the Far East was the Mexican dollar, and the Government thought the interest of foreign trade would best be served by issuing, aside from the standard gold coins, the silver 1 yen (or trade dollar), equal in size and quality to the Mexican dollar, and by making it legal tender only within the limits of the treaty ports. So the provision was made in the new coinage law of 1871 for the coinage of the silver yen to be called Boyeki ichi yen gin (or trade silver dollar). At the same time the disordered condition of finance, especially the issuing of inconvertible paper money, drove gold coins out of the country with enormous rapidity. Under these circumstances, situated as the country was in the midst of the silver countries of the East, it was found impossible to maintain the gold standard. These reasons, as well as the inconvenience of maintaining the two kinds of money—one for foreign and the other for home trade—led the Government to issue Imperial ordinances Nos. XII and XIII in May, 1878 (eleventh year of Meiji), which made the trade dollar legal tender throughout the country, side by side with the gold coins. From this time on the country no longer maintained in reality a gold standard, but a gold and silver bimetallic system. This change must be regarded as one deviating step in the development of our monetary system.

The Government of that time should not, however, be too severely judged. The expenses of the revolutionary wars were very heavy, and the financial need was most pressing. Almost the only resort of the Government was the issuing of paper money. Moreover, when feudalism was abolished, in 1871 (fourth year of Meiji), the Imperial Government was obliged to take over all the paper money which had been issued by different Daimios, and for the adjustment of this class of paper money the Imperial Government was again obliged to issue further a large amount of paper currency. All these causes combined to raise the amount of the inconvertible paper money to an enormous figure.

The credit of these notes was at first exceedingly bad. This was doubtless due largely to the lack of credit of the Imperial Government itself, but also to the fact that the people could not free their minds of the sad experiences of the losses they had incurred on account of the various inconvertible notes of feudal times. The new paper money was shunned by the people, even at a large discount, so much so that the Government felt compelled to take steps to reduce its amount by exchanging it for the Government bonds, bearing 6 per cent interest, which were issued under the Kinsatsu (literally gold note) exchange bond regulations. Through these measures, as well as owing to the increase of the Government's credit, the hatred for paper money gradually wore off, the people finally even coming to prefer it because of the convenience of handling.

Matters were progressing favorably when, in 1877 (tenth year of Meiji), a rebellion broke out in the southwestern provinces. The Government was again obliged to resort to the issuing of a large amount of inconvertible notes, which brought on an inflation and consequent depreciation in the value of these notes. There was also another cause for this result, namely, the increase after 1876 of the amount of national-bank notes, due to increase in the number of national banks (owing to certain amendments in the national-bank regulation, which took place through Imperial ordinance No. CVI). The effect of this depreciation was felt in various directions; for instance, prices rose rapidly, gold and silver left the country, the imports soon came to exceed the exports, the farmers contracted habits of luxury, the industrial classes became over-excited with vain hopes of speculation. Thus was brought about the great financial distress of 1880-81. That disastrous results would inevitably follow if inconvertible paper money were made the standard of value might have easily been foreseen by mere common sense, but the measures adopted by the Government at this crisis seemed to show that the authorities did not grasp this simple truth. They regarded the difference in price between silver and paper as an indication, not of the depreciation of paper, but of the appreciation of silver. They attempted, therefore, to stop the rise of the price of silver by increasing the amount of its circulation. The Government sold silver coins, opened places for the exchange of Mexican dollars, and established the Yokohama Specie Bank in order to call forth the coins hoarded by the people. But the more these methods were resorted to, so much more rose the price of silver. The Yokohama Specie Bank finally became almost bankrupt, and no one knew how far the paper currency would go down in the scale of depreciation.

At last, however, the true method of relieving the financial distress began to dawn on the minds of the men in authority. From September, 1880, the Government began to take steps to redeem a part of the paper money in circulation. The depreciation, however; still continued without a sign of abatement. It was at this crisis, in October, 1881, that I received the portfolio of finance. It occurred to me, as I studied the case, that in order to effect the object in view the Government should, side by side with the redemption of a portion of the paper money in circulation, take steps to increase the specie reserve of the Government preparatory to the resumption of specie payment. Moreover, in order to put the country's finance on a sound basis and relieve the pressing distress of the time, I felt the need of a central bank having the sole privilege of issuing convertible notes. I submitted a scheme for the establishment of such a central bank to the consideration of my colleagues. In the cabinet council which followed my suggestions were approved, and in June, 1882, by Imperial ordinance No. XXXII, the Nippon Ginko (Bank of Japan) was established. Two years later, in May, 1884, by Imperial ordinance No. XVII, the Bank of Japan was empowered to issue convertible notes. After the necessary foundations were in this way laid, the Government used every means in its power to raise on these foundations a sound financial superstructure. The method of receiving and disbursing the Government revenue was changed, and the strictest economy was practiced in the expenditures of the different departments. One half of the surplus obtained in this way was devoted to the redemption of paper money, while the other half was added to the specie reserve of the Government. Besides, after the latter part of 1881 this reserve fund was employed for discounting foreign bills of exchange with a view to encourage the export trade of the country, which in its turn would lead to the importation of specie. Thus the Government took every possible measure, and left no stone unturned for the establishment of a convertible-notes system.

Thus took place on the one hand the gradual redemption of paper money, and on the other hand the increase of the specie reserve of the Government, so that not long after, about the close of 1885, the credit of the Government rose so much that the difference between the value of silver and that of paper almost disappeared. The opportune moment seemed now to have arrived to effect the substitution of the convertible notes for the inconvertible. The Government therefore gave notice by Imperial ordinance No. XIV, of June, 1885, that specie payment would be resumed after the 1st day of January, 1886. Thus at last was overthrown the system of inconvertible paper money, together with all the evils resulting from that system.

Previous to this the Government saw that the notes of the national banks were also in need of adjustment, and through Imperial ordinance No. XIV, of May, 1883, certain amendments were introduced in the national-bank regulations, the main point in those amendments being a method of conjoined redemption of the notes of all the banks. Thus the redemption of the bank notes began to take place, as also that of the Government paper money. The circulation of them both will cease altogether on the 31st of December, 1899.

While the evils of inconvertible paper currency were thus swept away, on the other hand, however, one effect of all these reforms was to make Japan a de facto silver-standard country. This was, perhaps, an inevitable step the country had to take in arriving at last upon a sound financial footing. The authorities knew, of course, that in order to give a healthy financial development Japan would have to enter sooner or later the international economic community, and that in order to do this she would have to adopt a gold standard. That the Government pursued a policy which led to the inevitable result of making Japan a de facto silver country was owing mainly to the great difficulty of at once accumulating a large gold reserve necessary for the establishment of gold monometallism. It was thought advisable, therefore, to leave the latter, as the second end to be aimed at, to some more favorable time.

The first cause of the recent rapid depreciation of silver we must attribute to Germany's adoption of a gold standard in 1873, in consequence of which she began to sell silver. Among other main causes may be mentioned the limitation and final cessation of the coining of silver in the countries of the Latin Union and the discovery of the rich silver mines of North America. When, however, in 1893, India, the greatest silver country in Asia, took steps to reorganize her currency system, the sudden fall in the price of silver was exceptionally noticeable. At that time Japan, being a de facto silver country, the effect upon her of this sudden fall was very great. Fluctuations in foreign exchange now became exceedingly frequent and unreliable. Business men lost a constant standard of value and became compelled to pay constant attention to the changes in the money market, so that foreign trade tended to become largely a matter of monetary speculation. It became more and more hopeless to expect to see the healthy growth of trade, both home and foreign. Thus was impressed most clearly upon the minds of the financiers of the country the necessity of adopting gold as the standard coinage in Japan, that metal being least subjected to changes in its price and most fitted for use as the medium of exchange.

The reform so necessary was, however, very difficult to undertake. Unexpectedly the reception of the Chinese indemnity seemed to offer the desired opportunity. Now, according to the terms of the treaty of peace, Japan was to receive her indemnity in Kuping taels. It occurred to me then that, on account of the inconstancy in the price of silver, as well as in view of the possible adoption of a gold standard by our country, it would be greatly to our advantage to receive the payment of the indemnity in British instead of Chinese money. The minister president of state, Marquis Ito, acting on my suggestion, negotiated with the Chinese authorities, which led to our receiving the indemnity money in pounds sterling.

Not long after, on my appointment to fill the post of the minister president of state, my efforts were immediately directed toward making preparations for adopting the gold standard. In February, 1897, the bill for effecting the reform was drawn up. There was, however, no little opposition. Some said the fall in the price of silver would rather encourage trade with the gold-standard countries, while the adoption of a gold standard by Japan would tend to decrease the amount of our exports to those countries. Others said Japan, situated as she was in the midst of the silver countries of the East, would be placed in a position of much disadvantage in her trade with these countries if she adopted gold monometallism. Some others said Japan did not produce a sufficient amount of gold to be able to maintain permanently a gold-standard system; yet again, others said the silver yen exported to foreign lands exceeded one hundred millions, and if all these coins came back for exchange, as might possibly be the case, the national treasury would have to suffer an immense loss. In the midst of all these oppositions the Government stood firm in its purpose, and the bill was introduced into the Imperial Diet in March, 1897, which, after being passed by both houses of the diet, was sanctioned by the Emperor and promulgated as law No. XVI on the 29th day of the same month. It must be looked upon as a most fortunate event, considering the future of the country's finance and the development of our national economy, that the gold standard was thus finally established.

For successfully carrying out the radical change that was thus accomplished I believe that the Government has been careful to take every necessary precaution. For instance, a part of the earlier installments of the indemnity was converted into gold bullion and conveyed to this country, to be minted as fast as possible into coins in the Government mint. In buying bullion much care was taken to secure it in the time and place most advantageous, so that so large an amount of bullion was bought altogether the process was accomplished without too great a disturbance of the market and without loss to the Government. The gold thus turned into coins between July, 1897, and April, 1898, amounted to 74,455,735 yen, which was kept in reserve for the exchange of silver yen. The process of exchanging was begun on the 1st of October, 1897, and closed on the 31st of July, 1898.

The total number of 1-yen silver pieces that had been coined since the opening of the Government mint at Osaka amounted to 165,133,710. Of this amount it is estimated that 99,508,740 yen were exported into foreign countries and never returned; 11,028,633 yen were taken abroad at the time of the war with China (1894–1895); 5,732,027 yen were sent to Formosa after the cession of that island by China and never brought in for exchange.[a]

On the other hand, the total amount exchanged for gold coins between October 1, 1897, and July 31, 1898, was 45,588,369 yen.[b]

Besides these, 460,904 yen had been recoined by the Government mint into subsidiary coins.

These different sums amounted to 162,318,673 yen, which still leaves 2,815,037 yen whose whereabouts can not be traced. Most probably they have been lost or worn out or been taken away by foreign visitors when leaving the country.

To make an estimate of the amount of the silver yen which would probably come back from abroad for exchange was no easy thing to do. Accordingly I had the most careful researches made as to the amounts of those coins circulating in Shanghai, Hongkong, the Straits Settlements, etc. It was made clear as the result of these researches that no inconsiderable part of them had either marks of private stamp, which unfitted them for circulation at home, or had been recoined into Chinese taels. Then, besides, a large quantity was being used as a medium of exchange in the Straits Settlements and neighboring islands, so that there was little prospect of their coming back. In view of these facts I estimated that no more than 10,000,000 yen would come back for exchange. It was gratifying that the result proved the almost literal correctness of that estimate.

Besides these silver coins there existed the promissory notes of the mint for the payment of silver yen, which had been given in exchange for silver bullion deposited at the mint by private parties. When silver coins were minted, these were to be handed over in exchange for those notes. Now the latter, which amounted altogether to 29,505,453 yen, were also all exchanged for gold coins.

The total amount of silver thus retired by the Government reached the sum of 75,093,822 yen. Of these, 45,588,369 yen came in partly through exchange for gold coins, and partly as taxes or in other forms of public payment; the rest consisted of the promissory notes of the Government mint.

It should be noted that the period of ten months allotted to the work of exchanging the silver yen was a comparatively short one, in view of the magnitude of the work to be accomplished. The authorities were not, indeed, without sense of the risk they were running; for should there be a slight hitch in the management the whole thing might have proved a failure. Yet on the other hand, if the time limit was much longer extended, it was feared that the return of the exported silver yen might become, in view of possible changes in the price of silver, unexpectedly great and thus embarrassing to the Government. It was also feared that chances for counterfeiting might perhaps be opened. For these reasons the time limit was made comparatively short, and exceptional care was taken to facilitate the process of exchange. The central Government treasury, as well as the 447 Government treasuries and subtreasuries scattered all over the country, besides the Yokohama Specie Bank, which served as agency for the Bank of Japan, and its Kobe branch office, were all directed to take charge of the work of exchange. Moreover, special permission was given to the people during the time allotted for exchange to pay taxes and make other public payments in silver yen. That no report has reached the authorities of any which failed to get exchanged seems to prove that the whole work has been well accomplished.

The Government had to find some proper method of disposal of these silver coins now suddenly brought in. They amounted, as mentioned above, to the sum of 75,093,822 yen. This large sum was disposed of as follows: 27,567,012 yen were recoined into subsidiary coins between the thirtieth and thirty-second fiscal years of Meiji (1897–1900); 40,786,662 yen were sold in Shanghai, Hongkong, and elsewhere; 6,740,148 yen were taken over to Formosa, Korea, and elsewhere, and expended in those countries. The whole amount was thus disposed of in just one year and three months after the new coinage law was promulgated. In thus disposing of the silver yen the Government took every precaution to sell them as speedily and as dearly as possible. At first it was feared that, owing to the fall in the price of silver, the Government would incur a loss of more than 10 per cent, but it was fortunate that the actual loss only amounted to 7 per cent, and that the sale was completed within a little over one year. The rate realized was even slightly higher than the average price of silver bullion in London at the time.

In disposing of these silver yen the Government incurred the loss of 5,397,581 yen, while the necessary expenses connected with the process was 155,731 yen, the two sums together making 5,553,312 yen, which had to be defrayed by the Government. This was, however, more than made good by the manufacture profit of the mint, amounting to 5,651,961 yen, which was obtained from the minting of subsidiary coins between the thirtieth and thirty-first fiscal years of Meiji (1897–1899).

As thus narrated, the new coinage law has been successfully put into effective operation and the disposal of the silver yen completed, so that Japan is now really a gold-standard country. I regret much, however, that I can not as yet present before your excellency in the present report the practical proofs of the advantage which that change has conferred upon the country. In the first place a sufficient time has not elapsed to test the real working of the new system, and in addition to the sudden industrial expansion due to the fact of the victorious war with China, the partial failure of the rice crops, as well as the going into effect of the new tariff laws, all combine to make the present financial condition of the country exceedingly complicated. Yet, judging from the condition of things after October, 1897, I can not but think that at least a part of the object aimed at has been attained. One good effect of the coinage reform is seen in the steadiness of the exchange value of money. While the prices of things have risen and fallen, according to the economic laws of supply and demand, no part of these changes was due to the result of a change in the value of money. For these reasons the industrial classes need be now no longer under constant apprehension of some unexpected changes in the value of money. Trade with gold-standard countries has been greatly facilitated through the unvariable rate of foreign exchange, as may be seen from the fact that since October, 1897, the rate of exchange on London has fluctuated only between 2s. 0.1611d. and 2s. 0.8071d. The trade with silver countries has also shown much activity. The exports to these countries have increased from some 54,200,000 yen in 1897 to some 69,800,000 yen in 1898. The imports also have increased in the same period from 65,450,000 yen to 77,170,000 yen. The hope of inviting capital at a low rate of interest from gold-standard countries, in order to help on the industrial growth of the country, will doubtless be realized before very long. These are, of course, but minor observations. That in the long run the advantages of the gold standard will be deep and abiding, conducive to the healthy industrial growth of the country, scarcely seems to admit of any doubt.

On one point, however, particular care needs to be exercised. It is possible that the state of coinage in Formosa may act as a disturbing factor in the successful working of gold monometallism in Japan. Much as it was desired to establish a pure and simple gold standard in the island of Formosa, it was found impossible to do so in view of the great difficulty of changing the usages and customs of the Chinese population in that island, and also because of the exceptionally close commercial relationship that is maintained between Formosa and the mainland. For these reasons while gold is made the standard of value, yet for a limited period of time the silver yen is to be allowed to circulate as legal tender at a value fixed by the Government from time to time.

There is no doubt that in order to lay the foundations of a national currency system firmly and lastingly it is highly desirable to supply enough hard money for ordinary transactions. It was for this reason that as soon as the Government took steps for the substitution of the convertible notes for the inconvertible paper money an increased appropriation was made for coining 10 and 20 sen silver pieces, so that as fast as produced they were issued in exchange for the paper money of smaller denominations consisting of 50, 20, and 10 sen pieces, the last-named 10-sen pieces being finally withdrawn from circulation on the 30th of June, 1887. The 50 and 20 sen pieces yet in circulation have been reduced now to an insignificant proportion. Besides, at the time the coinage law was promulgated there were in circulation more than 66,000,000 yen of the 1-yen convertible notes of the Bank of Japan, which were being used by the people in their smaller daily transactions. The plan adopted by the Government was to make the further issue of 40,000,000 yen of various subsidiary coins, consisting of 50 sen and other smaller denominations, and in exchange for these to retire the 1-yen silver notes of the Bank of Japan. When the plan is realized the total amount of subsidiary coins in circulation, consisting of silver, nickel, and copper pieces, will reach the sum of 81,820,000 yen, making about 2 yen per capita of the population. It seems to me that, in view of the present economic condition of the country, this is just about what the people would need. Up to the end of March, 1899, about 27,000,000 of these silver coins had been minted and made to circulate in place of 1-yen convertible notes, which are now being gradually withdrawn from circulation. It will not be long before the object aimed at by this measure will be fully attained.

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[a] Most probably these were taken over to the mainland by the Chinese.

[b] Of this amount 10,846,465 yen were sent back from abroad to be exchanged and the rest were in circulation at home.

To recapitulate, it will be noted that there are four periods in the coinage history of modern Japan. The first period extends from 1868 (first year of Meiji) to 1871, in which the beginning was made of the establishment of the new currency system by the promulgation of the new coinage regulations of 1871. The main effort of the finance ministers of those days was directed to the adjustment of the disordered condition of finance and coinage, created by the revolutionary state of affairs at the close of the Shogunate régime.

The second period extends from 1872 to 1879. This period is marked for the founding of the Government mint and the issue of new coinage, but more marked for the enormous issues of inconvertible paper money, which brought about all the evils of inflation.

The third period extends from 1880 to 1885, in which the efforts of the Government were directed to replacing the inconvertible paper money with the convertible notes, which prepared the way for the final inauguration of the gold-standard system, though for a time it resulted in the establishment of a de facto silver standard.

The fourth period extends from 1886 to 1898, in which the silver standard was changed into a gold monometallic system.

It will be noted that the first, second, and third periods are marked by efforts directed to the adjustment of the coinage system, in view of the condition of things at home, while the fourth period is marked by the attempt to adapt the national coinage system to the conditions of things abroad, these conditions of things being chiefly characterized by sudden and great fluctuations in the price of silver, endangering the safe economic growth of our country.

In conclusion, I can not refrain from expressing my humblest and deepest gratitude to His Majesty the Emperor, that, owing to his overruling gracious wisdom, the councils of his ministers on financial matters have, during these troublesome times, been invariably marked with wisdom and judgment, and the officials of all grades concerned have performed their duties well, so that there has taken place thus far an orderly and progressive development in the financial affairs of the Empire.

It is plain, however, that in order to strengthen the foundations of the gold-standard system now established it will be necessary in the future not only to keep up but to increase the gold reserves of the Bank of Japan. It will also be necessary that efforts be increasingly directed toward the development of the agricultural and industrial enterprises of the country, and the consequent growth of foreign trade. In these efforts allow me to humbly assure your excellency that I shall not be found remiss, so that His Majesty's gracious intentions may be as far as possible realized.

I have, etc.

COUNT MATSUKATA MASAYOSHI,
His Imperial Japanese Majesty's Minister of State for Finance.

EFFECT OF THE CHANGE IN STANDARD UPON ECONOMIC CONDITIONS IN JAPAN.

Since the adoption of the gold standard our currency has been freed from constant fluctuations in its exchange rate, to which it was subject before. Owing to this latter fact, moreover, the relations between the claims of the creditor and the liabilities of the debtor became less subject to sudden and unexpected changes; business transactions were made safe; an improvement in credit took place in the community at large; prices became more constant—in a word, the way was now opened for the steady and orderly growth of our commerce and industry.

Leaving out of account in this section the questions concerning the effect of the coinage reform on the foreign trade of the country, it can be very clearly seen that since October, 1897, the prices of commodities have kept comparatively even; that while there have been some changes, yet, when compared with the sudden and great changes which used to occur formerly, we must say that the fluctuations were remarkably small. Besides, these small changes in the price of commodities can be amply explained by referring to the partial failure of rice crops, to the sudden expansion of industry, and then to its as sudden depression, to a stringency in the money market, as well as to some other causes. These changes in the price of commodities were due, therefore, to the natural working of the economic law of supply and demand in the commodities themselves. If we notice the fact, moreover, that the amount of checks and bills cleared at the clearing houses in Tokyo and Osaka has remarkably increased during these recent months, notwithstanding the fact that during this very time there prevailed much business stagnation everywhere, we can not but conclude that business transactions on credit have come to prevail more widely and freely than before.

The beneficial result of the coinage reform is seen in another direction. Since now that the capitalists of the gold-standard countries have become assured that they will no longer be in constant danger of suffering unexpected losses from investments made in this country, on account of fluctuations in the price of silver, they seem to show a growing tendency to make such investments at low rates of interest. This tendency, if encouraged, will doubtless bring about a closer connection between this country and the central money markets of the world—a state of things which I believe we shall be able to see realized more and more fully as years go on.

So far as our trade with gold-standard countries is concerned, our adoption of the gold standard, which made us use the same standard of value as those countries, has proved to be a source of great benefit. This may be inferred from the fact that changes which have since taken place in the rate of foreign exchange have been but very slight, and these all traceable to changes in the condition of the foreign trade of the country, and not all traceable, as formerly, to sudden changes in the price of silver. For this reason there was eliminated from our foreign trade much of that speculative element which was caused by constant changes in the value of our currency, so that the way was at last opened for the steady and natural development of the foreign trade of the country. Again, concerning our commerce with silver-standard countries, contrary to the gloomy prospects indulged in by some critics, our trade with those countries has not ceased to make a steady growth, and this in the face of certain events occurring in the interior of China, our greatest customer among the silver countries—events such as natural calamities and disturbances, which have greatly hindered the commercial activity of that country.

Since our coinage reform enabled us to avoid all the evil effects of fluctuations in the price of silver we stand now no longer, as formerly was the case, under the necessity of making plans for financial matters with the currency constantly changing in value and sometimes suffering unexpected losses and evils in times when those fluctuations are unusually violent. All those fears of miscalculation and losses have now become things of the past. Most particularly in the last few years, when national expenditures for things bought abroad, such as war ships, etc., have greatly increased in amount, we have doubtless been able to avoid, on account of our coinage reform, great losses on the part of the national treasury. Besides, since our adoption of the gold standard, our Government bonds have been sold in no small amount in the European market, so that their names appear regularly in the price list of the London Stock Exchange. This fact at once converted our bonds into an international commodity and will, no doubt, lead to a closer relationship between our home and the foreign money markets.

The discussion also quotes a report of the higher commission on agriculture, commerce, and industry, which, after an elaborate discussion of the effect of the monetary system, closes by saying: "We believe that the beneficial effect of our coinage reform on our foreign trade has already been great, and we do not notice any material evil in connection with it. Besides, our adoption of the gold standard has made it easier for our country to enter into the economic community of the world at large, so that henceforth it will become practicable for us to invite capital from other countries, where it is plentiful, to be invested in our country. This will doubtless be another of the benefits conferred upon the country by our coinage reform. We conclude, therefore, that the effect of the coinage reform upon our foreign trade has been beneficial, without a trace of evil."

THE REPORT OF THE HIGHER COMMISSION ON AGRICULTURE, COMMERCE, AND INDUSTRY ON THE ADOPTION OF THE GOLD STANDARD.

A report of the higher commission on agriculture, commerce, and industry, drawn in October, 1898, in response to an inquiry made by the minister of agriculture and commerce concerning the effect of coinage reform on the foreign trade of the country, is quoted by the minister of finance in his report, as follows:

In replying to the question put before the present commission we believe it is well to say a few words in regard to the circumstances under which the recent coinage reform was effected. There is no doubt that in the case of any country the most important question to

be considered in connection with a coinage reform to be effected would be as to the effect of that reform on the price of commodities at home and on the responsibility and liability in cases of monetary contracts, and that the questions connected with the effect on the foreign trade of the country must be looked upon as of lesser importance. Now, considered in relation to the effect of coinage reform on the prices of commodities and on the responsibility and liability connected with monetary contracts, we believe that the reform was undertaken at a most favorable moment. There were other causes, too, which made the reform easier. First among these causes may be mentioned the fact that though our country had adopted a gold standard once before, soon after the restoration, it became changed into a bimetallic system, so that while there were always gold coins in existence in the country, they were not used in the daily transactions of the people. And later, when a de facto silver standard came to prevail, even then silver coin was scarcely used in daily transactions, but the convertible note representing that coin, the latter being merely kept in the Bank of Japan as the conversion reserve. The second fact to be noted is the smallness of the native output of gold and silver. The quantity of these metals produced in the country is so small that Japan can scarcely be called a gold or silver producing country. The third cause is the fact that both gold and silver coins, as well as bullion of these metals found in the country, were nearly all absorbed by the Bank of Japan, and but very little was found among the people in general. Then, fourthly and lastly, there was but very little foreign capital directly invested in industrial and commercial enterprises in the country. All these causes combined to make the conditions prevailing in Japan very different from those in American or India, and made it very much easier to carry into effect the plan of coinage reform.

Another fortunate thing was the fact that the price of silver, which had shown a growing tendency to depreciate, remained almost stationary at the time the reform was being effected; and since the price of silver which prevailed at the time made our old 1-yen gold coin about equal to 2-yen silver, the Government was able, in establishing the new system, to fix upon the weight of our new coin at one-half the weight of the old coin. For this reason, although the standard of our coinage was changed from silver into gold, yet the value of our standard coinage remained almost unchanged. These favorable circumstances together enabled our country to accomplish the reform without disturbing the prices of commodities or the responsibility or liability in cases of monetary contracts, and thus to avoid evils most dreaded in foreign countries. We must therefore affirm that our coinage reform was successful in accomplishing the most important object it had in view. What, then, has been its effect on the foreign trade of the country? There is no doubt, of course, that this is a very important question. In trying to answer it we must remember that all of the countries of the world to-day, except a very few, have now adopted the gold standard, and the volume of our trade with the gold-standard countries amounts to two-thirds of the entire volume of our foreign trade, while the amount of our trade with the silver-standard countries comprises but about one-third. And since it is clear that we have benefited greatly through reform in our trade with the gold-standard countries, we must conclude that the effect of our recent reform on the foreign trade of the country has been, on the whole, wholesome and beneficial. We are not indeed entirely free from the danger that, in competing with the silver-standard countries in the market of the gold-standard countries, we may be sometimes placed at a temporary disadvantage owing to the changes in the ratio between gold and silver; yet it is a fortunate thing that, in regard to silk, which is our most important product, there is scarcely any such danger, since the silk that our own has to compete with is not the Chinese silk, but the Italian silk, the former meeting different customers from ours. Some would indeed attribute the dull state of commerce with China since last year to the effect of our coinage reform, but such critics perhaps do not understand the real state of affairs in regard to our commerce with China. We need hardly to say that the growth or decrease of our exports to any foreign country depends very largely upon the economic conditions of that country.

Owing to financial derangements consequent upon her war with our country, as well as to the failure of crops and of silk culture, China was in no condition to buy from us, so not alone in her import trade with this country in cotton yarns, etc., but also in her trade with other countries as well, she has not shown much activity. For this reason, the specie which was received in payment for the exports was absorbed into the interior of that country and never came out. This produced a great scarcity of currency in Shanghai, Hongkong, etc., raising the rate of interest to 20 or 30 per cent per annum. For this reason, and from the fact that the exports of some articles, like matches and coal, which are in great demand throughout the Far East have not decreased at all, we may safely infer that as soon as the business condition of China improves our export of cotton yarn into that country will increase, as also indeed the exports of other articles. Again, some critics would regard the reduction in the market price of our cotton yarn from 100 yen or thereabouts of last year to 75 yen or thereabouts of this year as due to the influence of our coinage reform. This opinion, again, seems to rest upon ignorance of the facts, for it must be remembered that last year's cotton crop of America was very abundant, so that the price of raw cotton fell from 22 or 23 yen to 15 or 16 yen, i. e., by about 20 to 30 per cent. When a raw material becomes reduced in price, the article manufactured from it will, as a matter of course, also be reduced in price. There was perhaps another cause for the reduction in the price of our cotton yarn, namely, its overproduction and oversupply in the market, owing to the greatly increased number of spindles which were set up. In fact, India seems to be similarly suffering on account of the difficulty of selling its cotton yarn and the consequent fall in the price. And when we remember that the currency of India is not a silver standard, but one which may most fitly be called an artificially constructed gold standard, there does not seem to be any cause for alarm on account of our change of currency from the Indian competition in the production of cotton yarn.

Such, then, being the case, we believe that the beneficial effect of our coinage reform on our foreign trade has already been great, and we do not notice any material evil in connection with it. Besides, our adoption of the gold standard has made it easier for our country to enter into the economic community of the world at large, so that henceforth it will become practicable for us to invite capital from other countries where it is plentiful to be invested in our country. This will undoubtedly be another of the benefits conferred upon the country by our coinage reform. We conclude, therefore, that the effect of the coinage reform upon our foreign trade has been beneficial, without a trace of evil, so that there does not seem to be any need for adopting measures for the warding off of possible evils.

DETAILS OF THE COINAGE HISTORY OF JAPAN.

The above extracts present, in official form, a condensed statement upon the subject in question. For the convenience of those desiring to make a more elaborate study of the subject, the following additional details from the report are presented:

The report proper, which follows the letter of presentation from the minister of finance, already quoted, states that the monetary system in vogue when the restoration took place in 1867 consisted largely of debased coins issued by the various governments, counterfeit coins, and depreciated paper money, and adds:

After the country was opened to trade with Western nations the Shogunate government was the first to realize the greatness of the loss from which the country was suffering on account of the disordered state of coinage. Before any steps were taken, however, toward reform the Shogunate régime was overthrown and the restoration régime ushered in.

The Imperial Government at once felt the pressing need of a monetary reform, and in April, 1868, while the revolutionary wars were yet going on, a plan of recoinage was drawn up and adopted. Steps were immediately taken to found a Government mint, and in November, 1869, it was determined to base the new coinage on the metric system, making silver the standard unit of value and gold subsidiary. In November, 1870, the Government mint began to coin silver. While such steps were being taken at home there arrived, early in 1871, a memorandum from Mr. Ito Hirobumi, vice minister for finance, then traveling in the United States. In that memorandum Mr. Ito (now marquis) sets forth the advantage of adopting a gold standard. The memorandum runs as follows:

REASONS FOR BASING THE JAPANESE NEW COINAGE ON THE METRIC SYSTEM.

According to the coinage system recently adopted in Japan the silver yen is the standard unit of value, so that may be used as legal tender in transactions to any amount; the smaller coins, various fractions of 1 yen, are to be the subsidiary medium of exchange, each kind being permitted as legal tender in transactions amounting to one hundred times its value. There is, besides, the gold yen, but it is subsidiary, and may be used in the payment of sums of not more than ten times its value, or 100 yen.

The silver yen consists of 90 per cent of pure silver, its weight being 416 troy grains. It is equal in quality to the American dollar, but slightly exceeds the latter in weight, for the American dollar weighs 412½ grains. The different fractional silver coins weigh in proportion to the fraction of the unit yen. This system, now adopted by the Government, is based on the system adopted some years ago by the English Government for coinage in Hongkong, only the subsidiary gold coin is a new idea.

The new coinage system of Japan is in many respects like the system in vogue in America and England, the chief difference being that while in Japan the silver yen is made the standard unit of value, in England and America gold is the standard of value, gold coin being legal tender to any amount. Silver coins are treated in these countries as subsidiary, the legal-tender circulation being limited to small sums only—the sum of $5 in the United States, that of 40 shilling in England, being regarded as the maximum amounts. In Japan, gold being treated as subsidiary, its limit as legal tender is fixed at 100 yen—an exceptionally large amount. I presume the Government is in hopes that on account of such exceptional treatment the gold coin will always remain abundant, while the silver yen will gradually wear out through constant handling, so that in course of time gold will of itself become the standard unit of value. Should such hopes be indeed realized, the Japanese gold coin being almost equal in value to the American gold coin, the prices of gold and silver in Japan and California will tend gradually to be on a par.

But the Japanese 10-yen gold coin is lighter in weight than the American 10-dollar gold piece, for while the former weighs 248 grains the latter weighs 258 grains. Not only is it lighter in weight than the American gold piece, it is even lighter than the English gold coins; for 2 English sovereigns (1 sovereign is 1 pound sterling) weight 251.1 grains. Still again, the Japanese coin is lighter than the French, for the 50-franc pieces weigh 248.9 grains.

Just now there is under discussion in the House of Representatives of the United States a bill for establishing an international system of coinage. The 10-dollar gold piece according to that system is to weigh 257.2 grains, or 16⅔ grams. Now, if the Japanese gold piece were slightly increased in weight so as to equal this international standard coin, it would seem that the coinage system of Japan would be established on a sound basis and be forever free from all fluctuations of exchange value. In case the Japanese coinage system is to be thus remodeled the weight of each coin will have to be altered as laid down in the following table:

		Fineness.	Weight of 1 yen.	Troy grains.
Silver yen	Standard unit [a]	$\frac{9}{10}$	Fine silver=5 pentagrammes	Fine silver=385.80872.
Gold yen	Subsidiary [b]	$\frac{9}{10}$	5 tiers-grammes with $\frac{1}{10}$ part of copper	25.72058133, $\frac{1}{10}$ part of which being copper. Fine gold=23.1485232.
Silver coins which are fractions of 1 yen.	Subsidiary	$\frac{9}{10}$	5 pentagrammes with $\frac{1}{10}$ part of copper	385.80872, $\frac{1}{10}$ part of which being copper. Fine silver=347.227848.

[a] Legal tender to any large amount. [b] Legal tender only up to ten times its value.

I give below a table for reference, showing the weights of different coins according to the proposed international system now under discussion in the House of Representatives of the United States:

		Fineness.	Weight of $1.	Troy grains.
Silver dollar	Trade dollar [a]	$\frac{9}{10}$	Fine silver=5 pentagrammes	Fine silver=385.80872.
Gold dollar	Standard unit [a]	$\frac{9}{10}$	5 tiers-grammes with $\frac{1}{10}$ part of alloy	25.72058133, $\frac{1}{10}$ part of which being copper. Fine gold=23.1485232.
Silver coins which are fractions of $1.	Subsidiary [b]	$\frac{9}{10}$	5 pentagrammes with $\frac{1}{10}$ part of alloy	385.80872, $\frac{1}{10}$ part of which being copper. Fine silver=347.227848.

[a] Legal tender to any large amount. [b] Legal tender up to $5.

The trade dollar in the above table is intended to be used for trade with China and other Eastern countries. The ratio of gold and silver in the new coinage system of Japan is 1 of gold to 16.77 of silver. If this ratio should now be changed to 1 of gold to 16⅔ of silver, basing it on the metric system, a 10-yen gold piece would contain 231.48 grains of fine gold. In that case at the fineness of nine-tenths the weight of the coin would be 257.2 grains or 16⅔ metric grams. The 1-yen silver piece coined according to this ratio would contain 385.80872 grains of fine silver, which at the fineness of nine-tenths would make the coin weigh 424.38959 grains.

It will be remembered that according to the system already adopted the silver yen weighs 416 grains and the gold 10-yen piece 248 grains.

The metric system, according to which I suggest our coinage system be reestablished, is a system of weights and measures which originated in France and has now passed into universal use throughout the world. The proposed international coinage system will be based on this system.

Let me quote what Mr. Kelley, chairman of the American coinage committee, says in one of his writings:

"The United States of America has adopted the French metric system of weights and measures for the purposes of coinage and postage. Now that we have adopted this system the nations of the world will be compelled to adopt it also. Our adoption of this system was, therefore, not merely for our own advantage, but also for the ultimate benefit of the world at large. The metric system of coinage was for the first time adopted in the United States, it being three years afterwards that France followed our example. Canada, too, followed our example, and is now using dollars and cents. There is no question that other nations will gradually adopt this system, for the people of every country will come to see how easy and simple the monetary calculation becomes, either in subtraction or multiplication, if that system is adopted."

In regard to the question which metal should be made the standard of value the opinion of the economists all tend to coincide in regarding gold as the fittest metal for standard. That Austria, Holland, and some other countries still maintain a silver standard is probably due to the great difficulty of changing the old system. If a system of coinage were to be newly established by any of these countries there is no question but that the gold standard would be invariably adopted. It will be a wise policy for Japan, therefore, to consider the trend of opinion in Western lands and establish her new system in accordance with the best teachings of modern times. It may be that for the time being, on account of the possible great loss to the country from the too sudden adoption of the gold standard, a silver standard may have to be maintained. Otherwise, there is no question that gold is the best metal for the standard of value. If the gold standard is introduced silver may be fitly coined for a subsidiary medium of exchange, putting a limit to its legal-tender amount. It may be as well to establish our system as laid down in the table given above—provisionally making silver the standard—strictly keeping in view, however, the time when gold will be made to supersede silver as the standard of our system of coinage.

P. S.—The foregoing memorandum was written necessarily in haste, and I must confess there are no few repetitions and some confusion in statement. The main points I wanted to emphasize were:

1st. The necessity of slightly reducing the weight of the unit of value of the silver coinage; and

2d. To determine the weight of the gold coin according to the metric system.

Written in America on the 29th day of December, 1870.

(Signed.) HIROBUMI.

The above memorandum was chiefly instrumental in effecting a change in the coinage policy of the country. The Government decided to adopt at once the gold standard, and issued the new coinage regulations on the 10th of May, 1871. These regulations run as follows:

THE NEW COINAGE REGULATIONS.

The standard of unit of the new coinage shall be called yen, and all reckonings and calculations of money shall be made, whether large or small, by the addition of numerals to the unit yen. Amounts less than 1 yen shall be estimated in terms of sen, or one-hundredth part of 1 yen, and rin, or one-tenth part of 1 sen. * * *

LIMITATIONS IN THE CIRCULATION OF THE NEW COINAGE.

The standard coins are to be of gold consisting of 20-yen, 10-yen, 5-yen, 2-yen, and 1-yen pieces, of which 1 yen shall be the standard unit of value. These gold coins are all legal tender and may be used in monetary transactions to any amount.

By the standard coin is meant the coin whose value is the standard on which the values of other coins are based. Hence there is no need of limiting the amount in which they may be legally used in transaction. One yen gold is the standard unit of value, because it is the standard on which the values of other coins are based.

The silver coins, which consist of 50-sen, 20-sen, 10-sen, and 5-sen pieces, are issued as subsidiary money. They are legal tender either in one kind or in different kind up to the amount of 10 yen only.

The copper coins, which consist of 1 sen, one-half sen, and 1 rin, are also subsidiary money, and may be used as legal tender up to the amount of 1 yen only.

By the subsidiary money is meant the smaller coins issued to assist in the circulation of currency. Their legal value is fixed by Government regulations. Hence the need of limiting the amount beyond which they may not be used in transactions.

The 1-yen silver piece is to be coined during a limited period of time, particularly in response to the desires of individuals both Japanese and foreign, in order to facilitate trade at the treaty ports. This silver yen shall be legal tender at the treaty ports, so that they may be used in the payment of all customs duties and of taxes by the foreign residents, as well as in all monetary transactions between the Japanese and foreigners. This coin shall not be legal tender outside of the treaty ports limits, though, of course, it may be freely used in transactions where parties concerned mutually consent to its use.

The relative legal value of the silver yen and the gold yen at the treaty ports shall be 100 silver yen to 101 gold yen.

Thus, while there was introduced at this early date a gold-standard system in Japan, at the same time a silver yen was also to be coined as legal-tender money in the treaty ports. This was due to the fact that the Mexican silver dollar was at that time universally used in the commerce of the Far East, so that the coining of the silver yen was considered a necessity. In February, 1875, by imperial ordinance No. XXXV, the Government changed the name of the silver yen to boyeki gin, or trade dollar, and its weight from 416 grains to 420 grains. * * *

The chief motive in making this change was to drive off the Mexican dollar and replace it with the trade dollar, but it was found out very soon that the attempt was a failure. The Government soon ceased to coin the trade dollar and returned again to coining the silver yen. * * *

All these different measures were, however, not sufficient to maintain gold monometallism in healthy growth. The issuing of a large amount of inconvertible paper money drove specie, especially the gold coins, out of the country. This and the smallness of the natural output of gold in Japan both constituted reasons which, in 1878, led Mr. Okuma Shigenobu (now Count), at that time minister of finance, to advise the Government to adopt gold and silver bimetallism as a policy more conducive to the country's prosperity. The Government, acting on his advice, by imperial ordinance No. XII, of May, 1878, sanctioned the free use of the silver yen and the trade dollar as legal tender throughout the country. The silver-yen piece thus acquired the same legal value as one yen gold and the system of coinage was changed from the gold standard to the gold and silver bimetallic system.

The above statements, which are referred to at various places in the report as the history of the attempted adoption of the gold standard and the transition to the gold and silver bimetallic system, are followed by a detailed statement of the issue, and, finally, the overissue by the Government of inconvertible paper intended originally purely as an emergency measure, the amount, however, being increased from time to time until the quantity in circulation became very large, and to this was added a series of national-bank notes which, while originally converted into specie, were afterwards permitted to be convertible into Government paper money, which, however, was itself inconvertible, thus making the bank notes another kind of inconvertible paper money. The report continues:

In this way rose, step by step, the amount of paper money issued by the Government, until by the end of January, 1878, it reached to some 120,835,000 yen. Besides these the Government got into the habit of making temporary issues from the paper-money reserve to fill up temporarily the deficits in the revenue, this paper-money reserve being a large stock of unissued paper money kept for the exchange of worn-out notes. And since after 1878 the amount thus issued averaged, as a rule, about 20,000,000 yen a year, this much must also be regarded as added to the amount of paper money in circulation.

Moreover, after the introduction of the amendments in the national-bank regulations as mentioned above, the number of national banks rapidly increased, which brought about an increase in the amount of bank notes, so that in April, 1880, it rose to 34,420,000 yen. The issuing of so large an amount of inconvertible paper money naturally brought about results disastrous to the healthy financial development of the country; prices rose enormously; the imports came to always exceed the exports; the specie daily left the country for abroad; people contracted luxurious habits of life; business men ran wild in speculation. All these evils reached their climax in the years 1880 and 1881. The amount of inconvertible paper money in circulation reached its highest point in January, 1880, as may be seen from the figures given below, according to the returns on the last day of that month:

	Yen.
Government paper money	113,831,709
Reserve paper money temporarily issued	22,188,116
Notes of the national banks	34,137,652
Total	170,157,477

At the beginning of the Meiji era there was a great difficulty in getting the Government paper money circulated, and at that time its price very much depreciated. But with the return of peace and the increase of the credit of the new Government the credit of paper money also increased. The amount issued, moreover, did not exceed the actual need of the country. For these reasons it came soon to circulate at par with specie. Early in 1878, however, the Government issued quite suddenly another very large amount of paper money, and from that time on its depreciation again commenced.

At first the ratio between silver and paper was 1 yen of silver to 1 yen and 7 or 8 sen of paper, but at the close of that year it became more than 1 yen and 21 sen of paper to 1 yen of silver. There seemed to be no end to depreciation. Unfortunately, there prevailed at that time among the authorities an erroneous opinion that these differences in the value of paper and of silver were due not to the depreciaton of paper, but to the appreciation of silver. The Government, therefore, made various attempts to keep the price of silver down. The authorites, indeed, drew up at this time a plan for the redemption of Government bonds and of paper money; but their more serious efforts were directed toward preventing the rise of the price of silver. For instance, the Government prevailed upon the First and Second National banks, and the Mitsui Bank, as well as some other banks, to sell out silver coin; opened places for transacting the exchange of Mexican dollars; in February established the Yokohama Specie Bank, with the object of inviting the people to invest hoarded coins, so that these coins might be supplied to the financial market. The Specie Bank was, moreover, to engage in foreign exchange in order to facilitate monetary circulation between Japan and foreign countries. The Government believed that, as in these ways the supply of silver would be increased, its market price would necessarily come down. But, as a matter of fact, the Yokohama

bank suffered so much loss as to become almost bankrupt, and other measures did not produce the desired result. The difference in value between silver and paper kept on increasing, so that in April, 1880, the average ratio between the two was 1 yen 54 sen 9 rin of paper to one yen of silver. When all these attempts had failed the Government at last opened its eyes to see the necessity of making redemption. With this object in view the ratio of tax on saké was doubled by imperial ordinance No. XL, of September 27, 1880, so that the increased revenue on that score might be set apart as a redemption fund. Again, by imperial ordinance No. XLVIII, the spheres of local taxation were increased, correspondingly lightening the financial burden of the central government, and at the same time the Government expenditures were much curtailed, the surplus obtained in all these ways being also added to the redemption fund. Besides all these, the Government decided gradually to transfer by sale to private hands the Government factories which had been established for the encouragement of industry, stopped making loans to companies and individuals out of the reserve fund in the treasury, and every yen thus gained went to further increase the amount of the redemption fund.

Yet the depreciation of paper did not stop. In April, 1881, 1 yen silver fetched on an average 1 yen 79 sen 5 rin of paper (the lowest point reached in depreciation during that month being 1 yen 81 sen 5 rin).

This was, indeed, the lowest point ever reached. At this time a plan to raise a foreign loan of 50,000,000 yen for the purpose of redeeming paper money was advocated by some in the Government, but the plan was never adopted. With the appointment of Mr. Matsukata Masayoshi (now count) to the portfolio of finance, on the 20th of October, 1881, the Government determined at last to adopt the policy on the one hand of redeeming the paper money, and on the other of increasing the specie reserve of the Government as preparatory to the introduction of a convertible note system. The amount of Government paper and of bank notes at this time in circulation stood as follows:

	Yen.
Government paper money	105,905,212
Government paper money temporarily issued out of the paper-money reserve	14,500,000
Notes issued by national banks	34,398,030
Total	154,803,242

The finance minister of the time (Count Matsukata) thought it an irregular practice to issue a part of the paper-money reserve for temporarily meeting the deficit of revenue, as had been the practice of the Government for some years past. In order to pay back once for all the amount thus utilized from the paper-money reserve, he introduced certain changes in the method of making receipts and disbursements of the public revenue. He had, besides, the method of disbursing the expenditures of the Government departments changed, so that henceforth these disbursements were all made at the exchequer, instead of having the amounts of the estimated expenditures turned over in lump sums to the departmental authorities in the early part of the fiscal year. These changes were effectual, as may be presumed, in leading to economy in the State expenditure. Yet further steps were taken toward economy and the increase of the Government reserve by ceasing to make any further loans out of the Government reserve in aid of industrial enterprises, and at the same time by requiring that all the past loans should be paid back to the Government according to the terms of agreements. Now, with the money which came into the treasury in these ways, as well as by temporarily utilizing the money which came in response to the Nakasendo railway bonds, issued about this time, the Government was able to pay back to the paper-money reserve in January, 1883, the entire amount of the paper money which had been subtracted for temporary circulation out of the said reserve. A plan was now adopted, on the other hand, of issuing the treasury bills to meet the demand of the exchequer for any temporary deficit in the revenue. * * *

While in this way was effected the adjustment of the troubles connected with the temporary issue from the paper-money reserve, not quite so easy was the adjustment of the larger troubles which existed in connection with the paper currency proper.

The minister of finance of the time (Count Matsukata) felt that in order to effect the much needed adjustment of the Government paper money it would be necessary to establish a great central bank, which should have the sole privilege of issuing convertible bank notes; which should serve as a supreme organ for the regulation of the currency of the country; which should, moreover, discount the foreign bills of exchange in order to regulate the influx and efflux of specie and bullion; which should still further be intrusted with certain services in the treasury, so as to simplify the business of the exchequer.

The above recommendations of the minister of finance, Count Matsukata Masayoshi, for a great central bank were approved by the Government, and in June, 1882, regulations issued authorizing its establishment.

At the same time with the establishment of the Bank of Japan the Government took measures to increase its revenue. In 1882 the Government first levied stamp duties on patent medicines and license tax on the brokers of the rice exchange and the stock exchange, and revised saké and tobacco taxes, and in 1885 taxes on soy and confectionery were levied for the first time. One-half of the surplus of revenue which was secured through these means was devoted to the redemption of inconvertible paper money, while the other half was added to the reserve fund with the object of employing it for securing the importation of specie from abroad.

The Government now established consulates in London, New York, and Lyons, the three greatest foreign markets for Japanese goods, and by employing the reserve fund of the Government in discounting foreign bills of exchange tried to absorb specie from abroad, as well as to encourage the export trade. To import foreign specie in some way was at the time an absolute necessity, since the output of gold and silver from Japanese mines only amounted to 400,000 or 500,000 yen annually. As results of this policy the amount of paper money was reduced at the end of 1885 to about 88,345,096 yen, while at the same time the Government was yet able to keep about 42,260,000 yen of specie in the reserve fund. In view of these facts, the price of paper money gradually kept rising until it stood on a par with silver. The minister of finance, Mr. Matsukata (now count), now presented to his colleagues a plan of permitting the Bank of Japan to issue a certain amount of convertible bank notes as a sort of experiment preparatory to the resumption of specie payment.

The Government, on approving this plan, had regulations drawn up concerning covertible bank notes. Imperial ordinance No. XVIII and the accompanying regulations in regard to convertible bank notes, which were issued on the 26th of May, 1884, run as follows:

IMPERIAL ORDINANCE NO. XVIII OF THE 26TH DAY OF MAY, 1884.

The convertible bank-note regulations are hereby issued. They will go into operation on the 1st day of July, 1884. Imperial ordinance No. C, promulgated in September of 1874, will cease to be effective one year after the day these regulations are issued.

THE CONVERTIBLE BANK-NOTE REGULATIONS.

ARTICLE I. The convertible bank notes shall be issued by the Bank of Japan, in accordance with the provisions of Article XIV of the regulations concerning the Bank of Japan. These bank notes shall be convertible with silver.

ART. II. The Bank of Japan shall keep a sufficient amount of silver coins as reserve fund for the conversion of its notes.

ART. III. The denominations of the convertible bank notes shall be 1 yen, 5 yen, 10 yen, 20 yen, 50 yen, 100 yen, 200 yen—seven kinds in all. The minister of finance shall determine the amount to be issued of each kind.

ART. IV. The convertible bank notes shall be legal tender in the payment of taxes and customs duties, as well as in all monetary transactions.

ART. V. The convertible bank notes shall be manufactured by the Bank of Japan according to the shape, lettering, and design fixed by the minister of finance, the amount manufactured being reported to the said minister from time to time. The minister of finance shall previously notify the public as to the specimen of the note to be issued.

ART. VI. Persons desirous of getting the notes exchanged for coins may get them so exchanged at the central or branch office of the bank at any time when the bank is open for business.

ART. VII. Persons bringing gold and silver coins to be exchanged for the notes may get them so exchanged at the central or a branch office of the bank without fee.

ART. VIII. The bank shall prepare tables showing the receipts and disbursements of the notes for each day, as well as for the month, and report the same to the minister of finance.

ART. IX. The minister of finance shall instruct the comptrollers to oversee all matters relating to the issuing of the notes; when necessary, the comptrollers may examine the safes where the notes are kept, as well as the books recording the notes issued.

ART. X. The notes which get defaced or mutilated so as to be unfit for circulation may be exchanged, without fee, at the central or a branch office of the bank.

ART. XI. All processes regarding the manufacture of the notes, their redemption, the exchange of damaged notes, etc., shall be determined by the minister of finance.

ART. XII. All crimes respecting the counterfeiting and fraudulent alteration of the notes shall be punished in accordance with the articles relating to the counterfeiting of paper money in the criminal code.

In accordance with these regulations the Bank of Japan began to issue convertible bank notes on the 9th of May, 1885; and the minister of finance (Count Matsukata), in view of the fact that every preparation was now fully made for the Government to resume specie payment, presented the following memorandum to the Government:

Very soon after the restoration the Imperial Government was sorely pressed with the need of money to defray manifold expenses to which the Government was subjected, and as the only measure of relief they decided to issue paper money. The paper money was thus issued on the 19th day of the second (fourth) month of the first year of Meiji (1868), and the period of circulation was limited to thirteen years.

On the 28th day of the fifth month, second year of Meiji (1869), the system was changed, and it was publicly notified that the notes would be exchanged with new coins which were then to be issued. But the demand for the Government expenditures continued to be so great—owing to the facts that every piece of administration had to be newly begun, as well as to the fact that the Government had on hand the task of adjusting the disordered state of affairs resulting from the war just closed—that the promised conversion of paper money had to be practically abandoned. In the twelfth month of the fourth year of Meiji (1871) it was announced by imperial ordinance that the various kinds of paper money would all be exchanged with the new paper money.[a] In the following year the Government put forth a plan of redemption by inviting the people to have paper money exchanged with the Government bonds to be issued for that purpose. The kinsatsu (literally, gold notes) exchange bond regulations were thus issued in the third month of the fourth year of Meiji (1872). Yet the amount thus exchanged was small, never accomplishing the purpose of reducing the amount of notes in circulation. After those days a series of political disturbances occurred, culminating in the rebellion in the southwestern provinces in 1877; and from these causes the financial distress of the Government grew greater step by step, so that the Government was led to issue another large batch of paper money. Thus, while the amount of paper circulating before the war of the rebellion stood at 93,323,156.3385 yen, it was increased by the addition of 27,000,000, issued during the war, and also by the issue of a large amount of national-bank notes. In 1878 the amount arose to such enormous proportions, and their prices fell so rapidly, that in the years 1880 and 1881 the depreciation amounted to as much as 50 per cent of the face value. This was due, doubtless, to their overissue, but also no less to the fact that the notes being inconvertible could not command enough credit.

At the time the undersigned (Count Matsukata) accepted the present post the Government was most seriously engaged in an attempt to find some fit measure of relief. The measures I had the honor to suggest having been approved by the Government, and having received the august sanction, progress was made step by step in the line of financial reform. As such steps may be mentioned the reduction of the expenditures of the Government with the view to the contraction of paper currency; the increase of the specie reserve as preparatory to note redemption; the retirement of the paper money temporarily issued from the paper-money reserve; the founding of the Bank of Japan, by which the financial organization of the country was perfected; the revision of the national-bank regulations, by which a way was opened for the redemption of the national-bank notes; and lastly, the issuing of the convertible bank-notes regulations. During the first part of the period the amount of paper in circulation was 154,803,242.282 yen, of which 34,398,030 yen were national-bank notes and 14,500,000 yen were the temporary issues from the paper-money reserve. But this amount has been reduced during the past three years—including the present year, 1884—by the redemption of 34,133,754.25 yen, of which 14,500,000 yen were issues from the paper-money reserve and 3,637,772 yen were the notes of national banks. Of the Government paper money that remains, and is now in circulation, there are 89,909,230.032 yen. On the other hand, the increase of the Government's specie reserve has been not inconsiderable. In 1881 the specie reserve of the Government for the purpose of redemption amounted to but 7,385,997.16 yen. (This is the balance remaining of the amount of specie in the Government reserve on the 21st of October, 1881, after from that amount has been deducted 1,288,176.722 yen, being the amount employed in discounting foreign exchange bills.) Now, after but little over three years, in October of this year, the specie reserve will probably amount to 39,612,810.722 yen. Comparing this with the volume of paper money in circulation to-day, it comes up to almost half the amount of the latter. That so much has been accumulated in times when there have been so many calls for expenditures must be attributed largely—though, no doubt, partly due to certain natural causes—to the earnestness of the Government in making the attempt to relieve the financial distress.

In view of past circumstances and of the probable direction of future affairs, I can not but think the present to be the most opportune moment for redeeming the inconvertible paper money. I pray most earnestly that the Government will approve these suggestions and not let go the present opportunity. I have no doubt that if these reforms are now effected that all fear of certain unexpected disturbances in commercial affairs will be quieted, and the much-needed facilities finally offered for the circulation of currency. But currency reforms need to be effected with extreme caution on account of their many-sided influence. It will be well, therefore, to effect the change now contemplated gradually—not too suddenly. The 1st day of January, 1886, may be fixed as the date on which the process of redemption shall begin to take place. The present specie reserve may first be devoted to redemption, while the coins minted out of the redemption fund, year by year, may be set apart, as fast as produced, as reserves for further exchange. Let the business of exchange be intrusted entirely to the Bank of Japan and that bank instructed to exchange all the Government paper money that may come to that bank by way of ordinary circulation. Thus may the too sudden change be avoided and the reform effected smoothly and quietly. If these suggestions shall happily receive the august sanction, not only will the Government be able to accomplish its original purpose in regard to the paper money, but the credit of the Government, both at home and abroad, will be thereby assured, the national finance placed on a firm basis, and the future happiness of the people greatly enhanced.

As the result of this memorandum the public was notified, through imperial ordinance No. XIV, of June, 1885, that the Government would commence to pay specie in exchange for Government paper money on January 1, 1886. The ordinance runs as follows:

IMPERIAL ORDINANCE NO. XIV, OF THE 6TH DAY OF JUNE, 1885.

The paper money issued by the Government shall be gradually exchanged with silver coins from January, 1886, on, and the paper money thus exchanged shall be canceled. The rules concerning the process of making the said exchange shall be fixed by the minister of finance, and the business intrusted to the Bank of Japan.

As to the conversion of national-bank notes, the minister of finance, Mr. Matsukata (now count), saw the need of first amending the national-bank regulations, with reference to which he presented a memorandum to the Government. * * *

The policy laid down in the memorandum was adopted by the Government, and by imperial ordinance of the 5th of May, 1883, the Government introduced certain amendments to the national-bank regulations. According to these amendments the term of business of national banks was to be twenty years, counting from the day they received their charters, and if they desired to continue their business after the expiration of their term they were to do so as private institutions; moreover, each bank was required to keep as a reserve fund for the redemption of notes money equal in amount of one-fourth the amount of notes issued by that bank, and effect redemption within its term of business according to the methods laid down in the following regulations. It was also stated in these amendments that persons desirous of having the bank notes exchanged for currency might do so by taking them to the Bank of Japan.

[a] Manufactured in Germany; these new ones also inconvertible as the old ones.

The various plans for the redemption of inconvertible paper money having been faithfully carried out, on the last day of June, 1888, the amount in circulation was found to be much reduced, of the Government paper money there being in circulation some 49,337,247 yen and of the national-bank notes some 28,059,486 yen. The minister of finance, Mr. Matsukata (now count), seized this opportunity for introducing amendments into the convertible bank-notes regulations in order to establish the currency system of the country on a sound basis. The following memorandum was presented by him to the cabinet council in July of the same year:

"While the Government issued paper money—notes issued by the Daijokwan—at the beginning of the restoration as an emergency measure for the relief of the financial distress of the time, the disadvantages of issuing inconvertible notes was plainly seen at the time, and hence the period of circulation of these notes was limited to thirteen years. It was hoped that after the expiration of this term of years the Government would be able to introduce a convertible system of paper currency. But the ever-increasing Government expenditures—which were owing to the fact that every department of the Government as well as public enterprises of all kinds had to be all at once either reformed or newly begun—compelled the Government to forego the first plan, and instead of redeeming the paper money in circulation, they kept adding to that amount. In 1878 the depreciation of notes was so striking that the Government, getting alarmed, made every effort to bring about the introduction of a convertible system. These efforts were now directed on the one hand toward the contraction by making partial redemption of the amount in circulation, and on the other toward increasing the specie reserve which was intended to serve as a fund for redemption.

"Owing to these measures the price of paper returned to its face value, and, in June, 1885, the Government publicly notified its determination, as has been previously stated, to begin the gradual redemption of the Government paper money. After this decisive measure had been adopted, still further steps were taken in succession toward effecting the entire redemption of the Government paper money by substituting for it the system of convertible bank notes. Yet, on the other hand, the amount of the paper money already issued was so great that, notwithstanding every possible effort on the part of the Government, it has not yet been all redeemed. This is indeed to be deeply regretted. Now, after careful examination of the methods and processes of the banking operations of Europe and America, which may possibly be taken as examples for our present case, I have come to the conclusion that to enlarge the privileges of the Bank of Japan in regard to its power of issuing notes, and then to borrow a portion of its notes, at a low rate of interest or without interest, and employ them for redeeming the Government paper money, would be, under the circumstances, the best possible method that can be found. These reasons lead me to submit to the cabinet council for its careful consideration a draft of the amendments to be introduced in the convertible bank-notes regulations, with a statement of reasons for these amendments, and some tables."

(NOTE.—The above-mentioned statement of reasons and tables is now omitted.)

The policy embodied in this memorandum being approved by the Government, the public was notified, through imperial ordinance No. LIX, of August, 1888, of the introduction of amendments in the convertible bank-notes regulations. These amendments run as follows:

IMPERIAL ORDINANCE NO. LIX, OF THE 1ST DAY OF AUGUST, 1888.

ARTICLE II. The Bank of Japan shall keep gold or silver coins, or bullion of those metals, as a conversion reserve, equal in amount to the amount of the convertible bank notes issued.

The Bank of Japan may, outside the provisions of the preceding paragraph, further issue convertible bank notes, on the security of Government bonds or treasury bills, or other bonds and commercial bills of a reliable nature, within the limits of 70,000,000 yen. Of this amount, however, 27,000,000 shall be set apart to be issued after the 1st day of January, 1889, in installment, from time to time, in proportion to the amount of the national-bank notes redeemed.

The Bank of Japan may, outside of the provisions of the two preceding paragraphs, make still further an issue of convertible bank notes, in order to meet some special emergency of the market, and with the special permission of the minister of finance, on the security of Government bonds or treasury bills, or other bonds and commercial bills of a reliable nature. The notes shall be subject to a special tax of not less than 5 per cent per annum, the rate of interest to be fixed in each case by the minister of finance.

The Bank of Japan shall supply by way of loan not more than 22,000,000 yen to the Government, at the interest of 2 per cent per annum, for the purpose of redeeming the Government paper money. The loan shall be without interest after 1898. The period of time within which this loan shall be repaid by the Government and the rate of annual installment shall be fixed by the minister of finance. * * *

In March, 1890, the Government adopted the plan of setting apart as a redemption reserve a sum of 10,000,000 out of the reserve fund in order to accomplish the entire withdrawal of the Government paper money. * * *

In these ways both the Government paper money and the national-bank notes were all exchanged with the convertible silver notes of the Bank of Japan. As a result of thus replacing the inconvertible paper money with the convertible silver notes, Japan now became a de facto silver-standard country. * * *

The report then details the methods adopted by the Government through additional taxation and otherwise for the creation of a sinking fund and reserve fund, and adds:

THE STATE OF AFFAIRS WHICH NECESSITATED THE COINAGE REFORM OF 1897.

The adjustment of the paper currency, accomplished in 1886, prepared the country to reap all the benefits of a scientific system of coinage. The rate of interest now gradually became low, the commercial and industrial enterprises began to rapidly expand, the volume of foreign trade of the country increased greatly; in a word, there took place a marked improvement in the economic conditions of the country. Yet, on the other hand, Japan became a de facto silver-standard country, and all the fluctuations of the price of silver in the world's market came to exercise an immediate influence on her economic and financial condition.

THE DEPRECIATION OF SILVER AND THE COINAGE REFORMS IN FOREIGN COUNTRIES.

Before 1873 the price of silver did not show great fluctuations, the ratio between gold and silver standing, as a rule, at 1 of gold to 15.5 of silver. About 1871, however, there began to appear causes which finally led to its sudden fall in recent years. The chief among these causes were two—the greatly increased annual output of silver since 1871, and the establishment of the German Empire.

The Government of the united Germany immediately took up the scheme of unifying the coinage systems in vogue in the different portions of the Empire by replacing with gold coins the silver currency then in use. It issued, therefore, a new coinage law, stopped coining standard silver pieces, and in 1873 put into effect the gold-standard system. It soon began to sell large quantities of silver, which had the immediate effect of causing depreciation. The bimetallic countries of Europe now saw the danger of being turned into silver countries, so that they became constrained to adopt the lines of policy which had the tendency of making them gold-standard countries. Now, these lines of policy all aimed at the expulsion of silver and the absorption of gold. In 1873 the United States of America adopted a gold standard, stopped coining silver dollars (except silver trade dollars), and limited the legal-tender amount of the silver dollar to $5. France put a limit to the amount of silver deposits received at its mints; and Sweden and Norway, too, adopted a gold standard, discarding its standard silver coins, in 1874. The countries of the Latin Union also put a limit to the coinage of standard silver coins, Holland stopping the free coinage of silver in 1875, and Switzerland deciding to cease entirely the minting of silver coins. In 1876 France, Belgium, Spain, and Russia followed these examples, and the United States of America took away the legal-tender qualifications of the silver trade dollar. These measures all assisted to bring about the sudden fall in the price of silver, so that in 1876 the average rate for the year stood at 1 of gold to 17.88 of silver.

At this stage the countries which had in possession large stocks of silver, or which annually produced it in large quantities, took measures intended to stop the fall of the price of silver. In 1878 the Government of the United States promulgated what is called the

Bland Act, according to which the American Government was to buy silver in order to coin it into money, hoping in this way to stop its depreciation. In 1890, again, this Bland Act was replaced by the Sherman Act, which authorized the Government to greatly increase the amount of its annual purchase of silver. These measures, however, did not have the least effect in checking the fall. The rate of gold and silver, which was, on an average, 1 of gold to 18 of silver in 1879, became 1 of gold to over 19 of silver in 1885. After that year the fall became still more marked, so that while the average rate in 1891 was 1 of gold to 20.92 of silver, it became in 1892 1 of gold to 23.72 of silver, at last the fall reaching in 1893 the rate of 1 of gold to 26.49 of silver.

Thus the prospects of silver became daily more gloomy. This led Austria-Hungary in 1892 to adopt a gold standard and the United States to repeal the Sherman Act in 1893. Russia, too, though it had allowed the free coinage of silver for a time, stopped it again in 1893. In 1894 Persia took the same course, while India placed a tariff of 5 per cent on all the imports of silver. In 1895 Chile and in 1896 Costa Rica both adopted a gold standard; Russia at the same time showing signs of taking the same course, and in 1894 the fall in the price of silver reached as low a rate as 1 of gold to 32.56 of silver (being the average rate for the year).

In 1895, however, silver showed signs of appreciation, the average rate for that year being 1 of gold to 31.60 of silver, and the rate becoming, in 1896, 1 of gold to 30.66 of silver. Yet this appreciation was merely temporary, owing to certain obvious causes, one of which was an erroneous supposition that the Chinese indemnity would be paid in silver, while the other was a widespread conjecture that the silver party would win in the Presidential election of the United States. When, therefore, these suppositions were both proved to be unfounded, in 1897 silver again began to fall, reaching at the lowest point to 1 of gold to 39.70 (or more) of silver, making the average for the year 1 of gold to 34.34 of silver. * * *

CIRCUMSTANCES WHICH CALLED FOR THE COINAGE REFORM OF JAPAN, AND THE RESULTS OF THE INVESTIGATIONS CONDUCTED BY THE COINAGE INVESTIGATION COMMISSION.

As was narrated in the previous section, the depreciation of the price of silver grew daily greater, and there seemed to be no end to sudden fluctuations. In consequence, foreign countries were led one by one to adopt a gold standard. Under these circumstances Japan, as a de facto silver-standard country (since the establishment of the convertible paper-money system in 1886), could not but suffer from this depreciation. The constant fluctuations in the rate of exchange took away from foreign trade an unchanging standard of value and prevented it from making normal and healthy growth. As a result the price of commodities rose rapidly, the spirit of speculation became rampant, and, finally, the State expenditures began to increase on account of this depreciation; in a word, there took place a general derangement of the national economy. It was now feared that the further maintenance of a silver standard would be against the far-reaching interest of the country. The finance minister of the time, Mr. Watanabe Kunitake (now viscount), presented a memorandum on the 11th of September, 1893, advocating the necessity of conducting investigations in regard to the monetary policy of the country, advising for that purpose the appointment of a commission. The following is the text of the memorandum:

"The recent fluctuations in the ratio between gold and silver have exerted an extraordinary influence on the economic affairs of the world, and the governments of all countries have been led to pay the greatest attention to the method of averting further calamities from the same source. In July of last year the Austrian Government adopted a gold-standard in place of the silver-standard system, while the International Monetary Congress, which was to meet in Brussels, with the avowed object of discussing measures of the price of silver, has not been convened. These things have tended to assist the rapid depreciation of silver. In addition to these, the Indian government suddenly stopped the free coinage of silver, and the American Government seems to be strongly inclined to repeal the Sherman Act; in fact, the bill for that object is now under consideration in the United States Congress. It is thus inevitable that the depreciation of silver will yet continue to increase. For these reasons the ratio between gold and silver is in a constant fluctuation, in some cases bringing international trade almost to a standstill. It is but natural, therefore, that silver-using countries of the world should, with a view to the protection of their national interest, take steps to conduct investigations concerning the question of coinage. Some countries have already put into effect the results of such investigations.

"The coinage system of our country was a gold standard, according to the new coinage regulations of 1871. However, when, in 1878, the 1-yen silver coin, which had been coined for circulation within the limits of the treaty ports only, was made legal tender throughout the country by Imperial ordinance No. XII of 1878, there came into vogue the double-standard system of gold and silver. But this has been further changed, and we are living under a de facto silver-standard system. For this reason these fluctuations in the price of silver exert an immense influence on the economy and finance of the country. Moreover, since the Indian government has recently undertaken to reform its coinage, the people of all classes of our country have become excited with the liveliest anxiety as to the probable future of silver coinage. Discussions on the subject are rife all over the country, and business men are in fear and trembling, not knowing what course to take. For these reasons it seems to me to be a most proper course to take for the Government to appoint a commission, composed of men experienced and learned in economic matters; to instruct that commission to conduct investigations as to the causes and effects of recent fluctuations in the ratio between gold and silver, especially their effects on the past, present, and future of our national economy; to make inquiries on the question whether there be need of reforming the coinage system of the country; if so, what system to choose and what means to adopt toward effecting that reform. I look forward to the time when the researches of such a commission will be completed, with hopes that the Government will then be able to pacify the present anxieties of the nation at large, as well as to fix upon a line of monetary policy to pursue at this important juncture. I adjoin herewith the draft of the Imperial ordinance respecting the appointment of the commission and of the estimate of the expenses connected with that commission. These are now respectfully submitted for the consideration of the cabinet."

The scheme embodied in the preceding memorandum was adopted by the Government, and the regulations concerning the coinage investigation commission were promulgated by Imperial ordinance No. CXIII, on the 14th of October, 1893.

According to these regulations the commission was appointed, and the first thing they did was to choose a subcommittee to make preliminary researches, the result of which being reported to the commission, the latter held several meetings in which long and exhaustive discussions took place. Finally, in July, 1896, the commission presented the report of its resolution to the minister of finance. The main points in that report are as follows:

(1) The resolution respecting item No. 1 of Article I of Imperial ordinance No. CXIII, 1893.

On this subject the commission accepted the result of the researches conducted by the subcommittee, and after further investigations concerning the recent fluctuations in the ratio between gold and silver, as well as concerning the relative value of gold and silver as against commodities, gave the following nine points as the causes of recent fluctuations:

a. Increase in the output of silver.
b. Reduction in the expense of producing silver.
c. The fact that there has been less demand for silver for coinage in proportion to its increased output.
d. Decrease of the demand for silver for works of art.
e. The fact that the amount of silver in existence, which is directly influenced by the laws of supply and demand, is comparatively small, while the yearly supply of silver is comparatively large.
f. The fact that the rate of increase in the output of gold is less than the rate of increase in the output of silver.
g. Increased demand for gold for coinage.
h. Increased demand for gold for works of art.
i. Increase of the tendency to hoard gold.

In regard to the general effect of the recent fluctuations the following resolutions were taken: First, as to their effect in silver countries; second, in the gold countries, and, third, on the economic relations between gold and silver countries.

First, as to their effects in silver countries:

a. Increase of exports.
b. Rise of the price of commodities.
c. Reduction in the liabilities of debtors and of the taxpayers paying fixed rates.

d. The prosperity in agriculture.
e. The growth in trade.
f. Increase of the public revenue from tax and other sources.
g. The increased demand for laborers.
h. Increase of the State expenditures.
i. Sufferings of the people who live on salaries or wages.
j. Loss to the creditors.
k. The growth of speculative enterprises.
l. Rise in the price of commodities imported from gold countries and the consequent decrease of imports.
Second, as to the effects in gold countries:
a. Profit to the creditors.
b. Fall in the price of commodities imported from silver countries.
c. Reduction in the State expenditures.
d. Fall in the price of commodities.
e. The loss to debtors and to the taxpayers paying fixed rates.
f. The stagnation of commerce and industry.
g. Reduction in the rate of interest.
h. Sufferings of the agricultural classes.
i. Reduction of the public revenue from taxes and other sources.
j. Sufferings of the employers who pay out salaries and wages.
k. The reduced demand for laborers.
l. Increase of the imports from silver countries.
Third, in regard to the effects on the economic relations between the gold and silver countries:
a. The stagnation of business transactions between the silver and gold countries.
b. Reduction in the investment of capital made from gold countries in silver countries.
(2) Resolutions in regard to item No. 2 of Article I of the Imperial ordinance.
a. The increase of export.
b. Rise in the price of commodities.
c. Reduction in the liabilities of debtors and taxpayers paying fixed rates.
d. The prosperity in agriculture.
e. The growth of trade and industry.
f. Increase of the revenue from taxes and other sources.
g. Increase of the demand for laborers.
h. Increase of the State expenditures.
i. Sufferings of the people who live on salaries and wages.
j. Loss to the creditors.
k. The growth of speculative enterprises.
l. Rise in the price of commodities imported from gold countries.
m. Growth of habits of luxury.
n. The free coinage at the mint acts as inducement to the importation of silver.
o. Stagnation of the business transactions between Japan and gold countries.
p. Reduction in the investment of capital made in this country from gold countries.

In the discussion of the question whether the recent fluctuations in the ratio between gold and silver were for the advantage or disadvantage of the country, the commission was at first divided, one part holding the opinion that the economic effect of these fluctuations was on the whole to the advantage of the country, while the other part held to the view that the effect was not for the permanent and general advantage of this country. On taking votes, however, the former opinion prevailed, which was accordingly reported as the resolution of the commission.

(3) The resolutions of the commission in regard to item No. 3 of Article I of the imperial ordinance:

In regard to this item, the subcommittee took vote on the question whether there was an immediate need of making changes in the present coinage system of the country, leaving out the question whether there may not be such a need at some future time, if not now. When the commission came to take vote, however, the question was enlarged so as to include the latter question also, and the final decision was, in consequence of this enlargement of the question, contrary to the conclusion of the subcommittee and in favor of making changes. Yet, with reference to the reasons for making these changes, the kind of standard to be adopted, and the time and method of effecting these changes, the commission was by no means unanimous. It was, therefore, thought advisable to state separately these various opinions in the report, as also the opinion of the minority, who held that there was no need of making changes, the latter being presented as a minority report.

MAIN OUTLINE OF THE OPINIONS.

I. That there is need of making changes in the present coinage system.

1. Its reasons:

A. The advantages that may accrue to the country from the recent fluctuations in the ratio between gold and silver being limited in time and sphere, we must not be misled by the thought of these advantages, but look beyond to the permanent and general good of the nation at large, and adopt a coinage system which shall be in harmony with the coinage systems of the countries in closest relation to our own.

B. That there are certain benefits which accrue to the country from the fluctuations in the ratio between gold and silver we willingly grant; but, on the other hand, we need to adopt a system of coinage which, while according to the traditions of our country, shall also be able to meet the need of these times in view of the changed condition of things abroad, i. e., to keep this country in accord with the economical progress made abroad and with the changes effected in the coinage systems of foreign lands.

C. We grant the greatness of the benefits which the country is enjoying from the recent fluctuations in the ratio between gold and silver. Yet there is a tendency abroad to bring about a reaction in the contrary direction. It will be needful, therefore, for Japan to adopt a coinage system which shall be able to meet the effects of such a reaction.

D. While we grant that the benefits to the country from the recent fluctuations in the ratio between gold and silver are comparatively large, yet, on the other hand, these fluctuations have had the effect of greatly raising the price of commodities and bringing about the present economic derangement. For this reason it will be necessary to adopt a coinage system which shall be free from these fluctuations.

2. In regard to the kind of new standard to be adopted:

A. The gold standard.
a. The unlimited circulation of silver coinage is not to be permitted.
b. The 1-yen silver coin now in circulation to be permitted to circulate without limit at a certain fixed rate of exchange, but its free coinage to be stopped.
B. The bimetallic standard.
a. The alliance of the leading nations of the world needed for the purpose.
b. The alliance of the leading nations not needed.
C. As to the mode of effecting these changes.
a. To begin making preparations at once, with a view of realizing the scheme

b. To stop for the present with making preparations only.

c. To wait for some future opportune moment.

II. That there is no necessity of making changes in the present coinage system of the country. (Report of the minority.)

The various opinions advanced in support of this proposition are:

A. The advantages to the country of the effect of fluctuations in the ratio between gold and silver are great. It will be to the country's benefit to maintain the present system in future.

B. Since the advantages accruing to the country from these fluctuations are great, it will be the best policy for the country to wait without making changes till the formation of an international bimetallic union and then to join the union.

C. We grant the advantages the country is deriving from these fluctuations, but as to the future line of policy which the country ought to pursue in regard to its coinage system we hesitate to express any opinion.

In making the above resolutions eight members voted for the resolution advocating the need of making changes, while seven voted for maintaining the present system unchanged. Among those who advocated the necessity of making changes, six advocated the adoption of a gold standard, while two advocated a bimetallic system.

Thus the majority of the commission were of the opinion that there was a necessity of making changes in the present coinage system of the country, and the majority again of those who advocated the need of making changes were in favor of adopting a gold standard. It was thus clearly shown that the coinage reform and the adoption of a gold standard was the pressing necessity of the time. Yet the difficulty of creating at once the large gold reserve necessary in order to effect this reform kept the Government from taking steps forward in that direction, until the Chinese indemnity enabled the Government to plan for creating this necessary gold reserve.

The report then states the methods by which the Chinese indemnity, which, under the original agreement, was to have been paid in Kupong (silver) taels, was finally, under a new agreement, paid in British coin (gold), and the stock of gold thus utilized for use in the adoption of the gold standard, and adds:

Since now the way was opened for the creation of a gold reserve, as was narrated in the last section of the previous chapter, the finance minister, Count Matsukata, seeing that the time was fully ripe for putting into effect the plan of coinage reform, on the 25th February, 1897 (thirtieth year of Meiji), submitted the drafts of the coinage law, with its subsidiary laws, to the cabinet council.

The policy sketched in the memorandum being adopted by the cabinet, the Government introduced into the Diet on the 1st day of March, 1897, the drafts of the coinage law and other subsidiary laws. The first of these laws took place on the 3d day of March. * * *

The bills recommended introduced to the House of Representatives were intrusted to a committee of 27 members, who approved them as a whole. The committee reported on the bill to the House on the 10th day of March. During the discussion which followed there were a few opinions advanced in opposition, and some attempts were made at amendment, but in the end these bills were passed in the House as a whole, without amendment, and were forwarded duly to the House of Peers.

In the House of Peers these bills went into first reading on the 15th day of March, and were intrusted to a committee of 15 members, who reported on them to the House on the 23d, and the bills were passed by the House of Peers also without a single amendment.

In this way where the coinage law and the subsidiary law passed by the Diet, and, after receiving the august sanction, were promulgated on the 26th day of March, 1897. * * *

The important sections of the new coinage law are given below, the sections omitted relating merely to the limit of deviation in fineness, abrasion, etc.

THE COINAGE LAW.

ARTICLE I. The power of minting and issuing coin belongs to the Government.

ART. II. The weight of 2 fün of pure gold shall be the unit of the coinage and shall be called yen.

ART. III. The coins shall be of nine denominations, as follows: Gold coin, consisting of 20-yen, 10-yen, and 5-yen pieces; silver coin, consisting of 50-sen, 20-sen, and 10-sen pieces; nickel coin, consisting of 5-sen pieces; bronze coin, consisting of 1-sen and 5-rin pieces.

ART. IV. The decimal method shall be followed in the calculation of coinage, one-hundredth part of 1 yen being called sen, and one-tenth part of 1 sen being called rin.

ART. V. The quality of the coins shall be as follows:

1. Gold coin, 900 parts of pure gold and 100 parts of copper.
2. Silver coin, 800 parts of pure silver and 200 parts of copper.
3. Nickel coin, 250 parts of nickel and 750 parts of copper.
4. Bronze coin, 950 parts of copper, 40 parts of tin, and 10 parts of zinc.

ART. VI. The weights of the coins shall be as follows:

1. The 20-yen gold piece shall weigh 4 momme, 4 fün, 4 rin, 4.4 mo (or, grams, 16.6665).
2. The 10-yen gold piece shall weigh 2 momme, 2 fün, 2 rin, 2.2 mo (or, grams, 8.3333).
3. The 5-yen gold piece shall weigh 1 momme, 1 fün, 1 rin, and 1.1 mo (or, grams, 4.1666).
4. The 50-sen silver piece shall weigh 3 momme, 5 fün, 9 rin, and 4.2 mo (or, grams, 13.4783).
5. The 20-sen silver piece shall weigh 1 momme, 4 fün, 3 rin, and 7.7 mo (or, grams, 5.3914).
6. The 10-sen silver piece shall weigh 7 fün, 1 rin, and 8.8 mo (or, grams, 2.6955).
7. The nickel piece shall weigh 1 momme, 2 fün, 4 rin, and 4.1 mo (or, grams, 4.6654).
8. The 1-sen bronze piece shall weigh 1 momme, 9 fün, and 0.8 mo (or, grams, 7.1280).
9. The 5-rin bronze piece shall weigh 9 fün, 5 rin, and 0.4 mo (or, grams, 3.5640).

ART. VII. The gold coins shall be legal tender up to any amount. The silver coins shall be legal tender up to any amount of 10 yen. The nickel and bronze coins shall be legal tender up to the amount of 1 yen. * * *

ART. XIV. Should any person deposit gold bullion and apply to have it minted into gold coin, the Government shall grant the application.

APPENDIX.

ART. XV. The gold coins already issued shall circulate at double the value of the gold coins to be issued under the provisions of this law.

ART. XVI. The 1-yen silver coin hitherto issued shall be gradually exchanged for gold coin, according to the convenience of the Government, at the rate of 1 gold yen for 1 silver yen. Pending the completion of that exchange, 1-yen silver coin shall be legal tender to any amount, at the rate of 1 silver yen for 1 gold yen, and the prohibition of their circulation shall be announced six months in advance by imperial ordinance. If these coins are not presented for exchange within the period of five full years, reckoning from the day on which their circulation is prohibited, they shall be regarded thenceforth as bullion.

ART. XVII. The 5-yen silver coin and the copper coins hitherto issued shall continue in circulation as before.

ART. XVIII. From the day of the promulgation of this law, the minting of the silver 1 yen shall cease; but this prohibition shall not apply to silver bullion deposited at the Government mint prior to that date.

ART. XIX. All laws or ordinances hitherto issued that conflict with the provisions of this law are hereby rescinded.

ART. XX. With the exception of Article XVIII this law shall go into operation from the 1st day of October, 1897.

LAW NO. XVII, OF THE 26TH DAY OF MARCH, 1897—REGULATIONS GOVERNING THE SPECIAL COMPTABILITE OF THE COINAGE ADJUSTMENT FUNDS.

ARTICLE I. The Government shall set apart a fund for the exchange and retirement of 1-yen silver coin and of coins inconvenient for circulation. The fund shall be called the coinage adjustment fund, and its income and expenditures kept as special comptabilite, separate from the general account of the Government.

ART. II. All profits arising from seigniorage and other items at the mint, resulting under a special comptabilite after 1897, shall be turned into the coinage adjustment fund.

ART. III. When 1-yen silver coin withdrawn from circulation through exchange, or other coins withdrawn from circulation on account of their inconvenience, are to be sold as bullion, such sales may be transacted by the Government by any contract it may choose to enter into.

Now, such being the coinage law and the subsidiary laws, the main points in the practical scheme of executing the reform set on foot by the finance minister may be stated as follows:

I. To mint the new gold coins with gold bullion bought with the Chinese indemnity money.

II. To exchange with gold coin the 1-yen silver coins and the silver promissory notes of the mint previously issued.

Now that gold was made the standard of coinage, according to the coinage law, it is very clear that the silver 1 yen, which had hitherto occupied the position of the unit of coinage, ought to be exchanged for gold coins. Should, however, the actual amount of these silver yen brought in for exchange exceed their estimated amount, it would not only be impossible to accomplish the work of exchange, but also the latter fact would at once destroy the very basis of the new coinage system. For this reason careful researches were made as to the amount of the silver yen which would be brought in for exchange with gold coins.

The estimated amounts stood as follows:

	Yen.
1-yen silver coin circulating at home	39,320,000
1-yen silver coin which would be brought back from abroad for exchange	10,000,000
Silver bullion corresponding to the promissory notes of the mint	30,000,000
Total	79,320,000

III. As to the method of disposal of the silver yen withdrawn from circulation:

The total amount of the silver yen to be exchanged, some 79,000,000 in all, according to the estimate in the preceding paragraph, shall be disposed of partly by minting them into subsidiary coins, according to the purposes explained under Paragraph V, and partly by transporting them abroad for sale, after disfiguring them so as to make them legally unfit for circulation at home.

IV. As to the disposal of the silver bullion corresponding to the promissory notes of the mint:

Although with the promulgation of the coinage law of 1897 the further coining of silver yen was to cease, there must be provided a means for the disposal of the silver bullion corresponding to the promissory notes of the mint. It was intended now to dispose of it in the same way as the silver yen, by partly devoting it to minting subsidiary coins and partly selling it abroad.

V. To make an increased issue of subsidiary silver coins, the gold piece which would correspond with 1 yen, if coined, would be so small in weight as to be inconvenient for daily transactions. For this reason no provision was made in the coinage law for the minting of 1-yen gold pieces. Yet in order to keep firm the foundations of our coinage system the people must be supplied with hard money for the purposes of small daily transactions. There was therefore the more need of making an increased issue of subsidiary coins, since not only were the Government paper money and national-bank notes to be retired, but the convertible 1-yen notes, which were being largely used in the smaller transactions among the people, were to be reduced in amount. For these reasons it was now planned to make the increased issue of subsidiary coins, consisting of 50-sen and other smaller coins.

Such, in general, were the lines of policy according to which the coinage law was carried into operation. * * *

REGULATIONS CONCERNING THE EXCHANGE OF 1-YEN SILVER COINS.

In accordance with the Article XVI of the coinage law (law No. XVI of 1897), where it is provided that 1-yen silver coins shall be exchanged gradually, at the rate of 1 yen gold for 1 yen silver, the Government now issued regulations concerning the exchange of 1-yen silver coins by finance department notification No. LXI of September 21, 1897. The regulations run as follows:

FINANCE DEPARTMENT NOTIFICATION NO. LXI OF THE 21ST DAY OF SEPTEMBER, 1897.

From the 1st day of October, this year, 1-yen silver coins hitherto issued shall be gradually exchanged with gold coins. Persons desirous of having them thus exchanged may apply at the central Government treasury. The application may be made at the Yokohama Specie Bank and its branch office at Kobe, both of which act as agencies for the Nippon Ginko, and the Government treasuries in different parts of the country, where the officials in charge will accommodate the applicants by getting the coins exchanged at the central treasury.

In regard to the circulation of the 1-yen silver coins, there was issued on the 18th of September, 1897, imperial ordinance No. CCCXXXVIII, as follows:

IMPERIAL ORDINANCE NO. CCCXXXVIII OF THE 18TH DAY OF SEPTEMBER, 1897.

The circulation of 1-yen silver coins hitherto issued is prohibited after the 1st day of April, 1898.

While the circulation of 1-yen silver coins was thus to cease altogether on April 1, 1898, a term of full five years after these coins ceased to circulate was allowed for making their exchange. Yet, on the other hand, when the actual state of affairs was studied soon after they ceased to circulate, as well as the state of affairs since October of the previous year (1897), at which date the Government had begun to make the exchange, it was seen that the work of exchange had progressed with unexpected speed, so much so that there was no need to further continue making the exchange. In fact, there was not only no need, but some danger that, if the five-year period was allowed to remain, counterfeit 1-yen pieces might be imported from abroad. For these reasons, already at the end of 1897, Count Matsukata, finance minister at that time, presented to the cabinet a draft of the law for the shortening of the period allowed for the exchange of 1-yen silver coins. Yet, owing to the dissolution of the Imperial Diet, that draft was never laid before the houses. When Count Inouye succeeded Count Matsukata as finance minister, he also saw the need of cutting short the five-year period, and the draft of the law to that effect laid before the extraordinary meeting of the Diet was passed by both houses. The draft became law No. V of the 10th of June, 1898, and runs as follows:

LAW NO. V OF THE 10TH DAY OF JUNE, 1898.

No exchange of 1-yen silver coins shall take place after the 31st day of July, 1898.

While it had been the rule hitherto to exchange 1-yen silver pieces with gold coins and transact the business connected with that exchange only at the central treasury (the treasuries in different parts of the country simply accommodating themselves in assisting applicants to get the exchange made at the central Government treasury), the Government regarded it necessary to make certain changes in connection with the process of exchange in order to make sure that there should be no 1-yen silver coins left over unexchanged on account of the shortening of the five-year period. These changes were embodied in the finance department notification No. XLIX of June 15, 1898, and are as follows:

FINANCE DEPARTMENT NOTIFICATION NO. XLIX OF THE 15TH DAY OF JUNE, 1898.

I. Any person desirous of getting the 1-yen silver coin exchanged for any kind of currency may apply during the period allowed for its exchange at any of the Government treasuries and subtreasuries.

II. The 1-yen silver coin may be used in the payment of taxes or in otherwise making payment to the Government during the period allowed for its exchange. * * *

The mint now immediately increased its working capacity, began minting these coins, and worked both day and night scarcely without cessation, so that by the prescribed day—i. e., September 30—it succeeded in turning out 49,587,160 yen of the new gold coins.

The original estimate of the new coins to be minted was now increased, and it was decided to coin by the 31st day of March, 1898, in addition to the amount mentioned above, 500,000 yen of 5-yen gold pieces and 24,500,000 yen of 10-yen gold pieces; total, 25,000,000 yen,

making the revised total of the new gold coins to be issued 73,000,000 yen altogether. Accordingly the amount of new gold coins turned out by the mint from October, 1897, to April, 1898, was altogether 24,868,575 yen.

The total sum of gold coins minted by the Government between April, 1897, and April, 1898, in preparation for effecting the coinage reform was thus altogether 74,455,735 yen, and this amount was now devoted to making the exchange of silver yen.

THE MINTING OF SUBSIDIARY SILVER COINS.

In order to place the currency system of a country on a sound basis, it is essential that a sufficient supply of coins be provided for the use of the community at large. It is particularly important that coins be used by the people in their smaller daily transactions. Now, the amount of 1-yen convertible notes issued by the Bank of Japan had reached the vast sum of over 66,000,000 (estimate at the end of March, 1897). And since a greater portion of these notes was being used in daily transactions by the people, it was thought proper to order the Bank of Japan to commence withdrawing gradually its 1-yen convertible notes, along with the adoption of the gold standard, in order that the Government might issue hard money in their place; but in regard to the nature of the hard money to be thus issued in exchange for these notes it was feared that 1-yen gold pieces, if coined, would be too small, and hence inconvenient for handling. For this reason in the coinage law no provision was made for the minting of gold 1-yen. Accordingly the Government adopted the plan of issuing an additional amount of subsidiary silver coins, consisting of 50, 20, and 10 sen pieces, and of making them take the place of 1-yen convertible notes, so far as these were being used in daily transactions by the people.

THE WITHDRAWAL FROM CIRCULATION OF THE 1-YEN SILVER COIN—THE PREPARATIONS FOR EXCHANGING 1-YEN SILVER COINS.

By Article XVI of the coinage law of 1897 (law No. XVI), it was provided that all the 1-yen silver coins then in circulation should be, at the convenience of the Government, exchanged at the rate of 1-yen gold for 1-yen silver. As this law was to be put in force on the 1st day of October of the same year, the Government at once took up the work of providing the fund needed for the exchange of 1-yen silver coins. But early in July of the same year some of the foreign banks at our treaty ports, being doubtful as to the actual working of the coinage law, sent out circulars to their customers notifying them to the effect that, after the 1st of October, those banks should exercise the liberty of choosing either gold or silver coins in making specie payments. Under these circumstances, the outlook was not free from the danger that if things were allowed to proceed as they were they would eventually lead to a change in the market ratio between gold and silver; and, perceiving that in order to prevent such a contingency it would be a matter of the most urgent necessity to effect the change of 1-yen silver coins with all possible dispatch and promptness, the finance minister (Count Matsukata) decided on adopting the following course:

1. On the 1st day of October to get all the 1-yen silver coins in the possession of the Bank of Japan and of the Yokohama Specie Bank exchanged for the gold coins in the possession of the Government.
2. To allow foreign banks in the treaty ports to get the 1-yen silver coins in their possession exchanged for gold coins after the 1st day of October, the transactions connected with this business to be intrusted to the Bank of Japan.
3. In view of the above-mentioned course taken by the Government, to instruct the Yokohama Specie Bank and its branches to use gold in all their payments.
4. That the president of the Bank of Japan should endeavor to induce the foreign banks to also make their payments in gold.

Then, on the 15th of July, the following instruction was issued to the Bank of Japan:

Since the coinage law goes into operation on the 1st day of October of the current year, the Bank of Japan is hereby ordered to undertake the exchange of 1-yen silver coins now in circulation according to the following method:

1. One-yen silver coins which may be in the possession of the Bank of Japan on the 1st day of October, as well as those that may come into its possession after that date, the bank shall get exchanged for gold coins at the Government treasury.
2. As regards 1-yen silver coins in the possession of the Yokohama Specie Bank and of the foreign banks in the treaty ports after the 1st day of October of this year, the bank shall endeavor to persuade their possessors to exchange them for gold coins.
3. As regards all payments made at the head office of the Yokohama Specie Bank, whether these payments are made by it as an agency of the Bank of Japan or not, the Bank of Japan shall see that after the 1st day of October those payments are made entirely in gold coins.

The exchange of 1-yen silver coins for gold coins is a matter requiring great care on the part of the Government, since it is virtually connected with the successful working of the coinage law; for it would be a very grave thing, indeed, if, on account of the lack of promptness in exchanging 1-yen silver for gold coins, there should be produced a change in the ratio between gold and silver. Particular care and caution need to be exercised therefore, both preceding and following the going into operation of the coinage law; and by entering into a very thorough consultation on this matter with the Yokohama Specie Bank, and also by ascertaining the state of feeling among foreign bankers, the Bank of Japan shall regulate things in such a way as to bring about the successful completion of this work of exchange.

In accordance with the foregoing instruction, the Bank of Japan commenced making the necessary preparations for the coming event, while the Yokohoma Specie Bank, after consulting with the Bank of Japan, sent out the following circular to its customers:

"We beg herewith to state that on and after the 1st day of October of this year we shall meet all our obligations, which are already due to our customers or which will become due, with gold coins, regardless of our promise to pay them in silver. Further, while this bank will accept silver coin in payments made to it, silver coin will not be used in making our payments.

"We remain, etc."

P. S.—We beg to further notify our customers that we have received orders to exchange for gold coin on demand after the date mentioned above the convertible notes of the Bank of Japan up to any amount.

This course of action had the effect of dispelling the doubt at first entertained by foreigners concerning the actual working of the coinage law, and the foreign exchange also came to resume its normal rate.

Then, besides, as stated in Section IV, Chapter V, the regulations for the exchange of 1-yen silver coins were issued by the finance department notification No. LXI of the 21st of September, same year. In the meanwhile, the work of minting new gold coins to be used for exchanging the silver yen having made good progress while that of coining subsidiary currency to fill the place of retired 1-yen silver pieces was also completed, the finance minister (Count Matsukata) on the 2d day of September submitted to the cabinet council a measure for forbidding the circulation of the 1-yen silver coins after the 1st day of April, 1898. * * *

Accordingly the Government decided to prohibit the circulation of 1-yen silver coins after the 1st day of April, 1898, and to announce the fact of that prohibition by imperial ordinance No. CCCXXXVIII of the 18th day of September. The imperial ordinance runs as follows:

IMPERIAL ORDINANCE NO. CCCXXXVIII OF THE 18TH DAY OF SEPTEMBER, 1897.

The circulation of 1-yen silver coins, hitherto issued, will be prohibited after the 1st day of April, 1898.

AMOUNT OF 1-YEN SILVER COINS AND OF THE PROMISSORY NOTES OF THE MINT WITHDRAWN FROM CIRCULATION.

The exchange of 1-yen silver coins, commenced on October 1, 1897, as stated in the preceding section, was concluded, according to law No. V, of June, 1898, on the 31st of July of the latter year, as was related in Section IV, Chapter V. During the interval the number of 1-yen silver coins exchanged for gold coins amounted to 45,588,369 yen. Of this sum 38,648,297 yen was received in direct exchange for gold coins, and 3,977,099 yen was first received into the Government treasury in the form of revenues and other public payments, and then exchanged for gold, while the amount received into the Government treasury at Formosa and there exchanged was 2,962,973 yen.

Besides these, there was the sum of 29,505,453 yen 4 sen 2 rin, which had been received into the mint bureau in bullion form previous to the promulgation of the coinage law, and which had not yet been minted into 1-yen silver coins, but against which the promissory notes of the mint to pay silver yen had been issued. This amount of promissory notes, therefore, the Government was

under obligation to exchange for gold coins. Now, a portion of these notes was redeemed previous to the passage of the coinage law in exchange for the convertible notes and turned into bullion, to be coined into subsidiary currency, while the rest was exchanged for gold coins simultaneously with the enforcement of the coinage law.

In other words, the total of 1-yen silver coins and the promissory notes of the mint withdrawn from circulation in connection with the adoption of the gold standard was altogether 75,093,822 yen 4 sen 2 rin. * * *

CHAPTER X.—FINAL DISPOSAL OF THE RETIRED SILVER YEN.

The aggregate total of 1-yen silver coins retired in consequence of the enforcement of the coinage law (law No. XVI of the thirtieth year of Meiji) and of the silver bullion corresponding to the promissory notes of the mint to pay coins (also retired) was 75,093,822 yen 4 sen 2 rin. Out of this total the sum of 27,567,011 yen 58 sen 4 rin was set apart for minting subsidiary silver coins, and the sum of 40,786,662 yen 45 sen 8 rin was sold at Hongkong, Shanghai, and elsewhere, while the sum of 6,740,148 yen was sent over to Formosa, Korea, etc., to be placed in circulation in these countries. In this way in December, 1898, was completed the final disposal of the retired 1-yen silver coins and of the silver bullion corresponding to the promissory notes of the mint (also retired).

SECTION IV.

The aggregate total of 1-yen silver coins withdrawn from circulation and the silver bullion corresponding to the promissory notes of the mint (also retired) was 75,093,822 yen 4 sen 2 rin, and, as stated in the preceding section, the disposal of this whole amount was completed in December, 1898, while the total price obtained from the sale of this whole amount was 69,696,240 yen 85 sen 3 rin. (This price was on an average at the rate of 92 yen 81 sen 2 rin per 100 yen silver, which, reduced to the rate per ounce of English standard silver, equals 27.0570d. per ounce; compared with actual average quotation on silver bars on both advance and immediate sales ruling in London, during the period in which the above-mentioned sale was effected, was higher by 0.2660d., the average quotation in London being 26.7910d.) The transaction thus produced a discrepancy of 5,397,581 yen 18 sen 9 rin; added to this there were the expenses incidental to the retirement and the sale, amounting to 155,730 yen 63 sen 1 rin in March 31, 1899, so that the total loss came up to the sum of 5,553,311 yen 82 sen. In order to make good this loss the sum of 5,651,960 yen 91 sen, being the net profit realized by the mint bureau for the thirtieth and thirty-first fiscal years of Meiji, was transfered to the currency adjustment fund special comptabilite, in accordance with law No. XVII of March, 1897. (The profits to the mint bureau were mainly the profits arising from the minting of subsidiary silver coins, whose amount for the thirtieth fiscal year was 2,035,860 yen 82 sen 1 rin, and that for the thirty-first year 3,616,100 yen 8 sen 9 rin.)

In looking back over the circumstances attending the retirement and disposal of the silver yen, we must note the fact that the scarcity of money prevailed throughout the thirtieth fiscal year (1897) as a result of the sudden expansion of business and industrial enterprises following the victorious war with China (1894–95); and it being impossible in consequence to float in the home market the Government bonds issued as a post-bellum measure, the Government itself had to buy them by appropriating 14,670,000 yen out of the indemnity money. Coming to the thirty-first fiscal year (1898), the stringency of the money market yet more increased, so that in order to ameliorate this condition of affairs the Government made a further disbursement of over 36,990,000 yen out of the indemnity money for buying Government bonds, and of over 3,040,000 yen for buying the bonds, to be newly issued, of the Industrial Bank of Japan. Even yet the condition of the market did not allow the floating of a public loan. Under these circumstances the Government had to make further temporary appropriations out of the indemnity money to the extent of over 70,650,000 yen to cover the expenditures which were to be met by floating Government bonds and of over 15,000,000 yen to meet the deficit in the general account, owing to the delay in the passage of the law for increased taxation. For these reasons it was apparent that if the retired silver yen were kept idle in the Government treasury for any length of time it would become difficult to meet the annual expenditures. Although it was decided to recoin a part of the amount of the retired silver yen into subsidiary coins, still there was also an immediate necessity for making proper disposal of the remainder. This was, moreover, at a time when silver quotation in London was depreciated to the level of 23d. (August, 1897). There was thus a peril that the rate might be yet further forced down, if a large amount of silver were sold off just then, and the transaction might have resulted in a loss of tenor, even 20 per cent. The situation, therefore, created much anxiety in the minds of men in authority. But toward the winter of 1897 the price of silver rose at one time above 27d., owing to the tight money market which was produced by the scarcity of currency in Shanghai, Hongkong, and their vicinities. While in this country it happened that the harvest of 1897 proving unusually bad, large quantities of foreign rice were imported via Hongkong.

The situation offered a good opportunity for selling abroad 1-yen silver coins, and with the latter object in view an order was issued to the Yokohama Specie Bank to forward to and sell off the retired yen silver in the above-named regions, to employ a part of the money obtained in the payment of bills drawn against the imported rice, and to send home the rest in other forms of draft. At the same time here at home, the Hongkong and Shanghai and the chartered banks having requested the Government for the sale of silver yen in order to meet the demand of silver in Shanghai and Hongkong, a considerable amount was sold to them. By March of 1898 (thirty-first year of Meiji) silver again showed signs of depreciating, but owing to the outbreak of the war between Spain and America and to the policy of the Spanish Government to buy up silver, its price again commenced to rise. Under these circumstances our efforts to sell silver in Shanghai and Hongkong were kept up with increased vigor, and the price obtained in payment was sent home either in the form of immediate drafts on Japan or in drafts on London. In Formosa, as will be stated in Chapter XI, the stamped 1-yen silver coin now came to be put in circulation, while after the expiration of the period allowed for the exchange of silver yen, the same in its original form was put in circulation, so that a portion of the retired 1-yen silver coin was forwarded thither and disbursed at current valuation. Other ways of disposal consisted of shipping certain quantities to Korea and there exchanging them for the convertible notes of the Bank of Japan, and of making an attempt to circulate them in Weihaiwei, in both cases at the current rate of valuation. In these latter places the prices obtained were higher than at others; but the demand for these coins never rose to very high figures.

In this manner, within a short period of about one year, by December of 1898 (thirty-first year of Meiji) the disposal of the retired silver yen was entirely completed. The most satisfactory part of the whole transaction was that the disposal of this vast amount of silver in so short a space of time not only did not cause any fluctuation in the price of silver abroad, but the rate realized was actually higher than that quoted in the London market, while the loss resulting from the discrepancy between the amount retired and the price realized from its sale was no more than about 7 per cent, and that loss was amply made good by the net profit from the minting of subsidiary silver coins, and thus giving no additional burden whatever to the state.

Table XXXIX is herewith adjoined for reference concerning the present sections:

TABLE XXXIX.—1. GENERAL ACCOUNT OF THE RETIRED SILVER YEN DISPOSED OF BY SALE.

	Yen.
Total amount of 1-yen silver coins and of silver bullion corresponding to the promissory notes of the mint retired	75,093,822.042
Items under the above:	
Amount of the silver yen retired by being exchanged for gold coin between October, 1897, and July, 1898	38,648,297.000
Amount of the silver yen retired by being received in payment of taxes and other public dues and then exchanged and retired	3,977,099.000
Amount of the silver yen received in Formosa and then exchanged and retired	2,962,973.000
Amount of the promissory notes of the mint exchanged for gold coins	25,678,148.840
Amount of the promissory notes of the mint retired before October, 1897, for the purpose of coining subsidiary silver pieces	3,827,304.202
Total	75,093,822.042
Amount of retired silver yen deposed of by sale	75,093,822.042

THE EMPLOYMENT OF FUNDS IN THE GOVERNMENT TREASURY IN CONNECTION WITH THE COINAGE REFORM.

As may be seen from the preceding chapters, the coinage reform was effected by applying the gold coins belonging to the Chinese indemnity fund as a gold reserve for the exchange of 1-yen silver coins. But this does not mean that a farthing out of the indemnity money was consumed for the purpose. To explain, before being applied to various purposes for which the indemnity fund was appropriated according to the budget estimate, the gold coins belonging to the said indemnity were utilized for the exchange of 1-yen silver coins, while the amount thus utilized was paid back and the expenditures for which that amount had been appropriated met with by the money realized from the sale of the retired silver yen. In effecting all these transactions, funds in the Government treasury were made use of under different comptabilite—i. e., the indemnity money special comptabilite, the currency adjustment fund special comptabilite, and the mint bureau manufacture special comptabilite, in the following manner:

I. The indemnity money special comptabilite shall buy gold bullion with its fund deposited in London, ship the said bullion home and deliver it to the mint bureau in order to be coined into money.

II. The mint bureau shall receive gold bullion from the indemnity money special comptabilite, coin it into gold currency, and then return the latter to the said comptabilite.

III. The indemnity money special comptabilite shall exchange 1-yen silver coins for the gold currency received from the mint bureau, thus effecting their retirement.

IV. The indemnity money special comptabilite shall transfer 1-yen silver coins which have been exchanged for gold currency to the coinage adjustment fund special comptabilite at their face value.

V. The coinage adjustment fund special comptabilite shall sell at a market price the retired 1-yen silver coins received at face value from the indemnity money special comptabilite.

VI. The coinage adjustment fund special comptabilite shall pay for the retired 1-yen silver coins received from the indemnity money special comptabilite (Paragraph IV) with the money realized from the sale of those retired silver yen.

VII. The mint bureau shall coin subsidiary silver pieces with 1-yen silver coins bought from the coinage adjustment fund special comptabilite, and shall transfer to the same comptabilite the profits resulting from these subsidiary coins and from other items of manufacture.

VIII. The coinage adjustment fund special comptabilite shall make good the loss resulting from balancing the price obtained for the sale of the retired silver yen and the price at which the same were received, with the profits transferred from the mint bureau.

IX. The indemnity money special comptabilite shall in the above manner receive from the coinage adjustment fund the payment for the retired silver yen, and apply the money thus received in payment toward expenditures determined by the budget.

Thus, the indemnity money special comptabilite, while it exchanged 1-yen silver coins at its face value, did not suffer the least loss since the said comptabilite transferred it to the coinage adjustment fund special comptabilite at its face value, while the loss which the coinage adjustment fund suffered by receiving the retired silver yen at the face value and selling the same at current valuation was made good by the profits realized at the mint bureau from the coining of the subsidiary pieces.

In this manner were accomplished the retirement and disposal of 1-yen silver coin by employing funds in the Government treasury, while the loss arising from the transactions was made good by the profits of the mint bureau.

COMMERCIAL CONDITIONS AND PROSPECTS.

Commercial conditions in Japan, the demands of trade, and the methods which should be followed by those desiring closer business relations with the people of that country, the prospects as to the effect of the new treaties, and commerce in general are discussed in the following extracts from reports of consuls of various nations, excerpts from newspapers published in Japan, and other discussions by those having exceptional facilities for information upon this subject. These extracts and expressions are followed by statistical tables from Japanese official sources, which are very complete, since the Japanese Government not only publishes elaborate commercial statistics, but takes an annual census of population, schools, railways, manufacturing and other internal industries, thus presenting recent and complete statistical views of the condition of the Empire and its people.

AMERICAN FLOUR GAINING IN POPULARITY IN JAPAN.

From reports to the State Department, published in the Consular Reports for 1898, it appears that American flour is gaining in popularity in Japan. Consul-General McIvor reports to the Department as follows:

The Japanese have not been consumers of bread, but have used flour in the manufacture of confections, of which great quantities are sold and used, not only as accessories (as with us), but as staple articles of diet. For years rice flour has been used in the preparation of these confections, but they are beginning to use wheat flour, both for this purpose and, to a limited extent, in making biscuits. Almost all of the wheat flour imported into Japan comes from the United States and the import is now increasing, as is shown by the following table, taken from the official customs returns of the Empire for 1894, 1895, and 1896, compared with the table accompanying my report for the years 1890–1893, dated April 30, 1894:

QUANTITY AND VALUE OF IMPORTS OF WHEAT FLOUR INTO JAPAN DURING THE YEARS 1890-1893.

YEARS.	FROM THE UNITED STATES.		FROM OTHER COUNTRIES.		TOTAL.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.	*Dollars.*	*Pounds.*	*Dollars.*	*Pounds.*	*Dollars.*
1890	8,888,032	179,148	56,940	2,225	8,944,972	181,373
1891	11,952,270	270,655	113,602	3,348	12,065,872	274,003
1892	10,025,250	191,902	8,918	6,000	10,034,168	197,902
1893	11,862,682	199,067	158,875	4,197	12,021,557	203,264

IMPORTS INTO JAPAN OF WHEAT FLOUR FROM THE UNITED STATES FOR THE YEARS 1894-1896.

YEARS.	Quantity.	Value.
	Pounds.	*Dollars.*
1894	19,753,041	302,049.16
1895	13,866,971	205,422.29
1896	31,408,314	519,508.09

The first annual returns (1896) for the ports of Formosa (now a part of the Japanese Empire) show that the import of wheat flour from the United States was 6,900,330 pounds, valued at 218,898.76 yen ($116.016.34).

A portion of the increase in the import for the year 1896 may be accounted for by the fact that it has been discovered that a steady rice diet encourages the tendency to a disease known as "kakke," or beriberi. If wheat is used occasionally, this tendency is greatly reduced or removed, and the authorities have required the occasional use of wheat flour in the army and navy.

Almost all of the flour imported is the soft-wheat flour of Washington and Oregon. The importing merchants inform me that they have made more than one effort to introduce the hard-wheat flour, but without success. The Japanese, accustomed as they are to the white flour made from rice, object to the dark color of the hard-wheat flour. I understand that objection has also been made that this flour is more gritty than that made from soft wheat.

In the past, the import of flour has been made almost entirely by the large foreign firms at the open ports of the Empire, but the Japanese are now evincing a desire to engage in direct trade, and three or four of their larger houses in Tokyo and Yokohama are now, I believe, importing flour.

Vice-Consul Sharp, of Osaka and Hiogo, also reports to the State Department as follows:

There is a steady market here for American flour, and, in my opinion, the demand is on the increase. In 1895, the statistics of the imperial customs here show the imports to have been 581,789 catties (775,718 pounds), valued at 29,894.31 silver yen ($14,947.16); in 1896, 2,437,541 catties (3,250,055 pounds), valued at 129,447.50 silver yen ($68,736.62), showing the increase for 1896 to have been 1,855,752 catties (2,474,337 pounds), valued at 99,553.19 silver yen ($53,789.46). This increase I believe to be due to the increased transportation facilities and lower freights from the Pacific coast.

The equivalents of the Japanese yen in United States gold have been computed at 50 cents for 1895 and at 53.1 cents for 1896.

The American flour imported here comes principally from San Francisco, Cal., Pendleton and Portland, Oreg., and Spokane and Tacoma, Wash.

The demand for flour here is chiefly confined to the lower grades, not only because the use of flour is making the greatest strides among the poorer classes of the country, with whom cheapness is the greatest desideratum, but because a large quantity is used for making paste in the enormous paper industries, such as the manufacture of screens, fans, kites, and numerous other articles for which a good and cheap quality of paste is necessary.

The higher grades of American flour are chiefly sold to the naval vessels and foreign bakers, who supply the local market with bread and cakes.

The uses of flour have become more general among the Japanese during the past few years.

The difference between the average price of American flour and Japanese flour is about one cent on the pound. This information I have procured through the local government from the several provinces within this consular district.

There are two classes of Japanese flour, one manufactured from wheat and the other from rice, the latter being much smaller in quantity than the former. Japanese flour is principally used for making vermicelli, macaroni, and cakes.

The method employed by the Japanese for the manufacture of flour is primitive, compared with that in the United States. The rice or wheat, being cleaned, is then ground to a powder, or proper consistency, by means of a stone mortar, run usually by water power, which is one of nature's greatest gifts to this country. There are no flour mills of foreign construction within the limits of this consular district.

In view of the small quantity of freight offered for the outward passages of vessels from San Francisco to Hiogo (Kobé), special low rates have been made on flour, owing to its use as ballast or stiffening, instead of rock ballast.

The principal importers of American flour here are Messrs. Frazar & Co. and Dodwell, Carlill & Co., both being agents of steamers, and receive commission on their cargo, which enables them to lay flour down here at a lower figure than one engaged in other pursuits.

The question of difference between hard-wheat flours and soft-wheat flours is unknown here, and therefore cuts no figure in the flour trade.

As to whether there is a favorable opening in this consular district for hard-wheat flours, it is simply a question of price and push. The long rail from Minnesota, or as far west as Great Falls, Mont., to the Pacific coast shipping points, is the problem to be solved, and as, according to the United States inter-state commerce bill, a railway can not charge less for a long than a short haul, and wheat can be produced in Washington at as low a cost as in the Middle West, Washington flour dominates this market.

WHEATEN-FLOUR BUSINESS IN JAPAN.

[From the Japan Times, September 6, 1898.]

The flour business in this country is yet in its infant stages, and consequently there are no large mills, such as are to be found in other countries. In Tokyo there is only one establishment of the kind, two or three in Osaka, one in Nagasaki, one in Hiroshima, while a similar one was lately established in Sapporo, Hokkaido. At the one in Tokyo, where the latest improved machinery has been employed since 1896, the output of flour per month is said to amount to 16,000 bags on an average, about 4,000 koku (19,852 bushels) of wheat being consumed every month. But the output of all the mills in the country together can not be expected to entirely meet the demand of the ever-increasing number of consumers, thus necessitating the import of flour in considerable quantity. In 1892 the flour imported, chiefly from America, amounted to 752 kin (1,002 pounds); and in 1896 the imports amounted to 24,000,000 kin (32,000,000 pounds), with a marked increasing tendency. With regard to the quality of the home and American flour there is some difference, the latter being perfectly white; and it is on this account that the American flour is widely consumed now in Japan. In order to remedy this state of things, some seeds of the American wheat plant have recently been introduced into Japan, and are now cultivated and successfully raised in Joshu, Ibaraki, and other neighboring localities of the capital. It is therefore expected that after the lapse of some years the import of American flour will be greatly reduced.

TRADE CONDITIONS IN JAPAN—OPENING FOR AMERICAN GOODS.

The following extracts are from the annual report of United States Consul Lyon, of Hiogo, in Commercial Relations, 1897-98:

Nothing serves better to illustrate the progressive spirit of the Japanese than their great anxiety for the introduction of foreign capital for business purposes. The efforts in this direction by the business classes are strongly supplemented by the vernacular press and by the Japanese chambers of commerce in Kobe and elsewhere.

The foreign and Japanese chambers of commerce lately held an informal joint meeting in relation to this subject, at which time it was plainly pointed out by the foreign chamber that the capital sought, being necessarily timid, required to be properly safeguarded by a more liberal display upon the part of the Government, such as, for instance, the equalization of foreigners with Japanese in regard to the holding of shares in stock companies and in reference to the ownership of land.

Japanese business people are slow, methodical, and cautious in their dealings, and it is characteristic of them to protect themselves at every point. Business must be done carefully with them, as well as with others; their responsibility must be thoroughly investigated, and also their general business reputation. There are mercantile agencies in this country which furnish financial ratings and some of the representative Japanese houses have branches in one or more of the leading American cities.

It may be noted that there has of late been considerable complaint that goods have not been promptly taken upon arrival, and this is said to be part of a scheme by some to finally obtain them at a lower rate. The only way to do business successfully with this class would be to require the deposit of a sum sufficient to reimburse the shipper in such cases. It has largely become the practice for even reputable Japanese merchants to not only put up margins upon orders, but to fully secure the payment of large invoices upon delivery of bill of lading.

There is a peculiarity about the Japanese that does not attach to any other people, and it is this: The average Japanese are very suspicious of small wares that are not backed up with fancy trade-marks. They buy goods much more readily that carry a device or an emblem or that bear a seal, and many a good article would be in danger of rejection because not put up fancifully.

They also attach importance to small, neat packages, not too many of a kind together. This is more in keeping with Japanese tastes. In America small articles are put up and sold by the dozen; the Japanese want them separate, and this is not only true because things here are generally on a smaller scale, but there are financial reasons why it is so. Their means are limited, and they use everything sparingly.

It is probably true that the German exporter understands the native taste better than any other. The markets here are full of small wares from Germany, put up in attractive style and in small quantities to find ready sale. Another point in favor of German exporters is the fact that they do not confine themselves to the quick and ready methods of others, but stay upon the ground until they get the trade. It would be well for the Americans to note a little more closely the fact that the markets of the East can not be obtained entirely by wide-awake methods, but that much patient and persistent effort is required.

SUPERIORITY OF AMERICAN GOODS.

The Japanese have no prejudice against American goods or manufactures; on the contrary, their superiority is freely admitted in many lines. As an illustration, there was recently made at Tokyo, by the authorities of the locomotive department, a critical test of English and American locomotives, and it resulted in favor of those made in America. The American locomotives were pronounced superior in all respects, and it was especially noted that they worked more economically. Tests have also been made of American machinery and many other manufactures from our country, and in regard to their quality the results have proved most satisfactory. The chief difficulty in the way of the greater introduction here of American goods lies in the fact that our merchants and manufacturers are not putting forth the same degree of effort for the Japanese markets as exporters from other foreign countries.

SENDING CIRCULARS AND PRICE LISTS.

Too much of this is done to the exclusion of personal effort. The hotel reading rooms and private offices are stocked with mail matter from all parts. In the United States, circulars and price lists alone may produce some result; but they will avail but little 9,000 or 10,000 miles away from home, unless followed up by salesmen. One firm might deluge the market with trade literature for years, and another could send an energetic man along and pick up all the business. It might be well to pave the way by advertising; but in order to insure sales the man must be upon the ground. He must be intelligent and persistent, and his firm should bear in mind that this market is not worked any more easily than are the overworked markets at home.

CARE IN PACKING GOODS.

For the better protection of shippers' interests, it may be said that much more care should be taken by them in packing their goods for this market. Several well-founded complaints have recently been made in this respect concerning American goods, and while it is true that the same fault attaches to other foreign shippers, that fact is not of much value to American exporters. As one instance of many that have lately been brought to the attention of this consulate, it may be mentioned that one of our leading American houses here recently received from New York an invoice of seven metal fireplaces for immediate delivery. They were fine specimens and just what would have suited, but when received they were all found to be in a badly broken condition, caused simply by being improperly packed.

Such cases as these not only entail considerable loss upon shippers, but they destroy the prospect of future orders. In connection with this subject, attention should be called to several recent shipments of American cotton claimed by the consignees to be not up to standard. Four cases of this kind have occurred at this port within the last four months. Upon application at the consulate, surveyors were appointed to inspect the cotton and to extract samples from each bale, in order that they might be forwarded, under the consular seal, to cotton experts in America for examination as to value.

This not only entails loss to the shipper, but, in the estimation of some here, it tends to lower the high standard of American cotton, which export is by far the most valuable one from the United States to this port.

RAILWAY LOCOMOTIVES.

England started the railway system of Japan and was thus given a natural precedence in the railway development of the country, but she has not maintained her lead. The United States has proved its ability during the last three years to compete with and outdistance its great rival. In 1895 England exported locomotives to Japan valued at $380,935, against $142,165 worth from the United States. This year exportations of locomotives to this country stand thus: Great Britain, $899,130; United States, $1,191,906.

This is a field of industry which has been properly worked and in which the superior merits of American locomotives have been recognized, or no such results could have been obtained.

RAILROAD IRON.

The contest for supplying Japan lies between England and the United States, and it is likely that it will continue. In 1895 Great Britain furnished nearly all the railroad iron imported into this country, a very small quantity having been exported from Belgium and Germany; the United States supplied none. In 1896 the United States exported only a little more than one-sixth as much of railroad iron to this country as England did; but in 1897 a very notable increase took place from the United States in such shipments, and exportations from the two countries stood thus: Great Brttain, $810,110; United States, $615,018.

At this rate another year will show the United States to have left its competitor in this export far behind.

IRON NAILS, BOLTS, AND SCREWS.

In 1895 the United States exported to Japan but $33 worth of iron bolts and screws and $2,521 worth of iron nails, against which we exported last year iron bolts and screws valued at $5,262 and iron nails valued at $469,689. Germany was the largest shipper of nails to Japan in 1896, sending an amount equal to $469,485, against $116,160 worth from the United States; but last year these two countries changed places, the United States having shipped a large amount, while Germany dropped to less than one-half her former export.

COTTON-SPINNING MACHINERY.

The United States does not materially help to supply the vast quantity of spinning machinery required in Japan. This field is one in which England seems to have always had a monopoly. Her exports here of such machinery during the last year amounted to $2,632,509, against $4,557 worth from the United States and but little from any other country.

This state of affairs should be looked into carefully by enterprising American manufacturers of machinery, as cotton spinning in Japan is rapidly on the increase, involving a brisk demand for equipment.

Japanese agencies for the purchase of spinning machinery are established in New York. Osaka is the chief cotton spinning and weaving district, and manufactures immense quantities of cotton cloth, not only for home use, but for export to China, Korea, and Hongkong.

PAPER-MAKING MACHINERY.

The United States slightly leads in this export. Nearly all of it comes from there and England. In 1896 our country shipped paper-making machinery into Japan valued at $65,466, against shipments of the same from England of $24,796. During the year under review exports stood: United States, $197,000; England, $175,032. These latter figures show a largely increased demand for this machinery, and it should be noted that the exports from the two countries named are now nearly balanced. Large paper mills are established in this consular district.

DYNAMO-ELECTRIC MACHINERY.

The United States is well ahead in this export and should strive to maintain its lead, as there is no doubt that with the opening up of Japan consequent upon the operation of the new treaties in 1899 the demand for this machinery will be greatly stimulated, as will also be the case with many other foreign inventions and productions.

The following table gives the principal countries exporting this machinery and the value exported from each during the last three years:

COUNTRY.	1895	1896	1897
	Dollars.	*Dollars.*	*Dollars.*
United States	34,913	148,143	341,154
Great Britain	86,854	131,306	92,161
Germany	20,585	80,643	83,095

MINING MACHINERY.

This is used for the mining of coal, silver, copper, sulphur, and antimony. The imports were:

COUNTRY.	1896	1897
	Dollars.	*Dollars.*
Great Britain	34,200	119,231
United States	12,533	31,250
Germany	2,754	7,860

FLOUR.

Flour is a growing import into this country, and the United States supplies most of it, a very small quantity being shipped from British America and China. The United States more than doubled its export of flour to Japan in 1896, but during the last year the exports of this article gained only about 17 per cent, in consequence of its enhanced value at home, cheapness being an indispensable condition to ready sale in this country. When the price of flour in the United States again becomes normal it will no doubt soon be much more extensively exported to this country.

RAW COTTON.

Since 1895 British India has gained largely in the exportation of raw cotton to Japan, having more than trebled its shipments in three years, while China has fallen behind about 50 per cent.

The United States gained more than 80 per cent in 1896 over the preceding year, and more than 70 per cent in the year under review. In commenting on the increased import here of American cotton, the annual report of the foreign chamber of commerce at Kobe states that from October to December last 120,000 bales were contracted for, and that in consequence spinners would in the near future be using 40 per cent of American cotton against 12 to 15 per cent in former years. It was also stated in the report that the working of American cotton both reduced the running expenses of the mills and increased their capacity to turn out the finished product.

GROWTH OF AMERICAN IMPORTS INTO JAPAN.

[From British consular report in British Board of Trade Journal.]

In last year's report attention was drawn to the fact that rails were exported from the United States of America to Japan for the first time in 1896. The development in 1897 deserves attention from British manufacturers and merchants. The following table gives the figures for all Japan:

RAILS FROM—	VALUE.	
	1896	1897
	£	£
Great Britain	163,000	203,000
United States of America	123,500	37,500
Belgium	29,000	9,000
Germany	17,000	10,000
Total	332,500	259,500

In 1896 British rails were four-fifths of the total imported. In 1897 they were less than half. £73,000 more rails were imported in 1897 than in 1896, but the import of British rails fell off by £40,000, while the import of American rails increased by £86,000. Belgian and German rails also advanced slightly at the expense of the British.

In 1897 of railway material Great Britain had 61½ per cent; United States of America, 16¼ per cent; Belgium, 13 per cent, and Germany, 9¼ per cent of the imports. In 1896 Great Britain had over 77 per cent of it all; Germany nearly 12 per cent; Belgium, 6 per cent, and the United States of America only 5 per cent. Although the railway material is less important than the rails, it is nevertheless noteworthy that in this, as well as the rails, the States increased their exports to Japan to over treble the 1896 amount.

Previous to 1897 all the pig iron came from England, but this year about 8 per cent came from the States. The American pig iron is not liked so much as the English, and what is used is mixed with British pig. The American compares favorably with the English in price. Of all imported, perhaps 15 per cent is taken by the Government shops, and the balance in privately owned foundries.

Of bars, 80 or 85 per cent is Belgian, and only 15 or 20 per cent is British. At the most, 10 per cent of the total is high quality; this is all English. Probably 5 to 10 per cent of cheap quality bars now come from England; formerly all the cheap bars came from Belgium. About 70 per cent of these bars are iron and the rest mild steel.

Of plates and sheets about 75 per cent is English and 25 per cent is Continental, the greater part of the former being mild steel. Crucible steel is practically all English.

Of wire nails, 62 per cent comes from the States, 32 per cent from Germany, 4 per cent from Belgium, and 2 per cent from England.

HINTS TO EXPORTERS TO JAPAN.

The following paragraphs are from the annual report of United States Consul Harris, of Nagasaki, in Commercial Relations, 1897–98:

"Whenever an article of American manufacture has secured the favor of Japanese tradesmen, there is no reason for its not continuing to monopolize the market (for the sentiment of the people is strongly in our behalf), provided the standard of quality be fully maintained and an equal amount of care and attention be paid to the appearance of the packages and to the methods of shipping that are given to such matters by European manufacturers. There is a preference on the part of most foreigners and of many Japanese for glass jars for all fruits, vegetables, etc., rather than tin cans, when the former are practicable. Whatever is put upon the glass in the nature of label or advertisement should be so heavily varnished or shellacked or prepared in some way as to permit of its being washed without marring the beauty or clearness of the label, while cans should be provided with labels other than those of thin paper, which do not allow the can to be washed and have its appearance restored when it becomes flyspecked or shopworn. The methods adopted by most of the French purveyors are recommended. In the matter of packing, it is very desirable that the initial jar or tin be as small as is practicable—for example, butter in half-pound cans, fruit and vegetables in half-pound cans or pint jars, while cases of such size as can be carried conveniently by a porter along rough mountain roads will find a much readier sale with the Japanese than the large cases containing two dozen 2-pound cans. In the one item of biscuits (crackers), it is believed that the American bakers are gradually supplanting the European, and there is no apparent reason why our merchants should not secure a monopoly of this business, provided the standard be fully maintained. The present size of the tin boxes used rather checks the sale to the Japanese, and it is probable that tins of half the size would sell much more readily. Besides the matter of cost, there is an additional reason for the preference for small tins in that the biscuits soon lose their crispness in this moist climate.

"In textiles, machinery, implements, and all other articles it is equally important that the standard of excellence originally established when first soliciting orders be rigidly maintained, and also that the requirements of the Japanese dealers and consumers be carefully ascertained and fully complied with. These may at times seem to be somewhat whimsical in that they differ so widely from established customs in the United States—for example, as to the width of a piece of cloth, the length of the bolt, the number of pieces in a bale, the dimensions of a package, or the size of a case of machinery; but it will always be found that there is good reason for these requirements, either in the meagerness of the demand or the inadequate transportation facilities.

"It is worthy of note that the Western Light and Power Construction Company, of San Francisco, supplied to the recently opened Nagasaki Hotel (one of the finest hostelries in the Far East, representing an investment of some 300,000 yen) its entire outfit of electrical apparatus, including engines, in competition with several other bidders. The same company has also secured another profitable contract.

"There is already a considerable importation of leather into this consular district, both sole and upper, all of which is used for making boots and shoes. Of this the bulk comes from the United States, and there is no reason why our tanners should not have a practical monopoly of this business and largely increase their export of raw leather to Japan. There is little reason to expect a demand for harness leather or for boots and shoes. The duty on leather after January 1, 1899, will be 0.0558 yen (2.77 cents) per pound, specific, for sole, and 10 per cent ad valorem for other kinds."

AMERICAN COMPETITION WITH BRITISH TRADE IN JAPAN.

[From the British Board of Trade Journal.]

The assistant Japanese secretary to Her Majesty's legation at Tokyo, in a report to the foreign office on the trade of Japan for 1897 (Annual Series, 2109), states that the appearance of the United States as a serious competitor with Europe was, in 1896, attributed to the prevailing depression in the States, but the same reason will not account for the continued growth of this competition in 1897, and other causes must be sought.

In the first place, it would seem that the period of prosperity experienced in the States until about 1893 or 1894 ended with a considerable overproduction in every branch of manufacture. The depression which ensued brought about an era of economy and stimulated the development of labor-saving machinery and appliances of every description, and by their adoption the American maker has been able not only to meet the lower prices offered to him by his own countrymen, but in many cases to create a demand abroad by selling his surplus at cost price and thus freeing the home market from any excess.

In the second place, the development of an export trade from the United States has been taken up by large combinations of varied interests, having as their object the collection and dissemination of such practical information respecting the world's requirements as will lead to an extension of commerce. These institutions stand ready to furnish gratis all details with regard to the resources and industries of the States, and there can be little doubt but that this broad and comprehensive policy is of incalculable assistance to those concerned in American trade. Another point to be mentioned is the development of direct steamship lines from New York, whereas formerly goods were sent to Liverpool or London for transshipment to Japan.

While the relative growth of Japan's imports from the United States shows a very large increase in recent years, the amount of exports from Great Britain has increased by a larger total value; but it must be borne in mind that the American invasion has only just commenced, that the ground has been prepared for large extensions in the future, and that unless some unforeseen changes take place the tendency will be toward encroachment upon the trade hitherto belonging to Great Britain. The import trade to Japan of the United States is growing rapidly, more particularly in machinery, locomotives, and railway material—articles for which the United Kingdom has hitherto held a monopoly.

A reference should also be made to the quick deliveries which can always be obtained from America. As an instance, English locomotive builders required two years for the delivery of an extensive order, while the Baldwin Locomotive Works turned them out at the rate of two a day and shipped the whole quantity within eight or ten weeks.

Another case recently occurred where the English time for shipment of five locomotives was ten months and the price about $12,000 gold, delivered in Japan; and American makers offered to ship in fourteen weeks at about $8,000 gold. The same specification was submitted to both countries. The time allowed for execution of orders by the Japanese buyer is always very short and the tendency is to make it shorter still; consequently prompt shipments are a great advantage, and when, in addition, the shortness of the rail and sea route via the Pacific coast is taken into consideration, it is apparent that the British maker must, even on the same terms as to price, offer strong counter inducements to insure successful competition. At the same time there seems to be no doubt in the minds of the Japanese as to the superiority of the British-made engine.

The total imports from the United States and Great Britain in 1890, 1895, 1896, and 1897 are shown as follows:

FROM—	VALUE OF IMPORTS INTO JAPAN.			
	1890	1895	1896	1897
	Yen.	*Yen.*	*Yen.*	*Yen.*
United States	6,874,531	9,276,360	16,373,419	27,090,537
Great Britain	26,619,102	45,172,110	59,251,780	65,409,266

The British vice-consul at Tacoma (U. S. A.), in a recent report to the foreign office (Annual Series, 2115), says that respecting commercial relations with China and Japan, in addition to the regular steamships of the Northern Pacific Steamship Company, four chartered steamers have been employed for single voyages to cope with the requirements of the traffic during the summer months; at this time the question of the imposition of duties on tea, matting, and other products of China and Japan was under consideration by the Government; and importations that, under ordinary circumstances, would have been spread over an entire season, were hurried across within the second quarter of the year in the hope of arriving in the United States before the duty had been imposed. In consequence, the volume of trade from the far East for the remainder of the year was comparatively small. On the other hand, the exports of flour, raw cotton, machinery, wire nails, steel rails, electrical material, and manufactures of all kinds from the United States to Japan, China, and the East generally show a perceptible increase; and the capacities of the steamers connected with the trans-Pacific lines have been taxed to the utmost on the western voyage to afford the shipping facilities required. The quantity of steel rails brought across the American continent by rail from the manufactories in the vicinity of Chicago, and exported via Puget Sound to Japan, has aggregated about 15,000 tons; and it is a remarkable circumstance that the American manufacturers, under the disadvantage of the expense of 2,000 miles transportation by rail, can successfully compete with English and Belgian firms selling rails in Japan. There has been some falling off in the number of bales of cotton domestics, with other textile manufactures, passing through the Puget Sound ports for China, the exporters apparently finding cheaper shipping facilities by steamers running from New York via the Suez Canal. Exports from America have, to an appreciable extent, been curtailed by the dearth of opportunities for shipment across the Pacific in consequence of the steam tonnage in the regular lines being insufficient to carry all the cargo offered, and the rates of freight not proving remunerative enough to induce outside steamers to run the risk of coming across from China or Japan in ballast for the return cargoes offering.

The Nippon Yusen Kaisha, the Japan Mail Steamship Company, whose American terminus is at Seattle, has greatly improved its service during the year, the company's boats having been carrying very full cargoes. The principal articles of export and import to and from Seattle have been carried by this line, and an enormous amount of business done by the company. A very large increase may also be noticed in the cotton and textile manufactures, as well as in the iron manufactures, under which head are included the exportations of steel rails to Japan and Korea.

JAPANESE COMMERCIAL MUSEUM.

The Imperial Commercial Museum of Japan has been recently established under the control of the department of agriculture and commerce of the Japanese Government. The objects sought to be attained by the museum are of the same nature as those of the Philadelphia Commercial Museum.

The regulations, forwarded to the Bureau of Foreign Commerce of the State Department, are as follows:

REGULATIONS OF THE IMPERIAL COMMERCIAL MUSEUM OF THE IMPERIAL DEPARTMENT OF STATE FOR AGRICULTURE AND COMMERCE.

ARTICLE I. Samples of the following articles of commerce shall be placed on exhibition in the museum:

(*a*) Home products.
- (1) Staple commodities of export.
- (2) Articles capable of future exportation.
- (3) Articles to compete with imported commodities.
- (4) Raw materials of industry.

(*b*) Foreign products.
- (1) Articles serving as models for home manufactures.
- (2) Articles competing with Japanese products in foreign markets.
- (3) Articles apprehended as future competitors with our export commodities.
- (4) Articles commanding large sales in foreign markets, imported thereto from other countries, and capable of being manufactured in this country.
- (5) Staple commodities of import.
- (6) Articles promising future importation.
- (7) Raw materials of industry.

ART. II. Besides those specified in the preceding article, samples and models of patents, registered designs, and trade-marks, forwarded from the imperial patent office, shall be placed on exhibition.

ART. III. The museum authorities will accept, in accordance with the rules provided for the purpose, and provided there is no special reason to the contrary, exhibits on loan or donations from Japanese and foreigners of the articles enumerated in Article I, and a space shall be set aside for such exhibits in the respective departments classified under Article V.

ART. IV. In the case of articles of an explosive, combustible, or otherwise injurious nature, only the covers used for packing may be placed on exhibition.

ART. V. Exhibits will be classified and arranged in the following six departments: Agricultural products, forestry products, aquatic products, mining products, manufactures, and patents, each of which is subdivided into several groups.

ART. VI. An official catalogue will be published from time to time for distribution to those interested therein.

ART. VII. Explanation in regard to the articles on exhibition will be given to any visitor applying for same.

ART. VIII. The museum authorities will be in correspondence with commercial, industrial, and educational museums and schools at home and abroad, and will exchange printed matters as well as exhibits.

ART. IX. Any person desiring to purchase an exhibit will, on application, be referred to the exhibitor. In such case the museum authorities will not be held responsible for any difference arising from the transactions thereof.

ART. X. When any information is requested in connection with an article on exhibition as to its market price, freight charges, customs duty, wholesale price, quantity available, credit obtainable on the goods, etc., the same will be furnished after due investigation. In special cases the expense (if any) required for such investigation shall be paid by the applicant for information.

ART. XI. An application to ascertain the demand for any article newly manufactured, and to have same introduced to a possible purchaser, shall, after due investigation, be complied with, provided that the applicant shall defray any expense occasioned by such investigation.

ART. XII. An official bulletin shall be published by the museum, which will contain the home and foreign correspondence, reports, and other matters connected with foreign commerce.

ART. XIII. Those who are desirous of obtaining the bulletin shall send their names, addresses, and subscriptions to the publishing office; in special cases it may be furnished free of charge.

ART. XIV. A reading room shall be provided in connection with the museum, where industrial and commercial reports and statistics, maps and charts, books of reference, the Official Gazette, and detailed statements of patents, designs, and trade-marks, together with newspapers and magazines, shall be kept for the use of visitors.

ART. XV. Applications of exhibitors for the prohibition of sketching, drawing, photographing, or otherwise reproducing articles placed by them on exhibition may be complied with and enforced.

ART. XVI. Visitors shall be admitted free of charge.

ART. XVII. Strict observance of the rules and regulations of the museum is required of visitors.

ART. XVIII. The museum will be daily open to the public, except on those days specified in Article XIX, during the following hours, subject, however, to special closing or change of hours:

From January 8 to February 28, 9 a. m. to 3 p. m.
From November 1 to December 24, 9 a. m. to 3 p. m.
From March 1 to July 10, 8 a. m. to 3 p. m.
From September 11 to October 31, 8 a. m. to 3 p. m.
From July 11 to September 10, 8 a. m. to 2 p. m.

ART. XIX. The musuem shall be closed on the following days: The day folowing national holidays; from January 1 to 7; from December 25 to 31.

REGULATIONS RELATING TO THE EXHIBITION OF ARTICLES IN THE IMPERIAL COMMERCIAL MUSEUM.

ARTICLE I. Any person desiring to exhibit articles in this museum must present to the museum authorities an application, accompanied by an inventory and detailed statement of each article, written in Japanese, English, German, or French, in accordance with the forms annexed herewith. When several articles not of kindred nature are to be sent in by one exhibitor, they must be properly classified before being sent.

ART. II. After due examination, the museum authorities will communicate to the applicant the suitability or otherwise of his articles for exhibition.

ART. III. As early as possible after receiving the notice of approval, the article or articles must be forwarded, securely packed. Each package must be marked "commercial samples," and addressed to the "Imperial Commercial Museum, Department of State for Agriculture and Commerce, Tokyo," with the name and address of the exhibitor appended thereon.

ART. IV. The exhibitor must prepare a list of his exhibits and place the same in the package containing them. He shall be entitled to a receipt for the articles so forwarded, provided they conform in number and quality with the articles approved under Article II. In case of disparity or damage thereto, the same shall not be accepted for exhibition.

ART. V. Exhibitors may at any time change a portion or whole of their exhibits, or have them returned, while the museum authorities may notify an exhibitor to withdraw or change any or all of his exhibits when deemed necessary so to do.

ART. VI. Any exhibits recognized to be of special importance or benefit may be purchased by the museum authorities.

ART. VII. Exhibits may be accompanied by tables showing their yearly production and sales, and by trade-marks and covers generally used for packing them.

ART. VIII. The choice of location for the display of exhibits shall be determined by the museum authorities alone.

ART. IX. Care taking for the exhibit may be undertaken by the museum authorities, or by the exhibitors or their agents if such are located in Tokyo; in that case, the address of such care takers must be communicated to the authorities at the time of forwarding the exhibits.

ART. X. Exhibitors may undertake, by consent of the authorities, to arrange their own exhibits; and, when deemed necessary, the museum authorities may notify the exhibitors so to do.

ART. XI. Exhibitors are required to defray only the packing expenses and freight charges to and from the museum; all other expenses for arranging exhibits shall be borne by the museum, and under special circumstances freight charges may also be defrayed by same.

ART. XII. For exhibition of specially valuable articles the museum authorities may, when deemed necessary, pay rent for same.

ART. XIII. Exhibitors may, by consent of the authorities, place special decorations around their exhibits, or place them in decorated cases, at their own expense.

ART. XIV. In the absence of special conditions as mentioned in Article XI, any package for which freight charges have not been prepaid shall not be accepted. If the sender of such package is not known, the museum authorities shall have power to deal with it according to their discretion.

ART. XV. The museum authorities shall take proper precautions for the safe preservation of all exhibits, but shall in no way be held responsible for damage, stain, or loss caused by water, fire, robbery, or any other unavoidable cause.

ART. XVI. When the applications for space for exhibits become too numerous, or when otherwise deemed necessary, the museum authorities may temporarily decline to receive or arrange exhibits.

ART. XVII. In regard to exhibition of machineries, only small articles shall be accepted for the present.

APPENDIX.—FORM OF APPLICATION.

Date ——.

To the Imperial Commercial Museum, Department of State for Agriculture and Commerce:

I (or we), the undersigned, do hereby apply for permission to exhibit on loan (or to present) the articles specified in the accompanying inventory, and appoint (name and address) as agent, in conformity with the regulations of the museum.

Signature —— ——,

Address ——.

FORM OF INVENTORY.

(1) Name of article and quantity.
(2) Nature and quality thereof, and measurement.
(3) Shape, color, and design.
(4) Price.
  (*a*) Retail price.
  (*b*) Wholesale price at the place of production.
  (*c*) Wholesale price after being landed in this country.
(5) Period to be exhibited.
(6) Disposal of the exhibit after the period has expired (return to owner, sale, or presentation to this or other commercial museum).

FORM OF DETAILED STATEMENT.[a]

(1) Place of production.
(2) Name of producer, manufacturer, or manufactory.
(3) Materials used in the manufacture and their respective places of production.
(4) Quantity annually produced at that establishment.
(5) Quantity annually sold.
(6) Percentage of discount (if any) for wholesale trade.
(7) Address of business offices (head office, branches, and agents).
(8) Places where each article is in demand.

[a] As a copy of this statement is intended to be placed on view with the exhibit to which it refers, items of information which the exhibitor does not desire to make public must each be clearly marked "not to be made public," and will accordingly be omitted from the copy for exhibition.

(9) Social class of principal customers.
(10) Seasons (if any) when chiefly required and when chiefly produced.
(11) Cost of packing (per ton).
(12) Freight charges (per ton) from the place of production to Yokohama or Kobe.
(13) Time occupied in transportation.
(14) Export duty (if any) and other charges.
(15) Amount of subsidy or other aid, if any.
(16) Any other useful particulars.

THE FINANCIAL FUTURE OF JAPAN.

[From Japanese-American Commercial Journal.]

The balance of English trade has of recent years been in favor of excess of imports over exports, the same amounting last year to the large sum of £237,000,000. The Jiji's explanation of this astounding condition is that England stands as a creditor nation toward the entire financial world, by which fact she is not only able to import foreign products at cheaper rates, but furnishes and controls the money market of the world with an enormous surplus fund. The steady increase of imports is the sign of her growing financial power. This prosperous condition of the British trade sets the Jiji conjecturing upon the future of Japan's finances. Thus far, it argues, our financial relation with other nations has been confined to export and import transactions. True, we are at present under obligations to foreign capitalists for the amounts of the old and new loans and interests thereon, but in future, thinks the Jiji, our indebtedness toward foreign capitalists will grow much greater by our borrowing from them inevitably. This, according to the Jiji, will but be a natural consequence to a greater proximity of relations between this and foreign markets. Foreigners will invest in our stocks and participate in the liabilities accruing therefrom. But at the same time, the Jiji points out, they will be empowered, as a matter of course, to sell their shares in the Japanese market, and get back their capital at any time. Or, if foreigners should start up their own enterprise in this country, they will reap not only the interest on the capital they may invest, but also the profits of the business. For the last two years our imports have been in excess of exports owing to the fact, so argues the Jiji, that we have not yet come to redeem the war bonds that were sold abroad two years ago, and also to the fact that the Chinese indemnity fund was brought home, which made Japan for the time being a creditor nation. On the expiration of the term of the bonds, however, the introduction of foreign capital will become more urgently demanded. The situation will quicken the exportation of our products, undertaken by foreign exporters, to whom we shall have to pay a large fee for the transaction. All these facts, then, the journal concludes, indicate that this country will before long become a debtor nation, a fate exactly opposite to that of England. The Jiji's opinion as to how we may best cope with such a situation is to employ the introduced capital with so much tact as to make it contribute to the gradual recovery of the position of a creditor nation by increasing the amount of production far in excess of exports.

FOREIGN COMPANIES IN JAPAN.

Copies of ordinances recently published in Japan have been forwarded to the State Department by Minister Buck, of Tokyo, under date of June 20,1899. They read as follows:

ORDINANCES FOR FOREIGNERS.

[Translated by Dr. Loenholm.]

I. *Imperial ordinance No. 172, of June 15, 1899, relating to branch offices of foreign commercial companies, and to commercial companies and associations established by foreigners.*

Article 1. A foreign commercial company which has set up a branch office in Japan before the commercial code takes effect must, within six months from its taking effect, register such fact according to the provisions of article 255 of the commercial code and appoint a representative in Japan and register his name and domicile.

The provisions of article 257 of the commercial code and of article 202 of the law concerning matters not in contention apply correspondingly to such foreign companies.

Art. 2. A commercial company formed by foreigners in Japan before the commercial code takes effect must, within six months from its taking effect, make a company contract in accordance with the provisions of the commercial code and register the formation of the company.

Art. 3. If a commercial company act in contravention of the provisions of article 2, the court may, on the application of the public procurator or of its own motion, order the dissolution of the company.

The order of dissolution must be published in the same manner as registered facts are published.

Art. 4. As to commercial companies formed by foreigners in Japan before the commercial code takes effect, the legal relations which will arise before the registration is made according to the provisions of article 2, or before an order of dissolution has become finally binding, are governed by the law of the country to which the company belonged.

Art. 5. An association formed by foreigners in Japan before the commercial code takes effect, which has property of its own, must, within six months from the date of the commercial code, change its organization into that of some kind of commercial company recognized by the commercial code. The provisions of the preceding two articles apply correspondingly to such an association.

II. *Imperial ordinance No. 273, of June 15, 1899, concerning foreign insurance companies.*

Article 1. If a foreign commercial company establishes an agency in Japan to carry on the business of insurance, it must appoint a representative in Japan. The provisions of article 62 of the commercial code apply correspondingly to such representative.

Art. 2. The foreign company must notify the Government of the name and domicile of its representative in Japan.

ART. 3. The provisions of articles 95 and 97–101 of the law concerning the operation of the commercial code apply correspondingly to foreign insurance companies.

ART. 4. If it appears to the Government that the continuance of the business of a foreign insurance company is endangered, or if the foreign company acts in contravention of an order of the Government, the Government may order that the prosecution of the business be suspended or the representative be removed.

ART. 5. Whenever a foreign insurance company makes an inventory and a balance sheet, it must, without delay, submit it to the Government, together with a business report, an account of profits and losses, and a statement as to the distribution of the profits.

ART. 6. A foreign insurance company which has set up a branch office or an agency in Japan before the taking effect of the commercial code must, within six months from its taking effect, obtain permission of the Government.

The provisions of article 95, 2, of the law concerning the operation of the commercial code apply correspondingly to such foreign companies.

ART. 7. The provisions of articles 1, 2, 4, and 5 of this law and of articles 98–101 of the law concerning the operation of the commercial code apply correspondingly to foreign insurance companies which have established a branch office or an agency in Japan before the commercial code takes effect.

FOREIGN TRADE IN JAPAN.

[From the British Board of Trade Journal.]

The following totals relating to the foreign trade of Japan during the years 1897 and 1898, taken from the customs returns, have been published in the Japan Weekly Mail:

	1897	1898	Increase.
	Yen.	*Yen.*	*Yen.*
Exports	163,135,077	165,662,304	2,527,227
Imports	219,300,771	276,996,526	57,695,755
Total	382,435,848	442,658,830	60,222,982

The total growth of the trade is the largest on record, the nearest approximation being the growth shown in 1894 as compared with 1893, namely, 52,758,011 yen. But in the year 1894 the increase was tolerably evenly divided between exports and imports, the increment in the case of the former being 24,000,000 yen, and the increment in the case of the latter 29,000,000 yen in round numbers. In 1898, on the contrary, exports showed a development of only 2,500,000 yen, whereas imports increased by 57,500,000 yen. These facts, however, must not be taken without analysis. Japan's export trade is made up of raw products and manufactured goods, in the proportion of 5 to 3, approximately, as seen in the following table:

	1897	1898
	Yen.	*Yen.*
Export of raw products	117,771,632	106,197,206
Export of manufactured goods	45,363,445	59,465,098

It appears therefore that whereas the export of raw products fell off by 11,500,000 yen, that of manufactured goods increased by 14,000,000 yen. Indeed of the twelve chief staples making up the export trade in manufactured goods only one failed to increase, namely, carpets, which fell from 973,871 yen in 1897 to 850,879 yen in 1898. Nothing is more interesting in Japan's foreign trade than the steady development of manufactured goods. The following table gives the figures for 1898, 1897, and 1889, so as to show not only the growth in those years, but also the growth that has taken place in a decade:

	1898	1897	1889
	Yen.	*Yen.*	*Yen.*
Habutaye	12,055,506	9,[illegible]576	894,147
Other silk piece goods	573,551	185,940	
Silk handkerchiefs	3,555,144	3,[illegible]146	2,164,420
Cotton piece goods	2,601,507	1,[illegible]576	148,574
Carpets	850,871	973,871	[illegible]
Matches	6,273,572	5,641,996	1,[illegible]
Flowered matting	3,938,218	1,[illegible]738	[illegible]
Cotton yarns	20,105,671	13,[illegible]157	.....
Porcelain and pottery	1,989,545	1,819,[illegible]	1,[illegible]
Lacquer	783,131	767,408	[illegible]
Straw braid	5,981,125	3,181,945	144,847
Umbrellas	687,196	628,[illegible]	[illegible]
Total	59,465,048	45,[illegible],445	6,[illegible]

It thus appears that the exported value of these 12 staples of manufacture increased ninefold in a decade. The Japan Weekly Mail, from which the above is taken, says that it would appear from these figures that Japan's future will probably be industrial. On the other hand, the export of raw products is made up of seven principal staples, namely, silk, tea, rice, copper, coal, camphor, and marine products. The last, marine products, may be capable of great development. It is, perhaps, one of the fields where foreign

enterprise and foreign capital might be profitably employed, but its growth during the past decade has been insignificant. Taking the other six staples, the following table shows the value of the exports:

	1898	1897	1889
	Yen.	*Yen.*	*Yen.*
Silk	44,673,342	58,683,102	29,250,052
Tea	8,215,991	7,860,460	6,156,728
Rice	5,919,230	6,145,249	7,431,653
Copper	7,267,074	5,776,774	2,879,335
Coal	15,229,969	11,545,801	2,237,804
Camphor	1,174,574	1,318,292	1,391,371
Total	82,480,180	91,329,678	49,449,943

The rate of development in this branch of the export trade does not bear comparison with the rate shown above in the case of manufactured products; the rate for the principal staples of raw products being less than two to one and that for the manufactured products more than nine to one. Further, the items that make up the list do not seem to suggest any prospect of large increment hereafter. Tea, rice, and camphor may be set aside at once—tea, because the market for it is limited and shows no sign of growing: rice, because the domestic demand will probably keep the quotation at such a point that profitable export will be impossible; and camphor because, whatever Japan's product might become under careful husbanding, it tends at present and has for many years tended to diminish rather than increase. With regard, then, to the remaining three staples, the figures for silk seem at first sight encouraging. It used to be thought, indeed, that an almost unlimited field offered for the export of Japanese silk; but of late China, with her newly established filatures and her originally better product, has become a powerful competitor, and there is now reason not only to modify the hopes once entertained for the Japanese staple, but even to apprehend that it may be partly driven out of the arena. At all events, the trade in raw silk is shown by experience to be a delicate business, and the annual fluctuations are very heavy, as seen in the following table:

YEARS.	EXPORT OF RAW SILK DURING THE PAST SIX YEARS.	
	Yen.	*Millions.*
1893	31,591,935	.....
1894	42,892,751	Increase 11¼
1895	50,928,440	Increase 8
1896	31,666,210	Decrease 19¼
1897	58,683,102	Increase 27
1898	44,673,342	Decrease 14

Apparently the export of this staple reached its maximum in 1897. As for coal, it shows a substantial increase—from 2½ million yen in 1889, to 15¼ millions in 1898. But the growth of manufacturing industry in Japan will involve a correspondingly increased domestic consumption of coal, so that the portion available for export will become more and more limited. It is supposed that Japan is not rich in coal. New seams may be discovered, but experts allege that even at her present rate of extracting the mineral, a fifty years' supply is not in sight. Coal, then, can not be regarded as a considerably expanding staple of export. Copper alone remains, and the same remark applies to it, that the sources of supply are comparatively small. On the whole, it can not be said that the future of the export trade in raw materials offers an encouraging prospect. The great hope seems to lie in manufactured products.

It might be supposed that the remarkable increase of imports—namely, 57½ million yen—was in anticipation of the high rates imposed by the new tariff, which went into operation from the beginning of this year. But whatever the influence of that factor may have been, it does not make itself conspicuously apparent in the returns. Here are the figures for the regular staples which ought to be chiefly affected by an appreciation of import duties:

	1897	1898
	Yen.	*Yen.*
Cotton yarns	9,625,258	8,547,588
Shirtings	5,835,347	7,082,427
Other cotton goods	2,474,023	2,458,090
Camlets	3,835,881	4,398,427
Flannel	1,187,656	1,360,283
Woolen cloth	1,943,532	2,803,918
Watches	1,991,813	2,960,212

The total increase under these headings does not exceed 2½ million yen. It is to the following imports that the greater part of the growth in the returns must be attributed:

	1897	1898
	Yen.	*Yen.*
Raw cotton	43,620,214	45,744,899
Sugar	19,799,092	28,256,359
Rice	21,528,429	48,204,197
Alcohol	969,360	2,698,039

These five articles account for 32 millions of the increase. Among them rice is the most remarkable. The import of rice under normal circumstances ranges from 4 to 6 millions of yen; but the exceptionally bad harvests of 1896 and 1897 created an extraordinary demand, which will of course disappear in the face of the fine yield for 1898. Should the rice crop in the current year be of average quality, it may be anticipated that under this heading alone the imports for 1899 will show a diminution of fully 40 million yen.

THE TEXTILE INDUSTRIES OF JAPAN.

The details of the textile industries of Japan, which differ in many particulars from those of the United States, are described by Consul Lyons in a recent report to the State Department, and published in the Consular Reports of May, 1899, as follows:

The manufacture of textile goods in Japan is not confined to certain localities, as in the United States, but extends, by means of hand looms, all over the country. The spinning wheel was formerly in general use, but during the last twenty years it has been almost wholly displaced by spinning mills using machinery. More than 1,000,000 spindles are now thus operated, 47 mills in Japan producing last year an estimated yield of 650,000 bales of cotton yarn of 400 pounds each. Present returns show that more than 200,000 bales will be shipped to China during the current year, and the home demand for counts averaging 18s. will be nearly supplied by the remaining 450,000 bales. Only one of the spinning mills in Japan has imported the machinery necessary for spinning the higher counts above 30s. The Nippon mill, of Osaka, has done this, but so far has probably not made a success of it. Higher counts are steadily imported from England, and in greatly increasing quantities, to meet the home demand. When mill hands with greater skill are to be procured in Japan, the spinning of the higher counts will increase more rapidly, in order to supply the domestic market and the demands from China and Korea.

Increasing demand for the higher counts of cotton yarn explains the rapidly growing market for American cotton, from which it is produced. It would be well for American cotton producers to note this fact with a view to educating a sufficient number of Japanese workmen to become expert and teach others, in order to extend the sale of American cotton, from which the higher counts are made.

Many of the large class of persons formerly employed in spinning by hand are now engaged in weaving textiles on hand looms. It has recently been computed that more than 600,000 hand looms are in use in Japan, and it is stated that they employ 890,000 women and 50,000 men. As these hand looms are generally operated in private houses, giving a home character to the work, it can readily be seen why such slow progress is being made in the introduction of power weaving machinery. The hand looms now in use are called "battan," and are an improvement on those formerly used. They cost but about 5 yen ($2.50 gold) each, and take up little room in a house, while a power machine would require a separate building, and with the necessary power would cost, say, nearly 500 yen ($250 gold). The hand loom will produce about half as much as a power loom, but one person could attend to perhaps four or five of the latter at a time, and thus be able to turn out, say, eight or ten times the product with a power loom as with a hand loom. The convenience, however, of having the hand loom in the house and the difference in its cost will perhaps be sufficient to delay the introduction of power looms to any great extent for some time to come. The comparative cost of labor is about one to eight or ten in favor of the power looms, and this should tend to crowd out the hand looms very fast; but it is not doing so yet, though the progressive spirit of the Japanese will no doubt ultimately cause them to substitute power looms for the hand looms now in use. In regard to spinning machinery, the labor cost is about one to one hundred and fifty in favor of the machine, and this very great difference is of course the cause of the rapid introduction of spinning machinery.

The hand looms are handmade, and are principally used in supplying some 1,000,000 pieces of goods, say 14 inches in width and from 12 to 25 yards in length, to the home market and for export to China and Korea.

SILKS.

The Japanese manufacturers are very conservative in their business methods, and manufacture large quantities of goods only on orders. The largest silk factory in Japan using power looms is the Kyoto Orimono Kaisha, of Kyoto. It imported these machines from France. It was the intention of the company to manufacture silk fabrics for export, but after some years of unsuccessful attempt the project was abandoned, and the company commenced making satins and "obi" materials for home use. In these lines, it is said, it has been very successful. This mill also manufactures curtain and upholstery materials, and it has found a good market for them in England and Australia. The power looms first obtained have been copied here, and the company is using large numbers of them; but they are not equal to the imported ones.

Silk in its various forms, from the raw material to the finished product, is mainly exported from Yokohama. The industry dates back to an early period, and is to-day in an advanced condition.

Exports of manufactured silks from Japan during 1897 were as follows:

ARTICLES.	Quantity.	Value.	
		Yen.	*Dollars.*
Silk piece goods:			
Chirimen (silk crapes) ..... pieces..	1,005	11,608	5,781
Habutai (pongee) ..... do....	642,801	9,530,676	4,746,276
Others ..... do....	47,433	297,047	147,929
Silk and cotton mixtures ..... do....	7,123	13,576	6,761
Silk handkerchiefs ..... dozen..	1,157,913	3,390,145	1,688,292
Other silk manufactures	.....	450,036	224,118

WOOLENS.

There is no doubt a great misapprehension existing in our country as to the necessity for the use of woolen goods in Japan. The climate is thought by many to be such as not to require warm clothing in winter, but this is not the case. During the last winter, which was said to be not as cold as usual at this port, foreigners were clothed as warmly as persons need to be during the cold season in Washington, D. C., and the masses of the Japanese people needed, but did not have, the same protection; and it must be remembered that this locality is a warm one in comparison with some other parts of the Empire.

The manufacture of woolen goods is a new industry here and a small one, as only about 13 per cent of the woolen textiles used in Japan are made in this country. The raw material is all imported from China, Australia, and London. The four woolen factories of the country are located in Osaka and Tokyo. One is owned and operated by the Imperial Government, and manufactures supplies for the army and navy. Some of the better grades of cotton and woolen yarns are made there, but they are mostly imported. A large proportion of the woolen cloths used are made on hand looms similar to those already referred to.

Importations of wool and woolen fabrics into Japan during 1897 were as follows:

ARTICLES.	Quantity.	Value.	
		Yen.	*Dollars.*
Wool.....catties (1⅓ pounds)..	2,702,486	1,337,424	666,037
Woolen cloths.....yards..	1,613,232	1,943,531	967,878
Woolen mixtures.....do....	461,764	290,543	144,690

TOTAL VALUE OF TEXTILE AND FIBER IMPORTS INTO JAPAN DURING 1897.

ARTICLES.	Value.	
	Yen.	*Dollars.*
All-wool fabrics, woolen mixtures, wool, and woolen yarns.....	12,677,370	6,313,330
Raw cotton and cotton fabrics.....	63,113,602	31,430,574
Raw silk and silk mixtures.....	1,315,661	655,199
Raw flax, hemp, canvas, and linen mixtures.....	1,060,680	528,219
Other manufactured fabrics and goods, as cotton handkerchiefs, towels, velvets, felts, webbings, and other raw materials.....	1,242,936	618,982
Total.....	79,410,249	39,546,304

A much more general use of woolen products is requisite for the comfort of the people, and all classes are constantly becoming more able to purchase them; hence, there is no doubt that the demand for them will increase.

RUGS.

Japanese rugs have deteriorated in quality to such an extent as to greatly check the American demand. The materials used are hemp, jute, cotton, wool, and silk, the two latter separately and in combination. They are made on upright hand looms, which vary from 3 to 24 feet in width. The pattern is worked from the front. This is largely a "home industry." There are no large factories. Only one or two employ more than 100 hands each. Kobé is the center of the rug-making district.

Mr. Brennan states in his report that in the neighborhood of Osaka and Hiogo there are some 2,000 establishments, employing in 1896 about 13,000 females and 5,000 males, producing some 3,000,000 square yards of rugs, at prices ranging from 6½ to 20 sen (3¼ to 10 cents) per square foot.

Countries from which Japan imports hemp and flax for making rugs, and the value of such imports, are as follows:

COUNTRY.	Value.	
	Yen.	*Dollars.*
Philippine Islands.....	202,758	100,973
British India.....	90,202	44,921
China.....	390,748	194,592
Great Britain.....	2,867	1,428

Hemp and flax yarns were also imported to the value of 197,105 yen ($98,058).

KNITTING MACHINERY.

The first knitting machinery used in Japan was brought from England; some has since come from other countries, and the Japanese have copied all, thus deteriorating it. The machines are of hand power, and operated in private houses, from one to five being found in a house. The knitting business is not scattered through the country like weaving, but is concentrated in manufacturing centers, a great deal being done in Osaka.

Large quantities of cheap underwear are made here, all from cotton yarn spun in Japan. Cotton and woolen yarns used in making the better grades are imported. Not much woolen underwear is used, the demand being confined to the better classes of the Japanese people, who also wear light-weight all wool with open meshes in summer. This light weight referred to has been made here for some time for the Indian market. The Japanese children have lately begun wearing mixed knitted singlets in the central part of Japan, and, on account of the comfort derived, they should be extensively used in the northern part of this country. They might be if furnished at low prices; coarse quality would not hinder their sale.

SPINNING MACHINERY.

As stated in my annual report for 1898, nearly all the spinning machinery still comes from England. American manufacturers of machinery have obtained large orders for other kinds, but they seem to have utterly ignored the constant demand for spinning machinery and for all the other spinning-mill requirements, including engines and boilers. This may also be said in regard to almost all the weaving machinery in the country. The first spinning machines used in Japan were sent from England, where a single firm has supplied more than half the spindles. Another English firm supplies a complete mill equipment, including boilers and engines. Weaving machinery is largely furnished by a third. French and German makers have supplied a considerable quantity of the silk and woolen weaving machinery, and I learn that some woolen machinery for an Osaka mill came from the United States; but our country is practically sending almost none of the large quantity of spinning and similar machinery constantly in demand.

There are 52 spinning and 16 weaving establishments here using imported machinery. The weaving establishments with machinery are located as follows: Five at Tokyo, four each at Osaka and Kyoto, and one at Nishinomiya, Sidzuoka, and Wakayama. There are four flax (jute) mills making canvas and twine, located in Shimotsuke, Sapporo, Otsu, and Osaka.

JAPANESE INDUSTRIAL PROGRESS.

The growth of industrial, and, especially manufacturing, enterprise in Japan is discussed in an address by Mr. Ariga Nagafumi, of the agricultural and commercial department of the Government, which is summarized as follows by the Hiogo (Japan) News, and forwarded to the State Department by Consul-General Gowey:

"The actual state of Japanese industry is best explained by statistics. Taking the sum total of the exports to be 100, the ratio of increase of industrial exports was 66 per cent in 1888, 64 per cent in 1889, 67 per cent in 1890, 55 per cent in 1891, 67 per cent in 1892, 71 per cent in 1893, 75 per cent in 1894, 77 per cent in 1895, 74 per cent in 1896, and 78 per cent in 1897. In short, the exports have increased from 66 per cent in 1888 to 78 per cent in 1897. The decrease in the import of industrial products for the same period is shown by the following figures: Ninety-two per cent in 1887, 87 per cent in 1888, 87 per cent in 1889, 73 per cent in 1890, 73 per cent in 1891, 72 per cent in 1892, 76 per cent in 1893, 67 per cent in 1894, 71 per cent in 1895, 71 per cent in 1896, and 60 per cent in 1897. That is, imports of industrial products declined from 92 per cent in 1887 to 60 per cent in 1897. There is thus a tendency to decrease in manufactured imports and to increase in exports.

"Of the capital used in Japanese industry no perfect statistics are obtainable with regard to moneys absorbed in industrial works conducted by partnerships and individuals. But in regard to industrial companies, the increase of capital is from 56,000,000 yen ($28,000,000) in 1894 to 62,000,000 yen ($31,000,000) in 1895, 74,000,000 yen ($37,000,000) in 1896, and 151,000,000 yen ($75,500,000) in 1897. That is to say, the capital employed by industrial companies in 1897 is about three times that used in 1894. But all this capital was not actually paid up. The actually subscribed sums were 36,000,000 yen ($18,000,000) in 1894, 41,000,000 yen ($20,500,000) in 1895, 48,000,000 yen ($24,000,000) in 1896, and 74,000,000 yen ($37,000,000) in 1897. Thus, the actual capital of industrial companies is 74,000,000 yen, to which debentures—4,000,000 yen ($2,000,000) in 1894, 4,900,000 yen ($2,450,000) in 1895, 5,500,000 yen ($2,750,000) in 1896 (that of 1897 is not yet ascertained)—have to be added. Of these debentures 610,000 yen ($305,000) in 1894, 420,000 yen ($210,000) in 1895, and 440,000 yen ($220,000) in 1896, were actually paid up. Briefly stated, the industrial capital in 1897 was three times that in 1894.

"The capital employed by companies carrying on Western industries is 140,000,000 yen ($70,000,000)—of which 74,000,000 yen is paid up—with debentures, etc., as above stated. It consists generally of fixed capital, floating capital for the payment of wages, purchase of raw materials, etc. The interest charged is very high. In the case of one company, 36,943 yen ($18,977) and in that of another company 26,400 yen ($13,200) were paid in interest in the first half of 1898. It is thus inevitable that, with high interest and inefficient workmanship, the companies sometimes suffer great losses."

CHEAP LABOR IN JAPAN.

[From United States Consular Reports, 1899.]

From a recent issue of the Japan Times, a daily newspaper edited and published in Tokyo by Japanese, I take the following information relative to cheap labor in Japan:

"A member of the Osaka Watch Company says that the wages paid to the workers in that factory are certainly much lower than those paid in European or American factories; yet, despite this fact, the business of watch making is not a paying one in Japan. Lack of skill among the mechanics is one of the reasons given for this state of affairs. The employment of men at 40 to 50 sen (20 to 25 cents in American money) per diem would appear a much more profitable method than paying workman $3 per diem, and such are the wages said to be received by Western watchmakers; but against this it may be said that 10 of the latter can easily do work which would require from 70 to 80 Japanese."

The Times goes on to say:

"We are apt to think that wages in Japan being very low at present, foreigners will take advantage of the cheap labor and make very profitable investments of their capital when the revised treaties are put into practice. It is true that wages are low, counted by yens and sens, but when we consider the nature of the labor, the wages will be found to be far from low."

THE BANK OF JAPAN.

[The following article on the Bank of Japan is reproduced from the Bankers' Magazine of April, 1899, by permission of Bradford Rhodes & Co., of New York, by whom it will be reissued as part of a volume entitled History of the Great Banks of the World:]

THE BANK OF JAPAN.

GROWTH OF THE JAPANESE BANKING SYSTEM.

In order to understand the organization of the Bank of Japan let us briefly study the growth of the Japanese banking business in general. Before the restoration there were a number of rich merchants who kept what were known as "exchange houses" and who acted as the financiers of the Shogunate Government and local feudal Daimios. They also received deposits and made advances to the public, being the centers of the credit system of the time. There still exist some firms in Tokyo and Osaka which now carry on an extensive banking business, which may be rightly regarded as the direct heirs of these exchange houses.

In 1869 ten discount companies were established under the special patronage of the new Government. Among many other privileges they received a large sum of the Government paper money as the public deposit and acquired the right of issuing certificates with the security of gold, silver, or foreign coins. But these establishments shortly passed away without any success.

In 1870 Mr. Ito (now Marquis), then vice-minister of finance, advised the estsblishment of banks after the model of the national-banking system of the United States. This suggestion was favorably received, and as its result the national-bank act was enacted in

November, 1872. Under this act a bank was allowed to issue notes, convertible in gold, having as their securities Government bonds to 60 per cent of the capital, which was to be not less than 50,000 yen.[a] As a natural consequence of the political crisis, the new Imperial Government issued a large amount of inflated currency. The Government, in establishing these national banks, had in view the reduction of the amount of paper circulation by issuing the so-called gold redemption bonds, and with these bonds as the basis of banking, to let the banks supply the vacancy thus created in circulation with their notes convertible in gold. But in this respect the Government was disappointed. Within six years there were but four banks organized under this act and they could issue only about 1,420,000 yen of bank notes out of 15,000,000 yen, which were beforehand printed in New York. Even these were rapidly retired, as they lost specie reserve on account of the constant efflux of bullion.

So in 1876 the Government felt it necessary to introduce many important amendments to the national-bank act. Among many other changes the bank notes were made legal tender for all payments, except for the payment of custom duty and interest on Government bonds, and became convertible into Government paper money instead of standard gold. Besides, the amount of the bonds to be deposited in the treasury by the banks was increased from 60 to 80 per cent of the capital and the kind of bonds was made optional so long as they bore 4 per cent interest. The most important change, however, consisted in a gold reserve of 40 per cent of the capital being transformed into a paper reserve of 20 per cent.

These radical changes of the statute, combined with the issue of the Government loan to the amount of more than 174,000,000 yen to pay off feudel pensioners in exchange for their hereditary rights, greatly facilitated the establishment of national banks. They sprung up in rapid succession. Between 1876 and 1879 one hundred and fifty-three banks were organized in various districts of the Empire, their total capital amounting to 48,816,100 yen. At last the organization of the banks became so prevalent that the bank act was again amended, empowering the minister of finance to restrict, on the basis of population and taxation, the total amount of the issue of the bank notes, which was fixed at 40,000,000 yen, as well as the number and capital of the national banks. Their legal term of existence was also limited to twenty years. Although there were some failures among these national banks, most of them enjoyed good, prosperous business. Side by side with these national banks there also sprung up ordinary banks, which are at present regulated by the bank act of 1890. They are either individual, partnership, or joint-stock concerns. When the legal term of national banks expires, they usually continue their business as ordinary banks. These now number 1,485, their paid-up capital amounting to 191,028,716 yen.

ORGANIZATION OF THE BANK OF JAPAN.

The rise of national banks in rapid succession increased the evil effects of an inflated currency. The price of all commodities and rate of interest rose by leaps and bounds, while the Government bonds lost their value. The proper regulation of the currency became the prime necessity of finance. To relieve this situation the Bank of Japan (Nippon Ginko) was organized in 1882. This was a part of the broad scheme of Mr. Matsukata (now Count), then minister of finance.

He sets forth in his memorandum the object of this institution as follows:

(1) To promote the cooperation and assimilation of banks under a central bank; (2) to increase capital available to trade and industry; (3) to reduce as well as to equalize the rate of interest; (4) to transfer to the bank various services in the treasury when its business is firmly organized; (5) to discount foreign bills so as to regulate the influx and efflux of specie.

At the same time national banks were ordered to give up their right of issue.

In 1884 the convertible bank-note act was enacted, whereby it was aimed to replace both the Government and national-bank notes with those of the Bank of Japan, so as to unify the currency system under this central institution. These objects were steadily pursued. On October 10, 1882, the Bank of Japan commenced its business. In December of the same year it opened its branch office at Osaka. Since then its business has grown to an enormous extent, and at present it has branch offices in Osaka, Moji, Nagoya, and Hakodate, and subbranches in Otaru, Sapporo, Kyoto, and Taihoku (Formosa), besides many agencies for the management of Government money.

CAPITAL AND RESERVE OF THE BANK.

At first the capital of the Bank of Japan was 10,000,000 yen. This was divided into 50,000 shares of 200 yen each. One-half of this capital was subscribed by the Government with its surplus fund. This was afterwards transferred to the Crown property. The expansion of business necessitated the increase of capital, and in 1887 it was increased to 20,000,000 yen, and again in 1895 to 30,000,000 yen. Its capital, which is all paid up, is divided into 150,000 shares. The shares are all registered, and their ownership is allowed only to Japanese who have permission of the minister of finance to acquire it. The number of the shareholders now stands at 877.

For some years a distinction was made between the shares owned by the Government and those owned by people in the rates of dividend, but since 1887 all shares are equally treated. The profit is semiannually divided in the following way: Out of the net profit 6 per cent is declared as the first dividend, and then at least one-tenth of the rest is added to the reserve and another one-tenth is distributed as the bonus of the bank officers. The second dividend is to be declared out of the remainder, some part of which may be carried to the reserve account. Since 1887 the sum of these two dividends varies between 10 per cent and 15 per cent per annum.

The reserve fund can be paid out only to make up for the losses of the capital or to equalize the annual dividends. This fund is to be invested only in the purchase of gold, silver, or Government bonds, and the profit from the same is carried to the gross income of the bank. The latest account of this fund stands at 12,570,000 yen. The successive directors of the bank always endeavored to increase the fund so as to strengthen its credit.

THE BUILDING OF THE BANK.

The bank now occupies a three-storied granite building, 110 feet by 115 feet. Its whole ground is about 3½ acres. The plan of this building was settled upon after a careful study of the European central banks. Strong rooms are built in its basement. Electric light, water supply, and other conveniences are all up to the latest improvements. In spite of comparatively low wages and cheap materials in Japan, it cost some 1,150,000 yen. It was due to the energy of the late Governor Kawada that such a magnificent building was projected. And it is also noticeable that the plan as well as the execution of this building is the work of a Japanese architect, Dr. Tatsuno.

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[a] The present value of the Japanese gold yen in American currency is about 50 cents ($0.498.)

ISSUE OF NOTES BY THE BANK.

At the time when the Bank of Japan was organized the market was flooded with inconvertible paper currency. The Government paper money amounted to 115,381,292 yen, with denominations as small as 10 sen. The notes of national banks were over 34,396,818 yen, which did not all pass with the same credit. The currency was inflated to such a degree that the premium on specie was once 79 sen per yen. Under such circumstances it was the policy of the Government to place the power of regulating the currency in the single hand of the Bank of Japan, and to replace this inflated currency with the notes of the bank, which are elastic and redeemable in silver. For this purpose the Government again issued gold-note redemption bonds to contract the circulation of depreciated paper and purchased silver and foreign bills to prepare the way for the return to specie payment. Within three years the Government paper money was withdrawn to such an extent that the Bank of Japan felt safe to issue its first notes in May, 1885, and the specie payment of all paper currency was announced to be commenced on January 1, 1886.

The law which regulates the notes of the Bank of Japan is based upon the German system, yet there are some interesting differences. The bank notes are of three kinds:

(1) The notes issued on metallic reserve. This reserve has been silver, but since the adoption of the gold standard on October 1, 1897, this is gold, save that one-fifth of the total metallic reserve may be kept in silver. But, like the Bank of England, this exception is seldom availed of.

(2) Those issued on business assets within legal limit. This issue is limited at present to the amount of 85,000,000 yen. The limit was at first 70,000,000 yen, but has been increased to the present amount since May, 1889. But the outstanding circulation of the Government and also the national-bank notes are to be counted into this amount, and it is meant to replace them gradually with the notes of the bank. Again, for this privilege the bank advanced to the Government a sum of 22,000,000 yen without interest. This has been used as the fund to withdraw the Government paper money. Recently there has been much discussion of increasing this authorized amount of issue; and while the writer is preparing this essay the lower house of the imperial diet has just passed a Government bill proposing to increase the amount to 120,000,000 yen.

(3) The emergency notes, or those issued upon business assets in excess of the above legal limit. These notes are subject to a special tax. The rate of the tax is to be 5 per cent or more. In the German system, as we all know, this rate is fixed at 5 per cent; but in the Japanese system only the minimum rate is fixed, and the power of discretion is given to the minister of finance, who may charge any rate above 5 per cent, according to the state of the money market. This is quite an effectual measure to prevent stringency of the market, and at the same time to secure the immediate withdrawal of superfluous notes when the necessity is over.

That this system of note issue is admirably adapted to meet the varying demands of trade has been very well tested in the German system. But this is especially so in the case of Japan, where, for the reason of her geographical situation, specie can not be called in from abroad to respond to the immediate demand of trade. Since 1890 the emergency issue has been availed of seven times. That it is effective in relieving the market is shown by the fact that Japan has so far been free from any serious commercial panic.

The notes of the Government and of national banks have been gradually retired, and the bank notes are taking their place. The day is near at hand when the whole paper-circulating medium will be unified into the notes of the Bank of Japan. The following table will show this fact:

TABLE SHOWING THE AMOUNT OF CIRCULATION OF VARIOUS NOTES.

	Jan. 1, 1886.	Jan. 1, 1889.	Jan. 1, 1899.
	Yen.	*Yen.*	*Yen.*
The bank notes[a]	3,944,763	65,547,249	193,799,901
The Government paper	86,304,010	46,566,086	5,411,726
The national-bank note	30,108,129	27,862,931	1,864,620

[a] The notes of the Bank of Japan are of seven denominations: One yen, 5 yen, 10 yen, 20 yen, 50 yen, 100 yen, 200 yen; but 20, 50, and 200 yen notes have never been issued, and 1-yen notes are being speedily retired.

KINDS OF BUSINESS TRANSACTED BY THE BANK.

The kinds of business transacted by the Bank of Japan are mentioned in its statute, as follows:

(1) The purchase or discount of exchequer bills, bills of exchange, and other commercial paper.

(2) Dealing in gold and silver.

(3) To make loans upon gold and silver coin and bullion.

(4) To make collection of bills for banks, corporations, and individuals who are the regular customers of the bank.

(5) To receive deposits and accept the custody of objects of value and documents.

(6) To make advances in current account or in loans upon the securities of Government bonds, exchequer bills, or other bonds and shares guaranteed by the State.

Besides these the bank performs a number of important services for the treasury without compensation. Not only does it receive and pay out public revenues and expenditures for the State, but it also manages all operations concerning public debts, public deposits, and the retirement of the Government and national-bank notes. In fact certain parts of the bank are closely united with the various departments of the treasury.

Bills and checks in modern forms are new things in Japan. For the last twenty years the Government as well as the bank has not spared every encouragement to their use in commercial transactions. As the result of these efforts, the discount business has grown to a considerable amount. The return of the clearing houses in Tokyo and Osaka during the last year amounts to 782,744,613 yen and 226,369,144 yen, respectively. Bills offered for discount to the bank must be indorsed by at least two substantial names and be payable within one hundred days. Those which bear a single name must be accompanied with collaterals, either in the form of warehouse receipts of merchandise or of the shares and bonds classed as securities of good credit. These shares and bonds are mostly of domestic railways, and are valued at 60 per cent of their market price.

The loans upon securities are much smaller in amounts than the discounts. These securities are the bonds of the Imperial Government and of Tokyo and Osaka municipalities, and also those shares and bonds guaranteed by the State. Loans can be made for a period of three months or less and renewal is allowed only once when necessary.

The bank receives deposits and makes advances in current accounts. The Bank of Japan does not pay interest on current deposits. Customers place their surplus money in the vault of the bank to secure the convenience of drawing checks upon it. The banks of the clearing-house association also settle their daily balances with their current accounts in the bank. Indeed, either in Tokyo or Osaka the whole business of the clearing house is transacted in a room of the building of the Bank of Japan. The bank also issues deposit receipts, draft and transfer checks. The distribution of various kinds of coins and bank notes to the different districts of the Empire constitutes no inconsiderable portion of the business of the bank.

Hitherto the bank allowed loan and discount exclusively to bankers, being literally the bank of banks; but since June, 1897, the way has been opened to deal directly with individuals and corporations which have good business standing. This measure has been taken to extend the benefit of the low rate of interest to the general market, and to check the excessive profit often secured by other bankers as a mere intermediary between the bank and the public. So at present the rates of interest announced by the bank are of two sorts, namely, banker's rates and private rates. At present they are as follows:

	Loan.	Discount local bill.	Current account.
Private rate[a]	2.5	2.2	.....
Banker's rate	2.3	2	2.5

[a] Interest is counted so much a day per 100 yen. For instance, 2.5 means 2 sen and 5 rin for 100 yen per day.

The change of the rates of interest on loans and discounts is subject to the sanction of the minister of finance. Their movements from week to week are carefully watched in commercial circles as indicating the state of the money-market. They are determined not to check the outflow of gold so much as it is in England, but they fluctuate chiefly with reference to the economic conditions at home.

The Bank of Japan has no direct dealings in foreign markets, but it uses its sister institution, the Yokohama Specie Bank, as its foreign agent. Indeed, to encourage foreign commerce, the Bank of Japan assists this institution in many ways. Among other favors, the former advances to the latter up the amount of 10,000,000 yen in rediscounting foreign bills at the rate of 2 per cent per annum. Recently it has been proposed to increase the amount of this advance. The indemnity money lately received from China was also transferred from London to Japan through this institution, either by the purchase of bullion or by exchange operations. The whole sum of money thus dealt with amounts to 363,446,464 yen, and this was carried within the space of only two years and a half.

The total business transactions of the bank for 1898 were 9,019,330,231 yen. The discount of commercial paper amounts to 287,746,025 yen, representing 105,515 pieces of various kinds of bills. The advances upon securities amount to 128,060,910 yen, in 3,751 separate transactions. In current account 530,579,883 yen were paid and 532,530,150 yen were received. The range of these discounts and loans at one date fluctuate between a minimum of 55,134,193 yen and a maximum of 98,642,637 yen. Generally speaking, about three-fourths of this business is done in Tokyo and Osaka, while the rest is distributed among the other three branches and one subbranch. The following figures will show the growth of business of the bank since its foundation:

	Total business transactions.	Amount received in deposit account.	Total loans and discounts.
	Yen.	*Yen.*	*Yen.*
1883	157,639,152	14,988,494	5,943,950
1887	2,657,655,064	27,245,446	81,007,987
1892	1,888,088,536	216,112,764	159,773,825
1898	9,019,330,231	532,530,150	415,806,935

PERIODICAL REPORTS OF THE BANK.

The bank is required to advertise every week in the Official Gazette the average amount of its note issue. In the Bank of Japan, as in the Bank of England, the issue department is quite separated from the business department. Since January, 1897, the bank has felt it advisable to make public the statement of the condition of its business department at the close of every week. These two reports are published every Wednesday in the Gazette. They are given herewith to show the latest condition of the bank.

THE GOVERNMENT AND THE BANK.

The Bank of Japan, being the only bank of issue, is not only placed under the control of the Government, but it is heavily burdened in return for the privileges granted. It has, as said before, to perform the following among other functions:

(1) The receipt and disbursement of Government money.
(2) The call and payment of the principal as well as the interest on the national debt.
(3) The custody of money and the goods intrusted to the Government.
(4) The redemption of the Government paper money.
(5) The redemption of the national-bank notes.
(6) The rediscounting of foreign bills of exchange for the Yokohama Specie Bank, at specially low rates.

All these involve considerable sacrifice for the bank, but are done simply for the public convenience, as directed by the Government.

For the management of the Government money there are established 44 treasuries in the principal towns of the Empire, and each treasury has a certain number of subtreasuries. These are all placed under the control of the central treasury, which is in the bank. Most of the treasuries are intrusted to other banks as agencies of the bank, which are paid for their management.

In addition to all these, the bank is under an important obligation to support the public credit in times of financial emergency. During the late war of 1894–95 it performed most valuable services for the country. Indeed, the war would not have been possible without the effective cooperation of the bank. At the commencement of the war the negotiation of a foreign loan was quite generally favored in influential quarters. But the bank opposed this idea, and was fully confident that it could depend upon the internal

resources. While it supplied the Government with the necessary funds and did its best in collecting subscriptions to the war loan, the bank was always active in providing capital to trade and industries. To the high credit of the bank, its notes circulated during the war even in the heart of the Leao Tung peninsula of China. The total cost of the war was 200,475,508 yen, but this was paid without causing any serious calamities in industrial circles.

ADMINISTRATIVE MACHINERY OF THE BANK.

The government of the Bank of Japan is composed of a governor, vice-governor (now vacant), four directors, and from three to five auditors. The governor and vice-governor are appointed by the Government for five years. The directors are also chosen by the Government out of the double number of candidates nominated at the general meeting of shareholders, and their term of office is four years. The governor and the directors meet daily together and constitute the governing board, which decides all important questions of the bank. The auditors are elected by the shareholders for the term of three years. They constitute the board of auditors, which meets at least once a month. All important actions of the board of directors, such as the changes of the rate of interest and the rate of dividend to be declared, are subject to their approval. They also inspect books and documents of the bank. The governor, the vice-governor, the directors, and auditors constitute the general meeting of the bank, which deliberates upon questions proposed by the governor. These officers must live in Tokyo, and during their terms of office they can not accept any other office either in the Government or other banks and corporations. The regular meeting of shareholders takes place semiannually, on the third Saturday of February and August. Those who own ten shares or more have a voice at this meeting.

Besides these bodies, the Government appoints a certain number of comptrollers out of the high officers of the treasury department. They have the power to stop any act either contrary to the laws and by-laws or deemed to be against the best interest of the Government. They weekly visit the bank and receive various reports regarding the condition of the bank and its transactions. They can attend any meeting of the bank officers and express their views in regard to the business of the bank.

The internal organization of the bank has passed through many changes since its foundation. At present it is divided into eight departments and the office of the private secretary; namely, inspection department, business department, teller's department, issue department, state treasury department, secretary's department, the department of securities, and accountant's department. The control of each department and of each branch or subbranch is intrusted to either managers or submanagers, who number at present twenty-three. The total number of employees now stands at 1,102.

The bank has had already four governors, and the present incumbent is the fifth, in the person of Mr. Tatsuo Yamamoto. He has already rendered very distinguished services to the bank, both as a director and as the chief of the business department. At the resignation of Baron Iwasaki, in October last, he was promoted to the present office. He is still a young man of 43 and much is expected in his future career.

COLLECTION OF DEBTS IN JAPAN.

In reply to the State Department's instruction of March 17, 1899, Consul-General Gowdy states that the method of collecting debts in Japan is in general similar to that prevailing in the United States, namely, by action at law simply or by action with attachment of the debtor's property.

The courts provided for this purpose are—

(1) Ku saibansho, or local courts, having jurisdiction over claims under 100 yen ($50) in amount.

(2) Chiho saibansho, or district courts, having jurisdiction in cases involving larger amounts. From the chiho saibansho appeals lie to the

(3) Koso in, or appeal courts, and to the

(4) Daishin in, or supreme court of the Empire.

Foreign plaintiffs not residing in Japan should furnish their agents or attorneys with ample powers of attorney, with authority of substitution. Such documents should be attested by a diplomatic or consular officer of Japan. Foreign plaintiffs are required to give security for costs.

The period of limitation of actions arising out of contracts for the sale of goods is two years.

NEW LAWS IN JAPAN.

Mr. Herod, secretary of the legation at Tokyo, sends the State Department, under date of April 10, 1899, translations of recent laws relating to the duties of consular officers and to the arrest and detention of mariners of foreign vessels, as follows:

LAW RELATING TO CONSULAR DUTIES.

ARTICLE I. Restrictions with regard to matters in the treaties especially relating to the rights of consular officers shall, within limits prescribed by law, be fixed by ordinance.

ART. II. When provisions of law are wanting in regard to matters relating to the duties of consular officers under the treaties, in cases where such provisions of law are required they shall be determined by ordinance.

ART. III. Consular officers and others who, in accordance with this law, are performing consular functions, shall perform their duties in harmony with the provisions of the laws and treaties.

Such officers, however, may conform to the usages founded on international law or to the special usages of the place of residence.

When the preceding clause can not be observed, special regulations may be fixed by ordinance.

ART. IV. When the date of the operation of a law in foreign countries is not fixed, the date of the operation of said law shall be fixed by ordinance.

ART. V. The limits of jurisdiction relating to the duties of consular officers shall be fixed by notification.

ART. VI. Consular officers who, by treaty in usage, have authority to exercise consular judicial powers, shall perform their duties relating to civil and criminal cases and to registration in harmony with Articles VII and XIII.

ART. VII. With respect to the duties mentioned in the preceding article, consular officers may, within limits not opposed to the law, treaty, or usage, perform the functions of a district or local court of justice.

ART. VIII. Consular officers can not conduct a trial for a major criminal offense. In minor criminal cases a preliminary examination is not necessary.

ART. IX. The trial of cases of major criminal offenses, the preliminary examination of which has been conducted by a consular officer, shall belong to the jurisdiction of the Nagasaki district court.

ART. X. When diplomatic correspondence is necessary relating to a case belonging to the jurisdiction of a consular officer, the minister for foreign affairs may order the consular officer not to take jurisdiction, and may cause the accused to be placed in a prison of the country.

In the case mentioned in the preceding clause the minister of justice shall, when the case falls within the province of a district court, cause the public prosecutor of the Nagasaki court of appeals to apply to that court to appoint the place of trial; and when the case belongs to the province or a local court, he shall cause the public prosecutor of the Nagasaki district court to apply to that court to determine jurisdiction.

ART. XI. With respect to the petition and trial mentioned in the preceding article, the provisions of Article XXXIII of the law of civil procedure shall be applied.

ART. XII. Appeal from a decision in a case tried by a consular officer belonging to the scope of a district court shall be made to the Nagasaki court of appeals. Appeal from the decision in a case tried by a consul which falls within the scope of a local court shall belong to the jurisdiction of the Nagasaki court.

ART. XIII. A consular officer may cause a member of his consulate or a police officer to act in the capacity of public procurator or clerk of court. When there is no suitable person to serve in the capacity of clerk of court as provided in the preceding clause, the consular officer may select some Japanese subject residing within the district of his jurisdiction to perform the duties of clerk temporarily.

ART. XIV. A consular officer may cause a member of his consulate or a police officer to perform the duties of public undertaker.

The person who executes the function mentioned in the preceding clause may, on his own responsibility, specially intrust the performance of the duties to another suitable person.

ART. XV. Any person who desires to act in the capacity of counsel or attorney, except in accordance with the provisions of law, must receive the permission of the consular officer.

ART. XVI. The provisions relating to contempt of court usually applied to courts of law shall not be applied to consular officers or others performing their duties in accordance with this law.

ART. XVII. In case there is no person to perform the duties mentioned in Articles XIII and XIV, the minister of foreign affairs may dispatch an official from another consulate in the same country to perform the said duties.

ART. XVIII. A person who is not a consular officer can be appointed by ordinance to perform the duties of such officer, as set forth in the provisions of this or other laws, only in a place where there is no consulate established.

ART. XIX. The terms "consul or consular officer," as used in this law and other laws, designate consuls or their deputies who are not honorary consuls.

ART. XX. Provisions necessary for the enactment of this law shall be fixed by ordinance.

ART. XXI. The regulations of consular courts in China and Korea shall be abolished from the date of enforcement of this law.

LAW RELATING TO ARREST AND DETENTION OF MARINERS OF FOREIGN VESSELS.

ARTICLE I. Assistance in the arrest or detention of mariners of foreign vessels, as provided for in the treaties of navigation and commerce and consular conventions with the various treaty powers, shall be given by the public prosecutor on the application of the proper consular officer.

ART. II. In the following cases the public prosecutor can not comply with the request for assistance in arrest or detention:

(1) When the person to be arrested or detained is a Japanese subject.

(2) When a person is under trial for a major or minor criminal offense in Japan or undergoing punishment therefor.

(3) When a mariner has already been released according to Article VIII and application is again made on the ground of the same offense.

(4) When the consular officer does not include with the application a correct copy of the ship's register and the list of names of mariners or a certified document sufficient to identify the mariner.

(5) When the consular officer will not guarantee the costs connected with the assistance.

ART. III. The public prosecutor, upon receipt of an application from a consular officer for the arrest or detention, if the request appears to be a proper one, shall comply with the same immediately.

ART. IV. When the public prosecutor orders the arrest of a mariner, he shall issue a warrant of arrest.

ART. V. The person to whom the order for the execution of a warrant of arrest is given shall, when the arrest is made, deliver (the person) to the public prosecutor who issued the warrant of arrest.

ART. VI. In the case mentioned in the preceding article, the public prosecutor shall immediately inspect the person, and, when it appears that he is without doubt the person designated, shall deliver him to the consular officer.

ART. VII. On application from the consular officer, the mariner who has been arrested shall be put in prison by the order of the public prosecutor.

ART. VIII. A mariner who has been detained shall, on the application of the consular officer, be released; or he may be released if within six months from the day of arrest no application has been received for his delivery.

ART. IX. In regard to the issuance and execution of a warrant of arrest, the provision in the law of criminal procedure respecting warrants of arrest shall be applied.

ART. X. Application shall be made by the public prosecutor to the proper consular officer for the amount of actual expense connected with the assistance.

ART. XI. The public prosecutor shall, on receipt of an application for assistance in arrest or detention, immediately report the same to the minister of justice; likewise when the request appears to be one that can not be complied with, it shall be reported to the minister of justice on the completion of the proceedings.

LENGTH OF RAILWAYS IN JAPAN.

[From United States Consular Report, 1899.]

Consul-General Gowey sends from Yokohama, under date of August 24, 1898, the following printed statement, showing authorized and completed mileage of railways of Japan on July 31, 1898:

NAME OF COMPANY.	Authorized (total) length.	Length completed.	NAME OF COMPANY.	Authorized (total) length.	Length completed.
	Miles.	*Miles.*		*Miles.*	*Miles.*
Japan	853.14	821.15	Nankai	42.31	20.6
Hankai	6.22	6.22	Nanboku	12.38	12.23
Iyo	12.79	12.79	Hankaku	68.58	14.22
Sanyo	321.47	280.05	Kiwa	32.34	10.79
Sanuki	27.19	27.19	Koya	23.7	10.38
Kanshi	150.63	140.57	Chugoku	98.13	.....
Osaka	45.25	45.25	Nanao	31.6	31.6
Kobu	26.77	26.77	Seiwa	64.75	.....
Kyushiu	323.73	282.51	Iga	25.4	.....
Sobu	72	72	Zuso	10.41	7.3
Sangu	26.15	26.15	Imari	8.27	.....
Hoshiu	59.51	48.34	Omi	27.45	7.42
Kawagoye	18.4	18.4	Yamaga	12.4	.....
Ome	13	13	Kibi	13	.....
Sano	9.54	9.54	Bisei	15	3.13
Nara	38.17	37.1	Tsugaru	20	.....
Hantan	71.14	30.62	Kinbe	260.74	.....
Naniwa	16.6	16.6	Uwajima	15.4	.....
Boso	53.03	26.74	Ganyetsu	108.52	.....
Ota	12.12	9.74	Tohi	140	.....
Nanyo	6.65	6.65	Tokushima	21.56	.....
Dozo	3.06	3.06	Joso	52.12	.....
Kyoto	104.06	6.27	Shunko	46.43	.....
Chuyetsu	22.6	18.4	Tobu	48.51	.....
Narita	31.79	24.57	Ishinomaki	39.52	.....
Hokuyetsu	99.06	66.47	Mobu	32.37	.....
Kozuke	21	21	Joya	31.26	.....
Toyokawa	18.55	13.36	Tango	34.45	.....
Kayo	11.23	6.06	Tsuga	13.52	.....
Karatsu Kogyo	27.3	.....			
Nishinari	3.52	3.52	Total	3,521.2	2,231.16

JAPAN AND THE NICARAGUA CANAL.

[From the New York Commercial.]

According to S. Uchida, the Japanese consul at this port, the United States has found in Japan a strong champion in the building of the Nicaragua Canal. Though the United States has gone steadily ahead in its determination to cut through the narrow neck of Central America and thus join the two great oceans, rumors of international disputes have grown so numerous that even those who have been most enthusiastic in the advocation of the canal have grown to fear the outcome of its construction.

From the Far East, however, recently came the report that the merchants and officials of Japan were heartily in favor of the canal, and yesterday Mr. Uchida was willing to be quoted to the effect that his countrymen and his Government were particularly anxious that the canal should be pushed through as rapidly as possible and that it should be controlled exclusively by the United States.

"My Government has always advocated the building of this canal," said Mr. Uchida, "and of course the hope has always been entertained that it would be exclusively controlled by the Americans. Japan only desires fair treatment, which it will undoubtedly receive, and will ask no favors. Should this canal be cut through, the shipping interests of the United States would not only be greatly benefited, but I also believe that it would greatly encourage the shipping interests of Japan. At present most of the trade between the United States and Japan is carried on from San Francisco and Seattle, but if the canal was completed to-day I am almost certain that the Gulf and Atlantic ports would receive a large proportion of the trade from my own country, which probably would be quickly doubled. Already several Japanese bottoms have appeared in the Gulf and on the Atlantic coast, but the trip around the Horn is entirely too long to render it possible for any successful trading in native vessels. The big canal would solve the problem, and my Government is heartily in favor of it."

From one of the most extensive Japanese importers in the country it was learned yesterday that quite recently a memorial was addressed to the Japanese throne urging the Emperor and his cabinet to take a bold stand in support of the effort of the United States to build the Nicaragua Canal.

"At present the Japanese merchants are practically at the mercy of British shipowners," said the Commercial's informant. "The appearance in the Pacific of the United States as a power gives sufficient reason to believe that once the Nicaragua Canal is built this Government will be able to protect it, and, above all, able to control it absolutely. Japan is already weary of the domination of the English and French shipping agencies, and hopes that with the building of the Nicaragua Canal not only to encourage her own shipping, but also to see the advent of the Yankee ship as an important factor in Oriental commerce. At present nearly every ship that enters the harbor of San Francisco laden with Japanese merchandise carries a British or a French flag. The day should not be far distant when the products of Japan should be carried to this country in American bottoms and the American export trade in the Pacific handled by the same shipping merchants."

Local exporters were greatly interested yesterday in the report that the Japanese Government had been making experiments in buying at Gulf ports. The original news that three or four Japanese vessels had appeared at certain Southern ports, most noticeably Mobile, during the last few months was not considered as of much importance, but a dispatch to one of the large exporting houses from its agent at San Francisco conveyed the intelligence that the vessels were really sent out, not by merchants, but by the officials of the Tokyo Chamber of Commerce, evidently for the purpose of seeing what advantages could be secured in the way of buying and selling in these ports. Whether or not this investigation is but part of the plan to demonstrate the value of the Nicaragua Canal to Japan could not be ascertained. When Mr. Uchida was questioned upon the subject, he simply smiled and intimated that his Government had already made exhaustive experiments in that direction.

A BRITISH VIEW OF TRADE PROSPECTS IN JAPAN.

The London and China Telegraph of July 3, 1899, publishes the following from R. G. E. Forster, acting consul-general at Yokohama:

Very naturally, merchants and other residents, the bulk of whom are British, have been and are still anxious to ascertain the conditions under which they will reside and trade hereafter. These conditions depend in a great measure upon recent legislation of the Japanese Diet, which has been to a large extent directed to meet conditions consequent upon the abolition of extraterritorialty, but it has now been more or less satisfactorily ascertained that a variety of laws, more particularly those governing the taxation of trades and industries and merchant shipping (tonnage dues), which threatened to effect the foreign merchants unfavorably, have either been amended or defined in a manner which should assure them that their important interests will not be materially affected or their enterprise be unduly handicapped. In respect of taxation, British merchants, if not others, recognize the justice of being now taxed, though, after forty years of exemption from any tax whatsoever, the change can not be welcome.

While the future for the foreign merchant generally may not be full of promise, it should be a great comfort to the British trader to think that he has been mainly instrumental in building up for Yokohama a foreign trade amounting last year to close on £20,000,000 or, roughly, 200,000,000 gold yen, whereas the foreign trade for the whole of Japan (treaty ports, not including Kobé-Hyogo) for six months is, in a report dated February 21, 1860, described as follows: "In the midst of all these impediments, from $300,000 to $400,000 have been turned over by foreign merchants in the six months, there is reason to believe at an enormous profit and not without considerable advantage to the Japanese engaged—a result which shows that the country possesses the elements of a flourishing trade."

For purposes of comparison the following figures are interesting: In 1888 the share of Japanese merchants in the import trade was 8,499,788 yen, to the foreign merchants 53,820,246 yen, 1897 the figures being 79,560,939 yen and 138,879,084 yen, respectively. In exports the Japanese merchants' share in 1888 was 7,081,324 yen, that of the foreign merchants 56,599,289 yen, and in 1897 44,374,130 and 115,013,429 yen represented the respective shares after ten years' development, mostly favorable to the Japanese merchants.

Though British trade does not go on increasing by leaps and bounds, and even occasionally shows a setback, its position is eminently satisfactory. In 1898 Great Britain and the colonies' share in the import trade of Yokohama was £9,680,628, or 76 per cent, and in the export trade £1,891,488, or 23 per cent. However other countries may improve, there is no reason to suppose that British merchants in Japan are not using their best efforts to keep what they have got.

In another respect also the British mercantile community may congratulate itself on being in possession of the lion's share of such lands held from the Japanese Government under perpetual leases, the interests in which are specially safeguarded in the new treaties. Of the whole area constituting the foreign settlement in Yokohama—namely, 338,024 tsubo (1 tsubo equal 36 square feet; 1,200 tsubo equal 1 acre)—173,987 tsubo, 51 per cent, are owned by British subjects. Small as this area of 145 acres may seem, it is a most valuable holding, for the land which passed into the possession of the foreign settler at an average price of £192 and £66 per acre is now, at a moderate valuation, worth £9,000 per acre in the settlement, and £2,000 on the Hill Settlement. But the value of land in the neighboring big thoroughfares of the native town of Yokohama is still higher, front lots being worth £36,000 an acre and rear lots £20,000 an acre, and the rentals for such being at the rate of £1,470 per acre per annum. It should be stated, however, that Japanese business premises do not as a rule occupy large spaces, though there is a tendency on the part of Japanese banks and similar institutions to build in Western style—on a larger scale.

Yokohama, with its present population (Japanese) of 183,760 (foreign) 5,213, has become an extremely valuable spot in the Japanese Empire, and owes its prosperity entirely to foreign trade.

In addition to the four foreign banks already existing, the Russo-Chinese Bank has established itself at this port, and it is not unreasonable to suppose that sooner or later the requirements of German merchants and the prospects of business may induce a German bank to start here. Seventeen Japanese banks, with capital aggregating 19,810,000 yen, or, roughly, £2,000,000, are established at Yokohama. Four of them have capitals of 1,250,000 yen and upward.

Japan apparently does not rest satisfied with the extraordinary efforts already made by her for the development of her mercantile marine and shipping trade. During 1898 the Nippon Yusen Kaisha added 6 vessels (five of which were built in England), aggregating 34,724 tons, to their fleet, and it has now running on the European line 12 steamers of a gross tonnage of 73,623 tons and 6 steamers, averaging 3,000 tons, on the Australian and American lines. In addition, another Japanese company, the "Toyo Kisen Kaisha" (Eastern Steamship Company), represented at this port by the agents for the Pacific Mail and O. and O. companies, has started running three new steamers of 3,000 tons each between San Francisco and Hongkong via Japan ports and Honolulu, and which are likely to have a large share of the ever-increasing trans-Pacific passenger traffic.

The gold standard has been most beneficial to both the import and export trades of Japan. The export trade was helped by a feeling of security on the part of shippers that their neighbors would not, later on, be able to come into the market with lower prices owing to a drop in exchange, and this must also have been the feeling on the part of buyers at home. The import trade was much in excess of exports, and had it not been for the ability of bankers to ship gold to make up the balance to a large extent, there is no knowing to what depth exchange might have fallen. Thus Japan has had to pay much less for her imports than she otherwise would have had. The paper currency has not been displaced by gold for ordinary use, and thus still remains the ordinary circulating medium representing gold instead of silver.

THE WEALTH OF JAPAN.

[From the Japan-American Commercial Journal.]

Last October we published statistics compiled by a writer calling himself "Onjoji Kyoshi," with reference to the wealth of Japan. The total sum, according to his estimate, was 7,898,062,444 yen, and the items were as follows:

	Yen.
Lands	3,527,085,739
Live stock	59,896,722
Buildings	1,082,597,116
Furniture and fittings	541,283,558
Railways	116,171,819
Shipping	28,440,536
Merchandise	428,380,142
Specie and bullion	139,721,201
Miscellaneous	1,974,515,611
Grand total	7,898,062,444

Referring to this table, we said:

The above figures are based on statistics for 1894 and 1895. In our opinion the value of lands should be nearly doubled, and that of buildings increased by 50 per cent. It is worth noting that Giffen's estimate of the wealth of the United Kingdom in 1875 was £8,548,000,000, or over ten times the figure for Japan. On the whole, a yen in Japan is approximately the representative of a sovereign in England.

Mr. Kusaka Yoshio has now undertaken the same calculation, and, after devoting six months to the work, has arrived at these results:

	Yen.
Lands	10,000,000,000
Live stock	75,000,000
Buildings	1,919,000,000
Furniture and works of art	788,000,000
Railways, telegraphs, and aqueducts	90,000,000
Shipping	98,000,000
Mines	405,000,000
Marine products	272,000,000
Capital (paid up) of companies and banks	242,000,000
Specie and bullion	176 000,000
Miscellaneous	1,028,000,000
Total	15,093,000,000

It will be seen that Mr. Kusaka's total is nearly twice that of "Onjoji Kyoshi;" that he more than doubles the latter's figure for the value of arable and forest lands, and that he nearly doubles the figure for buildings. It appears to us that Mr. Kusaka's estimate is nearer the truth than that of the former economist. He arrives at his results thus:

LAND.

The total area of the land in Japan is 413,201,088 tan (103,300,272 acres), of which 274,678,144 tan (68,669,536 acres) belong to the Government and 138,522,944 tan (34,630,736 acres) to the people. Now, the total yearly produce of the people's land is 1,000,000,000 yen annually, half of which must be set aside on account of labor and other costs of production, so that the net income derived from the land is 500,000,000 yen; and if that be regarded as 5 per cent of the value of the land we get 10,000,000,000 yen as the aggregate value of the privately owned lands. With regard to the lands owned by the Government there are no means of making any estimate, and Mr. Kusaka consequently omits them altogether from the list.

It will be seen that Mr. Kusaka assesses the gross average yearly produce of the land at 28 yen an acre, approximately, and the net produce at 14 yen, or 28 shillings. That is a liberal estimate, especially since the question of forests and moors does not appear to be taken into account. The area of forest land owned by the people is 7,300,000 cho (18,250,000 acres), and the area of moor land is 1,060,000 cho (2,650,000 acres). Deducting these figures, we find that the area of arable land owned by the people is only 13,730,706 acres; and since we know that the gross income derived from the moors and forests certainly does not exceed 40,000,000 yen annually, it would appear that Mr. Kusaka estimates the yield of the arable land at about 72 yen gross per acre, or 36 yen net, which seems to us to be above the mark. Two years ago we also examined this question, and arrived at the conclusion that the gross produce of the land, exclusive of root crops, concerning which no statistics are available, amounted to about 700,000,000 yen annually. There was thus a difference of 300,000,000 between our calculation and that of Mr. Kusaka, but without a more detailed statement of his method of reaching his conclusion it is impossible to query his accuracy.

LIVE STOCK.

	Yen.
Number of horned cattle, 1,091,360; total valued at 35 yen per head	38,000,000
Number of horses, 1,477,021; total valued at 25 yen per head	37,000,000
Total	75,000,000

These figures are certainly not excessive. An average price of 70 shillings a head for cattle and 50 shillings a head for horses—although the former are diminutive in Japan and the latter mere ponies—seems to err on the side of conservatism.

BUILDINGS.

	Yen.
Number of dwellings, 7,884,263; valued at 200 yen each	1,577,000,000
Number of shrines, 190,803; valued at 1,000 yen each	191,000,000
Number of temples, 71,831; valued at 1,000 yen each	72,000,000
Buddhist eidota, 36,498; valued at 500 yen each	18,000,000
Schools, 1,594; valued at 10,000 yen each	16,000,000
Departments of state, 10; valued at 300,000 yen each	30,000,000
City and prefectural offices, 50; valued at 30,000 yen each	2,000,000
City and prefectural assembly buildings, 50; valued at 20,000 yen each	1,000,000
Local (district) offices and police stations, 1,700; valued at 1,000 yen each	2,000,000
Jails, 50; valued at 50,000 yen each	3,000,000
Military divisional buildings, 7; valued at 500,000 yen each	4,000,000
Military brigade buildings, 28; valued at 100,000 yen each	3,000,000
Naval ports, 3; valued at 1,000,000 yen each	3,000,000
Total	1,919,000,000

It will be observed that whereas barracks are included in the above list, fortifications are excluded, and so are arsenals, private dockyards, harbors, and factories. As to harbors, dockyards, and factories, Mr. Kusaka doubtless includes their value in the paid-up capital of companies. Arsenals, however, might fairly be added to the list, though fortifications are properly omitted.

FURNITURE AND WORKS OF ART.

The figure under this heading is obtained by allowing an average of 100 yen per house.

RAILWAYS, TELEGRAPHS, AND AQUEDUCTS.

The average net profit obtained from the State railways in the last four years was 4,000,000 yen, and if this be capitalized at twenty years' purchase, we have a value of 80,000,000 yen. Thus the figures stand:

	Yen.
State railways	80,000,000
Telegraphs, 12,212 ri (30,530 miles); valued at 450 yen per ri	6,000,000
Submarine cables, 387 nautical miles; valued at 3,000 yen per mile	1,000,000
Aqueducts, 100 ri (275 miles)	3,000,000
Total	90,000,000

We can not regard this estimate as quite satisfactory. Considering that the mileage of the State railways has been steadily augmented year by year for several years past, the net profit during the last year of working would be a more correct figure for the purposes of such an account than the average profit for four years. But the difference would be only 20,000,000 or 30,000,000 at any rate. Mr. Kusaka omits the private railways, doubtless because the cost of constructing them appears in the paid-up capital of companies. The propriety of the omission may be questioned. At the lowest estimate the market value of the private lines now in operation is 140,000,000 yen, and if we substract that sum from the paid-up capital (242,000,000) of the companies and banks, we obtain 102,000,000 yen as the value of all the factories, dockyards, and other movable and immovable property of industrial and commercial associations in the Empire. That is surely too low an estimate.

SHIPPING.

	Yen.
Foreign model ships, 254,692 tons, valued at 100 yen per ton	25,000,000
Japanese model ships, 2,960,887 koku, valued at 5 yen per koku	15,000,000
Fishing, pleasure, and rowing boats and lighters, 200,000 koku, valued at 5 yen per koku	1,000,000
Men-of-war, 112,760 tons, valued at 500 yen per ton	56,000,000
Torpedo craft, 1,898 tons, valued at 590 yen per ton	1,000,000
Total	98,000,000

This is certainly a very conservative estimate so far as the navy is concerned. The figures for men-of-war must be at least 100,000,000 yen too small.

MINES.

The yearly yield of the mines is 40,506,833 yen, one-half of which may be regarded as the cost of working. Hence capitalizing at twenty years' purchase as before, the resulting value is 405,000,000 yen.

MARINE PRODUCTS.

The yearly yield is about 27,227,047 yen, half of which being regarded as net profit and capitalized at twenty years' purchase, the value is 272,000,000.

CAPITAL (PAID UP) OF COMPANIES AND BANKS.

The total paid-up capital is 259,000,000 yen, from which has been deducted 17,000,000, being the value (already included under the head of shipping) of the vessels (165,000 tons) belonging to the Nippon Yusen Kaisha and the Osaka Shosen Kaisha.

MISCELLANEOUS.

There are no trustworthy data for estimating the value of miscellaneous properties. Mr. Kusaka has therefore followed Mulhall, who adopts a figure representing 6.8 per cent of the country's wealth. That method of calculation gives 1,028,000,000 yen in Japan's case. It is difficult, however, to indorse such a manner of estimate. In Great Britain, objects such as jewelry, plate, and books are included in the category of miscellaneous; and since they represent the accumulations of hundreds of years in a country where conflagrations are comparatively rare, their value must reach an enormous figure. Plate and jewelry have practically no existence in Japan, and the value of the public and private libraries does not, we think, amount to anything like as large a fraction of the national wealth as it does in Great Britain. Mr. Kusaka, it will be observed, estimates the miscellaneous objects at a figure equal to one-tenth of the value of the land. It is a pity that he has not explained precisely what he includes under the heading. We do not pretend to assert that his figure is too large, however. What we desire to point out is the difference between England and Japan. If it be correct to assert that "miscellaneous" objects in Great Britain represent only 6.8 per cent of the country's total wealth, then it can not be correct to say the same of Japan, where such objects are obviously of far less value comparatively than in England. On the other hand, the estimates for England may be too low. A tolerably easy way of approaching the matter is to consider, as the main basis of the estimate, the average value of the clothes, jewelry, books, household utensils, and other personal belongings of each unit of the nation. Mr. Kusaka's figure, 1,28,000,000 yen, gives 24 yen approximately per head of population, and that certainly does not appear excessive.

Mr. Kusaka's principal object in making the above calculations is to obtain some means of determining what Japan's yearly national expenditure ought to be. He adopts as fundamental the rule that the State's ordinary annual outlays should not exceed $\frac{1}{100}$ of its total wealth, and thus arrives at the figure of 150,000,000 yen for Japan, to which he adds 50,000,000 for extraordinary expenditures. So far as we are acquainted with the Government's estimates, there will soon be no difficulty in keeping the outlays within that total. Tokyo newspapers publish some other statements which they attribute to Mr. Kusaka, with regard to the comparative wealth and the burdens of taxation in occidental countries and in Japan. But we imagine that there is some mistake on the part of the reporter, for the wealth of each unit of the British population is put at only 383 yen on the average, whereas it is really about 2,300 yen.

COTTON MANUFACTURING.

Cotton manufacturing in Japan continues to increase. A report to the British foreign office (annual series, 2277) shows that the number of spindles in operation at the end of 1898 was 1,108,404, or more than 200 per cent more than six years ago.

The following table shows the number of spindles, number of employees, wages, and profits per spindle for the latter half of the year 1898 in eighteen of the leading spinning companies in Japan:

SPINNING FACTORIES.	Number of spindles.	NUMBER OF EMPLOYEES.		DAILY WAGES.		Profit per spindle.	
		Male.	Female.	Male.	Female.		
				d.	d.	s.	d.
Settsu	50,608	600	2,400	[a]6¼	[a]5¼	5	7
Hirano	38,400	770	1,771	2 to 20	1⅛ to 7⅛	3	0
Sakai	16,128	199	768	2¼ to 13⅛	1⅛ to 7	2	5
Miye	49,712	632	1,881	.....	.....	3	3
Fukuyama	13,824	148	416	3¾ to 17⅛	1½ to 8¾	2	8
Owari	30,104	294	1,477	2⅛ to 9⅛	1⅛ to 8¾	3	7
Koriyama	12,956	273	769	1¾ to 15	1⅛ to 6¼	1	2
Amagaseki	59,108	583	1,596	.....	.....	2	7
Kurashiki	21,672	158	1,268	[a]5¼	[a]5⅛	1	0
Osaka	55,344	914	3,042	2 to 14	1½ to 6⅛	1	4
Lenshu	19,264	220	750	4¼ to 15	3 to 8¾	[b]3	4
Okayama	26,136	384	1,158	[a]6¾	[a]4¾	2	5
Tenma	28,088	178	763	[a]6¼	[a]3¾	[b]2	1
Kashu	9,520	196	555	3¼ to 15	2 to 7¼	[b]3	2
Tokyo Gas Spinning Factory	20,568	149	605	3¾ to 18¾	2¾ to 5¾	1	1
Kishiwada	22,656	349	907	1⅛ to 13¾	1 to 6¼	3	5
Fukushima	20,000	155	615	2¼ to 7¾	2 to 7⅛	1	1
Tamato	11,520	210	431	1¾ to 15	1¾ to 6¼	2	2

[a] Average. [b] Loss.

The rapid growth of cotton manufacturing in Japan indicated by the above statement accounts for the rapid increase in the exportation of unmanufactured cotton from the United States to Japan, and for the decrease in the exportation of cotton cloths.

The following table shows the exportation of raw cotton and cotton cloths from the United States to Japan since 1893:

YEARS.	Raw cotton.	Cotton cloths.
	Pounds.	Yards.
1893	[illegible]	89,[illegible]
1894	4,801,[illegible]	752,[illegible]
1895	11,[illegible]	1,386,[illegible]
1896	20,194,174	1,458,[illegible]
1897	[illegible]	2,525,[illegible]
1898	112,[illegible]	580,[illegible]
1899	91,[illegible]	529,479

JAPANESE WEIGHTS AND MEASURES.

[From Japan-American Commercial Journal.]

LONG MEASURE (SASHI).

1 mo (0.0001 shaku)	0.000099 feet.
1 rin (10 mo)	0.000099 feet.
1 bu (10 rin)	1.4317 lines.
1 sun (10 bu)	1.1931 inches.
1 shaku (10 sun)	11.9305 inches.
1 ken (6 shaku)	1.9884 yards.
1 jo (10 shaku)	3.3140 yards.
1 cho (60 ken)	5.4229 chains ($\frac{1}{15}$ m.)
1 ri (36 cho)	2.4403 miles ($2\frac{1}{2}$ m.)
1 kai-ri (marine ri)	1.1507 miles.

DRY GOODS MEASURE (KUJIRA-JAKU).

1 sun (0.1 shaku)	1.3913 inches.
1 shaku (10 sun)	14.9130 inches.
1 tan	About 11 yards.
1 hiki	About 22 yards.

WEIGHT (HAKARI).

1 mo	0.000008 pounds (avoirdupois).
1 rin (10 mo)	0.000083 pounds (avoirdupois).

WEIGHT (HAKARI)—continued.

1 fun (10 rin)	5.7972 grains (avoirdupois).
1 momme (10 fun)	2.1201 drams (avoirdupois).
1 kin (160 momme)	1.3251 pounds (avoirdupois).
1 kwan (1,000 momme)	8.2817 pounds (avoirdupois).
1 picul	$132\frac{1}{3}$ pounds (avoirdupois).

CAPACITY (MASU).

1 shaku (10 sai)	0.003973 gallon.
1 go (10 shaku)	1.2706 gill; 0.0199 peck.
1 sho (10 go)	1.5[illegible] quarts; 0.1[illegible] peck.
1 to (10 sho)	3.9703 gallons; 1.9851 pecks.
1 koku (10 to)	39.7033 gallons; 4.9629 bushels.

SUPERFICIAL MEASURE (TANBETSU).

1 square shaku	About 1 square foot.
1 tsubo (36 square shaku)	3.9533 square yards.
1 se (30 tsubo)	About 119 square yards.
1 tan (10 se)	0.2451 acre.
1 cho (10 tan) square	2.4507 acres.
1 square ri	5.9552 square miles.

NEW JAPANESE TARIFF, 1899.

The following is the new Japanese tariff as adopted by the Imperial Parliament and published in the Official Gazette. It went into operation on January 1, 1899:

CUSTOMS TARIFF LAW.

LAW No. 14.—*Sanctioned by His Imperial Majesty on the 26th day of the 3d month of the 30th year of Meiji (March 26, 1897). Promulgated and published on the 29th day of the 3d month of the 30th year of Meiji (March 29, 1897).*[a]

ARTICLE I. On the importation of articles from foreign countries, those enumerated in Class I of the annexed tariff shall be subject to import duties according to the rates of duty set forth in the said tariff; those specified in Class II of the said tariff shall be exempted from import duties; and the importation of the articles named in Class III of the said tariff is prohibited.

The articles mentioned in group 15 of Class I of the import tariff are subject to the duty of alcohol, No. 69 of the tariff, when the quantity of pure alcohol contained therein exceeds 65 per cent in volume at the temperature of 15° C.

ART. II. The dutiable value of imported articles shall be the actual cost of the articles at the place of purchase, production, or fabrication, with the addition of packing charges, cost of transportation, insurance, and all other charges incurred up to the arrival of the articles at the ports of importation.

ART. III. In regard to those articles enumerated in the annexed tariff, in respect of which it is found advisable to convert the ad valorem rates of duty into specific duties, the articles and their subdivisions may be determined by Imperial ordinance.

The specific duties above mentioned shall be determined according to the rates of duty set forth in the annexed tariff, taking average values for a period of six months or more, and calculated upon the basis prescribed in the preceding article.

ART. IV. In case of articles on which two or more rates of duty set forth in the annexed tariff are applicable, it shall be assessed according to the highest of such rates.

ART. V. Import duties shall not be levied on the following articles:

No. 1. Articles imported for Imperial use.

No. 2. Arms, ammunitions, and explosives imported by the Imperial army or navy.

No. 3. Ships belonging to the Imperial navy.

No. 4. Articles intended for the personal use of diplomatic agents accredited to this Empire.

No. 5. Orders of decorations and medals.

No. 6. Records, documents, and other writings.

No. 7. Samples of commodities, which are only fit as such.

No. 8. Traveling effects, carried by travelers.

No. 9. Articles imported for permanent exhibition in Government, public, or commercial museums.

No. 10. Articles of Japanese origin, reimported from foreign countries within the period of five years from the date of exportation, provided they retain the nature and shape in which they were exported, tobaccos in all shapes and spirituous liquors of all sorts being excluded.

No. 11. Reimported articles which were exported to foreign countries for repair.

No. 12. Articles of the Government monopoly imported by the Government.

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[a] This law and tariff thereunto annexed contain the various amendments made to the same under—

1. Law No. 18 of the 13th day of the 2d month of the 32d year of Meiji (February 13, 1899, which entered into force on August 15, 1899);
2. Law No. 69 of the 15th day of the 3d month of the 32d year of Meiji (March 15, 1899, which entered into force on September 18, 1899).

Articles mentioned in Nos. 7, 8, and 9 of this article shall be subject to the approval of the customs authorities at the time of importation.

In case of articles mentioned in No. 11 of this article, the period within which reimportation is to take place must be declared to the customs authorities at the time of exportation.

ART. VI. The following articles shall not be subject to import duties, provided they shall be reexported within six months from the date of importation; in this case a sum of money equal to the amount of import duties payable or security thereof must be deposited in the customs at the time of importation:

No. 1. Articles temporarily imported for repair.

No. 2. Articles temporarily imported by travelers engaged in scientific research for the professional use.

No. 3. Articles temporarily imported for purposes of trial.

No. 4. Articles temporarily imported as samples by merchants, manufacturers, and commercial travelers.

No. 5. Articles temporarily imported for theatrical or other similar performances.

ART. VII. Whenever it is deemed necessary to make any modifications in the annexed tariff, such modifications shall be notified at least six months prior to the date of enforcement.

CERTIFICATE OF ORIGIN.

In virtue of ordinances No. 385 of the 27th day of the 10th month of the 30th year of Meiji (October 27, 1897), and No. 363 of the 29th day of the 12th month of the 31st year of Meiji (December 29, 1898).

ARTICLE I. All goods imported into this Empire shall, in order to enjoy the benefits of conventional tariffs under the provisions of the treaties, be accompanied by certificate of origin.

In respect, however, of goods which are imported by parcel post or the dutiable value of which does not exceed 100 yen, no such certificates are required.

ART. II. The certificate of origin shall contain the marks, numbers, descriptions, number of packages, weights, and measurements of the goods, and the place of production or fabrication, as well as the place and date of departure; and shall be duly certified by the Imperial Japanese consulate or commercial agency at the place of departure, or where there is no such consulate or agency, by the custom-house, chamber of commerce, or other competent authorities of such place.

The certificate of origin shall be valid for a period of one year from the date of issue.

ART. III. In case no such certificate is attached or, if attached, the particulars contained therein are incomplete, or do not agree with the goods themselves, or in case the certificate shall be deemed improper by the customs authorities, the goods in question shall be subject to the rates of duty provided in the general tariff.

If, however, a proper certificate shall be produced within the period of six months from the date of importation of such goods, the duties imposed thereon shall be reduced to the ratio specified in the conventional tariff.

EXPLANATORY REMARKS.

1. *Conversion of ad valorem to specific rates of duty.*

The general tariff as enacted by the customs tariff law consisted wholly of ad valorem rates. In virtue of Article III of that law the several items which are subjected to specific rates of duty in the general tariff column of the annexed tariff were converted from ad valorem to specific rates by Imperial Ordinance No. 220, dated the 24th day of the 9th month of the 31st year of Meiji (September 24, 1898).

2. *Conventional tariffs.*

Conventional tariffs exist with the following powers: Austria-Hungary, France, Germany, and Great Britain.

The States with which conventional rates of duty have been established in respect of the several items appearing in the column of the annexed tariff headed "Conventional tariff" are indicated in the "Contracting States" column by the following initial letters: A.=Austria-Hungary; F.=France; G.=Germany; G. B.=Great Britain.

3. *States and possessions entitled to most-favored-nation treatment in the matter of customs duties.*

In virtue of treaty stipulations the produce and manufactures of the following countries and possessions on importations into Japan enjoy most-favored-nation treatment in the matter of the rates of customs duties: Austria-Hungary, including her customs union; Belgium; Brazil; Denmark, including Faroe Islands and Iceland, but excluding the Danish West Indian Islands; France, including Algeria; Germany, including her customs union; Great Britain, including her colonies and foreign possessions, excepting India, the Dominion of Canada, the Cape, New South Wales, Victoria, Tasmania, South Australia, West Australia, New Zealand; Hawaiian Islands; Italy; Mexico; the Netherlands; Peru; Russia; Siam; Sweden and Norway; Switzerland; the United States of America.

The following products, not only of Portugal proper, but of Portuguese colonies, if exported from Portugal or Macao, enjoy, on importation into Japan, most-favored-nation treatment: Cacao nut and its shells; coffee in the bean; candles, tallow and all other; hats, including felt hats; leather of all kinds; linen or cotton laces of all kinds; fruits of all kinds (fresh, salted, dried, pickled, and dressed with sugar, oil, vinegar, and preserved in the recipients of glass, earthen, tin plate, and all other wares); vegetable oil (olive oil, ground-nut oil, sesame oil, cacao oil, and palm oil); mineral oil; vegetables, green or preserved; cork bark, worked; metal manufactures; wares of cotton, wooden, and worsted, and linen tissues; wares of leather; lead, pig, ingot, and sheet; fishes, in oil or preserved; soap.

The produce and manufactures of all countries and possessions not above enumerated are, on importation into Japan, subject to the general tariff.

4. *Rules for calculating ad valorem duties.*

Duties payable ad valorem under the several conventional tariffs are calculated on the actual cost of the articles at the place of purchase, production, or fabrication, with the addition of the cost of insurance and transportation from the place of purchase, production, or fabrication to the port of discharge, as well as commissions, if any exist.

Duties payable ad valorem under the general tariff are calculated according to the rule laid down in Article II of the customs tariff law.

5. *Rule for the measurement of tissues.*

In determining the dutiable width of tissues, fractions of an inch not exceeding one-half of an inch are discarded, and fractions of an inch exceeding one-half of an inch are counted as a full inch.

Selvedges are not included in the measurement of tissues.

6. *Coins, weights, and measures.*

Coins.—The yen is the legal monetary unit of Japan.

Weights.—The kin is equal to the catty, or 600 grams of the metric system of weights, or 1.32277 pounds English avoirdupois weight. The pound and ton are English avoirdupois weights.

Measures.—The square foot and square yard are the English surface measure, and are, respectively, equal to 0.0929 and 0.8361 of a square meter. The cubic foot is the English cubic measure, and is equal to 0.0232 of a cubic meter. The gallon is the standard wine measure of the United States of America. The liter and hectoliter are the measures of capacity of the metric system.

Notes.—Where a difference in nomenclature or classification exists between the general and the conventional tariffs, the provisions of the latter are printed in italics.

Where two or more conventional rates of duty exist in respect of the same article, the lowest rate only is inscribed in the tariff.

The Customs Import Tariff of Japan in Force on and after the First Day of the First Month of the Thirty-second Year of Meiji (January 1, 1899).

CLASS I.—ARTICLES SUBJECT TO DUTY.

Tariff No.	ARTICLES.		General tariff.	Conventional tariff.	Contracting States.
	Group I.—*Arms, ammunition, clocks, watches, instruments, apparatus, tools, and machineries.*		Yen.	Yen.	
1	Arms and ammunitions, such as cannons, muskets, pistols, side arms, projectiles, cartridges, etc	ad val.	25%		
2	Balances, measuring scales, and tapes	do	[illegible]		
3	Barometers	do	[illegible]		
4	Binocular glasses:				
	a. In barrels covered with leather or japanned	do	15%		
	b. All other	do	[illegible]		
	Spyglasses, opera glasses, monocular and binocular field and marine glasses:				
	a. *Constructed with or mounted in shell, mother-of-pearl, ivory, gold, silver, plantinum, niellos (inlaid), enamelled or otherwise, or other precious materials of fancy and luxury, or garnished with precious stones or pearls*	ad val.	[a]20%	[b]0.750	F.
	b. *All other kinds* [c]	do	[a]15%	[b].250	F.
5	Clocks, standing and hanging, and parts thereof	do	20%	10%	G.
6	Compasses and chronometers, mariners', and parts thereof	do	10%		
7	Crucibles of all kinds	do	10%		
8	Cutlery, not otherwise provided for	do	20%		
9	Diving dresses and parts thereof	do	[illegible]		
10	Electric-light apparatus or instruments and parts thereof	do	10%		
11	Fire engines and parts thereof	do	10%		
12	Implements and tools of farmers and mechanics and parts thereof	do	5%		
13	Instruments, musical, and accessories	do	[illegible]		
14*a*	Instruments, philosophical, chemical, surveying, surgical, and all other scientifical, not otherwise provided for	do	10%		
14*b*	*Instruments, scientific, for drawing*	do	[illegible]	[illegible]	F.
15	Instruments or apparatus, photographic, and parts thereof	do	[illegible]		
16	Locomotive engines and parts thereof	do	[illegible]	[illegible]	G.
17*a*	Machineries or machines, engines of all kinds, and parts thereof, not otherwise provided for	do	10%		
17*b*	*Machines, printing*	do	[illegible]	[illegible]	F.
18	Microscopes and parts thereof	do	[illegible]		
19	Phonographs and parts thereof	do	[illegible]		
20	Pumps and parts thereof	do	10%		
21	Sewing machines and parts thereof	do	10%		
22	Spectacles and parts thereof	do	[illegible]		
23	Sporting guns and accessories	do	[illegible]		
24	Steam engines, boilers, and parts thereof	do	10%		
25	Telephones and parts thereof	do	[illegible]		
26	Telescopes	do	[illegible]		
27	Thermometers	do	[illegible]		
28	Typewriters	do	[illegible]		
29	Watches, watch cases, and accessories:				
	a. Gold and platinum	do	[illegible]		
	b. Silver and all other	do	[illegible]		
30	Watch movements and parts thereof	do	[illegible]		
	Group II.—*Beverages and comestibles.*				
31	Beverages, nonalcoholic, such as mineral water, lemonade, and soda water	do	10%		
32	Biscuits:				
	a. Sea biscuits	do	[illegible]		
	b. Fancy biscuits	do	[illegible]		
33	Butter	kin	0.086		
34	Cheese	do	.054		
35*a*	Coffee other than in the bean	ad val.	20%		
35*b*	Coffee in the bean	kin	0.084		
36	Confectionery and sweetmeats	ad val.	25%		
37	Eggs, fresh	1,000 pieces	1.115		
38*a*	Flour, wheat	100 kins	0.465		
38*b*	Flour and meal of all kinds of grains and starches, excepting wheat flour	ad val.	10%		
39	Fruits, fresh or dried, and nuts not otherwise provided for	do	15%		
40	Ham and bacon	kin	0.065		
41*a*	Mutton, fresh	100 kins	1.860		
41*b*	Meat, fresh, excluding mutton	ad val.	10%		
42	Milk, condensed or desiccated, dozen of 1-pound tins and proportionately for tins of other weight		0.371	0.123	G., G. B.
	Milk, sterilized	ad val.	[d]15%	5%	G.
43	Pepper in the seed or ground	do	15%		
44	Salt, sea and rock:				
	a. Crude	100 kins	0.083		
	b. Refined	do	1.370		
45	Salt fish	do	0.876		

[a] Included in the general tariff under No. 4 *b*.
[b] Piece.
[c] Included in the general tariff under No. 4 *a* or *b*
[d] Included in the general tariff under No. 50.

THE CUSTOMS IMPORT TARIFF OF JAPAN IN FORCE ON AND AFTER THE FIRST DAY OF THE FIRST MONTH OF THE THIRTY-SECOND YEAR OF MEIJI (JANUARY 1, 1899)—Continued.

CLASS I.—ARTICLES SUBJECT TO DUTY—Continued.

Tariff No.	ARTICLES.	General tariff.	Conventional tariff.	Contracting States.
	GROUP II.—*Beverages and comestibles*—Continued.	*Yen.*	*Yen.*	
46*a*	Salt meat, excluding salted beef and pork ..... ad val..	10%		
46*b*	Salted beef and pork in cask ..... 100 kins..	1.292		
47	Sekikasai (gelidium corneum) ..... do....	0.543		
48	Tea ..... kin..	0.062		
49	Vegetables, green, dry, salted, or in brine ..... ad val..	10%		
50	All other comestibles ..... do....	15%		
	GROUP III.—*Clothing and accessories.*			
51	Boots and shoes of all kinds ..... ad val..	20%		
52	Braces or suspenders:			
	a. Of silk, wholly or in part ..... do....	25%		
	b. All other ..... do....	20%		
53	Buttons, buckles[a], hooks[a], and eyes, excepting studs and sleeve or cuff buttons ..... ad val..	20%		
	Buttons of all kinds ..... do....	20%	10%	A.
54	Comforters, neckerchiefs, or mufflers:			
	a. Of silk, wholly or in part ..... do....	25%		
	b. All other ..... do....	20%		
55	Gloves of all kinds ..... do....	20%		
56	Hats, caps, and bonnets:			
	a. Set with gold, silver, or gems, etc ..... do....	30%		
	b. Of silk ..... do....	25%		
	c. All other kinds ..... do....	20%		
	Hats, including also hats of felt ..... do....	20%	10%	G., G. B.
57	Scarfs and neckties:			
	a. Of silk, wholly or in part ..... do....	25%		
	b. All other ..... do....	20%		
58	Shawls:			
	a. Of wool, embroidered, or of silk wholly or in part ..... do....	25%		
	b. All other ..... do....	20%		
59	Shirts ..... do....	20%		
60	Socks, hose, or stockings, knit:			
	a. Of cotton, wool, or of wool and cotton ..... do....	20%		
	b. Of silk, wholly or in part ..... do....	25%		
	c. All other ..... do....	20%		
61	Studs, sleeve and cuff buttons or links:			
	a. Of gold or platinum, set with gems, or otherwise ..... do....	30%		
	b. All other[a] ..... do....	25%		
62	Trimmings of all kinds, such as braids, cords, ribbons, laces, fringes, gimps, tassels, knots, stars, metallic threads and braids, etc., not otherwise provided for:			
	a. Of gold or silver, wholly or in part ..... ad val..	30%		
	b. Of silk, wholly or in part ..... do....	25%		
	c. All other ..... do....	20%		
63	Undershirts and drawers, knit:			
	a. Of cotton ..... dozen..	1.410		
	a[2]. Of wool ..... do....	2.543		
	a[3]. Of wool and cotton ..... do....	1.812		
	b. Of silk, wholly or in part ..... ad val..	25%		
	c. All other ..... do....	20%		
64	Waterproof coats:			
	a. Of silk, wholly or in part ..... do....	25%		
	b. All other ..... do....	20%		
65	All other clothing and accessories:			
	a. Of silk, wholly or in part ..... do....	25%		
	b. All other ..... do....	20%		
	GROUP IV.—*Drugs, chemicals, and medicines.*			
66*a*	Acid, carbolic, in crystal ..... kin..	0.036		
66*b*	Acid, carbolic, liquid ..... ad val..	10%		
67	Acid, salicylic ..... kin..	0.157	[b] 10%	G.
68	Acid, tartaric ..... do....	0.073		
69	Alcohol ..... ad val..	[illegible]		
70	Alum ..... 100 kins..	0.198		
71	Antifebrin ..... ad val..	10%		
72	Antipyrine ..... do....	10%		
73	Betel nut ..... do....	10%		
74	Blakujutsu (*Radix atractylis ovata or alba*) ..... 100 kins..	0.877		
75	Bismuth, subnitrate of ..... kin..	0.206	0.206	G.
76	Bleaching powder (chloride of lime or calx chlorinate) ..... ad val..	10%		
77	Borax (biborate of soda) ..... 100 kin..	1.[illegible]		
78*a*	Camphor, Blumea or Ngai ..... kin..	0.[illegible]		
78*b*	Camphor, Borneo ..... ad val..	10%		
79	Cassia and cinnamon bark ..... 100 kins..	0.7[illegible]		
80	Cassia and cinnamon oil ..... kins..	0.[illegible]		
81	Cataria, leaf of ..... 100 kins..	0.[illegible]		
82	Cinchona bark ..... do....	1.7[illegible]		
83	Cinchonine, muriate or sulphate of ..... kin..	0.[illegible]		
84	Cinnabar (hydrargyri sulphuritum rubrum) ..... do....	0.[illegible]		
85	Cloves ..... 100 kins..	1.[illegible]		
86	Cocain, hydrochlorate of ..... kin..	12.9[illegible]		
87	Cod liver oil ..... ad val..	10%		
88	Collodium, photographic, with iodizer ..... do....	1[illegible]		
89	Colombo ..... 100 kins..	0.[illegible]		
90	Cow bezoar ..... ad val..	10%		
91	Cutch and gambier ..... 100 kins..	0.[illegible]		
92	Gentian ..... do....	1.[illegible]		
93	Ginseng ..... ad val..	10%		
94	Glycerin ..... kin..	0.[illegible]		
95	Gum arabic ..... 100 kins..	1.[illegible]		
96	Gum, benzoin ..... do....	1.124		
97	Gum, dragon's blood ..... ad val..	10%		
98	Gum, myrrh ..... do....	10%		
99	Gum, olibanum ..... 100 kins..	0.[illegible]		
100	Hops ..... kin..	0.[illegible]	0.029	G.

[a] See No. 450.

[b] Ad valorem.

THE CUSTOMS IMPORT TARIFF OF JAPAN IN FORCE ON AND AFTER THE FIRST DAY OF THE FIRST MONTH OF THE THIRTY-SECOND YEAR OF MEIJI (JANUARY 1, 1899)—Continued.

CLASS I.—ARTICLES SUBJECT TO DUTY—Continued.

Tariff No.	ARTICLES.		General tariff.	Conventional tariff.	Contracting States.
	GROUP IV.—*Drugs, chemicals, and medicines*—Continued.		Yen.	Yen.	
101	Iodoform	kin.	0.541		
102	Ipecac	100 kins.	26.620		
103	Jalap	do.	[illegible]		
104	Lead, acetate of (sugar of lead)	do.	[illegible]		
105	Liquorice	do.	0.933		
106	Mawo (*Epedora vulgaris*)	do.	[illegible]		
107	Manganese, black oxide of	ad val.	10%		
108	Morphine, hydrochlorate or sulphate of	kin.	4.043		
109	Musk	ad val.	15%		
110	Musk, artificial	do.	15%		
111	Nard or spikenard	100 kins.	1.520		
112	Phosphorus, amorphous (*abolished*)	kin.	0.165	0.165	G.
113	Pilocarpine, hydrochlorate of	ad val.	[illegible]		
114*a*	Potash, bromide of	kin.	0.693	0.693	G.
114*b*	*Other bromides*	ad val.	[a]10%	10%	G.
115	Potash, chlorate of (*abolished*)	100 kins.	2.521	2.267	G.
116	Potash, iodide of	ad val.	[illegible]	10%	G.
117	Putchuk	100 kin.	1.371		
118	Quinine, hydrochlorate or sulphate of	ad val.	10%	8%	G.
119	Rosin	100 kins.	0.298		
120	Rhubarb, powdered or otherwise	do.	1.[illegible]7		
121	Saffron	kin.	1.177		
122	Saltpetre (nitrate of potash)	100 kins.	[illegible]	0.490	G., G. B.
123	Santonine	kin.	[illegible]		
124	Sarsaparilla	100 kins.	1.651		
125	Semen cyna	do.	1.[illegible]		
126	Shellac	kin.	[illegible]		
127	Soda ash	100 kins.	0.351		
128	Soda, bicarbonate of	do.	0.457		
129	Soda, caustic	do.	0.454		
130	Soda crystals or washing soda	do.	0.227		
131	Soda, salicylate of	kin.	0.142		
132	Sojutzu (*Radix atractylis lancea*)	100 kins.	[illegible]		
133	Stick-lac	do.	1.870		
134	Vaseline	do.	1.[illegible]42		
135	Wogon (*Radix scutellaria lanceolaria*)	do.	0.[illegible]		
136*a*	All other drugs, chemicals, and medicines	ad val.	10%		
136*b*	Acid, boracic	100 kins.	[illegible]		
136*c*	*Insect powder*	ad val.	[illegible]	5%	A.
136*d*	Soda, nitrate of	100 kins.	0.471		
136*e*	Phosphorus, yellow (*abolished*)	do.	12.353		
	GROUP V.—*Dyes, colours, and paints.*				
137	Alizarine dyes	ad val.	10%	10%	G.
138	Aniline dyes	do.	[illegible]	10%	F., G.
139	Blue, prepared from minerals, dry or liquid	100 kins.	6.690		
140	Carmine	ad val.	[illegible]		
141	Cobalt, oxide of	100 kins.	34.628		
142	Cochineal	ad val.	10%		
143	Emerald green	do.	[illegible]		
144	Galls of all kinds	100 kins.	1.715		
145	Gamboge	do.	6.802		
146	Gold, silver, and platinum, liquid	ad val.	15%		
147	Indigo, dry	100 kins.	12.953	12.953	G. B.
148	Indigo, liquid	ad val.	10%		
149	Indigo extract and indigo carmine	do.	[illegible]		
150	Lead, all colours	100 kins.	1.070		
151	Logwood	ad val.	10%		
152	Logwood extract	100 kins.	[illegible]	2.150	F.
		ad val.		10%	G.
153	Mangrove bark	100 kins.	0.119		
154	Paint in oil	do.	[illegible]	1.304	G., G. B.
155	Safflower	ad val.	[illegible]		
156	Sapan wood	100 kins.	[illegible]		
157	Smalt	ad val.	[illegible]		
158	Turmeric	100 kins.	[illegible]		
159	Ultramarine	do.	1.749		
160	Varnish	ad val.	10%		
161	Varnish, China	100 kins.	3.272		
162	Verdigris	do.	2.297		
163	Vermilion	kin.	0.190		
164	Wansho or gosu	100 kins.	5.423		
165	White zinc	do.	1.230		
166	All other dyes, colours, and paints	ad val.	10%		
	GROUP VI.—*Glass and glass manufactures.*				
167	Glass, window, ordinary:				
	a. Uncoloured and unstained	100 sq. ft.	0.400	0.302	G., G. B.
	b. All other	ad val.	15%		
	c. *Colored, stained, and ground*	do.	[b]17%	10%	G., G. B.
168	Glass, plate, silvered or unsilvered	do.	[illegible]		
169	Glass beads, known as "*Venetian beads*"	do.	[illegible]	10%	A.
170	Glass, broken or powdered	do.	5%		
171	Glass, looking, in frame	do.	[illegible]		
172	Glass, all other manufactures of, not otherwise provided for	do.	20%		
	Objects in glass, crystal and vitrification, excepting window glass	do.	[c]20%	10%	A.
	GROUP VII.—*Grains and seeds.*				
173	Barley	100 kins.	0.101		
174*a*	Beans, soja	do.	0.120		
174*b*	Beans, peas, and all other kinds of pulses excepting soja beans	ad val.	5%		

[a] Included in the general tariff under No. 136.
[b] Included in the general tariff under No. 167*b*.
[c] Included in the general tariff under Nos. 169 and 172.

THE CUSTOMS IMPORT TARIFF OF JAPAN IN FORCE ON AND AFTER THE FIRST DAY OF THE FIRST MONTH OF THE THIRTY-SECOND YEAR OF MEIJI (JANUARY 1, 1899)—Continued.

CLASS I.—ARTICLES SUBJECT TO DUTY—Continued.

Tariff No.	ARTICLES.		General tariff.	Conventional tariff.	Contracting States.
	GROUP VII.—*Grains and seeds*—Continued.		Yen.	Yen.	
175	Indian corn	ad val.	5%		
176	Oats	do.	5%		
177	Sesame	100 kins.	0.197		
178	Wheat	do.	0.153		
179*a*	Cotton seeds	do.	0.044		
179*b*	All other grains and seeds, not otherwise provided for	ad val.	5%		
	GROUP VIII.—*Horns, ivory, skins, hairs, shells, etc.*				
180	Bones, animal	ad val.	5%		
181	Feathers and downs of all kinds	do.	25%		
182	Furs, dressed or otherwise	do.	25%		
183	Hair, animal, excluding wool, and goat's and camel's hair	do.	5%		
184	Hair, human	100 kins.	5.641		
185	Hides or skins, bull, ox, cow, and buffalo, raw, dried, salted or pickled, and undressed	do.	0.962		
186	Hides or skins, deer, raw, dried, salted or pickled, and undressed	do.	1.588		
187	Hides or skins, Samba (Cervus clephas), raw, dried, salted or pickled, and undressed	do.	0.661		
188	Hoofs, animal	do.	0.414		
189	Horns, bull, ox, cow, and buffalo	do.	0.504		
190	Horns, deer	do.	0.654		
191	Horns, rhinoceros	ad val.	10%		
192	Ivory or tusks, elephant	kin.	0.298		
193	Ivory or tusks, elephant, waste	ad val.	10%		
194	Ivory or tusks, narwhal or unicorn	do.	10%		
195	Ivory or teeth of walrus or seahorse	kin.	0.102		
196	Leather, sole	100 kins.	7.441	5.620	G., G. B.
197	Leather, all other	ad val.	5%	10%	G., G. B.
198	Tortoise shells	do.	15%		
199	Tortoise shells, waste	do.	15%		
200	All other bones, horns, hides, or skins, raw, and shells	do.	15%		
201	All other tusks or teeth of animals	do.	10%		
	GROUP IX.—*Metals and metal manufactures.*				
202	Antimony, ingot and slab	ad val.	5%		
	Brass:				
203*a*	Bar and rod	100 kins.	3.070		
203*b*	Plate and sheet	do.	3.086		
204	Pipes and tubes	ad val.	10%		
205	Screws	do.	10%		
206	Brass, old, only fit for remanufacturing	100 kins.	0.915		
	Copper:				
207	Ingot and slab	ad val.	5%		
208*a*	Bar and rod	100 kins.	3.464		
208*b*	Plate and sheet	do.	3.488		
209	Nails	do.	3.956		
210	Pipes and tubes	ad val.	10%		
211	Wire	100 kins.	7.496		
212	Copper and nickel coins	ad val.	5%		
213	Copper, old, only fit for remanufacturing	100 kins.	0.799		
	German silver:				
214*a*	Plate, sheet, and rod	do.	6.020		
214*b*	Wire	do.	6.257		
	Iron and mild steel:				
215	Pig and ingot	do.	0.083	0.083	G., G. B.
216	Kentledge	ad val.	5%		
217*a*	Bar and rod exceeding one-fourth inch in any[a] diameter	100 kins.	0.356	0.261	F., G., G. B.
217*b*	Hoops and band	do.	0.427		
218	T, angle, and other similar manufactures	do.	0.313		
219*a*	Rails	do.	0.297	0.129	G., G. B.
219*b*	Bolts,[b] nuts,[b] chairs, dog spikes, and fish plates for rails	ad val.	10%		
220*a*	Plate and sheet	100 kins.	0.394	0.296	G., G. B.
220*b*	Plate and sheet, corrugated	ad val.	10%		
221	Sheet, galvanized, corrugated, or otherwise	100 kins.	0.853	0.749	G., G. B.
222	Plate, diagonal or checkered	do.	0.345		
223	Pipes and tubes	ad val.	10%	10%	G., G. B.
224*a*	Nails, galvanized or otherwise, not otherwise provided for	do.	10%		
224*b*	Nails, also wire nails,[c] including spikes, sprigs, tacks, and brads:				
	a. Plain	100 kins.	0.575	0.073	G., G. B.
	b. Galvanized	ad val.	10%	10%	G., G. B.
225*a*	*Screws, bolts, and nuts, plain and galvanized*	do.	10%	10%	G., G. B.
225*b*	Screws, bolts, and nuts not otherwise provided for	do.	10%		
226	Tinned plates or sheets:				
	a. Plain	100 kins.	0.631	0.631	G., G. B.
	b. Crystallized	ad val.	10%	10%	G., G. B.
227*a*	Wire and small rod not exceeding one-fourth inch in diameter	100 kins.	0.[illegible]	0.503	G., G. B.
227*b*	Wire and small rod not exceeding one-fourth inch in diameter, tinned	ad val.	10%		
228	Wire, telegraph or galvanized	100 kins.	0.[illegible]	0.2[illegible]	G., G. B.
229*a*	Wire rope, galvanized	do.	1.[illegible]7		
229*b*	Wire rope, otherwise	ad val.	10%		
230	Wire rope, galvanized or otherwise, old	100 kins.	0.[illegible]		
231*a*	Old hoop iron, only fit for remanufacturing	do.	0.103		
231*b*	Old wire and all other old iron or mild steel, only fit for remanufacturing	ad val.	5%		
	Lead:				
232	Pig, ingot, and slab	100 kins.	0.368	0.2[illegible]	G., G. B.
233	Sheet	do.	0.753		
234	Pipes and tubes	ad val.	10%		
235	Mercury or quicksilver	100 kins.	5.689	5.[illegible]	G. B.
236	Nickel	do.	3.529		
	Platinum:				
237	Ingot	ad val.	5%		
238	Bar, rod, plate, sheet, and wire	do.	10%		
239	Solders of all kinds	do.	5%		
	Steel, other than mild steel:				
240	Pig,[a] ingot, and slab[a]	do.	5%	[illegible]	F., G., G. B.
241	Bar, rod, plate, and sheet	do.	10%	7[illegible]	G., G. B.
242	Pipes and tubes	do.	10%	10%	G.

[a] According to the conventional tariff with France.
[b] Included in the conventional tariffs with Great Britain and Germany under No. 225.
[c] According to the conventional tariff with Germany.

THE CUSTOMS IMPORT TARIFF OF JAPAN IN FORCE ON AND AFTER THE FIRST DAY OF THE FIRST MONTH OF THE THIRTY-SECOND YEAR OF MEIJI (JANUARY 1, 1899)—Continued.

CLASS I.—ARTICLES SUBJECT TO DUTY—Continued.

Tariff No.	ARTICLES.		General tariff.	Conventional tariff.	Contracting States.
	GROUP IX.—*Metals and metal manufactures*—Continued.				
	Steel, other than mild steel—Continued:		*Yen.*	*Yen.*	
	Rails	ad val.	20%	5%	G.
	Sheet, galvanized, both plain and corrugated	do.	20%	10%	G.
	Tinned plates	do.	20%	10%	G.
243	Wire, and small rod not exceeding one-fourth inch in diameter	100 kins.	1.819	1.819	G., G. B.
244	Wire, paragon (for umbrella ribs)	do.	2.145		
245	Wire rope, galvanized or otherwise	do.	1.647		
246*a*	Old wire rope, only fit for remanufacturing	do.	[illegible]		
246*b*	Old files and all other old steel, only fit for remanufacturing	ad val.	5%		
	Tin:				
247	Block, ingot, and slab	100 kins.	1.992	1.992	G. B.
248	Plate and sheet	ad val.	10%	10%	G. B.
249	White metal, Babbitt's	do.	[illegible]		
	Yellow metal and muntz metal:				
250	Plate and sheet	100 kins.	2.871		
251	Bar and rod	do.	2.586		
252	Nails	ad val.	10%		
253	Pipes and tubes	do.	10%		
254	Yellow metal, and muntz metal, old, only fit for remanufacturing	ad val.	5%		
	Zinc:				
255	Block, ingot and slab	100 kins.	0.451	0.400	G., G. B.
256*a*	Sheet, excluding zinc sheet No. 2	ad val.	10%		
		100 kins.		0.880	G., G. B.
256*b*	Sheet, old	do.	0.297		
257	All other old zinc, only fit for remanufacturing	ad val.	5%		
258	Nails, screws, bolts, and nuts of metals not otherwise provided for	do.	10%		
259	Anchors and chain cables, new and old	do.	10%		
260	Bag frames	do.	15%		
261	Capsules for bottles	do.	[illegible]		
262	Chains, iron, not otherwise provided for	do.	[illegible]		
263	Door locks, knobs, bolts, hinges, etc	do.	[illegible]		
264*a*	Foils and powder of gold, silver, or other metals	do.	[illegible]		
264*b*	Bronze powder	100 kins.	11.269		
265	Gold and silver ware, not otherwise provided for	ad val.	[illegible]		
266	Gold and silver plated ware, not otherwise provided for	do.	25%		
267	Grates, fenders, stoves, and fittings thereof	do.	[illegible]		
268	Safes and cash boxes	do.	[illegible]		
269	Umbrella ribs and fittings thereof	do.	[illegible]		
	Wire, telegraph, all other than of iron and mild steel	do.	[a] 20%	5%	G.
270	All other metals, not otherwise provided for	do.	5%		
271	All other manufactures of metal or metals, not otherwise provided for	do.	20%		
	Kitchen utensils or vessels made of enameled iron and steel, decorated or otherwise	do.	[a] 20%	10%	A.
	GROUP X.—*Oils and waxes.*				
272	Candles of all kinds	100 kins.	3.522	2.146	F.
273	Gasolene	ad val.	10%		
274	Oil, bean	100 kins.	0.747		
275*a*	Oil, castor, in tin, cask, or jar	do.	[illegible]		
275*b*	Oil, castor, excepting in tin, cask, or jar	ad val.	[illegible]		
276	Oil, cocoanut	100 kins.	1.181		
277	Oil, groundnut or peanut	do.	1.122		
278	Oil, kerosene or petroleum:				
	a. In tin	gallon.	0.016		
	b. In bulk	do.	0.010		
279*a*	Oil, linseed, in tin or cask	100 kins.	1.724		
279*b*	Oil, linseed, excepting in tin or cask	ad val.	10%		
280*a*	Oil, olive, in tin or cask	100 kins.	2.920		
280*b*	Oil, olive, excepting in tin or cask	ad val.	10%		
281	Oil, palm	do.	10%		
282	Oil, paraffin	do.	10%	10%	G. B.
283*a*	Oil or spirit of turpentine, in tin or cask	gallon.	0.076		
283*b*	Oil or spirit of turpentine, excepting in tin or cask	ad val.	10%		
284	Wax, Chinese white or insect	do.	10%		
285	Wax, paraffin (*abolished*)	100 kins.	1.088	0.544	G., G. B.
286	All other oils and waxes	ad val.	10%		
	GROUP XI.—*Paper and stationeries.*				
287	Albums, photographic and postage stamp	ad val.	25%		
288	Books, blank and printed blank, and printed blank forms	do.	15%		
289	Ink, printing, copying, writing, and lithographic	do.	15%		
290	Paper, Chinese, of all kinds	do.	15%		
291	Paper, hanging	do.	15%		
292	Paper, printing:				
	a. *Not exceeding 24 pounds per ream of 500 sheets and measuring 1,086 square inches per sheet*	100 kins.	1.757	0.800	G.
	b. *All other kinds of printing paper*	do.	1.757	1.168	G., G. B.
293	Paper, all other kinds	ad val.	15%	10%	G.
294	Pencils:				
	a. In gold or platinum case	do.	30%		
	b. All other [b]	do.	15%		
295	Pen nibs:				
	a. Gold	do.	[illegible]		
	b. All other	do.	[illegible]		
296	Sealing wax	do.	[illegible]		
297	Strawboard	do.	15%		
298	All other stationeries	do.	15%		
	GROUP XII.—*Sugar.*				
299	Sugar, up to No. 14, inclusive, Dutch standard in color	100 kins.	0.204		
300	Sugar, refined:				
	a. From No. 15 to No. 20, inclusive, Dutch standard in color	do.	1.523	0.748	G., G. B.
	b. Upward of No. 20, Dutch standard in color	do.	1.828	0.827	G., G. B.
301	Sugar, rock candy	do.	2.273		
302	Molasses	do.	0.197		
303	Sirup	ad val.	[illegible]		

[a] Included in the general tariff under No. 271.

[b] See No. 450.

THE CUSTOMS IMPORT TARIFF OF JAPAN IN FORCE ON AND AFTER THE FIRST DAY OF THE FIRST MONTH OF THE THIRTY-SECOND YEAR OF MEIJI (JANUARY 1, 1899)—Continued.

CLASS I.—ARTICLES SUBJECT TO DUTY—Continued.

Tariff No.	ARTICLES.	General tariff.	Conventional tariff.	Contracting States.
	GROUP XIII.—*Tissues, yarns, threads, and raw materials used therefor.*			
	PART I.	*Yen.*	*Yen.*	
304	Cotton yarns (plain or dyed) ....100 kins..	6.606	4.180	G., G. B.
305	Cotton threads....ad val..	15%		
306	Bookbinder's cloth....do....	15%		
307	Cotton damasks....do....	15%	[a]10%	F., G., G. B.
308*a*	Cotton drills, other than gray or bleached....do....	15%	[b]0.016	F., G., G. B.
308*b*	Cotton drills, gray or bleached....square yard..	0.029	0.016	F., G., G. B.
309	Cotton duck....do....	0.080	0.053	F., G., G. B.
310	Cotton prints....do....	0.020	0.012	F., G., G. B.
311	Cotton sateens, plain, figured, or printed, cotton brocades, cotton Italians, and figured shirtings....square yard..	0.029	0.017	F., G., G. B.
312	Cotton velvet or velveteens....do....	0.062	0.041	F., G., G. B.
313	Ginghams....ad val..	15%	[a]10%	F., G., G. B.
314	Shirtings, gray....square yard..	0.010	0.006	F., G., G. B.
315	Shirtings, white and bleached....do....	0.015	0.010	F., G., G. B.
316	Shirtings, twilled....do....	0.017	0.011	F., G., G. B.
317	Shirtings, dyed....do....	0.020	0.013	F., G., G. B.
318	Taffachelass....ad val..	15%	[a]10%	F., G., G. B.
319	T-cloth....square yard..	0.015	0.009	F., G., G. B.
320	Turkey-red cambrics....do....	0.018	0.012	F., G., G. B.
321	Victoria lawns....do....	0.009	0.006	F., G., G. B.
322	All other sorts of pure cotton tissues and all tissues of cotton mixed with flax, hemp, or other fiber, including wool, the cotton, however, predominating in weight, not specially provided for....ad val..	15%	10%	F., G., G. B.
	PART II.			
323	Woolen and worsted or combed yarns, plain or dyed....100 kins..	12.308	9.169	G. B.
	a. For weaving purposes....do....	12.308	8.060	F., G.
	b. For other purposes....do....	12.308	9.169	G., G. B.
324	Alpacas....square yard..	0.113	0.075	F., G., G. B.
325	Balzarine....ad val..	15%	[c]10%	F., G., G. B.
326	Buntings....square yard..	0.058	0.031	F., G., G. B.
327	Camlets, lastings, and crape lastings....ad val..	15%	[c]10%	F., G., G. B.
328	Camlet cords....do....	15%	[c]10%	F., G., G. B.
329	China figures....do....	15%	[c]10%	F., G., G. B.
330	Flannels:			
	a. Of wool....square yard..	0.068	0.041	F., G., G. B.
	b. Of wool and cotton....do....	0.062	0.030	F., G., G. B.
331	*Italian cloth, including, also, Italian cloth in which cotton predominates in weight*....do....	0.053	0.029	F., G., G. B.
332	Long-ells....do....	0.061	0.036	F., G., G. B.
333	Mousseline de laine, wholly of wool:			
	a. Gray and white....do....	0.033	0.015	F., G., G. B.
	b. Dyed and printed....do....	0.035	0.021	F., G., G. B.
	c. All other kinds....ad val..	15%	[b]0.021	F., G., G. B.
334	Orleans and lusters....do....	15%	10%	F., G., G. B.
335*a*	Serges, where the warp is worsted and the weft woolen....square yard..	0.097	0.056	F., G., G. B.
335*b*	Serges of all other kinds....ad val..	15%	10%	F., G., G. B.
336	Spanish stripes....do....	15%	[c]10%	F., G., G. B.
337	Woolen and worsted cloths:			
	a. Wholly of woolen or worsted yarn, or of woolen and worsted yarn such as broad, narrow, and army cloth, cassimeres, tweeds, and worsted coatings....square yard..	0.141	0.093	F., G., G. B.
	b. In part of woolen or worsted yarn, and in part of cotton yarn such as pilot, president, and union cloth....do....	0.071	0.039	F., G., G. B.
338	Woolen and worsted damasks....ad val..	15%	[c]10%	F., G., G. B.
339	Woolen felt....do....	15%		
340	All other sorts, pure or mixed with other materials, the wool, however, predominating in weight....do....	15%	10%	F., G., G. B.
	PART III.			
341*a*	Silk thrown, tama or dupioni, skin, waste, and wild cocoons silk....ad val..	15%		
341*b*	Silk, raw....100 kins..	55.100		
341*c*	Silk, tussah....do....	23.846		
342	Silk, floss....ad val..	15%		
343	Silk, spun, for weaving purposes, and silk yarns mixed with other fibers....do....	15%		
344	Silk, threads, not otherwise provided for....do....	20%		
345	Silk crape, Chinese....do....	20%		
346	Silk, pongee, Chinese (Kenchu)....do....	20%		
	Satin in silk....do....	[d]20%	10%	F.
347	Silk satins, Chinese....square yard..	0.150		
348	Silk satins, figured Chinese....ad val..	20%		
349	Silk, faced cotton satins or *satin in silk and cotton mixed*....do....	20%	10%	F., G., G. B.
350	Silk, tissues, and silk and cotton tissues, embroidered....do....	25%		
351	All other silk tissues pure or mixed with other materials, the silk, however, predominating in weight....do....	20%		
	PART IV.			
352	Flax or linen yarns, plain or dyed....100 kins..	8.170	6.527	G., G. B.
353	Flax or linen threads....ad val..	15%		
354	Flax or linen canvas....square yard..	0.071	0.047	G., G. B.
355	Linen, gray, bleached, dyed, or printed....ad val..	15%	[e]10%	G., G. B.
356	Linen, damasks....do....	15%	[e]10%	G., G. B.
	All other sorts of linen tissues....do....	[f]15%	10%	G., G. B.
357	All other linen tissues mixed with other materials, the flax, however, predominating in weight....ad val..	15%		
	PART V.			
358*a*	Blanketing and whipped blankets in plain weave:			
	a. Of wool or worsted pure....100 kins..	13.984	7.458	F., G., G. B.
	b. Of wool or worsted mixed with other materials, the wool, however, predominating in weight....do....	13.984	7.458	F., G., G. B.
358*b*	Blankets of all kinds, single or in piece....ad val..	15%		
359	Carpets and carpetings, Brussels....square yard..	0.277		
360	Carpets and carpetings, felt....do....	0.077		
361	Carpets and carpetings, jute or hemp....do....	0.047		
362	Carpets and carpetings, patent tapestry....do....	0.255		
363	All other carpets and carpeting....ad val..	20%		
364	Chikutu....square yard..	0.027		

[a] Included in the conventional tariff under No. 322.
[b] Square yard.
[c] Included in the conventional tariff under No. 340.
[d] Included in the general tariff under No. 351.
[e] Included in the conventional tariff under No. 356.
[f] Included in the general tariff under No. 357.

THE CUSTOMS IMPORT TARIFF OF JAPAN IN FORCE ON AND AFTER THE FIRST DAY OF THE FIRST MONTH OF THE THIRTY-SECOND YEAR OF MEIJI (JANUARY 1, 1899)—Continued.

CLASS I.—ARTICLES SUBJECT TO DUTY—Continued.

Tariff No.	ARTICLES.	General tariff.	Conventional tariff.	Contracting States.
	GROUP XIII.—*Tissues, yarns, threads, and raw materials used therefor*—Continued.			
	PART V—Continued.			
365	Curtains:	*Yen.*	*Yen.*	
	a. Of silk, wholly or in part ..... ad val.	25%		
	b. All other ..... do.	20%		
366	Elastic boot webbing:			
	a. Of silk, in part ..... do.	20%		
	b. All other ..... do.	15%		
367	Elastic braids and cords ..... do.	15%		
368	Handkerchiefs:			
	a^1. Of cotton in single ..... do.	15%		
	a^2. Of cotton in the piece ..... square yard.	0.017	0.011	F., G., G. B.
	Of cotton mixed with other materials, the cotton, however, predominating in weight in the piece ..... ad val.	[a]15%	10%	F., G., G. B.
	a^3. Of linen, or of linen and cotton, single or in pieces ..... do.	15%		
	b. Of silk, or of lace ..... do.	25%		
369	Mosquito nets of all kinds ..... do.	20%		
370	Oil or leather cloths, for furniture, etc ..... square yard.	0.013		
371	Oil cloths, and linoleum cloths for floor ..... do.	0.071		
372	Table cloth or covers:			
	a. Of silk, wholly or in part ..... ad val.	25%		
	b. All other ..... do.	20%		
373	Towels of all kinds, single or in piece ..... do.	15%		
374	Traveling rugs, single or in piece:			
	a. Of silk, in part ..... do.	25%		
	b. All other ..... do.	15%		
375	Twines of cotton, flax, hemp, jute, manila hemp, or china grass ..... do.	10%		
376	Yarns and threads of all kinds not otherwise provided for ..... do.	15%		
	Yarns, jute or hemp, for weaving purposes ..... do.	15%	8%	G.
	Yarns of all sorts, not especially provided for ..... do.	[b]15%	10%	G., G. B.
377	All other tissues ..... do.	15%		
378	All other works of tissues:			
	a. Of silk, wholly or in part ..... do.	25%		
	b. All other ..... do.	20%		
	GROUP XIV.—*Tobacco.*			
379	Cigars ..... ad val.	100%		
380	Cigarettes ..... do.	100%		
381	Snuff ..... do.	100%		
382	Tobacco, cut ..... do.	100%		
383	Tobacco, leaf ..... do.	35%		
384	All other prepared tobacco ..... do.	100%		
	GROUP XV.—*Wines, liquors, and spirits.*			
385	Beer, ale, porter, and stout:			
	a. Bottles, not exceeding ½ litre each ..... per dozen.	0.388		
	b. Bottles, not exceeding 1 litre each ..... do.	0.515		
	c. In cask or barrel ..... ad val.	25%		
386	Brandy ..... do.	40%		
387	Champagne and other similar sparkling wines, exclusively the produce of the natural fermentation of grapes, in case:			
	a. Containing 24 bottles not exceeding ½ litre each ..... per case.	5.425	1.550	F.
	b. Containing 12 bottles, exceeding ½ litre and not exceeding 1 litre each ..... do.	5.425	1.550	F.
388	Chinese alcoholic liquors of all kinds:			
	a. Distilled ..... ad val.	100%		
	b. Fermented ..... do.	80%		
389	Gin ..... do.	40%		
390	Liquors of all kinds ..... do.	40%		
391	Port wine [c] ..... do.			
392	Rum ..... do.	40%		
393	Sake, resembling the home brewage ..... do.	80%		
394	Sherry [c] ..... do.			
395	Vermouth [d] ..... do.	35%		
396	Whisky ..... do.	40%		
397	Wine, still, of all sorts, exclusively the produce of the natural fermentations of grapes:			
	Not exceeding 16 degrees of pure alcohol—			
	a. In cask or barrel ..... 10 litres.	0.435	[e]1.242	F.
	b. In case—			
	1. Containing 24 bottles, not exceeding ½ litre each ..... per case.	2.660	0.760	F.
	2. Containing 12 bottles, exceeding ½ litre and not exceeding 1 litre each ..... do.	2.660	0.760	F.
	Exceeding 16 degrees and not exceeding 24 degrees of pure alcohol—			
	a. In cask or barrel ..... 10 litres.	2.774	[e]7.925	F.
	b. In case—			
	1. Containing 24 bottles, not exceeding ½ litre each ..... per case.	2.380	0.680	F.
	2. Containing 12 bottles, exceeding ½ litre and not exceeding 1 litre each ..... per case.	2.380	0.680	F.
398	Spirits or distilled liquors of all other kinds ..... ad val.	100%		
399	Wines or fermented liquors of all other kinds ..... do.	80%		
	GROUP XVI.—*Miscellaneous.*			
400	Aloeswood ..... 100 kins.	8.688		
401	Amber:			
	a. Unworked ..... ad val.	10%		
	b. Worked ..... do.	20%		
402	Animals:			
	Cattle, horses, asses, mules, sheep, goats, and domestic fowls ..... do.	5%		
	Horses ..... do.	5%	Free.	A.
403	All other animals ..... do.	10%		
404	Asbestos, in sheet or board ..... do.	5%		
405	Bamboo, unworked ..... do.	5%		
406	Beltings of leather, caoutchouc, or canvas, and hose of caoutchouc or canvas, for machineries ..... do.	10%		
407	Billiard tables and accessories ..... do.	30%		
408	Blasting gelatine and other similar explosive compounds, including detonators and fuses ..... do.	15%		

[a] Included in the general and conventional tariffs under No. 322.
[b] Included in the general tariff under No. 376.
[c] Subject to the provision regarding alcoholic strength, port wine and sherry are dutiable as still wines under No. 397.
[d] In virtue of the conventional tariff with France, subject to the provision regarding alcoholic strength, vermouth is dutiable in the conventional schedule as still wine, under No. 397.
[e] 100 litres.

THE CUSTOMS IMPORT TARIFF OF JAPAN IN FORCE ON AND AFTER THE FIRST DAY OF THE FIRST MONTH OF THE THIRTY-SECOND YEAR OF MEIJI (JANUARY 1, 1899)—Continued.

CLASS I.—ARTICLES SUBJECT TO DUTY—Continued.

Tariff No.	ARTICLES.		General tariff.	Conventional tariff.	Contracting States.
	GROUP XVI.—*Miscellaneous*—Continued.		*Yen.*	*Yen.*	
409	Bricks and tiles for building purposes	ad val.	1½		
410	Brushes and brooms of all kinds	do.	2½		
411	Canes, sticks, and whips	do.	2½		
412	Caoutchouc and gutta-percha:				
	a. Crude	do.	5%		
	b. Sheet	do.	10%		
	c. Manufactures of, not otherwise provided for	do.	20%		
	Manufactures of caoutchouc	do.	20	10%	G., G. B.
413	Carriages, bicycles, tricycles, and parts thereof	do.	25		
414	Cars or carriages, railway passengers', and parts thereof	do.	10	5%	G.
415	Cars and wagons, railway freight, and parts thereof	do.	10		
416	Cars and carriages, tramway, and parts thereof	do.	10		
417	Cars and drays for conveyance of commodities	do.	10		
418	Celluloid:				
	a. In sheet or rod	kin.	0.196		
	b. Worked	ad val.	20		
419	Cement, Portland	100 kins.	0.[illegible]	0.635	G., G. B.
420	Chalk and whiting	ad val.	5		
421	Charcoal, wood and animal	do.	5		
422	Clay of all kinds	do.	5		
423*a*	Coal briquettes, or patent fuel coal	do.	5		
423*b*	Coal	per ton	0.870		
424	Coke	do.	0.780		
425	Corals, worked or otherwise	ad val.	30		
426	Cordage and ropes of flax, hemp, jute, Manila hemp or China grass, for rigging or otherwise	100 kins.	1.954		
427	Cork bark	ad val.	5		
428	Corks	do.	10		
429	Diamonds, glaziers'	do.	10		
430	Dynamite	kin.	0.140	0.056	G.
431	Emery sands	ad val.	5		
432	Emery cloths and sandpaper	do.	5		
433	Emery wheels, and grindstones of all kinds	do.	5		
434	Felt, for ship's bottom, or for roofing	do.	10		
435	Fireworks of all kinds	do.	30		
436	Fishing guts (Tegusu)	100 kins.	16.976		
437	Flints	ad val.	5		
438	Flowers and blossoms, artificial	do.	25		
439	Frames for pictures, and moulding	do.	20		
440	Funori (*Gleopertis intricata*)	100 kins.	0.2[illegible]		
441	Furnitures, new and old, not otherwise provided for	ad val.	20		
	Furnitures of bent wood of all kinds	do.	[a] 2[illegible]	10%	A.
442	Games, all articles of, used in playing tennis, cricket, chess, etc., not otherwise provided for	do.	25		
443	Glue, common	100 kins.	0.972		
444	Gun cotton	ad val.	15		
445*a*	Gunpowder, smokeless	do.	15		
445*b*	Gunpowder of all kinds, excluding the smokeless powder	100 kins.	2.017		
446	Gypsum	do.	0.055		
447	Hay	ad val.	5		
448	Ivory, manufactures of, not otherwise provided for	do.	25		
449	Jewelry	do.	30		
450	Jewelry, imitation of	do.	10[illegible]	10%	A.
	Imitation jewelry:				
	Small articles of luxury used for personal adornment made principally of common metals, such as aluminium, aluminium bronze, nickel, German silver, argentine, copper, steel, zinc, lead, tin, iron, etc., or also of jet, hardened wood, beads, shells, horn, celluloid, bones, and other similar common materials:				
	1° *Gilt, silvered, treated with aquafortis, burnished, polished, varnished, tinned, enamelled, oxidized, or nickeled, garnished with "vitrification," enamelled (cloisonné) or not, false pearls, corals, both genuine and false, imitation precious stones*	ad val.	[b] 30%	10%	F.
	2° *Garnished with mother-of-pearl, ivory, tortoise shell; gold and silver plated if the value of the garnitures or plating does not surpass the value of the principal composition*	ad val.	[b] 30%	10%	F.
	NOTE.—*Jewelry most commonly used are rings, colliers, bracelets, car pendants, medals, medallions, brooches, combs, ornamental hairpins and hat pins, tie pins, breloques, buckles, hooks, snuffboxes, buttons (common buttons excepted), coulants, purses, handles and ferrules of sticks, umbrellas, and parasols, coins (sequins), pencil cases, and generally all other small objects of adornment not mentioned herein.*				
451	Labels for bottles, tins, etc	ad val.	15%		
452	Lamps and lanterns, and parts thereof	do.	20%		
	Lamps and accessories and parts thereof in metal or glass	do.	20%	10%	A.
453	Lard, tallow, and grease	do.	10%		
454	Leather, manufactures of, not otherwise provided for	do.	20		
455	Malt	100 kins.	0.344		
456	Matches of all kinds	do.	20%		
457	Matting, China, in rolls of 40 yards	per roll	0.610		
458	Matting, cocoa	square yard	0.058		
459	Mats and matting, all other	ad val.	25		
460	Mica in sheet	do.	10%		
461	Oakum	100 kins.	0.710		
462	Packing, for steam engine	ad val.	10%		
463	Paintings, in oil or water colour, lithographs, chromolithographs, photographs, calligraphical albums, and all other paintings, pictures, and calligraphy, not otherwise provided for	ad val.	25%		
464*a*	Pitch	100 kins.	0.187		
464*b*	Wood tar	do.	0.322		
464*c*	Coal tar	ad val.	[illegible]		
465	Plaster of paris	100 kins.	0.174		
466	Playing cards of all kinds	ad val.	35%		
467	Plumbago or black lead	100 kins.	0.730		
468	Pottery, including porcelain and earthenware, not otherwise provided for	ad val.	20%		
469	Precious stones and pearls	do.	35%		
470*a*	Precious stones and pearls, imitation of	do.	30%		
470*b*	Precious stones and pearls made of glass	do.	30	10%	A.
471	Pulp, for making paper	100 kins.	0.297		
472	Rattans	do.	0.[illegible]		
473	Rattans, split or otherwise	do.	0.[illegible]		
474	Saddles, bridles, and harness	ad val.	5		
475	Sandal wood	100 kins.	1.444		

[a] Included in the general tariff under No. 441.
[b] Included in the general tariff under No. 450.
[c] Included in the conventional tariff with Austria-Hungary under No. 172.

THE CUSTOMS IMPORT TARIFF OF JAPAN IN FORCE ON AND AFTER THE FIRST DAY OF THE FIRST MONTH OF THE THIRTY-SECOND YEAR OF MEIJI (JANUARY 1, 1899)—Continued.

CLASS I.—ARTICLES SUBJECT TO DUTY—Continued.

Tariff No.	ARTICLES.		General tariff.	Conventional tariff.	Contracting States.
	GROUP XVI.—*Miscellaneous*—Continued.		*Yen.*	*Yen.*	
476	Shoeblacking of all kinds	ad val.	20%		
477	Smoker's articles (articles for use in smoking opium are excluded)	do.	30%		
478	Soap:				
	a. Toilet	do.	[illegible]	[illegible]	F.
	b. Common	100 kins.	1.085	0.972	F.
	c. All others	ad val.	10%		
479	Soapstone, in lump or powdered	100 kins.	[illegible]		
480	Sparterie, for making hats	ad val.	10%		
481	Sponges	do.	5%		
482	Stones and slates not otherwise provided for:				
	a. Rough or unworked, for building purposes, etc	do.	5%		
	b. Worked, for ornamental works or furnitures, etc	do.	20%		
	c. Statutes and other, sculptured or engraved	do.	25%		
483	Submarine telegraphic cables and under-ground telegraphic lines or cables	do.	10%		
484	Timber, santalum (shitan)	100 kins.	[illegible]		
485	Timber, teak	100 cubic feet.	7.628		
486	Timber, lumber, boards, and planks of all kinds, not otherwise provided for	ad val.	5%		
487	Toilet or dressing cases	do.	[illegible]		
488	Toilet or perfumed water, hair oil, dentifrices, and all other cosmetics and perfumery	do.	[b] 30%		
	Perfumery:				
	a. Toilet soap (see No. 478).				
	b. Liquid perfumery: Essences or extracts of scents, oils, vinegars, waters, and alcoholes of toilet or scent and other liquids of the same kind	ad val.	[b] 30%	[a] 0.92	F.
	c. Dry perfumery: Salts, powder, cosmetics, pomades, pastes, and other nonliquid perfumeries for toilet([c])	do.	[b] 30%	10%	F.
489	Tortoise shell, manufactures of	do.	25%		
490	Toys of all kinds	do.	25%		
491	Trunks, portmanteaux, and traveling or courier bags	do.	20%		
492	Umbrellas, parasols, and sunshades:				
	a. Of silk, wholly or in part	do.	[illegible]		
	b. All other	do.	[illegible]		
493	Umbrella sticks and handles ([d]), except those made of gold or silver	do.	20%		
494	Vessels, steam or sailing, and boats	do.	[illegible]		
495	Wares of santalum or ebony wood	do.	25%		
496	All articles, raw or unmanufactured, not herein enumerated	do.	10%		
497	All articles, manufactured wholly or in part, not herein enumerated	do.	20%		

[a] Kin.
[b] Included in the general tariff under No. 488.
[c] Natural and artificial musk, civet, and gray amber are excluded from perfumery schedule of the conventional tariff with France.
[d] See No. 450.

CLASS II.—ARTICLES EXEMPTED FROM DUTIES.

498. Advertisements and signboards.
499. Animal bone ashes.
500. Atlases, maps and charts, and other scientific diagrams.
501. Bank notes, coupons, scrip, and all other negotiable papers.
502. Books, printed, including copy books, drawing books, pamphlets, periodicals, journals, and newspapers.
503. Bullion, gold and silver.
504. Cocoons of all kinds.
505. Coins, gold and silver.
506. Cotton, old.
507. Cotton, raw, ginned.
508. Cotton, raw, in the seed.
509. Cotton, waste.
510. Cotton, yarn, waste.
511. Flax, hemp, jute, Manila hemp, and China grass, hackled or otherwise.
512. Guano.
513. Gunny bags, new and old.
514. Gunny cloth.
514[1]. Manure, artificial, and manures of all kinds not provided for in the tariff.
515. Mats, packing.
515[1]. Minerals, phosphatic.
516. Models and architectural and engineering plans.
517. Oil cake, in lump or powdered.
518. Opium for medicinal purposes, imported by the Imperial Government.
518[1]. Paraffin.
518[2]. Potash, chlorate of.
518[3]. Phosphorus, amorphous.
518[4]. Phosphorus, yellow.
519. Plants, trees, shrubs, and roots, shoots and bulbs thereof.
520. Rice and paddy.
521. Sardines (Iwashi), dried.
522. Tea-firing baskets and sieves.
523. Tea-firing pans.
524. Tea lead.
525. Wool, goat's hair and camel's hair, new and old.
525[1]. Zinc sheet No. 2.

CLASS III.—PROHIBITED ARTICLES.

526. Adulterated drugs, chemicals, medicines, food, and beverages, considered to be injurious by laws, ordinances, and regulations of the Empire.
527. All articles for use in smoking opium.
528. All articles which are considered dangerous to the public health for sanitary reasons or to the safety of animals or plants, under the laws, ordinances, and regulations of the Empire.
529. Articles in violation of patent, design, trade-mark, or copyright laws of the Empire.
530. False coins of any kind, and imitations of coins which might be considered to be false coins.
531. Opium (opium imported by the Imperial Government for medicinal purposes is excluded from this prohibition).
532. Prints, printed books, paintings, engravings, carvings, or any other articles, which in view of public security or morals might offer any danger.

STATISTICAL STATEMENTS

OF THE

JAPANESE EMPIRE.

COMMERCIAL STATISTICS.

TOTAL FOREIGN COMMERCE OF JAPAN, AND SHARE OF THE UNITED STATES AND UNITED KINGDOM THEREIN, DURING THE CALENDAR YEARS 1881 TO 1900.

[Compiled from official reports of the Japanese Government.]

YEARS.	IMPORTS INTO JAPAN.					EXPORTS FROM JAPAN.				
	Total.	From United States.		From United Kingdom.		Total.	To United States.		To United Kingdom.	
		Value.	Per cent.	Value.	Per cent.		Value.	Per cent.	Value.	Per cent.
	Yen.	*Yen.*		*Yen.*		*Yen.*	*Yen.*		*Yen.*	
1881	31,128,125	1,781,108	5.72	16,364,740	52.57	30,282,563	11,056,464	36.51	3,514,476	11.61
1882	29,441,453	3,106,758	10.55	13,956,048	47.40	37,240,914	14,253,291	38.27	4,981,546	13.37
1883	28,431,939	3,187,114	11.21	12,744,943	44.83	35,706,356	13,247,840	37.10	4,832,067	13.81
1884	29,626,781	2,489,969	8.40	12,758,806	43.07	33,061,902	13,150,923	39.72	3,830,684	11.60
1885	29,356,967	2,751,320	9.37	12,456,610	42.43	35,792,752	15,639,005	43.69	2,453,167	6.85
1886	32,168,432	3,358,986	10.44	12,703,248	39.49	47,316,893	19,992,429	42.23	4,195,355	8.86
1887	44,304,251	3,309,269	7.47	18,970,544	42.82	50,551,523	22,243,441	44.00	3,478,722	6.88
1888	65,455,234	5,673,843	8.36	28,693,567	43.81	62,680,613	23,475,806	37.45	8,710,012	13.89
1889	63,995,009	6,173,141	9.65	26,067,934	40.73	68,423,131	26,109,835	38.16	7,664,599	11.20
1890	80,554,874	6,900,190	8.56	26,619,102	33.04	54,891,597	20,844,252	37.97	5,638,980	10.27
1891	61,969,183	6,840,047	11.04	19,996,050	32.27	77,915,626	29,795,754	38.24	5,633,136	7.23
1892	70,076,410	5,988,053	8.54	20,789,332	29.67	89,339,134	38,674,971	43.29	3,921,752	4.39
1893	87,597,095	6,090,408	6.95	27,929,628	31.88	88,140,793	27,739,458	31.47	4,995,974	5.67
1894	116,284,050	10,982,558	9.44	42,189,873	36.29	111,297,689	43,363,557	38.96	5,950,197	5.35
1895	127,260,844	9,276,360	7.29	45,172,110	35.49	133,516,985	54,028,950	40.46	7,883,091	5.90
1896	169,882,595	16,373,419	9.64	59,251,780	34.88	114,615,783	31,532,341	27.55	9,012,398	7.86
1897	218,440,623	27,030,537	12.38	65,406,266	29.94	159,388,425	52,436,404	32.90	8,481,195	5.32
1898	274,599,260	40,001,097	14.57	62,707,572	22.84	162,796,651	47,311,154	29.06	7,783,643	4.78
1899	219,228,647	38,215,894	17.43	44,836,994	20.45	211,495,335	63,919,270	30.22	11,270,770	5.33
1900	286,170,933	62,761,196	21.96	71,638,220	25.03	198,063,547	52,566,395	26.53	11,262,997	5.69

NOTE.—Prior to 1891 Canada was included in Japanese exports to and imports from United States. Imports and exports by Japanese Government are not included in this table.

Value of yen on January 1, 1885, in United States money, 85.8 cents; 1890, 75.2 cents; 1891, 83.1 cents; 1892, 74.5 cents; 1893, 66.1 cents; 1894, 55.6 cents; 1895, 49.1 cents; 1896, 52.9 cents; 1897, 51.1 cents; 1898 and 1899, 49.8 cents.

TOTAL FOREIGN COMMERCE OF JAPAN AND THE SHARE CONDUCTED BY FOREIGN AND JAPANESE MERCHANTS, RESPECTIVELY, DURING THE CALENDAR YEARS FROM 1883 TO 1900.

[Compiled from official reports of the Japanese Government.]

YEARS.	IMPORTS INTO JAPAN.					EXPORTS FROM JAPAN.				
	By Japanese.	Per cent.	By foreigners.	Per cent.	Total imports.	By Japanese.	Per cent.	By foreigners.	Per cent.	Total exports.
	Yen.		*Yen.*		*Yen.*	*Yen.*		*Yen.*		*Yen.*
1883	1,383,101	4.8	27,048,838	95.2	28,431,939	5,149,078	14.4	30,557,278	85.6	35,706,356
1884	2,282,913	7.7	27,343,868	92.3	29,626,781	5,125,459	15.5	27,936,443	84.5	33,061,902
1885	3,602,720	12.3	25,754,247	87.7	29,356,967	3,394,423	9.5	32,398,329	90.5	35,792,752
1886	3,834,632	12.0	28,333,799	88.0	32,168,432	5,713,200	12.7	41,603,692	87.3	47,316,893
1887	6,938,548	15.6	37,365,703	84.4	44,304,251	6,555,436	12.9	43,996,086	87.1	50,551,523
1888	11,634,987	17.8	53,820,246	82.2	65,455,234	7,081,324	11.1	56,599,289	88.9	63,680,613
1889	9,645,761	15.2	54,349,247	84.8	63,995,009	6,781,587	9.9	61,641,543	90.1	68,423,131
1890	19,521,764	24.2	61,033,109	75.8	80,554,874	6,123,961	11.1	48,767,635	88.9	54,891,597
1891	14,276,380	23.0	47,692,803	77.0	61,969,183	8,770,764	11.3	69,144,861	88.7	77,915,626
1892	13,812,662	19.7	56,263,748	80.3	70,076,410	11,395,210	13.0	77,943,923	87.0	89,339,134
1893	16,693,902	19.0	70,903,193	81.0	87,597,095	13,654,984	15.5	74,485,809	84.5	88,140,793
1894	33,947,596	29.2	82,336,454	70.8	116,284,050	20,450,979	18.4	90,846,710	81.6	111,297,689
1895	38,829,338	30.5	88,431,505	69.5	127,260,844	26,328,816	19.9	107,188,169	80.1	133,516,985
1896	51,211,805	30.0	118,670,789	70.0	169,882,595	29,565,478	25.8	85,050,296	74.2	114,615,783
1897	79,560,939	36.4	138,879,684	63.6	218,440,623	44,374,130	27.8	115,014,294	72.2	159,388,425
1898	90,472,259	32.6	184,127,001	67.4	274,599,260	55,060,559	33.7	107,736,092	66.3	162,796,651
1899	89,351,617	40.76	129,877,030	59.24	219,228,647	75,248,951	35.58	136,246,384	64.42	211,495,335
1900	112,737,050	39.39	173,433,883	60.61	286,170,933	73,381,634	37.05	124,681,912	62.95	198,063,547

Imports and exports by Japanese Government are not included in this table.

Value of yen on January 1, 1885, in United States money, 85.8 cents; 1890, 75.2 cents; 1891, 83.1 cents; 1892, 74.5 cents; 1893, 66.1 cents; 1894, 55.6 cents; 1895, 49.1 cents; 1896, 52.9 cents; 1897, 51.1 cents; 1898 and 1899, 49.8 cents.

PRINCIPAL DOMESTIC EXPORTS FROM THE UNITED STATES TO JAPAN DURING YEARS ENDING JUNE 30, 1892 TO 1900, BY ARTICLES AND VALUES.

ARTICLES.	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901
	Dollars.	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*
Raw cotton	132,729	68,423	360,492	806,058	1,481,056	2,315,016	7,435,526	5,775,784	12,712,619	4,086,317
Leaf tobacco	.....	.....	820	7,340	12,948	55,124	197,036	2,414,482	322,362	228,240
Illuminating oil	1,798,792	1,710,480	2,209,070	1,591,751	3,060,797	4,029,459	3,592,587	2,341,922	5,149,082	4,784,350
Iron and steel manufactures, not separately specified	33,916	40,552	35,426	95,731	357,217	1,509,173	1,268,644	1,465,715	4,260,369	2,600,141
Flour	179,246	193,945	211,579	245,122	286,111	819,620	644,039	722,710	1,554,739	1,035,893
Machinery, not separately specified	57,100	104,594	32,758	109,332	286,816	951,653	701,458	539,691	846,537	1,481,916
Locomotive engines	42,600	.....	115,578	157,434	173,160	920,130	1,283,865	529,514	202,981	372,162
Cigarettes	114,148	179,118	137,895	75,206	202,774	349,503	400,542	445,263	95,988	9,609
Distilled spirits	55,662	4,639	4,280	2,469	7,221	27,146	326,844	414,434	91,886	33,470
Paper, and manufactures of	1,371	4,745	2,569	5,006	10,126	6,952	491,256	350,118	251,912	206,586
Instruments for scientific purposes	6,398	32,587	34,600	24,861	98,243	148,271	230,197	232,892	313,076	376,068
Sole leather	139,384	147,071	115,028	371,479	474,692	213,853	327,831	165,603	442,109	224,371
Clocks and watches	134,317	114,694	44,452	35,654	99,742	177,607	163,438	133,307	291,810	237,381
Paraffin wax	976	77,824	73,315	63,858	127,001	171,476	158,205	132,273	224,469	167,118
Lubricating oil	13,622	14,492	17,177	64,691	88,730	192,918	222,536	119,553	259,343	197,342
Chemicals, drugs, and dyes	29,812	20,514	24,637	31,672	29,037	46,946	39,971	80,498	131,571	119,875
Condensed milk	43,723	8,866	40,347	34,446	45,395	58,766	76,106	76,701	99,433	118,311
Tobacco, not elsewhere specified	46,373	53,544	33,009	22,469	57,724	58,074	73,694	67,955	11,214	1,641
India-rubber manufactures	22,774	27,984	12,699	19,441	37,833	42,006	68,440	57,579	83,060	97,580
Beef, salted or pickled	986	1,934	4,961	34,002	2,616	9,457	50,242	42,893	8,357	72,325
Beef, canned	26,388	12,706	28,057	302,649	38,375	60,013	33,452	40,750	19,897	140,648
Firearms	41,048	30,145	8,707	6,012	21,475	32,372	33,433	38,306	32,361	42,512
Books, maps, engravings, etc	15,126	16,790	30,367	14,177	18,516	23,689	27,608	36,163	48,089	43,233
Leather, not elsewhere specified	5,439	4,422	10,614	2,792	19,857	7,026	32,129	34,383	53,731	47,576
Cotton cloths	10,330	9,084	42,764	92,590	92,830	141,264	47,284	33,828	34,529	37,891
Wood manufactures, not separately specified	1,978	697	440	3,719	4,627	5,326	5,530	30,677	28,013	51,892
Builders' hardware	20,763	10,832	13,401	22,491	49,847	44,914	76,500	26,498	106,251	121,697
Ink, printers' and other	31,916	12,229	8,513	15,020	39,166	16,493	25,010	26,337	34,989	33,975
Wine	17,395	15,478	14,828	9,277	26,012	17,636	17,252	24,327	28,906	27,425
Breadstuffs, other than flour	10,912	9,970	19,486	25,348	14,829	80,993	58,204	21,852	189,101	73,342
Fruits, canned	14,810	11,813	10,519	15,853	11,702	10,345	14,485	19,277	25,595	30,311
Butter	10,208	11,402	11,534	14,007	18,103	15,654	23,097	18,592	21,055	19,359
Cotton manufactures, other than cloths	22,915	43,418	7,707	18,552	12,639	35,344	16,003	18,019	28,989	31,060
Rosin	4,608	5,201	13,999	5,872	7,934	19,200	16,764	17,663	11,780	17,187
Household furniture	14,773	30,351	28,799	16,927	20,094	27,845	27,424	16,552	18,799	21,107
Bacon and hams	4,206	18,393	2,931	4,112	4,485	4,199	10,588	15,507	13,591	20,358
Lumber, other than boards and planks	16,700	419	803	439	4,613	12,955	5,525	15,059	8,991	5,354
Malt liquors	1,812	5,104	5,919	4,217	13,080	16,730	6,507	14,529	22,283	32,357
Bones, hoofs, horns, etc	15,702	18,055	19,987	31,377	34,202	24,646	12,307	12,307	8,352	19,044
Agricultural implements	2,445	1,145	1,529	429	1,323	7,276	3,401	10,461	20,799	42,399
Vegetables	1,205	1,320	1,345	6,892	2,913	1,893	11,473	10,360	7,181	24,132
Paints and colors	1,156	1,731	2,661	6,542	4,033	14,092	14,583	10,219	13,333	19,774
Copper, manufactures of	2,376	2,368	2,900	3,598	10,676	33,356	8,469	9,718	27,421	35,363
Leather manufactures, not elsewhere specified	5,126	2,073	4,517	4,060	8,481	19,170	18,072	9,625	18,754	13,604
Meat products, not separately stated	18,811	10,518	7,871	2,270	1,584	2,226	8,564	8,645	20,596	20,189
Turpentine, spirits of	1,687	200	1,355	2,883	4,410	8,651	4,088	8,476	16,263	13,181
Soap, other than toilet	4,432	1,919	3,263	2,192	4,228	3,288	6,430	6,890	11,971	9,545
Gunpowder and other explosives	9,977	3,272	3,004	19	7,457	14,558	12,886	6,592	25,016	21,863
Boards, deals, and planks	9,461	4,569	1,297	4,569	29,386	172,588	62,287	6,312	52,403	54,552
Cheese	1,760	1,355	1,884	1,553	3,603	4,433	3,867	5,965	6,052	8,494
Jewelry, etc	517	2,890	1,454	2,621	9,729	5,678	8,982	5,672	19,640	2,146
Sewing machines	1,052	2,499	1,265	3,465	9,685	7,275	5,883	5,270	11,706	30,979

PRINCIPAL IMPORTS INTO JAPAN DURING THE CALENDAR YEARS FROM 1892 TO 1900, IN ORDER OF MAGNITUDE OF VALUE IN 1898, BY ARTICLES AND VALUES.

[Compiled from official reports of the Japanese Government.]

ARTICLES.	1892	1893	1894	1895	1896	1897	1898	1899	1900
	Yen.	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*
Rice	2,052,900	3,254,842	8,413,148	4,357,096	5,632,336	21,528,428	48,219,810	5,960,166	9,021,596
Cotton, raw, ginned	11,026,637	15,291,897	19,103,922	24,304,814	32,106,275	43,122,262	45,410,497	61,[illegible]	[illegible]
Sugar	9,519,612	11,452,025	13,241,596	11,720,106	13,711,738	19,799,091	28,399,037	17,516,039	26,[illegible]
Cotton yarns	7,131,947	7,284,242	7,977,365	7,082,975	11,372,001	9,625,258	8,517,588	4,982,326	7,043,046
Vessels, steam	431,875	865,428	8,202,549	4,700,554	1,724,496	8,232,648	7,488,194	3,629,982	.....
Kerosene oil	3,328,398	4,401,040	5,135,332	4,303,928	6,331,056	7,667,350	7,452,880	7,918,149	14,[illegible]
Beans, pease, and pulse	2,712,044	3,446,636	2,977,794	2,554,763	3,475,015	5,889,616	7,101,103	8,822,111	4,817,767
Tobacco, leaf and cut	80,200	150,267	68,567	99,756	148,628	425,112	4,700,455	[b]5,086,354	[illegible]
Oil cake, for fertilizing	824,651	599,893	822,195	916,000	3,220,600	3,315,587	4,614,967	6,791,813	5,656,453
Shirtings, gray	1,727,185	2,315,024	2,935,033	3,071,495	4,057,763	3,783,808	4,382,509	3,575,191	5,558,604
Mousseline de laine, plain and white	2,448,899	2,305,505	3,150,822	3,633,467	6,498,102	4,[illegible]	4,[illegible]	4,[illegible]	7,[illegible]
Locomotive engines	200,418	356,533	1,580,272	1,663,694	1,620,767	4,235,616	4,265,874	1,268,574	[illegible]
Bar and rod iron	871,701	975,786	1,339,033	2,085,684	2,359,704	3,046,131	4,061,805	2,603,676	5,243,[illegible]
Watches, and parts thereof	485,593	523,126	404,646	971,968	1,977,571	1,[illegible]	[illegible]	[illegible]	[illegible]
Woolen cloths, all wool	640,417	801,407	641,270	2,951,041	3,407,150	1,943,531	2,863,607	2,004,198	[illegible]
Cotton-spinning machinery	([a])	([a])	([a])	1,886,195	2,992,360	5,481,761	[illegible]	778,[illegible]	[illegible]
Alcohol	392,540	379,476	174,185	440,904	481,464	969,360	2,692,982	2,060,800	[illegible]
Rails for railways	67,437	667,108	1,209,205	925,531	2,595,458	3,325,004	2,631,721	435,054	4,756,371
Material for railways, other than rails	51,865	147,641	881,805	1,253,343	1,302,374	2,011,465	2,514,232	.....	.....
Printing paper	217,309	217,694	257,857	307,699	723,437	856,957	2,283,215	748,414	[illegible]
Indigo, dry	386,193	444,208	329,861	581,369	1,067,357	1,538,021	2,270,815	2,903,829	[illegible]
Flour	278,736	322,641	641,929	406,854	994,201	1,156,569	2,022,413	1,370,857	[illegible]
Cigarettes	170,628	254,639	232,343	303,871	574,234	997,237	1,720,827	760,594	[illegible]
Satins of cotton	523,459	842,452	1,254,804	784,302	2,558,450	1,790,082	1,645,229	949,750	[illegible]
Wool, raw	302,501	425,120	567,197	1,136,951	998,305	1,057,482	1,642,819	4,524,427	[illegible]
Flannels	1,073,742	1,389,714	308,833	961,000	1,997,244	1,187,656	1,425,650	495,786	[illegible]
Plate and sheet iron	240,583	330,097	726,738	918,458	1,336,885	1,175,266	1,405,855	2,220,415	[illegible]
Pig iron	241,316	446,477	743,552	673,795	739,555	934,010	1,381,482	965,544	[illegible]
Iron pipe	55,814	122,885	484,086	604,753	891,339	894,581	1,332,940	953,436	[illegible]
Aniline dyes	418,481	405,047	543,494	682,137	1,139,929	931,197	1,218,842	904,013	[illegible]
Cotton prints	436,544	635,902	521,697	383,364	1,193,162	986,443	1,176,789	1,438,245	[illegible]
Nails	906,422	887,790	1,332,637	1,278,056	1,440,253	1,458,294	1,150,343	2,223,452	[illegible]
Italian cloth	1,062,571	1,489,304	1,759,795	921,741	2,813,096	1,858,581	1,068,270	1,132,575	[illegible]
Leather, other than sole	563,263	436,932	598,840	1,092,821	1,141,866	922,561	1,050,211	518,061	[illegible]
Iron wheels, axles, and springs	([a])	([a])	([a])	([a])	325,706	630,407	938,847	.....	.....
Steel bars	([a])	([a])	([a])	([a])	717,292	414,408	838,618	.....	.....
Cotton velvets	578,374	489,664	700,150	486,097	1,001,352	677,050	813,280	396,141	[illegible]
Wool yarn	427,992	513,930	563,501	951,035	1,114,872	1,337,424	785,192	593,337	[illegible]
Sole leather	219,429	215,702	281,782	497,774	576,584	462,524	716,879	549,029	[illegible]
Shirtings, white	330,558	168,304	337,607	505,719	655,448	250,863	708,348	517,808	[illegible]
Steam boilers and engines	180,547	157,958	215,155	431,925	822,694	1,317,260	697,173	327,144	[illegible]
Window glass	160,563	359,314	246,032	309,801	570,442	488,090	669,807	1,256,577	[illegible]
Chlorate of potash	309,960	742,316	840,640	419,053	429,042	497,650	632,060	418,884	[illegible]
Fish, salted	12,064	44,202	63,197	107,134	231,035	495,907	609,736	1,212,896	[illegible]
Electric-light apparatus	147,109	138,639	226,193	311,016	659,711	591,776	605,901	437,952	[illegible]
Plush or velvet, silk and cotton mixtures	.....	.....	.....	32,707	149,128	338,336	599,495	675,231	[illegible]
Flax, hemp, jute, etc	213,216	326,337	537,924	645,840	708,161	654,791	590,517	1,245,049	[illegible]
Hides, buffalo and cow	390,152	412,667	394,892	695,984	539,675	346,394	587,949	719,930	[illegible]
Zinc, sheet	225,018	339,027	426,253	500,862	453,709	734,571	556,443	907,927	[illegible]
Dynamite	35,284	84,561	137,506	231,489	154,274	325,265	507,591	244,303	[illegible]
Cars, railway, passenger	95,840	152,856	155,100	643,216	363,161	905,743	1,100,824	246,936	[illegible]
Wire	224,932	268,744	93,985	218,458	567,590	463,898	493,242	.....	.....
Eggs	70,444	108,055	56,118	95,206	300,388	337,169	492,553	826,960	[illegible]
Blankets	528,973	811,022	572,808	1,569,425	1,932,482	608,928	519,685	229,035	[illegible]
Galvanized sheet iron (other than roofing)	80,156	121,010	156,740	112,724	310,190	541,193	464,466	902,596	[illegible]
Woolen cloths (in part of wool)	196,618	318,798	175,559	169,265	706,902	290,543	444,144	531,554	[illegible]
Turkey-red cambrics	378,335	363,587	225,285	418,790	395,088	494,592	433,894	416,966	[illegible]
Caustic soda	173,009	192,426	205,466	234,000	84,263	229,593	422,714	521,852	[illegible]
Tin plate	52,024	56,267	352,673	313,644	250,962	559,909	411,422	569,923	[illegible]
Telegraph wire	89,294	121,986	142,214	205,714	506,490	477,775	408,842	817,200	[illegible]
Celluloid	([a])	([a])	([a])	([a])	134,552	174,554	406,678	244,263	[illegible]
Lubricating oil	([a])	([a])	([a])	([a])	210,113	334,134	401,344	289,394	[illegible]
Coal	105,379	81,707	472,757	853,079	519,380	578,570	399,189	937,094	[illegible]
Phosphorus	86,085	166,636	178,231	260,822	174,897	280,636	386,304	[c]216,124	[c]244,979
Roofing and galvanized iron	([a])	([a])	([a])	([a])	218,487	292,525	382,958	511,715	781,121

[a] Not separately stated. [b] Leaf tobacco only. [c] Amorphous only.

Value of yen on January 1, 1885, in United States money, 85.8 cents; 1890, 75.2 cents; 1891, 83.1 cents; 1892, 74.5 cents; 1893, 66.1 cents; 1894, 55.6 cents; 1895, 49.1 cents; 1896, 52.9 cents; 1897, 51.1 cents; since 1898, 49.8 cents.

IMPORTS AND EXPORTS OF THE UNITED STATES IN ITS TRADE WITH JAPAN, BY ARTICLES, DURING THE YEARS ENDING JUNE 30, 1892 TO 1901.

IMPORTS OF MERCHANDISE FROM JAPAN.

ARTICLES.	QUANTITIES.									
	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901
FREE OF DUTY.										
Animals										
Articles, the growth, etc., of the United States brought back.										
Art works										
Books, maps, engravings, etc										
CHEMICALS, DRUGS, AND DYES:										
Gums, camphor, crude ..... lbs.	1,577,329	1,258,116	804,490	1,222,866	327,051	769,711	1,608,235	1,510,318	1,436,636	1,567,475
Sulphur or brimstone, crude ..... tons.	12,227	8,307	4,777	14,241	8,997	9,446	7,489	4,328	9,958	11,798
All other										
Copper, pigs, bars, etc ..... lbs.						514,557			112,248	2,591,271
COTTON:										
Unmanufactured ..... lbs.	140,000		31,620	35		2,213				1,410
Waste and flocks ..... lbs.		59,200	20,800	2,000	15,400		3,000	2,000	900	400
Feathers and downs for beds										
Fruits, including nuts										
Furs and fur skins, undressed										
Hats, bonnets, and hoods, materials for, etc.										
Hides and skins other than fur skins .. lbs.									3,726	34,968
Household and personal effects, etc										
Ivory, animal ..... lbs.			10		8					
Matting, for floors, etc										
Oils, fixed or expressed ..... lbs.	363	8,640	1,512							
Paper stock: Rags other than woolen .. lbs.	7,008,883	10,588,550	14,998,760	14,309,703	2,467,500	4,131,250	5,277,556	7,758,199	141,097	3,772,200
Seeds, n. e. s										
Shells, not cut or manufactured										
SILK:										
Unmanufactured, cocoons ..... lbs.	73,173	130,653	129,682	158,175	75,128		2		15	
Raw, or as reeled from the cocoon . lbs.	4,062,362	3,697,675	2,644,388	3,788,171	3,951,389	3,474,865	5,294,[illegible]	4,545,116	4,765,091	4,658,111
Waste ..... lbs.	7,757	11,810	72,226	62,359	105,541	88,732	158,753	75,288	61,733	84,403
SPICES, UNGROUND:										
Pepper, black or white ..... lbs.			9,852		19,708		2,548	52		
All other ..... lbs.		1,112	27,275	76,118	462,267	105,540	7,675	1,906	156,468	154,111
Tea ..... lbs.	38,622,956	39,602,519	37,980,937	36,941,394	38,552,467	45,465,161	22,698,308			
Wood, unmanufactured										
All other free articles										
Total free of duty										
DUTIABLE.										
Animals										
Art works										
Bone and horn, manufactures of										
Books, maps, engravings, etc										
Brass, and manufactures of										
Brushes										
Chemicals, drugs, and dyes										
Coal, bituminous ..... tons.	4,660	4,630	13,206	11,760	2,972	1,579	2,675	7,552	10,177	7,011
Copper, manufactures of										
COTTON, MANUFACTURES OF:										
Cloths ..... sq. yds.	10,392	29,716	98,094	764,484	294,975	44,286	86,131	69,955	88,[illegible]	4[illegible],494
Other										
Earthen, stone, and china ware										
Fans, except palm leaf										
Feathers and flowers, artificial										
Fibers, vegetable, etc., manufactures of										
Fruits, including nuts										
Furs, and manufactures of fur										
Glass and glassware										
Hats, bonnets, and hoods, materials for										
Ivory, manufactures of										
Jewelry and precious stones										
Leather, and manufactures of										
Matting, for floors, etc ..... sq. yds.									18,101,[illegible]	18,447,872
Metal, metal compositions, and manufactures of.										
OILS:										
Animal, whale, and fish ..... galls.	2,398	191,852	156,456	31,411	219		30		40	2
Mineral ..... galls.			5,000		10,620	10,000		50		5
Vegetable, fixed or expressed ..... lbs.	1,466	11,782	7,[illegible]							
Volatile or essential ..... lbs.	280,453	625,559	279,605							
Paper, and manufactures of										
Pipes and smokers' articles										
Provisions: Meat products										
Rice and rice meal ..... lbs.	26,162,463	18,293,273	21,[illegible]	31,251,824	24,182,909	31,785,112	17,[illegible]	37,412,717	24,713,[illegible]	[illegible],[illegible],918
SILK, AND MANUFACTURES OF:										
Clothing, ready made										
Dress and piece goods										
Lace and embroidery										
All other										
Straw, manufactures of										
Tea ..... lbs.							2,099,501	28,331,198	33,919,330	[illegible],[illegible],884
TOBACCO:										
Leaf ..... lbs.	660	1,100	734	1,081	223	711	9		[illegible]	74
Manufactures of										
Toys										
Umbrellas										
Vegetables										
WOOD, MANUFACTURES OF:										
Cabinetware and house furniture										
All other										
WOOL, MANUFACTURES OF:										
Carpets and carpeting ..... sq. yds.	142	183	12,618	11,718	8,148	5,921	12,244	7,359	3,057	[illegible]
All other										
All other dutiable articles										
Total dutiable										
Total imports										

IMPORTS AND EXPORTS OF THE UNITED STATES IN ITS TRADE WITH JAPAN, BY ARTICLES, DURING THE YEARS ENDING JUNE 30, 1892 TO 1901.

IMPORTS OF MERCHANDISE FROM JAPAN.

VALUES.										ARTICLES.
1892	1893	1894	1895	1896	1897	1898	1899	1900	1901	
Dollars.	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	**FREE OF DUTY.**
122	51	1,318	223	667	548	324	423	359	424	Animals.
10,334	20,820	15,383	9,395	8,408	23,815	15,274	16,781	74,449	16,710	Articles, the growth, etc., of the United States, brought back.
878	580	1,025	2,449	3,027	1,645	2,263	.....	1,494	.....	Art works.
104	519	2,802	1,550	1,653	958	941	2,104	4,242	4,963	Books, maps, engravings, etc.
										CHEMICALS, DRUGS, AND DYES:
347,303	302,349	184,550	219,593	87,975	156,309	286,191	256,474	372,451	518,151	Crude camphor, crude.
213,776	133,455	62,567	130,988	95,244	149,426	146,813	81,818	156,847	219,193	Sulphur or brimstone, crude.
32,387	58,032	99,706	39,267	16,254	28,627	43,573	52,470	65,397	49,731	All other.
.....	.....	.....	.....	.....	53,194	.....	.....	15,223	321,510	Copper, pigs, bars, etc.
										COTTON:
6,210	.....	2,669	1	.....	192	.....	.....	.....	139	Unmanufactured.
.....	2,214	543	94	565	.....	165	98	46	25	Waste and flocks.
439	.....	1,151	191	2,602	3,227	696	.....	.....	.....	Feathers and downs for beds.
.....	59	47	1	93	20	107	.....	.....	90	Fruits, including nuts.
17,176	2,369	10,300	80,133	26,873	2,896	75	994	3,425	5,076	Furs and fur skins, undressed.
107,244	119,286	81,001	166,423	110,001	223,462	697	.....	.....	.....	Hats, bonnets, and hoods, materials for, etc.
235	858	397	.....	80	.....	205	380	365	8,078	Hides and skins other than fur skins.
28,513	32,182	24,882	16,945	18,791	27,111	21,272	12,294	25,529	30,632	Household and personal effects, etc.
.....	.....	30	.....	24	.....	.....	.....	.....	.....	Ivory, animal.
540,714	860,047	1,017,540	1,015,219	1,989,340	2,259,958	40,169	(a)	(a)	(a)	Matting, for floors, etc.
27	368	68	158	69	45	250	.....	433	2,484	Oils, fixed or expressed.
75,574	113,993	181,261	136,971	26,983	38,994	52,825	67,969	4,165	36,207	Paper stock: Rags other than woolen.
12,500	18,680	12,630	593	1,076	417	429	1,603	976	461	Seeds, n. e. s.
1,319	3,514	1,488	1,535	1,985	555	1,376	5,808	3,502	1,370	Shells, not cut or manufactured.
										SILK:
47,896	77,948	86,285	71,744	33,425	.....	1	.....	9	.....	Unmanufactured, cocoons.
15,116,579	14,784,432	8,024,743	10,284,798	12,918,590	10,010,885	16,453,466	14,920,787	19,688,132	14,571,547	Raw, as reeled from the cocoons.
4,024	7,201	40,497	37,238	35,781	517	58,263	27,073	27,217	53,131	Waste.
										SPICES, UNGROUND:
.....	.....	626	.....	739	.....	205	19	.....	.....	Pepper, black or white.
.....	67	793	2,491	16,109	3,051	262	112	6,440	8,307	All other.
5,508,317	5,699,582	5,504,411	4,601,041	4,911,448	5,651,279	2,714,679	(a)	(a)	(a)	Tea.
31,627	13,282	11,304	10,707	21,815	25,909	25,246	28,933	30,730	33,052	Wood, unmanufactured.
30,830	44,222	10,785	121,307	132,839	130,569	99,008	97,789	54,797	215,417	All other free articles.
20,134,718	22,296,110	15,380,802	16,951,055	20,462,456	18,808,609	19,963,715	15,553,932	20,596,198	16,096,498	Total free of duty.
										DUTIABLE.
95	114	135	261	947	676	624	698	814	647	Animals.
1,062	1,346	1,197	304	.....	.....	1,951	6,410	19,011	3,643	Art works.
6,407	10,211	6,952	2,017	2,110	3,393	4,495	5,023	5,091	4,336	Bone and horn, manufactures of.
6,503	11,406	6,917	10,997	23,320	34,552	13,414	10,742	12,351	14,215	Books, maps, engravings, etc.
1,420	1,626	330	178	209	119	239	104	539	738	Brass, and manufactures of.
25,618	30,632	45,402	57,238	59,369	88,165	101,256	123,613	130,093	191,911	Brushes.
28,861	71,856	35,174	67,121	77,566	78,860	43,864	44,116	59,908	64,775	Chemicals, drugs, and dyes.
14,768	8,544	20,000	23,206	7,397	3,928	8,075	21,412	38,691	17,341	Coal, bituminous.
904	847	2,096	13	162	628	4	183	330	66	Copper, manufactures of.
										COTTON, MANUFACTURES OF:
1,937	3,708	10,896	70,388	16,028	3,974	6,643	5,652	7,407	43,295	Cloths.
70,771	116,240	56,369	45,854	102,624	73,754	34,684	37,340	63,659	92,193	Other.
337,839	407,109	335,461	196,021	387,591	440,053	313,712	290,036	373,269	459,518	Earthen, stone, and china ware.
(b)	(b)	(b)	(b)	111,231	151,488	151,320	120,628	204,470	152,407	Fans, except palm leaf.
517	276	1,014	321	812	187	350	544	3,217	1,306	Feathers and flowers, artificial.
40,926	64,408	250,334	547,731	484,936	301,909	136,153	125,850	70,600	67,348	Fibers, vegetable, etc., manufactures of.
2,288	8,282	7,013	3,573	4,202	12,229	9,775	12,677	11,575	29,854	Fruits, including nuts.
769	22,004	183	164	314	2,252	832	388	1,111	1,150	Furs, and manufactures of fur.
532	750	2,192	3,786	6,839	6,160	2,535	654	2,942	3,088	Glass and glassware.
.....	.....	.....	.....	.....	.....	207,123	325,823	503,814	619,644	Hats, bonnets, and hoods, materials for.
.....	.....	9,164	9,974	8,835	6,039	10,473	16,220	20,449	14,860	Ivory, manufactures of.
1,768	1,798	1,595	935	1,354	4,015	1,592	1,707	854	15,861	Jewelry and precious stones.
27	18,955	2,194	188	1,844	9,386	730	4,243	1,970	4,235	Leather, and manufactures of.
.....	.....	.....	.....	.....	.....	863,578	1,674,158	1,497,634	1,699,819	Matting, for floors, etc.
61,700	92,848	81,124	66,575	98,409	99,721	75,248	97,087	132,061	116,859	Metal, metal compositions, and manufactures of.
										OILS:
426	30,746	24,656	10,130	131	.....	4	.....	10	2	Animal, whale, and fish.
.....	.....	495	.....	1,193	1,037	.....	5	.....	1	Mineral.
561	3,605	2,671	5,537	4,515	21	766	48	4,312	2,042	Vegetable, fixed or expressed.
11,133	19,404	9,356	10,180	21,173	26,239	37,715	14,917	14,844	18,194	Volatile or essential.
245,713	310,986	209,239	110,612	192,414	213,289	199,556	221,795	254,887	284,243	Paper, and manufactures of.
302	379	1,504	367	719	1,544	967	2,078	608	2,177	Pipes and smokers' articles.
.....	101	176	270	936	59	67	88	546	2,105	Provisions: Meat products.
510,084	324,412	334,356	522,449	377,678	629,296	406,889	1,061,724	491,471	474,431	Rice and rice meal.
										SILK, AND MANUFACTURES OF:
229,078	221,538	51,992	134,258	254,410	202,339	67,147	71,200	74,014	79,593	Clothing, ready-made.
387,327	930,264	970,381	1,861,493	878,487	1,107,907	1,503,409	2,042,797	2,736,788	2,135,727	Dress and piece goods.
21,819	31,944	47,189	66,030	61,912	44,690	84,880	124,719	177,924	126,968	Laces and embroideries.
1,444,713	2,164,088	1,318,213	2,713,557	1,610,097	1,401,028	413,232	435,991	432,418	500,550	All other.
14,919	14,875	18,332	4,327	12,319	5,909	8,781	7,402	62,910	29,498	Straw, manufactures of.
.....	.....	.....	.....	.....	.....	330,400	4,016,187	4,371,605	4,966,303	Tea.
										TOBACCO:
300	84	550	414	28	444	3	.....	56	37	Leaf.
.....	22	595	11	437	3	292	105	589	485	Manufactures of.
24,751	36,003	14,474	16,877	34,429	23,478	23,558	25,552	32,672	35,620	Toys.
854	1,261	1,689	396	474	555	240	.....	508	3,426	Umbrellas.
490	1,913	2,245	1,299	2,545	3,853	4,611	7,104	26,454	165,171	Vegetables.
										WOOD, MANUFACTURES OF:
844	4,693	3,101	2,966	7,743	4,804	2,134	1,318	1,569	791	Cabinetware and house furniture.
109,348	136,281	132,549	93,192	166,318	139,090	101,871	87,830	160,677	208,109	All other.
										WOOL, MANUFACTURES OF:
118	329	6,336	6,642	4,420	5,653	13,887	9,810	2,884	399	Carpets and carpeting.
46	108	670	1,965	5,489	21,965	4,552	198	5,495	1,399	All other.
17,816	53,644	10,209	74,955	40,616	43,296	65,764	106,652	167,103	476,965	All other dutiable articles.
3,655,484	5,158,110	4,045,720	6,744,902	5,074,582	5,201,147	5,259,895	11,162,828	12,182,704	13,133,045	Total dutiable.
23,790,202	27,454,220	19,426,522	23,695,957	25,537,038	24,009,756	25,223,610	26,716,770	32,748,902	29,229,543	Total imports.

[a] See dutiable.

[b] Not enumerated.

IMPORTS AND EXPORTS OF THE UNITED STATES IN ITS TRADE WITH JAPAN, BY ARTICLES, DURING THE YEARS ENDING JUNE 30, 1892 TO 1901—Continued.

EXPORTS OF DOMESTIC MERCHANDISE TO JAPAN.

ARTICLES.	QUANTITIES.									
	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901
Agricultural implements										
Art works: Paintings and statuary										
Blacking										
Bones, hoofs, horns, etc										
Books, maps, engravings, etc										
Brass, and manufactures of										
BREADSTUFFS:										
Wheat flour ....bbls..	38,052	51,836	68,428	93,889	103,582	237,126	161,654	226,029	538,406	354,887
All other										
Candles ....lbs..	14,208	2,000	9,600	2,400	9,470	2,520	3,550	5,600	61,780	49,180
Cars, passenger and freight, and parts of										
Cycles, and parts of										
Chemicals, dyes, and drugs										
Clocks and watches, and parts of										
Copper, manufactures of										
COTTON:										
Unmanufactured ....lbs..	1,574,315	793,242	4,801,595	11,064,859	20,194,174	32,011,252	112,200,355	91,367,161	161,661,219	39,279,023
Manufactures—										
Cloths ....yds..	84,286	89,052	752,266	1,186,970	1,438,553	2,525,985	580,861	529,479	423,968	317,494
All other										
FRUITS:										
Apples, green or ripe ....bbls..	716	542	451	283	314	580	581	900	700	395
Fruits, canned										
Glass and glassware										
Gunpowder and other explosives										
Hides and skins, other than furs ....lbs..									37,644	10,000
Hops ....lbs..	9,391	5,981	7,971	9,016	19,299	16,585	8,159	25,877	53,085	25,488
India rubber and gutta-percha, manufactures of.										
Ink, printers', and other										
Instruments, etc., for scientific purposes										
IRON AND STEEL, AND MANUFACTURES OF:										
Car wheels ....No..	104	850	1,520	3,098	1,127	2,336	1,780	1,600	2,476	2,664
Firearms										
Locks, hinges, saws, and tools										
Sewing machines										
Steam engines—locomotives ....No..	6		15	23	23	95	167	69	19	59
Other machinery										
All other										
Jewelry, and manufactures of gold and silver.										
Lamps, chandeliers, etc										
LEATHER:										
Sole ....lbs..	625,883	667,682	537,051	1,754,052	2,251,353	1,054,058	1,563,105	757,961	1,804,575	942,591
All other										
Manufactures of										
Malt liquors, in bottles ....doz. quarts..	1,627	4,867	6,393	5,665	13,308	14,367	6,784	15,090	17,982	33,582
Marble and stone, and manufactures of										
NAVAL STORES:										
Rosin ....bbls..	2,098	2,542	7,040	2,454	3,470	8,780	7,422	10,177	5,928	7,666
Turpentine and pitch ....bbls..	520	230	150	723	525	794	645	828	550	77
Turpentine, spirits of ....galls..	4,160	500	4,000	8,500	13,400	27,750	12,500	20,200	31,160	28,000
OILS, MINERAL, REFINED:										
Illuminating ....galls..	23,761,930	26,869,510	37,272,450	24,298,170	33,701,038	46,252,501	51,621,050	32,705,180	51,297,805	53,299,686
Lubricating ....galls..	45,410	53,293	60,299	238,370	432,367	1,158,625	1,777,115	897,096	2,044,167	1,244,878
Paints and painters' colors										
Paper, and manufactures of										
Paraffin and paraffin wax ....lbs..	15,841	1,530,081	1,842,548	1,620,399	3,062,790	4,313,395	4,380,586	3,328,059	4,825,819	2,806,724
PROVISIONS, COMPRISING MEAT AND DAIRY PRODUCTS:										
Beef, canned ....lbs..	183,020	85,230	189,780	2,213,022	261,470	706,490	227,672	345,778	134,350	972,489
Beef, salted or pickled ....lbs..	20,400	38,000	94,300	601,800	51,000	174,247	1,112,300	644,250	126,550	1,290,000
Bacon and hams ....lbs..	31,413	212,896	20,327	31,366	32,771	32,371	83,268	126,576	107,410	150,047
Pork, pickled ....lbs..	6,400	10,500	22,300	31,420	42,750	20,000	2,700	6,000	17,600	18,000
Lard ....lbs..	23,670	18,630	13,282	21,880	33,640	19,847	24,114	15,150	43,778	50,470
Oleomargarine ....lbs..			6,690	16,520	20,909	32,653	31,836	19,185	41,309	62,877
All other meat products										
Dairy products—										
Butter ....lbs..	44,333	56,664	58,189	77,001	101,751	87,180	115,203	92,495	101,287	96,000
Cheese ....lbs..	12,675	10,480	14,153	13,051	31,960	40,965	35,594	52,580	53,294	75,496
Milk										
Salt ....lbs..			146,000	20,000	125,600	250,000	240,000	1,204,000	1,111,400	1,485,400
Seeds										
SOAP:										
Toilet or fancy										
All other ....lbs..	108,900	52,400	173,140	60,010	117,478	94,583	140,557	182,054	348,275	293,562
Spirits, distilled ....proof galls..	251,911	9,852	3,175	1,450	4,903	67,640	876,766	1,366,892	242,488	48,329
Stationery, except paper										
Sugar, refined ....lbs..	119,851	135,447	3,150,337	428,353	41,302	44,450	51,306	48,732	74,230	90,039
TOBACCO:										
Leaf ....lbs..			12,087	73,512	237,041	861,677	2,751,246	24,198,879	3,104,472	2,249,766
Manufactures of—										
Cigarettes ....M..	39,424	102,864	76,580	49,991	130,453	215,981	263,363	297,143	78,265	10,003
All other										
Varnish ....galls..	1,140	4,030	790	1,440	6,679	4,469	3,429	3,183	5,372	7,060
Vegetables										
WINE:										
In bottles ....doz. quarts..	500	199	451	210	428	557	274	251	919	201
In other coverings ....galls..	42,705	41,287	34,843	23,819	92,512	43,660	49,853	67,865	77,726	81,835

IMPORTS AND EXPORTS OF THE UNITED STATES IN ITS TRADE WITH JAPAN, BY ARTICLES, DURING THE YEARS ENDING JUNE 30, 1892 TO 1901—Continued.

EXPORTS OF DOMESTIC MERCHANDISE TO JAPAN.

VALUES.										ARTICLES.
1892	1893	1894	1895	1896	1897	1898	1899	1900	1901	
Dollars.	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	
2,445	1,145	1,529	429	1,323	7,276	3,401	10,461	20,790	42,399	Agricultural implements.
701	350	1,000	.....	.....	562	3,000	319	2,120	.....	Art works: Paintings and statuary.
5,939	8,406	4,588	2,182	11,410	4,280	1,864	4,698	7,289	2,469	Blacking.
15,702	18,085	19,488	24,987	31,377	34,202	24,646	12,307	8,352	19,044	Bones, hoofs, horns, etc.
15,126	16,790	30,367	14,177	18,516	23,689	27,608	36,163	48,089	43,933	Books, maps, engravings, etc.
261	541	1,399	2,052	5,732	4,008	13,640	16,208	69,695	41,837	Brass, and manufactures of.
										BREADSTUFFS:
179,246	193,945	211,579	245,122	286,111	819,620	644,039	722,710	1,554,739	1,035,892	Wheat flour.
10,912	9,706	19,486	25,348	14,829	80,993	58,204	21,852	189,101	73,342	All other.
1,791	205	1,009	223	1,060	287	310	483	6,400	4,802	Candles.
2,182	719	1,671	1,356	5,370	513	7,640	4,025	23,615	7,246	Cars, passenger and freight, and parts of.
.....	.....	.....	.....	27,056	52,179	88,905	117,943	245,866	252,200	Cycles, and parts of.
29,812	20,514	24,697	31,672	29,037	46,946	39,971	80,498	131,871	119,875	Chemicals, dyes, and drugs.
131,317	114,694	44,452	35,654	99,742	177,607	163,438	133,307	201,810	237,381	Clocks and watches, and parts of.
2,376	2,368	2,900	3,598	10,676	33,356	8,469	9,718	27,421	35,368	Copper, manufactures of.
										COTTON:
132,729	68,423	360,492	866,058	1,481,056	2,345,016	7,435,526	5,775,784	12,712,619	4,086,317	Unmanufactured.
										Manufactures—
10,330	9,084	42,764	92,590	92,830	141,264	47,284	33,828	34,629	37,891	Cloths.
22,915	43,418	7,707	18,552	12,639	35,344	16,083	18,019	28,989	31,060	All other.
										FRUITS:
1,608	1,307	1,125	661	628	1,287	1,478	2,131	1,745	891	Apples, green or ripe.
14,810	11,813	10,519	15,853	11,702	10,345	14,485	19,277	25,595	30,311	Fruits, canned.
2,315	1,109	2,106	2,256	1,910	3,188	1,984	4,045	8,576	14,233	Glass and glassware.
9,997	3,272	3,004	19	7,457	14,558	12,886	6,592	25,016	21,863	Gunpowder and other explosives.
3,792	541	1,907	1,124	5,130	1,892	1,205	875	5,215	1,405	Hides and skins, other than furs.
1,966	1,439	1,821	1,304	1,691	1,404	1,125	3,538	6,088	3,813	Hops.
22,714	27,984	12,699	19,441	37,833	42,006	68,440	57,579	83,060	94,750	India rubber and gutta-percha, manufactures of.
31,916	12,229	8,543	15,020	39,166	16,493	25,940	26,337	34,989	33,975	Ink, printers', and other.
6,398	32,587	34,600	24,861	98,243	148,271	230,197	232,892	313,976	376,068	Instruments, etc., for scientific purposes.
										IRON AND STEEL, AND MANUFACTURES OF:
953	7,588	11,576	24,278	8,513	12,370	5,617	3,624	17,091	20,773	Car wheels.
41,048	30,145	8,707	6,012	21,475	32,372	33,433	38,306	32,361	42,512	Firearms.
20,763	10,832	13,401	22,491	49,847	44,910	76,500	26,498	106,251	121,697	Locks, hinges, saws, and tools.
1,052	2,499	1,265	3,465	9,685	7,275	5,883	5,270	11,706	30,979	Sewing machines.
42,600	.....	115,578	157,434	173,160	920,130	1,283,865	529,514	202,981	372,162	Steam engines—locomotives.
57,100	104,954	32,753	109,332	286,816	951,653	701,458	569,691	846,537	1,481,916	Other machinery.
33,916	40,552	35,426	95,731	357,217	1,509,173	2,881,644	1,405,715	4,243,278	2,579,368	All other.
517	2,890	1,454	2,621	9,729	5,678	8,982	5,672	19,640	2,146	Jewelry, and manufactures of gold and silver.
1,376	3,065	3,345	2,655	3,596	10,583	7,131	3,437	10,722	13,686	Lamps, chandeliers, etc.
										LEATHER:
139,384	147,071	115,028	371,479	474,692	213,853	327,836	165,603	442,109	224,371	Sole.
5,439	4,422	10,614	2,792	19,857	7,026	32,129	34,383	53,731	47,576	All other.
5,126	2,073	4,517	4,060	8,481	19,170	18,072	9,625	18,754	13,604	Manufactures of.
1,812	5,104	5,919	4,217	13,080	16,730	6,507	14,529	21,833	32,291	Malt liquors, in bottles.
1,331	1,402	1,948	1,496	1,346	573	1,053	590	780	3,410	Marble and stone, and manufactures of.
										NAVAL STORES:
4,608	5,201	13,999	5,872	7,934	19,200	16,764	17,663	11,780	17,187	Rosin.
823	378	228	1,340	951	1,246	998	1,416	910	136	Turpentine and pitch.
1,687	200	1,355	2,883	4,410	8,651	4,088	8,476	16,263	13,181	Turpentine, spirits of.
										OILS, MINERAL, REFINED:
1,798,792	1,710,480	2,209,070	1,591,751	3,060,797	4,029,459	3,592,587	2,341,922	5,149,082	4,784,350	Illuminating.
13,622	14,492	17,177	64,941	88,730	192,918	222,536	119,553	259,343	197,342	Lubricating.
1,156	1,731	2,661	6,542	4,033	14,092	14,583	10,219	13,333	19,774	Paints and painters' colors.
1,371	4,745	2,569	5,006	10,126	6,952	491,256	350,118	251,912	206,586	Paper, and manufactures of.
976	77,824	73,315	63,858	127,001	171,476	158,305	132,273	224,469	167,118	Paraffin and paraffin wax.
										PROVISIONS: COMPRISING MEAT AND DAIRY PRODUCTS:
26,388	12,706	28,057	302,649	38,375	60,013	33,452	40,750	19,897	140,648	Beef, canned.
986	1,934	4,961	34,002	2,616	9,457	50,242	42,893	8,357	72,325	Beef, salted or pickled.
4,206	18,393	2,931	4,112	4,485	4,199	10,588	15,507	13,591	20,358	Bacon and hams.
450	788	1,516	905	3,161	1,263	175	225	1,364	1,379	Pork, pickled.
1,995	2,088	1,235	1,811	2,511	1,445	1,731	1,160	3,358	4,338	Lard.
.....	.....	976	1,758	2,828	3,166	3,217	1,970	4,412	5,820	Oleomargarine.
18,811	10,518	7,871	2,270	1,584	2,226	8,654	8,645	11,372	8,652	All other meat products.
										Dairy products—
10,208	11,402	11,534	14,007	18,103	15,654	23,097	18,592	21,055	19,359	Butter.
1,760	1,355	1,884	1,553	3,603	4,433	3,867	5,965	6,052	8,494	Cheese.
43,723	8,866	40,347	34,446	45,395	58,766	76,106	76,701	99,433	118,311	Milk.
.....	.....	438	78	409	1,181	864	2,810	2,485	5,061	Salt.
571	139	1,330	225	390	514	735	386	946	895	Seeds.
										SOAP:
1,734	664	557	1,965	1,660	2,079	8,171	2,517	18,832	12,474	Toilet or fancy.
4,432	1,949	3,263	2,192	4,228	3,288	6,430	6,890	11,971	9,545	All other.
55,662	4,639	4,280	2,469	7,221	27,146	326,844	414,404	91,886	33,470	Spirits, distilled.
16,802	14,174	5,859	6,248	17,761	15,628	11,800	14,595	34,257	18,281	Stationery, except paper.
5,917	7,173	92,745	12,876	2,044	2,214	2,466	2,143	2,900	4,180	Sugar, refined.
										TOBACCO:
.....	.....	820	7,340	12,948	55,124	197,036	2,414,482	322,362	228,240	Leaf.
										Manufactures of—
114,198	179,118	137,895	75,206	202,774	349,503	400,542	445,263	95,988	9,009	Cigarettes.
46,373	53,544	33,009	22,496	57,724	58,074	73,694	67,955	11,214	1,641	All other.
1,361	4,477	1,029	1,409	6,108	4,264	3,403	2,930	5,037	6,129	Vinegar.
1,205	1,320	1,345	6,892	2,913	1,893	11,473	10,360	7,181	24,132	Vegetables.
										WINE:
1,976	874	1,823	803	1,845	2,290	1,133	1,218	3,446	817	In bottles.
15,419	14,604	13,005	8,474	24,167	15,346	16,119	23,109	25,460	26,608	In other coverings.

IMPORTS AND EXPORTS OF THE UNITED STATES IN ITS TRADE WITH JAPAN, BY ARTICLES, DURING THE YEARS ENDING JUNE 30, 1892 TO 1901—Continued.

EXPORTS OF DOMESTIC MERCHANDISE TO JAPAN—Continued.

ARTICLES.	QUANTITIES.									
	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901
WOOD, AND MANUFACTURES OF:										
Lumber—										
Boards, deals, and planks..M feet..	702	481	109	423	2,969	20,290	7,685	444	5,098	5,218
Other lumber and timber										
Manufactures of—										
Household furniture										
All other										
All other articles										
Total domestic merchandise										
Total foreign merchandise										
Total exports of merchandise										

GOLD AND SILVER.

IMPORTS:										
Gold										
Silver										
EXPORTS:										
Gold										
Silver										

IMPORTS AND EXPORTS OF THE UNITED STATES IN ITS TRADE WITH JAPAN, BY ARTICLES, DURING THE YEARS ENDING JUNE 30, 1892 TO 1901—Continued.

EXPORTS OF DOMESTIC MERCHANDISE TO JAPAN—Continued.

VALUES.										ARTICLES.
1892	1893	1894	1895	1896	1897	1898	1899	1900	1901	
Dollars.	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	WOOD, AND MANUFACTURES OF:
9,461	4,569	1,297	4,569	29,386	172,588	62,287	6,312	52,403	54,552	Lumber— Boards, deals, and planks.
16,700	419	803	439	4,613	12,955	5,525	15,059	33,055	23,517	Other lumber and timber.
										Manufactures of—
14,773	20,351	28,799	16,927	20,094	27,845	27,424	16,552	18,799	21,107	Household furniture.
1,978	697	440	3,714	4,627	5,326	5,534	30,677	28,013	51,892	All other.
36,461	31,628	17,966	52,612	42,674	74,014	149,145	323,244	315,889	[a]685,164	All other articles.
3,288,282	3,189,711	3,981,377	4,559,242	7,640,250	13,233,970	20,254,689	17,158,970	29,042,536	18,656,899	Total domestic merchandise.
1,829	5,783	5,438	75,475	49,435	21,508	30,852	105,718	44,939	343,741	Total foreign merchandise.
3,290,111	3,195,494	3,986,815	4,634,717	7,689,685	13,255,478	20,385,541	17,264,688	29,087,475	19,000,640	Total exports of merchandise.

IMPORTS OF GOLD AND SILVER FROM JAPAN.

326,628	89,274	43,680	6,400	4,915	148,227	2,000,247	5,020,424	4,526,724	5,625,230	IMPORTS: Gold.
.....	.....	.....	500	4,630	.....	.....	18,000	165	10,139	Silver.
										EXPORTS:
.....	2,407	1,000	2,921	13	.....	.....	.....	4,210	220	Gold.
2,304,369	4,150,980	3,849,030	4,440,763	3,382,732	2,987,351	61,910	.....	64,290	1,947	Silver.

[a] Including animals, $220,560.

Imports and Exports of the United States in its Trade with Japan, by Customs Districts, during the Years ending June 30, 1892, to 1901.

IMPORTS OF MERCHANDISE FROM JAPAN.

CUSTOMS DISTRICTS.	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901
	Dollars.	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*
Baltimore, Md	42,577	19,195	33,053	72,014	104,696	101,227	73,769	125,080	205,827	186,388
Bangor, Me										641
Bath, Me			56							
Beaufort, S. C										
Boston and Charlestown, Mass	21,722	49,434	42,703	39,951	97,068	123,843	87,116	94,265	190,826	128,287
Charleston, S. C						723		13,628	241	
Delaware					74					7,892
Fairfield, Conn									307	
Georgetown, D. C	7,534	2,250	1,305	7,236	1,303	132	7,719		1,256	1,691
Hartford, Conn	57,180	2,151	22,639	566	440	32,424	10,332	5,921	4,475	
Newark, N. J				15	731	394	520	234	495	
New Haven, Conn				431	442	77	247			28
New London, Conn					68					
Newport News, Va						25				
New York, N. Y	8,274,998	11,767,040	8,591,682	9,287,706	7,243,829	7,957,682	6,925,930	7,679,664	8,681,576	7,807,277
Norfolk and Portsmouth, Va					8					
Passamaquoddy, Me										
Philadelphia, Pa	12,711	33,448	18,725	107,327	115,563	103,083	76,834	110,189	108,020	121,675
Portland and Falmouth, Me			79,493	45,983	22,246				872	
Providence, R. I		1,518	4,628	2,105	3,728	1,182	210	270	518	2,219
Richmond, Va			182			1,500		513	35	29
Savannah, Ga										449
Wilmington, N. C					22	6	4	200		
Galveston, Tex			365	434	3,152	37			3,710	2,193
Key West, Fla								472	9,216	
Mobile, Ala		82								
New Orleans, La	407	752	1,881	5,304	54,891	53,198	8,852	49,186	93,908	88,187
Paso del Norte, Tex										1,987
Pensacola, Fla										
Saluria, Tex				570					3,677	3,162
Tampa, Fla										
Alaska									176	
Hawaii									24,484	699,966
Los Angeles, Cal		334	3,073	6,614	16,583	6,554	4,709	20,995	23,809	34,726
Oregon, Oreg			836	6,080	5	20	2	284		108
Puget Sound, Wash	27,852	89,400	106,189	487,133	2,272,183	4,770,340	2,923,588	5,155,598	3,914,659	3,297,842
San Diego, Cal		233			10	2		84,271	294,050	108,676
San Francisco, Cal	12,349,089	12,333,176	7,310,352	8,545,576	9,755,789	5,992,401	11,842,677	7,601,453	11,426,407	9,927,618
Willamette, Oreg	283,837	134,739	50,127	72,758	143,007	425,717	498,181	769,262	524,535	305,855
Buffalo Creek, N. Y	28,060	26,716	49,592	16,535	21,585	11,543	34	176	3,068	469
Chicago, Ill	2,118,289	2,164,590	2,086,930	2,050,102	2,025,815	1,136,781	811,416	1,228,694	1,194,531	1,337,005
Cuyahoga, Ohio	8,896	34,857	80,748	55,464	96,638	41,758	14,421	51,942	77,610	93,958
Detroit, Mich	97,672	130,933	151,643	109,027	123,074	48,381	19,942	67,065	157,728	104,917
Duluth, Minn		6,295	15,813	2,449	7,439	14		8,607	5,890	1,886
Erie, Pa							1,309	30		
Genesee, N. Y	9,447	21,760	44,634	21,020	17,547	21,715	13,712	36,758	41,662	53,195
Huron, Mich								7,305	45,200	
Miami, Ohio	5,919	12,352	27,906	6,110	19,791	21,923		18,058	25,604	34,183
Milwaukee, Wis	22,053	64,901	57,452	49,524	25,628	18,794	447	16,142	17,837	20,665
Minnesota, Minn	177,950	293,272	256,107	318,294	567,323	445,080	106,932	353,924	362,696	376,725
North and South Dakota	4,715	12,179	673	2,709	1,670	1,063	4,970	1,247		1,003
Oswegatchie, N. Y	151,573	75,926	79,260	2,121,487	2,345,847	2,381,021	1,638,809	3,512,476	5,386,239	3,939,959
Sandusky, Ohio								514		
Superior, Mich										
Vermont, Vt								2,347		401
Albany, N. Y	152	1,291		1,604	4,585	13,047		3,070	2,890	
Atlanta, Ga					182				1,632	6,380
Cincinnati, Ohio	949	1,372	802	15,573	25,256	25,229	6,227	4,534	14,530	13,102
Columbus, Ohio			549	18	2,294	487	1,600	1,030	5,918	8,181
Council Bluffs, Iowa										4,873
Denver, Colo	22,844	12,226	7,537	3,025	8,360	3,522	723	895	10,951	17,130
Des Moines, Iowa				104	8,485	5,767	4,835	6,820	16,899	14,305
Dubuque, Iowa		4,607	22,844	44,638	37,380	14,639	2,363	25,367	23,688	23,035
Evansville, Ind			1,000							
Grand Rapids, Mich			7,759	2,458	25,021	16,181	2,775	30,901	25,410	12,880
Indianapolis, Ind	192	50	1,292	1,647	1,122	5	420	1,001	3,751	4,966
Kansas City, Mo	4,550	7,254	14,383	31,461	50,024	35,330	20,038	18,542	144,752	183,601
Knoxville, Tenn									20	
Lincoln, Nebr	3,553	12,210	10,779	6,903	6,629	4,110	3,206	2,935	4,832	5,830
Louisville, Ky				864	6,859	3,823	7,691	550	21,250	22,699
Memphis, Tenn					132		80		20	42
Nashville, Tenn	35		2,169	206	204	934	934	43	748	1,057
Omaha, Nebr	47,656	93,888	124,274	68,803	76,251	68,409	5,122	67,648	77,764	88,384
Pittsburg, Pa	51	560	1,082	3,607	10,057	11,043	2,369	1,944	26,412	30,697
St. Joseph, Mo		17,251	24,577	20,876	19,519	17,587	69,717	15,987	41,262	18,600
St. Louis, Mo	7,639	21,375	47,256	40,803	141,253	69,101	2,154	84,577	111,426	115,630
Sioux City, Iowa		4,414	11,386	12,481	24,871	21,369	830	23,178	23,065	23,102
Springfield, Mass		89	786	362	359	533		160		119
Syracuse, N. Y								10,418	40,048	26,639
Total	23,790,202	27,454,220	19,426,522	23,695,957	25,537,038	24,009,756	25,223,610	26,716,770	32,748,902	29,229,548

IMPORTS AND EXPORTS OF THE UNITED STATES IN ITS TRADE WITH JAPAN, BY CUSTOMS DISTRICTS, DURING THE YEARS ENDING JUNE 30, 1892, TO 1901.

EXPORTS OF DOMESTIC MERCHANDISE TO JAPAN.

1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.	CUSTOMS DISTRICTS.
Dollars.	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	
								1,298,707	28,463	Baltimore, Md.
										Bangor, Me.
										Bath, Me.
			4,000			25,581	30,416			Beaufort, S. C.
1,417						3,297		450		Boston and Charlestown, Mass.
										Charleston, S. C.
										Delaware.
										Fairfield, Conn.
										Georgetown, D. C.
										Hartford, Conn
			8,961				185			Newark, N. J.
										New Haven, Conn.
										New London, Conn.
										Newport News, Va.
1,580,864	1,645,375	1,869,358	1,510,670	2,874,062	5,017,918	6,814,157	4,841,684	7,172,355	6,253,825	New York, N. Y.
							10,000		30,000	Norfolk and Portsmouth, Va.
							348			Passamaquoddy, Me.
1,052,335	920,811	1,169,367	842,621	1,885,487	3,065,489	2,566,837	970,369	3,372,109	3,071,354	Philadelphia, Pa.
										Portland and Falmouth, Me.
										Providence, R. I.
										Richmond, Va.
							10,000	563,568		Savannah, Ga.
										Wilmington, N. C.
						857,845	440,971	1,767,466		Galveston, Tex.
							73,860			Key West, Fla.
						305,052	14,289			Mobile, Ala.
						257,560	444,696	1,322,982		New Orleans, La.
										Paso del Norte, Tex.
					30,450	266,912	8,400	343,167		Pensacola, Fla.
										Saluria, Tex.
							23,574	108,718	60,120	Tampa, Fla.
										Alaska.
								33	3,391	Hawaii.
										Los Angeles, Cal.
	410			1,270	18,574			17,856	3,570	Oregon, Oreg.
30,000	37,679	132,203	555,380	590,984	2,216,991	4,234,383	2,897,259	6,051,843	4,456,628	Puget Sound, Wash.
							1,142,233	2,444,772	753,712	San Diego, Cal.
534,610	543,535	783,488	1,661,269	2,170,541	2,570,249	4,117,449	4,138,226	3,568,665	3,343,923	San Francisco, Cal.
64,154	33,608	11,781	27,580	116,311	235,928	717,277	434,016	875,155	439,039	Willamette, Oreg.
										Buffalo Creek, N. Y.
										Chicago, Ill.
				5,486						Cuyahoga, Ohio.
						3,090	1,357	3,356	13,735	Detroit, Mich.
					3,799					Duluth, Minn.
										Erie, Pa.
										Genesee, N. Y.
										Huron, Mich.
										Miami, Ohio.
										Milwaukee, Wis.
										Minnesota, Minn.
12,200	9,276	8,065	6,975	14,619	44,405	188,088	722,724	60,486	145,602	North and South Dakota.
4,561	4,800	12,125	17,461	30,925	51,675	28,073	56,584	54,600	50,810	Oswegatchie, N. Y.
										Sandusky, Ohio.
		428					3,497			Superior, Mich.
								16,257	2,729	Vermont, Vt.
										Albany, N. Y.
										Atlanta, Ga.
										Cincinnati, Ohio.
										Columbus, Ohio,
										Denver, Colo.
										Des Moines, Iowa.
										Dubuque, Iowa.
										Evansville, Ind.
										Grand Rapids, Mich.
										Indianapolis, Ind.
										Kansas City, Mo.
										Knoxville, Tenn.
										Lincoln, Nebr.
										Louisville, Ky.
										Memphis, Tenn.
										Nashville, Tenn.
										Omaha, Nebr.
										Pittsburg, Pa.
										St. Joseph, Mo.
										St. Louis, Mo.
										Sioux City, Iowa.
										Springfield, Mass.
										Syracuse, N. Y.
3,290,011	3,195,494	3,986,815	4,634,717	7,689,685	13,255,478	20,385,541	17,264,688	29,042,536	18,656,899	Total.

PRINCIPAL IMPORTS INTO JAPAN FROM VARIOUS FOREIGN COUNTRIES IN EACH YEAR FROM 1898 TO 1900.

[Fractions of yen are omitted.]

ARTICLES AND COUNTRIES WHENCE IMPORTED.	1900		1899		1898	
	Quantities.	Values.	Quantities.	Values.	Quantities.	Values.
Clocks, standing and hanging (number):		Yen.		Yen.		Yen.
France	[illegible]	[illegible]	304	2,711	296	3,230
Germany	[illegible]	140,[illegible]	[illegible]	27,[illegible]	187,679	[illegible]
Great Britain	[illegible]	[illegible]	[illegible]	2,736	47	494
United States	[illegible]	[illegible]	4,671	22,347	4,641	19,417
Other countries	2	18	[illegible]	[illegible]	[illegible]	765
Total	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	231,[illegible]
Electric-light apparatus:						
France		2,7[illegible]		1,[illegible]		[illegible]
Germany		71,215		[illegible]		[illegible]
Great Britain		114,237		172,[illegible]		184,198
United States		47[illegible]		[illegible]		[illegible]
Other countries		521				
Total		[illegible]		407,[illegible]		615,[illegible]
Fire engines and pumps:						
Germany		72,[illegible]		4,[illegible]		[illegible]
Great Britain		221,[illegible]		149,[illegible]		164,871
Holland		5,714		[illegible]		
United States		7[illegible]		50,[illegible]		57,510
Other countries		[illegible]		[illegible]		47
Total		374,[illegible]		[illegible]		[illegible]
Implements and tools of farmers and mechanics:						
Belgium				1,[illegible]		13,348
France		6,227		3,164		3,799
Germany		[illegible]		5,471		19,[illegible]
Great Britain		[illegible]		107,[illegible]		107,541
United States		[illegible]		[illegible]		[illegible]
Other countries		1,710		[illegible]		[illegible]
Total		[illegible]		187,172		[illegible]
Instruments or apparatus, photographic:						
France		18,567		18,448		19,102
Germany		21,[illegible]		7,[illegible]		18,[illegible]
Great Britain		192,411		92,640		161,195
United States		26,758		16,194		8,235
Other countries		170		241		278
Total		260,113		128,456		207,520
Locomotive engines:						
Belgium				2,874		9,744
France						21,[illegible]
Germany		25,114		[illegible]		[illegible]
Great Britain		[illegible]		[illegible]		[illegible]
Switzerland				[illegible]		[illegible]
United States		[illegible]		[illegible]		1,[illegible]
Total		1,[illegible]		1,[illegible]		[illegible]
Machinery, mining:						
France		1,[illegible]		[illegible]		[illegible]
Germany		[illegible]		[illegible]		[illegible]
Great Britain		15,[illegible]		[illegible]		172,417
United States		[illegible]		21,[illegible]		[illegible]
Total		[illegible]		[illegible]		211,[illegible]
Machinery, paper-making:						
Germany		[illegible]		1,[illegible]		179
Great Britain		[illegible]		[illegible]		[illegible]
United States		[illegible]		[illegible]		[illegible]
Other countries		[illegible]				
Total		476,[illegible]		[illegible]		[illegible]
Machinery, spinning (all kinds):						
Belgium		3,925				
France		12,971		7,855		81,819
Germany		70,562		83,519		187,117
Great Britain		715,349		680,276		2,818,694
Switzerland		1,241		1,355		[illegible]
United States		6,181		206		802
Total		809,634		773,205		3,088,762

ARTICLES AND COUNTRIES WHENCE IMPORTED.	1900		1899		1898	
	Quantities.	Values.	Quantities.	Values.	Quantities.	Values.
Machinery, weaving (all kinds):		Yen.		Yen.		Yen.
France		[illegible]		[illegible]		47,482
Germany		[illegible]		[illegible]		[illegible]
Great Britain		[illegible]		[illegible]		[illegible]
United States		2,[illegible]				
Other countries				[illegible]		[illegible]
Total		[illegible]		[illegible]		[illegible]
Sewing machines:						
Germany		[illegible]		[illegible]		[illegible]
Great Britain		[illegible]		12,[illegible]		[illegible]
United States		[illegible]		[illegible]		[illegible]
Other countries		[illegible]		[illegible]		[illegible]
Total		[illegible]		[illegible]		[illegible]
Steam boilers and engines:						
Denmark		2,[illegible]				
France		[illegible]		[illegible]		1,[illegible]
Germany		[illegible]		[illegible]		[illegible]
Great Britain		[illegible]		147,[illegible]		[illegible]
Switzerland		[illegible]				[illegible]
United States		[illegible]		[illegible]		[illegible]
Other countries				[illegible]		
Total		[illegible]		[illegible]		[illegible]
Telephones:						
Belgium		[illegible]		[illegible]		[illegible]
France		[illegible]		[illegible]		[illegible]
Germany		5,[illegible]		[illegible]		[illegible]
Great Britain		[illegible]		[illegible]		[illegible]
Holland						[illegible]
Sweden and Norway		[illegible]		[illegible]		[illegible]
United States		[illegible]		[illegible]		[illegible]
Other countries		[illegible]		[illegible]		[illegible]
Total		[illegible]		[illegible]		[illegible]
Turning lathes:						
France		[illegible]		[illegible]		[illegible]
Germany		[illegible]		[illegible]		[illegible]
Great Britain		[illegible]		[illegible]		[illegible]
United States		[illegible]		[illegible]		[illegible]
Total		[illegible]		[illegible]		[illegible]
Watches (all kinds) (number):						
France	[illegible]	[illegible]	[illegible]	14,[illegible]	[illegible]	[illegible]
Germany	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Great Britain	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Switzerland	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
United States	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Other countries	[illegible]	[illegible]	[illegible]	[illegible]		
Total	144,691	729,746	[illegible]	[illegible]	[illegible]	[illegible]
Watch cases and movements:						
France		[illegible]		[illegible]		[illegible]
Germany		[illegible]		[illegible]		[illegible]
Great Britain		[illegible]		[illegible]		[illegible]
Switzerland		[illegible]		[illegible]		[illegible]
United States		[illegible]		[illegible]		[illegible]
Other countries		[illegible]				[illegible]
Total		[illegible]		[illegible]		[illegible]
Watch movements:						
France		[illegible]		[illegible]		[illegible]
Germany		[illegible]		[illegible]		[illegible]
Great Britain		[illegible]		[illegible]		[illegible]
Switzerland	[illegible]	[illegible]		[illegible]		[illegible]
United States		[illegible]		[illegible]		[illegible]
Total		[illegible]		[illegible]		[illegible]
Cardboard, silk (boxes):						
France	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Germany	5,158	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Great Britain	165,668	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Holland	4,126	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Sweden and Norway	6,660	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Switzerland	85,324	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
United States	81,825	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Other countries	144	[illegible]	[illegible]	[illegible]		
Total	399,227	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

PRINCIPAL IMPORTS INTO JAPAN FROM VARIOUS FOREIGN COUNTRIES IN EACH YEAR FROM 1898 TO 1900—Continued.

ARTICLES AND COUNTRIES WHENCE IMPORTED.	1900		1899		1898	
	Quantities.	Values.	Quantities.	Values.	Quantities.	Values.
Eggs, fresh (mille):		Yen.		Yen.		Yen.
China	95,540	1,238,661	66,963	823,088	49,143	490,462
Korea	340	4,400	331	3,676	213	2,034
Other countries	.....	3	11	194	4	55
Total	95,880	1,243,064	67,305	826,960	49,360	492,553
Fish, salted (kin):						
British America	2,674,116	182,505	247,441	15,938	779,833	40,185
China	13,926	1,297	50,991	2,702	9,607	766
Korea	66,492	3,529	30,133	1,377	68,770	2,763
Russia	132	43	.....	.....	21,772	1,103
Russian Asia	40,178,092	1,945,250	23,328,158	1,186,743	8,645,982	475,536
United States	901,599	52,114	129,681	5,938	641,757	44,811
Other countries	1,076	104	1,799	195	445,159	44,568
Total	43,835,533	2,184,845	23,788,203	1,212,896	10,612,880	609,736
Flour (kin):						
Australia	2,828,211	127,761	272,896	11,807	18,750	940
Austria	107,111	5,663	31,287	2,080	.....	.....
British America	1,023,883	41,373	295,609	14,771	467,175	27,617
Germany	.....	.....	61,462	4,762	8,475	337
Great Britain	70,694	3,528	47	2	192,675	9,776
Hongkong	7,370	397	22,815	1,393	36,825	2,166
Russia	28	3	423	25	34,321	1,762
United States	80,255,208	3,703,360	28,258,815	1,333,675	38,087,424	1,979,359
Other countries	6,837	428	54,750	2,337	8,800	453
Total	84,299,342	3,882,516	29,001,104	1,370,857	38,854,445	2,022,412
Hats, caps, and bonnets (dozens):						
Austria	7	132	3	25	320	3,570
British India	30	599	61	1,294	46	1,022
China	977	2,107	2,837	7,670	2,214	4,570
France	156	4,628	52	962	509	4,419
Germany	3,630	45,476	861	9,732	2,200	19,601
Great Britain	15,935	343,615	8,655	183,960	13,242	210,370
Italy	342	4,403	192	2,539	21	497
United States	362	9,073	283	5,816	166	3,249
Other countries	303	1,004	96	1,017	10	114
Total	21,742	411,041	13,040	213,019	18,728	247,416
Acid, carbolic (kin):						
Belgium	34,716	18,396	56,221	21,036	.....	.....
Germany	116,880	47,220	108,737	41,919	69,798	23,023
Great Britain	332,787	157,426	561,203	211,312	401,322	145,822
Other countries	4	1	2,144	827	.....	.....
Total	484,387	223,045	728,305	275,088	471,120	169,845
Acid, salicylic (kin):						
Germany	208,912	167,318	54,630	57,132	230,273	256,020
Great Britain	.....	.....	1,698	2,170	756	861
United States	170	152	763	1,195	.....	.....
Total	209,082	167,470	57,091	60,499	231,029	256,891
Alcohol (kin):						
Austria	28,739	3,217	191,516	21,703	450	70
British India	.....	.....	.....	.....	14,625	1,560
Dutch India	21,258	1,792	.....	.....	14,820	1,383
France	9,056	1,018	36	12	318,060	36,474
Germany	617,182	67,234	14,927,108	1,768,856	23,011,576	2,207,315
Great Britain	41	49	191,176	21,113	255	54
Holland	210,729	23,311	78,317	8,555	585,728	52,025
Hongkong	.....	.....	.....	.....	11,212	1,844
United States	352,220	35,426	2,062,424	240,559	5,763,546	397,898
Other countries	.....	.....	.....	.....	9,776	1,424
Total	1,239,225	132,051	17,450,577	2,060,890	29,730,048	2,699,982
Glycerin (kin):						
Germany	105,896	35,256	588,677	175,397	444,141	126,115
Great Britain	170,035	53,890	313,063	88,186	290,666	77,477
Holland	.....	.....	.....	.....	10,920	3,193
United States	.....	.....	31,720	9,372	.....	.....
Other countries	423	146	.....	.....	.....	.....
Total	276,354	89,293	933,460	272,866	745,664	206,785
Phosphorus, amorphous (kin):						
Belgium	.....	.....	6,804	7,932	.....	.....
France	48,090	58,412	32,497	42,005	37,272	32,124
Germany	21,340	26,368	16,962	21,734	3,672	4,181
Great Britain	125,225	159,854	101,606	139,669	159,029	225,049
Russia	.....	.....	4,165	4,741	12,191	16,896
Other countries	227	342	.....	.....	.....	.....
Total	194,882	244,978	162,034	216,124	211,564	298,252

ARTICLES AND COUNTRIES WHENCE IMPORTED.	1900		1899		1898	
	Quantities.	Values.	Quantities.	Values.	Quantities.	Values.
Potash, chlorate of (kin):		Yen.		Yen.		Yen.
Belgium	126,711	20,686	20,321	3,771	57,628	8,367
France	1,624,647	259,064	510,363	93,997	689,840	112,699
Germany	858,350	142,014	266,810	49,371	704,369	112,121
Great Britain	1,540,597	252,847	1,473,638	260,262	2,311,758	396,757
Switzerland	.....	.....	61,286	11,489	18,900	2,777
Other countries	29,605	4,698	.....	.....	.....	.....
Total	4,179,913	679,312	2,331,918	418,886	3,782,426	632,699
Soda-ash (kin):						
Great Britain	12,223,664	482,808	8,993,561	336,416	7,068,129	184,654
United States	1,917	68	1,086,621	36,890	259	5
Other countries	.....	.....	4,068	153	.....	.....
Total	12,225,581	482,877	10,084,250	373,369	7,068,388	184,659
Soda, caustic (kin):						
Germany	5,151	2,236	2,581	1,357	.....	.....
Great Britain	14,980,405	920,608	11,120,878	515,998	11,799,685	422,714
United States	100,932	6,618	101,931	4,564	.....	.....
Other countries	190	12	1,964	90	.....	.....
Total	15,086,678	929,526	11,227,274	521,851	11,799,685	422,714
Soda, nitrate of (kin):						
British India	261,960	12,500	.....	.....	.....	.....
Germany	182,921	9,864	82,546	4,892	.....	.....
Other countries	360,395	18,750	4,949,090	226,595	3,371,224	117,319
Total	805,276	41,114	5,031,636	231,488	3,371,224	117,319
Aniline dyes (kin):						
Belgium	26,825	16,864	3,599	2,814	1,654	1,653
France	63,453	39,473	47,143	26,027	16,437	9,531
Germany	1,326,838	1,029,498	945,150	783,411	1,230,974	1,124,578
Great Britain	9,339	8,420	1,546	1,079	2,438	2,444
Holland	7,800	4,652	9,800	9,844	5,500	4,245
Switzerland	304,715	229,141	107,162	80,784	100,726	76,289
Other countries	1,000	699	100	51	.....	.....
Total	1,739,970	1,328,750	1,114,431	904,012	1,357,729	1,218,842
Indigo, dry (kin):						
Belgium	1,334	5,431	.....	.....	.....	.....
British India	1,326,340	2,379,534	1,412,542	2,107,067	1,696,259	2,110,179
Dutch India	420,111	1,231,957	290,630	639,752	43,879	72,898
France	675	1,152	.....	.....	.....	.....
French India	.....	.....	22,850	48,671	.....	.....
Germany	30,899	111,390	13,113	51,892	613	3,595
Great Britain	52,023	134,797	5,493	9,477	25,592	38,269
Holland	542	1,685	20	15	.....	.....
Philippine Islands	.....	.....	.....	.....	27,664	25,076
United States	2,582	4,481	302	777	.....	.....
Other countries	17,217	32,128	23,772	46,175	15,269	21,655
Total	1,851,673	3,902,558	1,768,728	2,903,829	1,806,276	2,270,814
Lacquer (kin):						
China	591,653	236,480	583,827	236,352	527,102	204,142
French India	2,250	446	.....	.....	16,921	3,535
Other countries	630	100	.....	.....	224	45
Total	594,533	237,026	583,827	236,352	544,277	207,723
Logwood extract (kin):						
France	1,063,054	222,840	518,860	112,065	945,073	199,699
Germany	418,057	89,655	237,319	47,973	150,479	29,813
Great Britain	42,675	8,752	66,445	12,382	21,420	4,264
United States	1,901	364	.....	.....	5,898	1,377
Other countries	847	193	.....	.....	16,880	2,879
Total	1,526,534	321,806	822,624	172,421	1,139,750	238,034
Paint in oil (kin):						
Austria	8,380	4,826	.....	.....	.....	.....
France	.....	.....	.....	.....	14,680	3,150
Germany	13,412	3,281	8,250	936	65,923	10,889
Great Britain	1,954,666	275,501	1,459,730	195,036	1,926,830	222,975
Holland	17,035	1,842	14,704	1,317	.....	.....
United States	2,397	1,137	1,082	300	9,324	1,186
Other countries	1,270	190	.....	.....	4,095	593
Total	1,997,160	286,783	1,483,573	197,610	2,020,852	238,783
Paints for vessel's base (kin):						
Austria	3,833	960	5,756	2,589	3,160	2,052
France	1,757	557	.....	.....	25,886	3,095
Germany	40,279	10,091	10,111	3,748	12,831	2,226
Great Britain	456,699	201,615	255,912	110,121	313,946	110,498
Holland	771	261	5,450	2,911	8,270	3,677
United States	36,575	11,917	40,569	11,566	15,066	5,077
Other countries	.....	.....	1,608	750	.....	.....
Total	539,414	237,403	319,406	131,618	379,699	127,227

PRINCIPAL IMPORTS INTO JAPAN FROM VARIOUS FOREIGN COUNTRIES IN EACH YEAR FROM 1898 TO 1900—Continued.

ARTICLES AND COUNTRIES WHENCE IMPORTED.	1900		1899		1898	
	Quantities.	Values.	Quantities.	Values.	Quantities.	Values.
Window glass (all kinds) (100 sq. feet):		Yen		Yen.		Yen.
Belgium	153,765	871,806	226,624	1,165,480	143,033	509,948
France	.....	.....	2,500	12,323	1,506	5,424
Germany	4,075	24,136	5,063	26,423	1,030	4,286
Great Britain	9,692	56,731	9,019	52,332	40,832	150,147
Other countries	38	244	2	17	.....	.....
Total	167,570	952,919	243,208	1,256,576	186,401	669,806
Beans, pease, and pulse (picul):						
British India	479	1,362	11,992	36,730	3	20
China	818,640	2,190,642	2,365,241	5,666,097	1,993,832	5,904,583
Corea	885,056	2,615,468	701,807	2,110,846	406,861	1,172,360
French India	.....	.....	201	581	1,481	5,056
Russian Asia	3,317	8,646	584	1,863	.....	.....
United States	182	1,178	930	5,758	3,985	17,555
Other countries	68	468	27	222	345	1,585
Total	1,707,742	4,817,767	3,080,786	3,822,110	2,406,507	7,101,103
Rice (picul):						
British India	249,344	973,747	53,827	174,507	2,663,087	11,642,416
China	83,998	327,673	60,323	231,625	967,216	3,989,422
Corea	1,131,787	4,694,166	436,716	1,689,909	649,570	2,701,887
Dutch India	403	1,816	.....	.....	.....	.....
French India	726,859	2,739,752	956,142	3,354,095	6,445,390	25,762,726
Siam	91,530	284,178	143,575	510,007	969,413	4,114,065
Other countries	58	200	9	21	1,576	6,290
Total	2,286,979	9,021,536	1,650,592	5,960,166	11,696,252	48,219,810
Seeds, cotton (kin):						
China	18,944,035	739,817	61,608,801	814,162	61,751,984	578,504
Other countries	2,954	39	5,875	71	761	6
Total	18,946,989	739,856	61,614,676	814,233	61,752,745	578,510
Seeds, sesame (kin):						
British India	214,570	9,990	726,114	30,042	330,562	13,338
China	3,688,479	182,884	3,554,619	172,880	2,099,025	97,489
Corea	26,961	1,634	53,993	3,208	127,114	6,044
French India	.....	.....	42,155	1,726	.....	.....
Other countries	.....	.....	200	13	.....	.....
Total	3,930,010	194,509	4,377,081	207,872	2,556,701	116,872
Wheat (kin):						
Australia	4,339,845	143,260	.....	.....	.....	.....
Corea	5,182,533	132,734	2,668,207	71,764	2,770,755	72,698
Great Britain	457,450	15,502	.....	.....	.....	.....
United States	12,370,022	400,829	395,009	14,697	2,039,371	71,173
Other countries	547	14	990	27	1,560	41
Total	22,350,397	692,341	2,064,206	86,489	4,811,686	143,913
Hides, bull, ox, cow, and buffalo (kin):						
Australia	7,171	2,087	2,040	564	12,128	2,293
British India	116,203	28,354	53,501	11,455	237,186	46,540
China	335,612	66,967	689,318	140,323	1,532,604	276,202
Corea	1,642,476	406,593	1,649,528	408,199	793,007	185,487
France	153,993	52,821	108,928	35,248	24,265	8,061
French India	259,748	47,283	535,070	107,411	241,113	48,521
Great Britain	81,965	28,820	31,907	9,536	3,563	1,195
Hongkong	.....	.....	15,858	1,928	2,841	570
Russia	16,324	2,316	.....	.....	.....	.....
Russian Asia	30,934	5,006	1,472	145	98	24
United States	32,548	12,113	11,186	4,332	65,351	16,708
Other countries	25,688	4,277	5,650	784	10,780	2,343
Total	2,696,662	656,643	3,104,458	719,930	2,922,936	587,948
Leather, sole (kin):						
Australia	128,998	75,760	52,951	28,443	27,672	13,472
British America	4,913	2,995	8,164	3,776	9,471	4,424
British India	243,513	99,155	492,487	164,401	497,287	143,507
France	3,697	2,451	4,047	2,463	71	35
French India	13,323	4,426	9,088	3,660	5,165	1,350
Germany	.....	.....	3,954	2,986	46,746	25,401
Great Britain	23,455	16,308	2,841	843	1,298	1,107
United States	1,066,578	782,862	535,375	341,994	896,514	514,431
Other countries	2,948	837	1,165	458	44,195	13,147
Total	1,487,425	984,797	1,110,072	549,028	1,528,419	716,879
Leather, other (kin):						
Australia	1,155	733	1,950	1,168	9,033	4,573
Belgium	1,642	3,163	50	80	4,163	10,993
British India	874,910	552,257	308,200	241,626	817,046	587,042
China	17,118	10,432	28,628	16,865	143,667	72,515
France	6,958	16,888	4,388	10,126	5,441	13,547
French India	20,663	17,096	5,986	3,878	6,375	3,032
Germany	53,631	131,630	19,218	43,392	27,841	73,608
Great Britain	80,689	168,155	40,537	94,230	62,108	142,649
Hongkong	16,636	13,544	2,640	1,743	.....	.....
United States	100,151	185,855	81,604	104,917	117,909	140,942
Other countries	948	1,423	18	31	1,844	1,306
Total	1,174,401	1,101,183	493,219	518,061	1,195,427	1,050,211

ARTICLES AND COUNTRIES WHENCE IMPORTED.	1900		1899		1898	
	Quantities.	Values.	Quantities.	Values.	Quantities.	Values.
Iron, pig and ingot (kin):		Yen.		Yen.		Yen.
Belgium	2,214,989	58,446	943,953	18,930	433,835	5,983
China	3,985,537	71,066	7,708,370	146,466	1,260,006	19,311
France	69,300	1,536	252,691	8,906	164,455	6,818
Germany	13,410,663	329,531	1,920,578	43,760	5,623,943	73,329
Great Britain	17,877,025	502,065	31,655,977	684,958	75,522,841	1,048,726
United States	13,071	220	2,925,733	62,520	22,651,949	226,915
Other countries	4,891	43	.....	.....	12,288	357
Total	37,575,476	962,910	45,407,202	965,543	105,669,311	1,381,442
Iron, bar and rod (kin):						
Austria	852,010	51,162	.....	.....	.....	.....
Belgium	47,847,634	2,498,803	37,289,603	1,564,710	51,890,359	1,654,509
France	2,231	248	642,421	23,138	1,049,033	49,736
Germany	13,335,132	758,018	4,593,320	196,057	13,957,327	458,617
Great Britain	29,542,760	1,854,483	16,041,462	781,309	51,266,040	1,825,697
Holland	.....	.....	.....	.....	196,943	7,701
Sweden and Norway	368,530	25,304	276,557	16,065	432,815	20,613
United States	1,018,381	54,784	588,615	22,336	1,836,349	53,685
Other countries	8,376	601	1,878	57	7,879	242
Total	92,975,054	5,243,407	59,433,856	2,603,675	120,636,743	1,061,805
Rails (kin):						
Belgium	2,732,823	123,972	613,153	24,147	2,498,651	75,487
France	.....	.....	116,624	6,754	268,878	9,678
Germany	11,057,507	562,234	78,502	2,916	5,315,088	134,988
Great Britain	20,537,073	905,763	4,461,697	171,719	30,475,900	801,802
United States	73,032,447	3,161,399	7,381,866	229,515	81,591,781	1,609,731
Other countries	.....	.....	.....	.....	1,111	32
Total	107,359,850	4,753,370	12,654,842	435,054	120,154,403	2,631,721
Fittings of rail (kin):						
Belgium	166,594	14,956	26,351	1,773	266,470	14,535
France	17,255	1,624	1,001	166	602,041	37,128
Germany	302,171	25,818	4,905	474	812,164	45,017
Great Britain	2,297,420	167,366	463,208	33,504	3,478,[illegible]	189,734
United States	7,255,209	491,583	454,974	22,280	10,656,989	339,195
Total	10,038,659	704,349	950,439	58,199	15,856,917	625,671
Iron, plate and sheet (kin):						
Belgium	13,274,861	845,735	10,498,340	515,017	4,946,5[illegible]	189,437
France	32,782	2,245	403,184	30,854	.....	.....
Germany	1,020,017	60,710	1,905,137	97,712	1,027,21[illegible]	63,184
Great Britain	53,970,673	3,105,878	30,414,060	1,545,244	29,202,1[illegible]	1,083,384
Holland	.....	.....	34,773	1,825	.....	.....
Sweden and Norway	69,091	5,504	.....	.....	.....	.....
United States	929,106	60,446	686,802	29,761	2,824,34[illegible]	81,726
Other countries	465	21	.....	.....	3,567	122
Total	69,296,935	4,080,542	44,002,603	2,220,414	38,603,7[illegible]	1,[illegible],855
Iron, corrugated and galvanized sheet (kin):						
Belgium	45,603	4,215	34,376	2,078	141,544	6,902
Germany	143,970	13,358	.....	.....	.....	.....
Great Britain	7,509,082	761,766	5,744,530	509,636	5,602,473	376,056
United States	16,410	1,489	.....	.....	.....	.....
Other countries	3,433	299	.....	.....	.....	.....
Total	7,709,498	781,121	5,778,906	511,715	5,744,017	382,958
Iron, galvanized-sheet (kin):						
Belgium	80,956	8,830	81,29[illegible]	8,254	16,8[illegible]	[illegible]
Germany	328,708	34,976	418	20	42,6[illegible]	2,[illegible]
Great Britain	11,129,093	1,279,509	9,418,5[illegible]	893,5[illegible]	6,040,847	461,1[illegible]
Other countries	.....	.....	5,315	802	.....	.....
Total	11,538,757	1,323,315	9,500,387	902,5[illegible]	6,148,[illegible]	[illegible]
Iron pipes and tubes (kin):						
Belgium	17,909,102	418,37[illegible]	4,064,97[illegible]	132,790	17,613,83[illegible]	[illegible],818
Germany	198,937	40,6[illegible]	18,84[illegible]	2,263	656,85[illegible]	[illegible],641
Great Britain	14,067,980	1,186,815	11,667,379	557,427	22,441,0[illegible]	734,324
United States	15,344,076	1,340,929	4,6[illegible]	260,477	4,791,28[illegible]	[illegible]
Other countries	15,739	814	9,079	446	24,76[illegible]	747
Total	47,535,885	2,981,6[illegible]	20,454,2[illegible]	[illegible]	45,527,7[illegible]	[illegible]
Iron nails (kin):						
Belgium	121,631	11,718	88,089	6,876	219,16[illegible]	[illegible]
France	7,753	1,080	8,944	1,153	7,8[illegible]	887
Germany	9,172,474	623,513	11,458,641	657,317	2,500,21[illegible]	[illegible]
Great Britain	1,584,271	121,169	807,808	60,524	487,0[illegible]	[illegible]
United States	21,330,844	1,422,6[illegible]	26,587,257	1,497,560	20,658,587	[illegible],846
Other countries	2,272	987	.....	.....	79[illegible]	[illegible]
Total	32,218,8[illegible]	2,181,0[illegible]	28,950,7[illegible]	2,223,[illegible]	22,3[illegible]	[illegible]

PRINCIPAL IMPORTS INTO JAPAN FROM VARIOUS FOREIGN COUNTRIES IN EACH YEAR FROM 1898 TO 1900—Continued.

ARTICLES AND COUNTRIES WHENCE IMPORTED.	1900		1899		1898	
	Quantities.	Values.	Quantities.	Values.	Quantities.	Values.
Iron screws (kin):		*Yen.*		*Yen.*		*Yen.*
Belgium	4,552	1,127	8,588	1,364	9,588	860
Germany	74,751	11,801	99,594	7,702	13,639	3,414
Great Britain	1,668,952	200,016	506,735	58,076	1,105,340	115,974
United States	76,737	14,628	127,799	18,673	488,514	28,360
Other countries	1,024	221	4,233	370	.....	.....
Total	1,826,016	227,795	746,949	86,187	1,617,081	148,610
Tinned plate or sheet (kin):						
Belgium	201,477	21,140	.....	.....	.....	.....
Germany	39,380	4,055	.....	.....	75	5
Great Britain	7,420,554	806,889	6,577,527	569,916	6,663,667	409,673
United States	120	63	75	6	20,062	1,479
Other countries	.....	.....	.....	.....	2,540	263
Total	7,661,531	832,149	6,577,602	569,923	6,686,344	411,421
Iron, wire, and small rod (kin):						
Austria	948,530	65,938	117,647	6,944	202,280	11,750
Belgium	1,711,741	99,253	2,431,952	105,362	104,979	5,741
France	1,493	446	76,396	5,010	.....	.....
Germany	3,339,481	258,395	1,263,221	72,357	1,553,422	92,903
Great Britain	9,853,398	627,323	3,805,130	176,171	88,301	3,986
United States	599,806	57,109	1,015,803	44,685	124,961	5,511
Other countries	5,080	340	820	20	.....	.....
Total	16,459,529	1,108,809	8,710,969	410,582	2,073,943	119,923
Telegraph wire (kin):						
Austria	127,006	8,920	209,781	12,749	.....	.....
Belgium	1,109,255	96,402	1,644,712	113,278	667,939	35,362
France	2,436,139	173,292	1,869,910	136,205	.....	.....
Germany	3,601,542	324,888	3,328,239	222,480	4,879,653	247,334
Great Britain	672,169	57,085	1,924,152	129,540	2,466,395	119,487
United States	5,342,356	434,984	3,012,727	202,945	126,059	6,657
Total	13,291,457	1,095,574	11,989,521	817,200	8,140,046	408,841
Materials of bridges and buildings (kin):						
Belgium	34,303	4,132	850,004	77,976	4,767,914	282,391
Germany	2,900,338	309,901	1,159,396	107,058	2,411,237	216,184
Great Britain	4,418,825	409,732	715,957	56,609	10,460,488	628,787
United States	12,807,882	1,156,547	666,926	44,198	14,097,147	781,198
Total	20,161,348	1,880,313	3,392,283	285,841	31,736,786	1,908,561
Steel, other than mild steel (kin):						
Austria	11,271	2,154	9,596	1,204	537	121
Belgium	32,384	2,496	150,958	8,419	705,054	35,012
France	59,238	7,694	51,418	2,813	225,443	14,385
Germany	1,561,230	125,466	836,494	59,633	1,287,740	74,267
Great Britain	4,234,870	909,029	6,168,401	818,114	6,651,520	793,129
Sweden and Norway	1,168,780	100,539	465,199	34,254	481,739	33,004
Switzerland	.....	.....	.....	.....	25,980	1,794
United States	46,059	6,440	436,797	30,258	354,508	12,623
Other countries	.....	.....	.....	.....	232	14
Total	7,113,832	1,153,821	8,118,863	954,699	9,732,753	964,354
Brass tubes (kin):						
Belgium	2,662	1,407	.....	.....	.....	.....
Germany	26,116	14,160	4,528	2,123	12,384	4,917
Great Britain	268,694	144,902	113,071	59,731	377,228	152,067
Italy	3,203	1,555	.....	.....	.....	.....
United States	151,414	79,764	60,483	27,418	28,704	10,158
Other countries	1,013	381	.....	.....	4,623	819
Total	453,102	242,172	178,082	89,272	422,939	167,962
Copper tubes (kin):						
Austria	833	1,275	.....	.....	.....	.....
Belgium	16,439	10,251	3,481	2,241	.....	.....
France	5,058	3,046	5,762	3,908	16,423	7,510
Germany	17,506	10,879	40,116	19,458	2,661	1,175
Great Britain	238,262	152,609	62,195	50,597	269,645	121,149
Italy	10,917	6,657	6,390	4,165	1,327	624
United States	55,734	34,654	75,043	44,061	6,509	2,808
Other countries	.....	.....	.....	.....	1,779	332
Total	344,749	219,373	192,987	124,433	298,344	133,601
Lead, pig, ingot, and slab (kin):						
Australia	8,096,314	731,880	3,445,386	273,691	3,042,911	219,093
Austria	.....	.....	593,045	48,782	.....	.....
British India	17,611	1,373	182,234	16,225	178,428	10,787
Germany	.....	.....	169,220	14,439	14	1
Great Britain	76,935	5,563	1,781	166	281,948	18,444
Korea	39,796	3,902	21,191	1,843	.....	.....
United States	1,874,672	182,822	741,246	56,979	1,675,458	116,416
Other countries	19,882	1,609	430	25	7,559	460
Total	10,125,210	927,152	5,154,533	412,155	5,186,318	365,202

ARTICLES AND COUNTRIES WHENCE IMPORTED.	1900		1899		1898	
	Quantities.	Values.	Quantities.	Values.	Quantities.	Values.
Mercury (kin):		*Yen.*		*Yen.*		*Yen.*
China	.....	.....	.....	.....	2,253	2,7[illegible]
Great Britain	99,774	146,752	109,098	156,551	65,619	76,315
Spain	562	918	2,812	3,499	1,125	1,012
United States	67,876	111,027	42,280	59,031	79,646	96,033
Other countries	.....	.....	.....	.....	112	143
Total	168,212	258,698	154,190	219,012	148,746	176,303
Tin, block, ingot, and slab (kin):						
Australia	.....	.....	.....	.....	3,322	1,292
British India	639,169	455,922	538,765	327,681	579,919	219,995
China	20,878	13,181	23,651	11,491	.....	.....
French India	.....	.....	14,407	4,391	.....	.....
Great Britain	5,080	3,998	31,933	17,086	6,689	2,413
Philippine Islands	.....	.....	.....	.....	10,012	3,504
Other countries	.....	.....	1,599	726	.....	.....
Total	665,127	473,103	610,265	361,286	599,996	227,257
Zinc, block, ingot, and slab (kin):						
Australia	10	10	.....	.....	72,199	5,601
Belgium	451,301	59,104	75,203	12,028	.....	.....
British India	156,700	16,239	283,333	29,750	295,424	17,224
China	88,106	9,362	.....	.....	.....	.....
French India	23,910	2,782	65,479	5,763	.....	.....
Germany	3,997,512	550,416	1,117,022	182,331	474,889	48,417
Great Britain	318,059	47,145	175,696	29,305	120,781	9,094
Other countries	9,348	1,018	2,203	224	13,820	633
Total	5,047,946	686,080	1,718,936	259,696	857,054	80,991
Zinc, sheet (includes No. 2) (kin):						
Belgium	1,296,047	221,255	1,429,362	268,172	266,324	32,401
France	12,080	2,348	.....	.....	.....	.....
Germany	2,535,235	441,117	2,293,775	444,327	2,917,357	388,210
Great Britain	1,267,505	217,996	1,030,991	195,071	923,324	125,830
Other countries	35	12	2,692	355	.....	.....
Total	5,110,902	882,731	4,756,730	907,925	4,107,005	556,442
Oil, kerosene (galls.):						
Dutch India	5,465,829	975,519	.....	.....	.....	.....
Russian Asia	8,861,761	1,378,343	10,625,642	1,276,286	12,581,319	682,349
United States	5,519	1,340	45,993	5,095	.....	.....
Total	14,333,109	2,355,203	10,671,635	1,281,381	12,581,319	682,349
Oil, kerosene, in cans (galls.):						
Dutch India	.....	.....	313,630	52,070	3,735,720	508,298
Russian Asia	5,042,505	1,033,673	6,319,620	1,153,170	3,622,690	451,457
United States	48,466,710	10,773,775	35,116,952	5,431,526	47,965,816	5,910,774
Total	53,509,215	11,807,448	41,750,202	6,636,767	55,324,126	6,870,529
Oil, linseed (kin):						
Great Britain	890,118	192,695	577,550	97,085	474,360	63,382
United States	89,192	18,003	.....	.....	8,077	958
Other countries	6,533	1,451	1,700	278	.....	.....
Total	985,843	212,150	579,250	97,361	482,437	64,341
Oil, lubricating (kin):						
China	.....	.....	8,566	1,668	.....	.....
Germany	20,917	2,670	11,263	2,654	15,045	2,507
Great Britain	42,483	5,552	7,273	1,603	167,266	16,762
Russia	29,292	1,014	18,939	1,298	7,013	849
United States	11,385,533	615,522	5,621,581	282,597	9,420,074	380,122
Other countries	195	68	1,326	171	6,719	1,101
Total	11,477,520	624,828	5,668,888	289,394	9,625,117	401,343
Paraffin wax (kin):						
Germany	23,013	4,059	.....	.....	2,299	242
Great Britain	410,124	66,605	100,926	9,133	572,440	41,334
United States	3,074,394	440,858	3,133,408	277,670	3,178,455	228,767
Other countries	260	35	.....	.....	75	4
Total	3,507,791	511,559	3,234,334	286,803	3,753,269	270,348
Paper, cigarette:						
Austria	.....	65,614	.....	17,928	.....	8,625
Belgium	.....	3,134	.....	397	.....	.....
France	.....	124,585	.....	78,759	.....	67,964
Germany	.....	30,282	.....	20,358	.....	47,356
Great Britain	.....	41	.....	7,785	.....	4,939
Other countries	.....	834	.....	1,587	.....	331
Total	.....	224,553	.....	127,126	.....	129,216

PRINCIPAL IMPORTS INTO JAPAN FROM VARIOUS FOREIGN COUNTRIES IN EACH YEAR FROM 1898 TO 1900—Continued.

ARTICLES AND COUNTRIES WHENCE IMPORTED.	1900		1899		1898	
	Quantities.	Values.	Quantities.	Values.	Quantities.	Values.
Paper, glazed, fancy (kin):		*Yen.*		*Yen.*		*Yen.*
Austria	543,288	64,000	130,019	15,947	45,794	5,016
Belgium	170,021	37,914	137,703	26,716	153,547	23,227
France	5,532	1,259	19,685	3,934	.....	.....
Germany	1,555,538	216,997	903,989	129,173	1,141,765	137,464
Great Britain	98,417	12,325	150,749	19,955	168,311	23,589
Sweden and Norway	39,113	4,122	29,669	2,789	.....	.....
United States	38,568	5,618	14,978	2,887	19,628	3,153
Other countries	.....	.....	.....	.....	2,586	825
Total	2,450,447	342,237	1,386,783	201,434	1,531,631	193,277
Paper, match (kin):						
Austria	317,196	28,032	135,793	10,663	90,653	5,858
Belgium	.....	.....	39,171	2,627	39,561	2,257
France	.....	.....	18,851	1,601	29,819	2,323
Germany	2,039,576	178,487	1,461,932	130,578	1,896,331	140,897
Great Britain	.....	.....	.....	.....	100,376	6,327
Holland	16,900	1,243	88,748	5,657	206,940	11,978
Sweden and Norway	399,810	32,395	209,639	20,739	65,162	5,548
Other countries	.....	.....	9,775	762	.....	.....
Total	2,773,482	240,159	1,966,909	172,629	2,428,845	175,192
Paper, packing (kin):						
Austria	1,270,842	123,499	528,975	47,196	93,633	7,309
Belgium	26,024	3,297	79,057	11,368	16,322	1,910
Germany	3,022,562	329,859	2,071,850	197,757	2,190,003	189,205
Great Britain	60,990	7,706	51,706	5,794	229,765	19,167
Holland	60,891	4,100	39,482	2,168	31,531	1,668
Italy	5,508	1,036	6,075	1,176	.....	.....
Sweden and Norway	538,490	57,927	146,204	14,687	39,729	3,131
Switzerland	.....	.....	19,668	2,922	9,580	1,255
United States	45,645	6,151	19,520	3,122	83,185	7,016
Other countries	13,700	1,541	3,606	828	394	136
Total	5,044,652	535,119	2,966,143	287,022	2,694,142	230,799
Paper, printing (kin):						
Austria	4,662,744	399,333	1,230,949	113,973	1,975,898	139,209
Belgium	3,139,989	351,761	1,371,297	154,695	2,160,609	194,795
British America	.....	.....	27,891	2,[illegible]	.....	.....
France	.....	.....	.....	.....	21,276	2,284
Germany	2,932,447	289,928	950,386	91,024	8,254,889	605,726
Great Britain	5,794,897	789,108	2,160,716	272,336	4,178,654	451,398
Holland	23,702	1,514	25,642	2,532	11,602	690
Sweden and Norway	125,517	11,900	22,433	1,842	33,717	2,489
United States	2,481,015	193,296	1,402,7[illegible]	109,[illegible]	15,118,979	8[illegible],607
Other countries	.....	.....	.....	.....	363	21
Total	19,160,341	2,036,844	7,199,11[illegible]	748,[illegible]	31,761,984	2,288,214
Pencils (gross):						
Germany	93,563	169,920	28,726	53,187	60,723	101,453
Great Britain	13,395	29,676	9,561	15,215	5,116	11,993
United States	36,767	42,046	37,150	30,545	17,357	14,869
Other countries	312	631	228	395	558	740
Total	144,037	242,274	75,665	99,344	83,754	132,056
Sugar (picul):						
Australia	4,212	21,773	18,01[illegible]	93,529	16	68
Austria	8,657	54,723	.....	.....	.....	.....
British India	2,118	10,770	1,041	5,375	20,916	70,833
China	655,996	2,758,052	670,458	2,880,266	527,865	2,034,258
Dutch India	446,574	2,427,562	87,198	519,502	121,620	698,996
Germany	74,805	479,615	6,690	42,989	455	2,115
Great Britain	.....	.....	.....	.....	420	2,260
Holland	.....	.....	18,234	118,520	.....	.....
Hongkong	120,623	792,277	133,317	852,223	181,806	981,285
Philippine Islands	358,675	1,749,586	375,215	1,908,021	659,642	2,825,561
Other countries	420,126	2,713,271	292,013	1,939,305	107,150	718,317
Total	2,091,786	11,007,633	1,602,181	8,359,735	1,619,890	7,333,699
Sugar, refined (all kinds) (picul):						
Australia	307	1,671	68	517	118	752
Austria	430,505	3,049,181	107,145	765,254	3,470	24,050
Belgium	13,969	101,024	18	137	5,498	38,579
British America	.....	.....	.....	.....	3,278	27,145
British India	1,055	6,348	49	365	.....	.....
China	[illegible]	464	8	68	84,371	572,798
Dutch India	1,417	8,871	2,032	14,846	40,035	321,934
France	171	2,227	224	2,377	238	1,978
Germany	401,313	2,938,987	251,068	1,863,452	791,438	5,266,624
Great Britain	1,692	12,630	37,574	300,146	3,118	22,003
Holland	.....	.....	169	1,643	.....	.....
Hongkong	1,097,324	9,448,859	730,927	6,203,441	1,786,726	14,586,871
Philippine Islands	156	954	53	396	18,701	141,472
Russia	2,333	18,013	9	114	636	8,300
United States	668	9,655	289	3,537	11,526	90,084
Other countries	1	7	.....	.....	.....	.....
Total	1,953,999	15,598,893	1,129,633	9,156,303	2,749,156	21,105,594

ARTICLES AND COUNTRIES WHENCE IMPORTED.	1900		1899		1898	
	Quantities.	Values.	Quantities.	Values.	Quantities.	Values.
Cotton, raw, ginned (picul):		*Yen.*		*Yen.*		*Yen.*
Australia	.....	.....	.....	.....	244	3,508
British India	739,973	17,686,130	2,261,574	39,165,965	1,4[illegible],672	24,781,[illegible]
China	548,7[illegible]	11,955,824	227,1[illegible]	4,370,147	278,42[illegible]	4,[illegible],936
Dutch India	.....	.....	148	2,222	.....	.....
Egypt	44,8[illegible]	1,4[illegible],621	34,529	932,72[illegible]	12,6[illegible]	3[illegible],497
French India	17,0[illegible]	362,253	23,6[illegible]	413,615	31,147	58[illegible],776
Mexico	5[illegible]	1,[illegible]	.....	.....	.....	.....
Siam	3[illegible]	7,7[illegible]	1,044	18,067	197	3,555
United States	1,112,[illegible]	27,010,154	820,617	16,478,[illegible]	779,173	14,751,199
Other countries	2	62	3	51	9[illegible]	26,415
Total	2,463,672	58,500,601	3,369,[illegible]	61,365,754	2,497,247	45,420,457
Cotton, raw, in the seed (picul):						
British India	27,774	167,795	24,895	142,810	9,664	53,236
China	70,061	492,635	24,[illegible]	167,124	19,167	112,092
Korea	55	244	385	3,269	[illegible]	2,149
Dutch India	1,2[illegible]	7,995	7,8[illegible]	47,[illegible]	3	25
French India	39,6[illegible]	2[illegible],[illegible]	69,3[illegible]	3[illegible],347	24,285	148,472
Siam	5,3[illegible]	3[illegible],922	13,2[illegible]	91,3[illegible]	2,824	18,016
Total	144,412	971,627	131,3[illegible]	844,[illegible]	56,329	333,914
Cotton yarns (kin):						
British India	30,2[illegible]	11,173	75,3[illegible]	21,514	105,915	24,639
France	6	15	3,881	5,739	1,9[illegible]	3,507
Germany	6,841	9,[illegible]	487	613	12,9[illegible]	2,213
Great Britain	9,010,657	7,0[illegible],295	8,1[illegible],[illegible]	4,985,[illegible]	15,9[illegible],147	3,[illegible],221
Switzerland	3,1[illegible]	2,[illegible]	.....	.....	.....	.....
Other countries	76	5[illegible]	.....	.....	29	6
Total	9,050,988	7,042,016	8,210,647	4,993,325	15,922,[illegible]	3,547,[illegible]
Cotton threads (kin):						
France	1,0[illegible]	2,5[illegible]	5[illegible]	129	.....	.....
Germany	114	2[illegible]	1,376	1,723	19,[illegible]	27,[illegible]
Great Britain	239,68[illegible]	332,2[illegible]	304,1[illegible]	352,7[illegible]	415,7[illegible]	647,701
Other countries	42	51	2[illegible]	47	.....	.....
Total	241,239	332,[illegible]	305,644	354,[illegible]	4[illegible],749	3[illegible],770
Cotton flannels (sq. yards):						
Austria	29,278	5,973	74,24[illegible]	17,97[illegible]	.....	.....
Belgium	58,352	12,186	16,2[illegible]	3,[illegible]	54	6
France	32,[illegible]	9,246	352	93	2,376	586
Germany	5,273,[illegible]	1,209,751	2,193,591	470,053	1,371,930	279,849
Great Britain	3[illegible],1[illegible]	84,7[illegible]	847,464	173,263	1,328,893	236,533
Holland	5[illegible],312	9[illegible],87[illegible]	1[illegible],9[illegible]	22,7[illegible]	25,[illegible]	5,075
Italy	3[illegible],1[illegible]	8[illegible],24[illegible]	1[illegible],9[illegible]	1[illegible],[illegible]	2[illegible],9[illegible]	7[illegible],[illegible]
Russia	251	9	5,206	1,857	1,073	185
Switzerland	.....	.....	.....	.....	[illegible]	[illegible]
United States	.....	.....	9,[illegible]	1,[illegible]	6,[illegible]	1,[illegible]
Total	6,672,018	1,515,408	3,728,332	797,425	3,128,098	662,781
Cotton prints (sq. yards):						
France	52,652	10,9[illegible]	22,8[illegible]	4,627	15,[illegible]	[illegible]
Germany	1[illegible],528	18,1[illegible]	2[illegible],1[illegible]	3,7[illegible]	2[illegible],[illegible]	2[illegible],[illegible]
Great Britain	13,772,347	1,941,1[illegible]	1[illegible],2[illegible]	1,7[illegible],2[illegible]	[illegible],1[illegible]	1,162,747
Holland	30,771	4,[illegible]	69,5[illegible]	11,[illegible]	.....	.....
Russia	39,4[illegible]	9,[illegible]	9[illegible],8[illegible]	24,[illegible]	144,[illegible]	2[illegible],[illegible]
Russian Asia	2,342	[illegible]	3,987	1,[illegible]	.....	.....
Switzerland	8[illegible],967	9,2[illegible]	17[illegible],8[illegible]	2,[illegible]	121,[illegible]	11,084
United States	32	4	14,3[illegible]	2,[illegible]	.....	.....
Other countries	618	115	4,7[illegible]	1,172	[illegible]	47
Total	14,0[illegible],8[illegible]	2,002,7[illegible]	[illegible],621,[illegible]	1,4[illegible],2[illegible]	[illegible],[illegible]	1,1[illegible],[illegible]
Cotton skins (sq. yards):						
Belgium	4,5[illegible]	1,3[illegible]	.....	.....	.....	.....
Germany	25,8[illegible]	6,5[illegible]	8,[illegible]	[illegible]	[illegible]	[illegible]
Great Britain	16,691,[illegible]	3,[illegible],141	4,7[illegible],7[illegible]	9[illegible],7[illegible]	8,7[illegible],7[illegible]	[illegible],[illegible]
Italy	4,3[illegible]	1,[illegible]	.....	.....	.....	.....
Russia	.....	.....	8,7[illegible]	1,[illegible]	.....	.....
Other countries	4[illegible]	179	42	[illegible]	[illegible]	146
Total	16,727,3[illegible]	4,[illegible],[illegible]	4,811,[illegible]	[illegible],7[illegible]	4,821,3[illegible]	[illegible],[illegible]
Cotton velvets (sq. yards):						
France	241	225	8,7[illegible]	1,[illegible]	10,[illegible]	5,[illegible]
Germany	2[illegible],[illegible]	152,[illegible]	8[illegible],[illegible]	[illegible],[illegible]	47,[illegible]	[illegible],[illegible]
Great Britain	1,5[illegible],277	7[illegible],[illegible]	[illegible],7[illegible]	[illegible],[illegible]	1,[illegible],[illegible]	7[illegible],[illegible]
United States	[illegible]	1,0[illegible]	.....	.....	.....	.....
Total	1,8[illegible],3[illegible]	[illegible],4[illegible]	[illegible],[illegible]	[illegible],1[illegible]	[illegible],[illegible]	[illegible],[illegible]
Shirtings, gray (sq. yards):						
France	1[illegible]	12	.....	.....	[illegible]	[illegible]
Germany	[illegible]	27	.....	.....	[illegible]	[illegible]
Great Britain	69,814,238	5,555,116	52,[illegible]	[illegible]	8[illegible],7[illegible]	[illegible],[illegible]
Holland	.....	.....	.....	.....	[illegible]	[illegible]
United States	25,490	2,[illegible]	.....	.....	[illegible]	[illegible]
Total	69,839,980	5,558,[illegible]	[illegible],[illegible]	[illegible],[illegible]	[illegible],[illegible]	[illegible],[illegible]

PRINCIPAL IMPORTS INTO JAPAN FROM VARIOUS FOREIGN COUNTRIES IN EACH YEAR FROM 1898 TO 1900—Continued.

ARTICLES AND COUNTRIES WHENCE IMPORTED.	1900		1899		1898	
	Quantities.	Values.	Quantities.	Values.	Quantities.	Values.
Shirtings, white (sq. yards):		*Yen.*		*Yen.*		*Yen.*
Germany	2,424	501	10,988	1,233	46,974	3,780
Great Britain	12,105,876	1,250,610	4,657,405	489,463	7,829,202	702,781
Holland	647,272	59,241	225,236	19,101	8,000	703
United States	93,150	14,700	61,188	7,789	9,107	1,026
Other countries	321	88	883	219	225	55
Total	12,849,043	1,325,141	4,955,700	517,808	7,893,508	708,348
Shirtings, twilled (sq. yards):						
Germany	21,084	3,012	7,911	1,115	63,593	7,793
Great Britain	2,622,759	333,977	326,336	36,003	865,650	101,113
Holland	19,774	2,038				
Switzerland					7,333	1,210
United States					24,731	4,458
Other countries					1,981	329
Total	2,663,617	339,028	334,247	37,118	963,288	114,905
Turkey-red cambrics (sq. yards):						
France					32,000	3,512
Great Britain	3,121,399	405,487	3,452,834	408,830	3,844,197	395,095
Switzerland	166,630	19,284	77,845	8,135	335,720	35,286
Total	3,288,029	424,771	3,530,679	416,966	4,211,917	433,891
Victoria lawns (sq. yards):						
Great Britain	4,151,833	281,718	2,699,280	159,079	1,819,737	104,096
Other countries			13,808	834		
Total	4,151,833	281,718	2,713,088	159,913	1,819,737	104,096
Wool (kin):						
Australia	1,117,416	760,219	1,325,943	941,117	1,120,232	722,881
Belgium	568,640	824,661	423,813	520,584	53,470	55,941
British India	62,671	36,738	365,056	151,732	217,147	77,441
China	999,513	282,961	3,475,133	810,616	689,628	205,425
Egypt					4,728	1,310
France	101,683	156,055	275,147	315,903	69,902	66,099
Germany	1,070,506	1,258,650	1,122,868	1,065,850	341,196	250,474
Great Britain	593,849	600,403	698,357	494,993	337,879	260,355
United States			60,192	23,629	4,620	2,887
Other countries	20	1				
Total	4,514,298	3,919,693	7,746,509	4,324,426	2,838,801	1,642,819
Woolen and worsted yarns (kin):						
Belgium	5,613	5,373				
France	8,838	19,231	1,215	1,238	12,306	15,058
Germany	1,067,544	1,601,154	309,410	420,035	627,448	693,140
Great Britain	159,662	172,764	168,656	172,063	82,336	76,276
Other countries	10	11			749	717
Total	1,241,667	1,798,535	479,311	593,337	722,839	785,192
Flannels (sq. yards):						
Austria					4,455	2,078
Belgium	5,241	3,257			3,820	2,037
France	22,896	13,200	959	524	9,586	3,974
Germany	1,456,631	846,076	713,468	347,744	2,680,316	1,195,013
Great Britain	89,818	54,881	52,114	26,679	312,380	156,933
Other countries	595	516	22	10		
Total	1,575,181	917,931	766,563	374,959	3,010,557	1,360,037
Flannels, in part of wool (sq. yards):						
Belgium	9,101	5,327			1,534	924
France	3,679	1,759	7,466	3,922		
Germany	139,981	85,655	31,703	10,822	12,764	5,106
Great Britain	749,604	350,487	232,550	106,055	151,410	59,582
Holland	5,549	1,604				
Other countries			74	26		
Total	907,914	444,835	271,793	120,826	165,708	65,613
Italian cloths, satins (sq. yards):						
Austria	13,598	7,045				
Belgium	24,797	9,802	16,411	4,093	3,935	2,402
Germany	142,600	71,156	58,036	25,288	386,979	141,455
Great Britain	2,478,872	1,032,589	3,049,004	1,102,627	2,752,581	924,412
Other countries	168	142	1,358	565		
Total	2,660,035	1,120,737	3,124,809	1,132,575	3,143,495	1,068,270
Mousseline de laine (all kinds) (sq. yards):						
Austria					7,919	1,779
Belgium	126,380	39,862	165,252	37,396		
France	16,341,269	4,746,741	11,872,554	2,832,664	17,947,074	3,763,330
Germany	3,434,819	1,020,065	1,649,724	402,201	1,303,269	278,783
Great Britain	97	29	46,001	9,050	57,212	10,593
Italy	35,615	10,750	8,922	1,747		
Switzerland	5,331,377	1,547,532	4,477,891	1,067,874	1,773,446	354,265
Other countries	37	9				
Total	25,269,594	7,364,991	18,220,344	4,350,934	21,088,920	4,408,752

ARTICLES AND COUNTRIES WHENCE IMPORTED.	1900		1899		1898	
	Quantities.	Values.	Quantities.	Values.	Quantities.	Values.
Serges (sq. yards):		*Yen.*		*Yen.*		*Yen.*
Belgium	[illegible]	23,666				
France	52,881	31,231	73	92		
Germany	292,029	196,051	23,041	15,556	11,[illegible]	4,848
Great Britain	1,034,338	867,847	91,181	61,875	56,487	32,222
Holland	49,196	36,020	2,196	1,049		
Italy	7,903	4,758				
Other countries	16	11	28[illegible]	776		
Total	1,465,893	1,162,418	117,479	79,346	68,175	[illegible]
Woolen and worsted cloths (sq. yards):						
Austria	32,171	41,578	2,642	2,531	1,712	2,394
Belgium	117,579	149,055	51,125	52,608	19,798	22,012
France	30,624	37,555	44,974	52,607	79,187	61,065
Germany	936,987	965,944	622,393	616,592	1,760,437	1,579,144
Great Britain	1,394,070	1,733,863	1,236,463	1,296,568	1,415,290	1,334,309
Holland	45,275	41,527	18,122	12,499	4,123	3,223
Russia	19	36	6	4	1,651	1,127
Other countries	87	201	897	842	639	419
Total	2,556,792	2,969,762	1,976,622	2,004,198	3,308,158	2,803,607
Woolen and worsted cloths, in part of wool (sq. yards):						
Austria	2,952	2,659	3,068	2,932	4,124	1,523
Belgium	51,485	47,273	16,796	18,069		
France	41,255	30,556	968	854	1,674	947
Germany	343,032	394,209	144,458	93,530	156,178	78,750
Great Britain	3,961,593	2,028,769	918,656	413,196	853,900	362,522
Holland	24,232	20,288				
Italy			3,627	2,735		
Other countries			251	206	500	400
Total	4,424,499	2,433,757	1,087,824	531,553	1,016,376	444,144
Cocoons (kin):						
China	589,813	609,594	804,219	639,951	458,443	211,901
Korea	1,427	1,189	3,543	2,271	159	206
France	5,159	5,113				
Switzerland	2,600	2,714				
Other countries					15	15
Total	598,999	618,611	807,762	642,222	458,617	212,123
Raw silk (kin):						
China	3,173	25,299	167,948	957,615	7,568	28,133
Korea	22	72	873	2,569	3	10
Other countries	93	427	18	151	15	58
Total	3,288	25,800	168,839	960,359	7,636	28,207
Tussah silk yarns (kin):						
China	147,94[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Korea			1,[illegible]	2,[illegible]		
Other countries	297	[illegible]				
Total	148,237	351,359	151,850	375,189	15,760	37,871
Silk yarns (kin):						
China	19,697	32,604	2,652	2,265	9,887	6,794
France	21,100	12,884	15	58	22,122	48,584
Germany	1,667	6,158			11,162	27,518
Italy	7,666	24,392	18	66	16,388	43,185
Switzerland	8,113	20,578			[illegible]	[illegible]
Other countries	151	[illegible]				
Total	55,[illegible]	97,147	2,[illegible]	2,[illegible]	[illegible]	[illegible]
Satins (sq. yards):						
China	57,489	94,210	45,409	73,602	173,933	224,412
France	1,340	2,233	793	1,773	548	484
Great Britain	921	1,805	51	181	6,337	4,891
Other countries	24	39	117	279	88	170
Total	59,724	98,320	46,370	75,836	180,946	229,958
Plush or velvets, silk and cotton mixture (square yards):						
France	1,559	2,974	34,124	47,541	682	1,205
Germany	9,371	13,453	34,982	41,496	32,842	34,891
Great Britain	690,583	968,506	426,864	586,192	394,649	563,395
Total	701,513	984,934	495,970	675,230	428,174	599,495
Flax, hemp, jute, and China grass (kin):						
Australia	469,160	61,949	279,331	36,675		
Belgium	30,760	9,486				
British India	1,741,781	132,593	3,450,014	220,875	2,191,794	101,149
China	9,149,502	991,794	5,935,748	611,025	3,786,037	394,047
French India	4,0[illegible]	220	44,900	5,984		
Great Britain	74,77[illegible]	21,239				
Italy	10,000	2,488				
Philippine Islands	2,979,935	477,297	2,899,279	370,276	1,252,904	95,198
Other countries	54,563	3,347	1,524	213	2,114	121
Total	14,514,147	1,700,409	12,610,796	1,245,048	7,232,849	590,517

PRINCIPAL IMPORTS INTO JAPAN FROM VARIOUS FOREIGN COUNTRIES IN EACH YEAR FROM 1898 TO 1900—Continued.

ARTICLES AND COUNTRIES WHENCE IMPORTED.	1900		1899		1898	
	Quantities.	Values.	Quantities.	Values.	Quantities.	Values.
Flax or linen yarns (kin):		Yen.		Yen.		Yen.
Austria	6,725	5,542				
British India					103,175	10,362
China	113	92	3,277	2,704	6,322	4,658
Great Britain	359,470	318,908	488,862	358,919	360,723	235,157
Other countries					507	807
Total	357,308	324,543	492,139	361,624	470,727	250,985
Linen tissues (sq. yards):						
Austria	10,028	2,262	2,604	258		
China	2,992	1,260	11,112	1,704	29,243	5,278
France	3,675	1,584	7,873	2,216	653	869
Germany	23,500	5,193	6,161	1,614	4,292	887
Great Britain	958,733	240,419	292,729	68,810	745,451	163,218
Russia	195	50	27	10	4,098	2,541
Other countries	1,908	437	688	152	344	169
Total	1,000,981	251,115	321,101	74,819	782,991	172,816
Blankets (kin):						
Austria	37	11	201	217	1,600	1,195
Belgium	3,658	2,334			789	1,289
France	663	1,472	1,348	1,277	2,326	2,018
Germany	87,624	102,491	20,413	25,219	28,410	28,949
Great Britain	363,026	281,611	262,074	198,955	578,775	484,903
Holland	6,913	2,895	467	638		
Switzerland	1,397	2,195	842	1,216	912	1,182
United States	619	1,078	268	263	148	158
Other countries			816	1,247	21	18
Total	462,827	393,635	286,360	229,035	612,402	519,685
Cotton handkerchiefs (all kinds):						
France		5,999		340		354
Germany		150		9,576		33,902
Great Britain		342,922		308,828		244,046
Switzerland		18,583		44,034		23,188
Other countries		15		13		456
Total		367,363		362,792		301,948
Traveling rugs (kin):						
Germany	40,502	71,538	14,904	22,890	9,186	17,682
Great Britain	130,730	138,731	98,824	96,717	169,152	147,864
Other countries	35	116	342	828	18	23
Total	171,268	210,387	114,070	120,436	178,356	165,571
Cigarettes, rolled in paper (mille):						
British America					1,400	4,069
China			63	239	6,259	14,087
Egypt	24	1,403	692	6,505	888	7,267
Germany	6,752	17,778	16,497	47,944	15,527	40,399
Great Britain	21,968	40,451	160,476	287,287	160,235	423,346
Italy	647	4,191	1,186	9,293	1,207	9,118
Philippine Islands	12	293	19	27	15,850	12,476
Russia	3	8	3	240	2,069	5,247
United States	14,513	31,450	145,563	407,922	518,101	1,203,283
Other countries	880	4,256	135	1,122	211	1,530
Total	45,127	99,828	264,513	760,594	721,847	1,720,827
Tobacco, leaf (kin):						
China			1,789,210	222,809	24,132,109	2,904,671
Corea			1,549	245	34,869	3,986
Dutch India					4,101	1,427
Philippine Islands			1,784	395	16,218	1,904
Turkey			17,662	23,856	14,133	16,260
United States	1,623,139	454,126	14,428,158	4,838,922	6,607,798	1,598,233
Other countries	145	166	402	143	3,738	1,175
Total	1,623,284	454,292	16,238,757	5,086,351	30,813,296	4,527,659
Wine, in casks (liter):						
France	455,120	88,[illegible]	881,[illegible]	140,[illegible]	2,592,215	296,930
Germany	78,[illegible]	14,[illegible]	13,813	3,[illegible]	64,894	7,221
Great Britain	1,892	[illegible]	300	175	4,[illegible]	1,398
Italy	641,7[illegible]	64,8[illegible]	26,[illegible]	5,029	9,165	3,273
Portugal	811	[illegible]	242,[illegible]	27,104		
Spain	26,[illegible]	5,011	278,739	34,064	357,210	32,152
United States	288,7[illegible]	51,691	146,761	25,[illegible]	272,895	37,649
Other countries	1,70[illegible]	324	649	138	1,781	224
Total	1,401,8[illegible]	223,541	1,573,8[illegible]	236,080	3,302,459	382,057
Celluloid (kin):						
Belgium	390	428	634	1,157		
France	1,[illegible]40	4,54[illegible]	78	98	7,71[illegible]	11,2[illegible]
Germany	10[illegible]48	183,092	30,694	70,317	82,719	1[illegible],127
Great Britain	109,[illegible]95	208,[illegible]	59,[illegible]	12[illegible],784	86,277	170,363
United States	24,[illegible]	44,088	20,972	35,89[illegible]	31,581	61,896
Other countries	1,[illegible]	891				
Total	241,[illegible]	442,[illegible]	122,113	244,2[illegible]	215,286	406,678

ARTICLES AND COUNTRIES WHENCE IMPORTED.	1900		1899		1898	
	Quantities.	Values.	Quantities.	Values.	Quantities.	Values.
Cement, Portland (kin):		Yen.		Yen.		Yen.
Belgium	8,595	154	7,582	10[illegible]	14,134,[illegible]	93,270
France			11,196	282	1[illegible]	1,643
Germany	2,747,938	58,316	31,839	845	6,[illegible]	63,762
Great Britain	3,196,949	59,177	4,803,187	76,[illegible]	11,[illegible]	198,377
Hongkong	142,504	2,25[illegible]				
Italy			106,292	99[illegible]	[illegible]	5,648
United States	16,557	238	8,328	15[illegible]	[illegible]	1,203
Other countries	35,507	810	16,440	391	9,757	114
Ttotal	6,148,050	120,945	4,984,864	79,25[illegible]	[illegible]	273,821
Coal (tons):						
China	15	104			1,475	14,759
Great Britain	83,062	1,829,490	51,118	936,653	40,[illegible]	378,978
United States	15,543	270,140	28	355	11	84
Other countries	40	318	8	85	770	5,371
Total	98,660	2,100,053	51,151	937,094	42,297	399,189
Coke (tons):						
Australia	1,102	25,022			215	2,[illegible]
Belgium	259	8,711				
British America	300	10,620		13		
Germany	913	28,636	1,148	21,42[illegible]	4,[illegible]	[illegible]
Great Britain	7,357	241,642	4,[illegible]	113,15[illegible]	5,[illegible]	[illegible]
Other countries	2	57			2	24
Total	9,933	314,090	6,[illegible]	134,58[illegible]	[illegible]	86,263
Malt (kin):						
Austria	182,423	17,845	56,750	6,033	[illegible]	62,173
Germany	5,125,242	576,158	3,899,709	437,125	2,[illegible]	[illegible]
United States	334,866	25,218	303,223	25,460	[illegible]	2,647
Total	5,642,531	619,219	4,261,683	468,619	[illegible]	[illegible]
Bone, animal, for manure (kin):						
Australia					7,7[illegible]	15,9[illegible]
China	8,280,669	170,[illegible]	9,2[illegible]	155,821	12,2[illegible]	170,396
Korea	1,602,310	30,447	1,67[illegible]	26,646	1,[illegible]	18,478
Russian Asia	355,214	7,671	[illegible]	4,748	1,[illegible]	16,525
Other countries	34,967	79[illegible]			[illegible]	2,[illegible]
Total	10,273,130	209,827	11,188,7[illegible]	186,715	15,[illegible]	221,[illegible]
Dried sardine, for manure (kin):						
Korea	6,986,981	235,597	1,289,411	41,409	5,300,613	128,282
Russian Asia			1,211,295	47,834		
Total	6,986,981	235,597	2,500,706	89,24[illegible]	5,300,613	128,282
Oil cake (picul):						
China	2,006,326	4,540,824	2,616,507	6,017,237	2,098,250	4,610,625
Korea	4,883	8,330	3,893	7,027	3,008	4,099
Russian Asia	269,098	1,146,115	175,050	737,156		
Other countries	370	1,121	54	390	82	242
Total	2,280,687	5,696,456	2,795,504	6,791,812	2,101,210	4,614,967
Phosphatic manure (kin):						
Australia	4,247,147	73,115	17,781	722		
Belgium			169,342	7,405	1,495,887	27,483
British India	2,309,421	41,672				
Germany	844,045	17,470	3,998,707	97,959	2,[illegible]	51,677
Great Britain	188,722	11,614	1,240,792	40,997	1,487,575	61,584
United States	21,913,032	348,474	18,981,710	252,960	12,279,[illegible]	[illegible]
Other countries	15,892,621	296,759	29,339,809	293,579	12,807,[illegible]	[illegible]
Total	45,305,038	789,106	53,739,132	693,625	30,334,[illegible]	[illegible]
Pulp (kin):						
Austria	659,227	45,051				
Belgium	41,866	3,669				
British America	486	37	2,871,488	116,795	378,917	7,189
Denmark	16,934	1,[illegible]			[illegible]	4,[illegible]
Germany	4,815,791	[illegible]	2,[illegible]	12[illegible]	[illegible]	[illegible]
Great Britain	231,969	14,716	1,068,[illegible]	64,[illegible]	[illegible]	8,[illegible]
Italy	16,656	1,144				
Sweden and Norway	629,643	42,[illegible]	[illegible]	21,848	[illegible]	[illegible]
United States	294,536	12,[illegible]	17,[illegible]	7,[illegible]	[illegible]	[illegible]
Total	6,707,118	4[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Timber, teak (cubic feet):						
British India			9,[illegible]	27,8[illegible]	[illegible]	[illegible]
Dutch India	2,629	4,564	1,[illegible]	8,372	[illegible]	185
French India					1,[illegible]	5,641
Siam	96,981	224,019	70,[illegible]	1[illegible],584	[illegible]	27,[illegible]
Other countries			120	228		
Total	99,610	228,584	81,542	142,502	52,250	91,935

PRINCIPAL IMPORTS INTO JAPAN FROM VARIOUS FOREIGN COUNTRIES IN EACH YEAR FROM 1898 TO 1900—Continued.

ARTICLES AND COUNTRIES WHENCE IMPORTED.	1900		1899		1898	
	Quantities.	Values.	Quantities.	Values.	Quantities.	Values.
Timber, santalum, and other lumber and planks:		*Yen.*		*Yen.*		*Yen.*
Australia	.....	11,598	.....	1,573	.....	128
British America	.....	9,518	.....	2,283	.....	29,181
British India	.....	1,610	.....	8,482	.....	10,189
China	.....	159,641	.....	106,6[illegible]	.....	59,184
Korea	.....	17,387	.....	14,9[illegible]	.....	11,728
French India	.....	18,931	.....	11,180	.....	4,662
Germany	.....	4,430	.....	5,146	.....	10
Great Britain	.....	23,398	.....	4,027	.....	2,797
Hongkong	.....	6,241	.....	571	.....	.....
Siam	.....	16,462	.....	3,340	.....	2,333
Spain	.....	1,926	.....	.....	.....	.....
United States	.....	363,929	.....	232,154	.....	116,716
Other countries	.....	5,048	.....	4,025	.....	5,414
Total	.....	640,756	.....	394,136	.....	242,645
Belting and hose, for machinery:						
Australia	.....	.....	.....	.....	.....	2,241
Belgium	.....	667	.....	3,058	.....	.....
Germany	.....	77,756	.....	40,865	.....	19,128
Great Britain	.....	260,850	.....	103,446	.....	89,111
Holland	.....	4,689	.....	5,278	.....	514
United States	.....	89,078	.....	58,365	.....	75,619
Other countries	.....	342	.....	651	.....	413
Total	.....	433,386	.....	211,665	.....	187,029
Caoutchouc, manufactures of:						
Austria	.....	7,818	.....	175	.....	.....
Belgium	.....	26,163	.....	10,692	.....	11,697
France	.....	34,188	.....	26,393	.....	19,584
Germany	.....	172,254	.....	88,684	.....	122,060
Great Britain	.....	75,983	.....	62,575	.....	87,915
Holland	.....	.....	.....	1,179	.....	.....
Italy	.....	1,516	.....	425	.....	8,115
United States	.....	14,453	.....	14,252	.....	29,543
Other countries	.....	479	.....	204	.....	1,037
Total	.....	332,859	.....	204,581	.....	279,954
Cardboard (kin):						
Austria	121,793	14,234	13,452	1,425	.....	.....
France	24,721	3,896	352	60	.....	.....
Germany	960,513	91,797	1,167,987	66,209	1,163,736	83,900
Great Britain	20,201	2,488	15,844	2,061	7,513	1,062
Russia	50,000	2,499	.....	.....	.....	.....
Sweden and Norway	20,565	1,279	.....	.....	.....	.....
United States	2,147,608	230,898	1,229,256	138,905	217,452	17,878
Total	3,345,431	347,094	2,426,891	208,663	1,388,701	102,840
Bicycles and tricycles:						
Australia	.....	.....	.....	.....	.....	4,833
British America	.....	46	.....	183	.....	1,283
France	.....	202	.....	1,664	.....	3,036
Germany	.....	1,719	.....	3,401	.....	1,611
Great Britain	.....	8,836	.....	4,261	.....	23,699
Holland	.....	25	.....	1,324	.....	686
United States	.....	510,104	.....	216,030	.....	205,089
Other countries	.....	76	.....	283	.....	627
Total	.....	521,070	.....	227,149	.....	240,866

ARTICLES AND COUNTRIES WHENCE IMPORTED.	1900		1899		1898	
	Quantities.	Values.	Quantities.	Values.	Quantities.	Values.
Railway passengers:		*Yen.*		*Yen.*		*Yen.*
France	.....	.....	.....	.....	.....	15,272
Germany	.....	35,058	.....	.....	.....	35,015
Great Britain	.....	424,050	.....	241,343	.....	1,068,060
Holland	.....	[illegible]	.....	.....	.....	.....
United States	.....	47,150	.....	5,592	.....	12,445
Total	.....	531,482	.....	246,935	.....	1,100,823
Railway freight:						
Belgium	.....	.....	.....	.....	.....	38,731
France	.....	4,628	.....	14,299	.....	5,090
Germany	.....	36,688	.....	32,013	.....	56,127
Great Britain	.....	671,782	.....	326,315	.....	221,704
United States	.....	91,879	.....	51,897	.....	8,826
Total	.....	804,989	.....	434,426	.....	330,280
Corks (kin):						
Belgium	25,677	9,521	.....	.....	.....	.....
France	37,569	24,795	12,059	8,345	15,169	7,774
Germany	252,709	179,792	117,498	86,810	133,071	95,096
Great Britain	79,929	57,652	47,575	44,603	28,863	24,075
Holland	2,935	3,437	.....	.....	.....	.....
Philippine Islands	91,895	13,477	.....	.....	.....	.....
Portugal	6,665	1,583	624	260	4,870	620
Spain	28,264	10,985	39,091	19,596	59,426	21,195
Other countries	4,361	1,238	8,126	1,503	2,089	996
Total	530,064	302,531	224,973	161,149	263,485	150,762
Dynamite (kin):						
Belgium	37,800	15,864	.....	.....	31,875	13,757
Germany	292,872	112,223	331,509	131,007	881,812	395,071
Great Britain	120,959	59,080	239,875	113,295	171,675	98,762
Total	451,631	187,169	571,384	244,303	1,085,362	507,591
Electric-light wire:						
Germany	.....	6,114	.....	1,379	.....	2,008
Great Britain	.....	42,484	.....	35,387	.....	168,320
United States	.....	128,144	.....	108,675	.....	151,170
Total	.....	176,744	.....	145,442	.....	321,499
Mats, packing (number):						
China	4,427,141	220,490	3,680,567	169,139	3,483,592	165,624
Hongkong	21,680	1,281	227,400	10,121	.....	.....
Other countries	1,700	34	300	7	2,600	81
Total	4,450,521	221,807	3,908,267	179,267	3,486,192	165,705
Submarine telegraphic cables and underground telegraphic lines or cables:						
Belgium	.....	5,866	.....	.....	.....	18,549
France	.....	266,983	.....	63,24[illegible]	.....	.....
Germany	.....	194,667	.....	4,5[illegible]	.....	.....
Great Britain	.....	697,265	.....	101,15[illegible]	.....	166,8[illegible]
United States	.....	88,628	.....	24,91[illegible]	.....	8[illegible]7
Total	.....	1,253,411	.....	193,922	.....	185,270

TOTAL VALUE OF COMMODITIES EXPORTED FROM AND IMPORTED INTO JAPAN IN EACH CALENDAR YEAR FROM 1889 TO 1900.

[From official reports of the Japanese Government.]

YEARS.	EXPORTS.			IMPORTS.			Total of exports and imports.	IMPORTS COMPARED WITH EXPORTS.	
	Japanese produce.	Foreign produce.	Total.	Foreign produce.	Japanese produce.	Total.		Increase.	Decrease.
	Yen.	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*
1889	69,306,893.81	753,812.01	70,060,705.82	66,041,584.27	62,182.33	66,103,766.60	136,164,472.42	.....	3,956,939.22
1890	55,791,846.67	811,659.36	56,603,506.03	81,670,354.26	58,226.14	81,728,580.40	138,332,086.43	25,125,074.47	.....
1891	78,738,053.76	789,218.58	79,527,272.34	62,880,670.60	46,597.78	62,927,268.38	142,454,540.72	16,600,003.96	.....
1892	90,404,735.05	698,018.58	91,102,753.63	71,276,942.28	49,137.22	71,326,079.50	162,428,833.13	19,776,074.13	.....
1893	88,950,014.19	762,850.40	89,712,864.59	88,187,628.97	69,542.74	88,257,171.71	177,970,036.30	.....	1,455,692.88
1894	112,171,175.47	1,074,910.68	113,246,086.15	117,371,361.43	110,594.03	117,481,955.46	230,728,041.61	4,235,869.31	.....
1895	131,991,029.82	1,121,148.10	136,112,177.92	129,083,297.32	177,280.96	129,260,578.28	265,372,756.20	.....	6,851,599.64
1896	116,575,578.85	1,267,181.77	117,842,760.62	171,459,555.85	214,918.40	171,674,474.25	289,517,234.87	53,831,713.63	.....
1897	161,459,341.78	1,675,765.54	163,135,077.32	219,155,356.14	145,415.50	219,300,771.64	382,435,848.96	56,165,694.32	.....
1898	162,903,212.36	2,850,540.52	165,753,752.88	277,270,728.90	231,427.61	277,502,156.51	443,255,909.39	111,748,403.63	.....
1899	212,952,136.47	1,977,757.84	214,929,894.31	220,050,983.74	350,942.25	220,401,925.99	435,331,820.30	5,472,031.68	.....
1900	200,178,993.38	4,251,000.60	204,429,993.98	286,588,420.70	673,424.88	287,261,845.58	491,691,839.56	82,831,851.60	.....

Value of yen on January 1, 1885, in United States money, 85.8 cents; 1889, 75.2 cents; 1891, 83.1 cents; 1892, 74.5 cents; 1893, 66.1 cents; 1894, 55.6 cents; 1895, 49.1 cents; 1896, 52.9 cents; 1897, 51.1 cents; 1898 to 1900, 49.8 cents.

TOTAL VALUE OF COMMODITIES EXPORTED FROM AND IMPORTED INTO JAPAN BY JAPANESE AND FOREIGNERS, RESPECTIVELY, IN EACH CALENDAR YEAR FROM 1889 TO 1900.

[From official reports of the Japanese Government.]

YEARS.	EXPORTS BY—			IMPORTS BY—			TOTAL BY—		
	Japanese.	Foreigners.	Total.	Japanese.	Foreigners.	Total.	Japanese.	Foreigners.	Total.
	Yen.	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*
1889	6,784,587.98	61,641,543.12	68,423,131.10	9,645,761.69	54,349,247.96	63,995,009.65	16,427,349.67	115,990,791.08	132,418,140.75
1890	6,123,961.56	48,767,635.82	54,891,597.38	19,521,764.71	61,033,109.96	80,554,874.67	25,645,726.27	109,800,745.78	135,446,472.05
1891	8,770,764.83	69,144,861.87	77,915,626.70	14,276,380.05	47,692,803.45	61,969,183.50	23,047,144.88	116,837,665.32	139,884,810.20
1892	11,395,210.47	77,943,923.79	89,339,134.26	13,812,662.45	56,263,748.15	70,076,410.60	25,207,872.92	134,207,671.94	159,415,544.86
1893	13,654,984.51	74,485,809.36	88,140,793.87	16,693,902.29	70,903,193.03	87,597,095.32	30,348,886.80	145,389,002.39	175,737,889.19
1894	20,252,975.28	90,846,710.15	111,099,685.43	37,947,793.12	82,333,554.38	116,281,350.50	58,200,777.40	173,180,264.53	231,381,040.93
1895	26,328,816.42	107,188,169.46	133,516,985.88	38,829,338.48	88,431,505.96	127,260,844.44	65,158,154.90	195,619,675.42	260,777,830.32
1896	29,565,487.03	85,050,296.42	114,615,783.45	51,211,805.76	118,670,789.46	169,882,595.22	80,777,292.79	203,721,085.88	284,498,378.67
1897	44,574,130.89	115,051,294.14	159,625,425.03	73,969,569.93	145,579,084.69	219,548,654.62	118,543,700.82	260,630,378.83	379,174,079.65
1898	55,060,559.41	107,736,092.45	162,796,651.86	90,472,259.06	184,127,001.44	274,599,260.50	145,532,818.47	291,863,093.89	437,395,912.36
1899	75,248,951.29	136,246,383.34	211,495,334.63	89,351,617.34	129,877,029.79	219,228,647.13	164,600,568.63	266,123,413.13	430,723,981.76
1900	73,381,634.27	124,681,912.40	198,063,546.67	112,737,050.27	173,433,883.08	286,170,933.35	186,118,684.54	371,497,429.48	557,616,114.02

TOTAL VALUE OF EXPORTS FROM AND IMPORTS INTO JAPAN, DISTINGUISHING DUTIABLE AND FREE OF DUTY, IN EACH CALENDAR YEAR FROM 1889 TO 1900.

[From official reports of the Japanese Government.]

EXPORTS.

YEARS.	DUTIABLE.	FREE OF DUTY.			Total.
	Japanese produce.	Japanese produce.	Foreign produce.	Total.	
	Yen.	*Yen.*	*Yen.*	*Yen.*	*Yen.*
1889	45,121,784.02	24,185,109.79	753,812.01	24,938,921.80	70,060,705.82
1890	35,962,240.97	19,829,605.70	811,659.36	20,641,265.06	56,603,506.03
1891	51,073,752.18	27,664,301.58	789,218.58	28,453,520.16	79,527,272.34
1892	59,184,901.14	31,219,833.91	698,018.58	31,917,852.49	91,102,753.63
1893	51,531,241.68	37,418,772.51	762,850.40	38,181,622.91	89,712,864.59
1894	62,860,041.23	49,311,134.24	1,074,910.68	50,386,044.92	113,246,086.15
1895	72,003,836.42	62,987,193.40	1,121,148.10	64,108,341.50	136,112,177.92
1896	50,595,375.47	65,980,203.68	1,267,181.77	67,247,385.15	117,842,760.62
1897	80,738,471.57	80,720,840.21	1,675,765.54	82,396,605.75	163,135,077.32
1898	68,067,035.52	94,836,176.84	2,850,540.52	97,686,717.36	165,753,752.88
1899	32,490,317.95	180,461,818.52	1,977,757.84	182,439,576.36	214,929,894.31
1900	250.00	200,178,743.38	4,251,000.60	204,429,743.98	204,429,993.98

TOTAL VALUE OF EXPORTS FROM AND IMPORTS INTO JAPAN, DISTINGUISHING DUTIABLE AND FREE OF DUTY, IN EACH CALENDAR YEAR FROM 1889 TO 1900—Continued.

IMPORTS.

YEARS.	DUTIABLE.			FREE OF DUTY.			Total.
	Foreign produce.	Japanese produce.	Total.	Foreign produce.	Japanese produce.	Total.	
	Yen.	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*
1889	63,403,344.60	.....	63,403,344.60	2,638,239.67	62,182.33	2,700,422.00	66,103,766.60
1890	65,795,097.97	.....	65,795,097.97	15,875,256.39	58,226.14	15,933,482.53	81,728,580.50
1891	54,822,790.71	.....	54,822,790.71	8,057,879.89	46,597.78	8,104,477.67	62,927,268.38
1892	64,992,861.87	.....	64,299,861.87	6,977,080.41	49,137.22	7,026,217.63	71,326,079.50
1893	79,462,140.41	.....	79,462,140.41	8,725,488.56	69,542.74	8,795,031.30	88,257,171.71
1894	103,195,819.67	.....	103,195,819.67	14,175,541.76	110,594.03	14,286,135.79	117,481,955.46
1895	118,680,124.61	.....	118,680,124.61	10,463,172.71	177,280.96	10,580,453.67	129,260,578.28
1896	130,431,093.81	.....	130,431,093.81	41,028,462.04	214,918.40	41,243,380.44	171,674,474.25
1897	139,975,246.22	.....	139,975,246.22	79,180,100.92	145,415.50	79,325,525.42	219,300,771.64
1898	165,493,049.01	[a] 29,387.45	165,522,436.46	111,777,679.89	202,040.16	111,979,720.05	277,502,156.51
1899	136,477,159.07	12,465.85	136,489,624.92	83,573,824.67	338,476.40	83,912,301.07	220,401,925.99
1900	200,439,717.44	18,289.07	200,458,006.51	86,148,703.26	655,135.81	86,803,839.07	287,261,845.58

[a] Dates before the year 1898 are unprocurable.

TOTAL VALUE OF COMMODITIES IMPORTED INTO JAPAN FROM VARIOUS FOREIGN COUNTRIES IN EACH CALENDAR YEAR FROM 1892 TO 1900.

[From official reports of the Japanese Government.]

COUNTRIES WHENCE IMPORTED.	1892	1893	1894	1895	1896	1897	1898	1899	1900
	Silver yen.	*Silver yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*
Australia	272,787.15	319,034.26	534,763.35	1,031,725.05	835,046.40	897,050.20	1,403,436.08	1,708,670.41	2,455,935.35
Austria	10,265.48	21,208.88	19,819.70	25,121.18	40,460.13	85,943.06	591,325.94	1,250,217.44	4,502,476.87
Belgium	951,537.45	935,000.83	1,201,120.78	2,066,244.73	3,106,094.28	3,173,218.44	4,316,703.24	5,415,809.87	7,949,253.70
British America	30,754.46	16,629.04	45,394.83	13,717.77	51,524.83	129,129.12	156,989.45	182,018.54	316,689.29
British India	7,652,093.81	8,679,629.05	10,560,448.31	12,001,810.52	22,527,424.51	29,775,900.09	40,794,244.93	46,935,985.62	22,[illegible]
China	12,509,410.42	17,095,974.88	17,511,506.67	22,985,144.47	21,344,521.22	29,265,845.35	30,523,890.78	28,687,780.80	29,990,740.02
Denmark	6,157.68	2,143.07	3,881.76	8,319.95	14,240.92	7,880.28	14,182.21	3,103.02	10,295.41
France	3,629,500.44	3,305,277.29	4,348,047.61	5,180,134.76	7,682,346.70	5,147,591.51	6,979,982.55	5,768,180.31	8,095,819.49
French India	.....	.....	.....	3,382,672.66	1,673,387.70	9,525,553.20	26,068,444.34	4,489,326.38	3,652,642.55
Germany	6,375,048.23	7,318,133.61	7,909,542.21	12,233,158.88	17,183,953.40	18,143,279.61	25,610,961.70	17,613,191.07	29,199,695.93
Great Britain	20,789,332.07	27,929,628.47	42,189,873.62	45,172,110.85	59,251,780.28	65,406,266.47	62,707,572.95	44,836,993.86	71,638,219.71
Hawaii	647.54	3,689.87	6,147.78	2,163.44	9,926.80	1,414.08	23,950.86	5,622.74	5,265.35
Holland	17,699.13	32,618.97	30,173.78	61,535.28	62,769.21	57,992.40	242,988.98	[illegible]	[illegible]
Hongkong	6,985,722.57	8,268,071.13	8,999,718.10	8,078,189.52	9,133,777.66	12,027,197.39	15,904,466.62	7,338,454.82	10,659,855.18
Italy	67,679.96	86,578.31	170,339.83	148,465.18	182,923.85	213,266.52	385,818.86	236,988.12	459,104.06
Korea	3,046,339.96	1,999,438.76	2,183,313.19	2,925,399.73	5,118,925.05	8,864,359.55	4,796,032.29	4,976,167.25	8,895,618.20
Peru	6,032.28	2,065.22	433.32	3,377.94	5,312.06	288.74	2,984.12	2,438.18	10,681.48
Philippine Islands	475,122.58	567,133.47	1,698,848.67	1,220,744.35	1,894,944.41	2,675,336.34	3,294,732.83	2,[illegible]	2,[illegible]
Portugal	6,049.94	6,126.57	4,329.01	7,175.24	15,339.32	24,025.48	18,[illegible]	[illegible]	[illegible]
Russia	835,395.12	1,871,113.47	1,173,774.27	46,045.97	97,655.92	47,932.93	116,280.60	49,123.36	309,227.15
Russian Asia				1,371,612.45	1,318,893.01	1,859,683.76	1,694,169.84	4,534,119.77	5,716,765.24
Siam	4,381.88	54,390.52	618,859.15	143,095.42	203,275.11	1,190,968.90	4,173,009.62	757,029.54	385,180.40
Spain	33,155.84	48,164.95	43,463.35	47,148.03	86,495.57	93,080.85	130,990.67	101,718.49	74,867.82
Sweden and Norway	49,816.24	7,679.34	18,623.32	208,335.23	117,460.60	85,279.91	128,546.39	120,683.49	390,749.85
Switzerland	713,659.16	669,301.19	629,207.60	1,040,211.52	2,534,217.39	2,555,904.80	3,498,309.98	1,676,669.28	3,012,504.52
Turkey	813.72	8,992.04	3,446.24	5,584.39	328.38	8,226.06	17,288.05	26,052.89	25.00
United States of America	5,998,053.56	6,090,408.40	10,982,558.44	9,276,360.35	16,373,419.85	27,030,537.56	40,001,097.52	38,215,894.42	62,761,196.48
Other countries	867,820.83	2,916,340.12	6,594,350.54	574,973.22	907,819.56	1,007,655.04	3,325,135.16	5,190,471.95	10,157,067.35

VALUE OF COMMODITIES EXPORTED FROM JAPAN TO VARIOUS FOREIGN COUNTRIES IN EACH CALENDAR YEAR FROM 1892 TO 1900.

[From official reports of the Japanese Government.]

COUNTRIES TO WHICH EXPORTED.	1892	1893	1894	1895	1896	1897	1898	1899	1900
	Silver yen.	*Silver yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*
Australia	731,658.69	890,637.44	1,098,065.78	1,281,103.91	1,458,253.20	1,875,169.76	1,995,679.86	2,169,921.42	2,530,524.75
Austria	341,932.20	322,120.39	465,186.56	450,625.57	539,278.58	258,371.95	349,826.24	674,527.25	497,194.50
Belgium	50,125.11	226,284.04	19,479.58	131,944.25	111,467.25	109,311.85	101,164.59	331,415.37	295,511.66
British America	1,088,407.02	1,720,559.42	2,211,686.56	1,986,169.23	1,594,045.14	2,054,619.85	2,365,629.48	2,358,099.31	2,950,662.78
British India	1,422,289.00	2,471,079.16	3,688,158.89	4,359,236.00	4,537,652.98	5,563,332.74	6,134,449.64	6,062,049.00	8,704,318.31
China	6,358,859.58	7,714,420.08	8,813,987.38	9,135,108.66	13,823,843.67	21,325,065.42	29,193,175.14	40,257,034.10	31,871,576.09
Denmark	365.00	1,377.00	1,125.40	5,347.28	8,358.34	9,823.69	66,350.80	21,798.07	18,955.69
France	18,093,693.59	19,531,975.34	19,498,776.22	22,006,286.03	19,027,389.31	26,213,654.45	20,496,406.54	29,247,837.06	19,150,422.97
French India	.....	.....	24,522.98	17,554.74	30,459.95	35,513.09	111,429.79	161,048.38	114,407.14
Germany	940,782.71	1,380,010.44	1,517,548.89	3,340,012.75	2,972,136.90	2,207,018.41	2,469,241.57	3,796,927.37	3,555,613.60
Great Britain	3,921,752.83	4,995,974.46	5,950,197.94	7,883,091.34	9,012,398.02	8,481,195.69	7,783,613.21	11,270,770.44	11,262,997.46
Hawaii	62,136.71	197,522.69	313,908.17	393,689.54	513,188.13	524,179.67	717,356.91	1,351,949.85	1,294,789.55
Holland	19,550.18	140,683.20	136,871.30	283,382.89	231,221.55	261,023.78	372,997.04	322,155.20	119,028.00
Hongkong	13,288,540.08	15,688,874.71	16,199,480.73	18,362,802.92	19,965,899.72	25,360,293.92	31,473,895.70	34,291,307.89	39,177,455.34
Italy	1,254,330.56	1,631,907.68	2,900,389.62	3,550,735.95	2,669,106.08	2,981,889.02	2,485,361.95	3,581,709.13	7,129,310.64
Korea	1,410,699.03	1,301,242.87	2,365,111.58	3,831,476.96	3,367,693.27	5,196,572.81	5,844,331.73	6,995,931.35	9,953,271.84
Peru	1,011.00	821.65	.....	7,180.34	1,931.15	7,369.70	1,735.50	4,764.29	3,426.00
Philippine Islands	96,530.69	120,416.98	220,586.84	194,831.66	187,785.72	186,383.13	115,433.04	286,771.92	1,257,125.83
Portugal	.....	85.60	.....	.....	500.00	550.00	855.25	.....	977.17
Russia	585,695.44	621,838.32	27,594.30	75,222.55	129,656.70	177,615.59	469,693.82	616,891.61	626,925.15
Russian Asia			992,754.68	1,247,523.07	1,780,928.13	1,861,727.17	2,181,971.59	2,556,093.02	3,541,833.15
Siam	3,485.60	6,402.75	2,953.40	7,930.44	9,892.21	22,466.42	41,729.03	26,614.03	35,621.57
Spain	3,160.93	6,848.65	52,307.11	48,422.63	20,705.00	30,700.07	38,195.15	57,731.61	20,503.62
Sweden and Norway	2,863.78	165.45	576.00	185.00	2,452.90	2,841.38	9,324.28	12,042.71	4,902.14
Switzerland	159,583.66	227,141.23	703,021.00	467,718.11	617,707.01	897,046.97	236,686.32	111,577.72	117,877.66
Turkey	43,646.38	7,619.83	16,744.45	62,215.79	37,093.53	33,915.50	44,856.97	92,650.56	54,940.25
United States of America	38,674,971.36	27,739,458.31	43,323,557.06	54,028,950.20	31,532,341.13	52,436,404.48	47,311,154.90	63,919,270.10	52,566,395.49
Other countries	783,063.13	1,195,295.18	753,097.11	358,138.57	432,400.88	1,244,368.51	393,282.82	916,625.87	1,299,577.72

TOTAL VALUE OF COMMODITIES EXPORTED FROM AND IMPORTED INTO EACH PORT OF JAPAN IN EACH CALENDAR YEAR FROM 1889 TO 1900.

[From official reports of Japanese Government.]

YEARS.	YOKOHAMA.		KOBE.		OSAKA.	
	Exports.	Imports.	Exports.	Imports.	Exports.	Imports.
	Yen.	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*
1889	41,862,129.11	34,320,917.30	20,331,552.73	26,035,330.99	261,013.29	2,131,442.08
1890	32,331,989.74	40,645,761.70	16,955,413.11	32,041,003.99	451,180.05	3,350,519.12
1891	49,540,893.51	28,982,815.63	21,733,717.73	25,700,501.48	981,103.01	4,084,704.78
1892	61,552,203.97	31,328,904.04	21,295,740.34	30,698,176.54	1,258,531.59	5,547,370.39
1893	55,209,586.46	36,305,069.01	24,968,974.26	41,294,276.35	1,212,891.62	6,504,997.16
1894	73,015,678.12	50,447,371.64	29,438,113.05	56,910,503.26	764,367.50	4,014,813.39
1895	84,791,633.51	56,095,829.78	38,307,954.53	63,098,426.70	1,131,699.58	2,621,261.49
1896	61,696,108.13	72,803,798.70	40,317,816.97	82,546,592.70	1,141,326.10	4,213,790.89
1897	90,700,984.57	86,836,855.03	51,408,079.75	110,741,830.56	2,342,437.47	4,424,742.17
1898	80,312,435.10	111,014,139.55	60,119,645.42	138,133,797.61	3,165,081.56	3,555,936.75
1899	108,278,729.49	76,453,005.11	75,320,884.41	120,289,524.49	6,244,298.30	6,405,091.49
1900	96,125,275.50	109,775,317.03	69,706,548.92	137,481,281.27	9,626,595.06	9,741,436.59

YEARS.	NAGASAKI.		HAKODATE.		OTHER PORTS.	
	Exports.	Imports.	Exports.	Imports.	Exports.	Imports.
	Yen.	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*
1889	6,193,062.53	2,912,842.75	781,446.59	117,705.59	631,501.57	585,527.89
1890	4,314,391.26	3,410,952.35	823,034.04	676,533.95	1,727,497.83	1,603,809.39
1891	3,842,222.11	2,932,133.00	638,709.00	217,480.61	2,799,626.98	1,009,632.88
1892	3,337,335.73	2,931,761.96	782,858.55	12,100.90	2,876,083.45	807,762.67
1893	3,226,061.65	3,524,199.17	639,626.77	24,322.27	4,455,723.83	634,307.75
1894	3,558,711.20	5,413,747.62	668,472.64	55,420.88	5,800,743.64	640,098.67
1895	4,244,197.89	6,370,689.25	748,388.46	160,361.88	6,885,303.95	914,009.18
1896	4,948,028.81	10,024,383.16	898,706.98	330,716.08	8,840,773.63	1,755,492.72
1897	5,542,012.74	13,601,233.64	1,264,266.61	423,723.70	11,877,296.18	3,272,386.57
1898	6,587,275.77	19,698,645.59	1,248,719.31	820,020.13	14,320,595.72	4,279,616.88
1899	6,207,771.46	11,147,510.08	2,116,050.96	1,726,462.14	16,762,159.69	4,380,332.68
1900	6,939,120.46	15,427,337.60	2,127,614.11	3,009,284.25	19,904,839.93	11,824,188.84

TOTAL VALUE OF SPECIE AND BULLION EXPORTED FROM AND IMPORTED INTO JAPAN IN EACH CALENDAR YEAR FROM 1889 TO 1900.

[From official reports of Japanese Government.]

YEARS.	EXPORTS.			IMPORTS.			EXCESS OF—	
	Gold coin and bullion.	Silver coin and bullion.	Total.	Gold coin and bullion.	Silver coin and bullion.	Total.	Imports.	Exports.
	Yen.	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*		
1889	268,009.79	4,920,519.68	5,188,529.47	749,923.51	13,423,322.04	14,173,245.55	[illegible]	[illegible]
1890	1,687,605.62	12,090,925.77	13,778,531.39	360,242.37	840,365.00	1,200,607.37	.....	[illegible]
1891	230,446.28	1,222,517.64	1,452,963.92	283,144.37	13,095,381.88	13,378,526.25	[illegible]	.....
1892	8,544,523.07	1,185,230.00	9,729,753.07	395,493.44	22,488,269.50	22,883,762.94	[illegible]	
1893	2,302,678.14	9,986,510.01	12,289,188.15	496,729.94	10,689,756.77	11,186,486.71	.....	[illegible]
1894	3,547,138.16	30,831,973.08	34,379,114.24	555,966.14	26,227,686.61	26,783,652.75	.....	[illegible]
1895	2,791,951.75	24,509,746.89	27,301,698.64	1,029,912.27	4,844,252.16	5,874,164.43	.....	[illegible]
1896	1,996,575.93	9,602,307.86	11,598,883.79	10,217,458.21	28,921,750.11	39,142,208.32	[illegible]	.....
1897	8,863,797.50	10,355,365.51	19,219,163.01	64,313,492.77	17,153,219.75	81,466,712.52	[illegible]	.....
1898	46,281,343.01	40,706,137.62	86,987,480.63	37,027,752.39	5,536,028.13	42,563,781.[illegible]	.....	[illegible]
1899	8,768,365.15	2,409,881.99	11,178,247.14	20,080,695.82	82,804.92	20,163,500.74	8,9[illegible]	.....
1900	51,761,619.68	4,945,443.37	56,707,063.05	8,967,198.12	2,550,636.99	11,517,835.11	.....	45,189,227.94

DECLARED VALUE OF ARTICLES EXPORTED FROM JAPAN IN VESSELS OF EACH NATIONALITY AND CLASS OF VESSEL DURING EACH CALENDAR YEAR FROM 1893 TO 1900.[a]

[From official reports of Japanese Government.]

EXPORTS.

NATIONALITY AND CLASS OF VESSEL.	1893	1894	1895	1896	1897	1898	1899	1900
Japanese:	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*
Steam vessels	6,594,278	5,746,869	3,453,299	12,543,114	23,098,787	39,574,417	65,410,628	62,573,707.05
Sailing vessels	260,744	307,870	477,121	537,048	964,563	788,868	1,037,121	1,125,407.94
Total	6,855,022	6,054,739	3,930,420	13,080,162	24,063,350	40,363,285	66,447,749	63,699,114.99
American:								
Steam vessels	7,094,235	10,011,732	12,609,343	7,330,401	9,405,871	6,518,450	11,658,606	7,695,212.97
Sailing vessels	1,648,610	2,073,608	1,340,382	707,131	968,620	864,733	703,052	177,680.88
Total	8,742,845	12,085,340	13,949,725	8,037,532	10,374,491	7,383,183	12,361,658	7,872,893.85
British:								
Steam vessels	44,682,061	62,936,982	78,269,645	58,899,283	81,551,881	72,206,082	85,174,651	68,521,486.40
Sailing vessels	1,068,737	1,667,108	1,699,178	160,344	341,332	169,519	310,814	580,441.50
Total	45,750,798	64,604,090	79,968,823	59,059,627	81,893,213	72,336,601	85,485,465	69,101,927.90
French:								
Steam vessels	14,279,421	13,045,372	14,014,475	13,733,174	19,042,457	14,767,413	20,652,030	19,546,656.16
Sailing vessels	43,016	.....	.....	.....	.....	.....	.....	92,165.88
Total	14,322,437	13,045,372	14,014,475	13,733,174	19,042,457	14,767,413	20,652,030	19,638,822.04
German:								
Steam vessels	9,962,150	12,119,428	16,142,602	15,111,469	17,198,081	19,735,210	20,632,724	30,616,142.23
Sailing vessels	519,467	279,103	88,930	47,095	.....	81,613	.....	13,759.91
Total	10,481,617	12,398,531	16,231,532	15,158,564	17,198,081	19,816,823	[illegible]	[illegible]
Russian:								
Steam vessels	190,735	333,504	307,685	206,379	192,160	354,458	859,637	1,271,987.27
Sailing vessels	.....	3,030	601	13,455	9,571	9,468	10,173	5,018.25
Total	190,735	336,534	308,286	219,834	201,731	[illegible]	[illegible]	[illegible]
Norwegian:								
Steam vessels	474,693	672,406	2,666,594	3,707,410	2,433,735	2,993,030	1,139,824	2,959,266.71
Sailing vessels	.....	.....	18,113	.....	6,050	.....	.....	.....
Total	474,693	672,406	2,684,707	3,707,410	2,439,785	2,993,030	1,139,824	2,959,266.71
All other:								
Steam vessels	733,119	1,602,849	2,274,143	1,488,698	4,095,807	4,625,199	3,839,236	3,320,571.71
Sailing vessels	.....	1,777	78,056	52,658	200	62,442	7,651	5,561.19
Total	733,119	1,604,626	2,352,199	1,541,356	4,095,007	4,687,641	3,846,887	3,326,132.90
Total:								
Steam vessels	84,910,692	106,469,142	129,737,786	113,019,958	157,018,779	160,774,259	209,367,336	195,815,010.50
Sailing vessels	3,540,574	4,332,496	3,702,381	1,517,731	2,290,336	1,967,643	2,068,811	2,009,035.55
Total	87,551,266	110,801,638	133,440,167	114,537,689	159,309,115	162,741,902	211,436,147	197,845,046.05
Flag unknown	571,528	483,348	72,869	70,444	74,310	.....	26,788	212,000.62
Total	88,122,794	111,284,986	133,513,036	114,608,133	159,383,425	162,741,902	211,462,935	198,027,046.67

[a] Exclusive of exports for ship's use.

DECLARED VALUE OF ARTICLES IMPORTED INTO JAPAN IN VESSELS OF EACH NATIONALITY AND CLASS OF VESSEL DURING EACH CALENDAR YEAR FROM 1893 TO 1900.[a]

[From official reports of Japanese Government.]

IMPORTS.

NATIONALITY AND CLASS OF VESSEL.	1893	1894	1895	1896	1897	1898	1899	1900
Japanese:	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*
Steam vessels	7,054,129	10,353,694	2,971,196	19,260,662	42,163,610	63,819,992	70,759,764	81,[illegible].71
Sailing vessels	517,993	422,064	884,694	1,380,905	2,573,588	2,448,747	2,2[illegible]	3,[illegible].32
Total	7,572,122	10,775,758	3,855,890	20,641,567	44,737,198	66,268,739	72,990,103	84,[illegible]
American:								
Steam vessels	1,107,384	1,249,687	1,167,349	2,548,923	2,675,659	2,784,782	3,038,761	[illegible]
Sailing vessels	206,994	1,152,499	1,066,903	1,857,808	2,193,303	1,509,084	124,941	1,[illegible]
Total	1,314,378	2,402,186	2,234,252	4,406,731	4,868,962	4,293,866	3,163,702	5,25[illegible]
British:								
Steam vessels	54,031,811	65,028,949	80,641,923	100,888,616	109,501,621	132,342,697	97,932,701	128,[illegible].77
Sailing vessels	979,535	1,579,404	1,549,504	2,134,610	2,600,468	3,153,774	2,706,665	4,[illegible]
Total	55,011,346	66,608,353	82,191,427	103,023,226	112,102,089	135,496,471	100,639,366	133,138,620.72
French:								
Steam vessels	7,202,642	9,197,054	10,465,784	12,981,259	10,113,477	12,611,250	7,467,132	8,987,370.50
Sailing vessels	45,468	.....	.....	.....	.....	.....	.....	45,008.57
Total	7,248,110	9,197,054	10,465,784	12,981,259	10,113,477	12,611,250	7,467,132	9,032,379.07
German:								
Steam vessels	13,278,512	17,373,809	19,680,612	23,336,670	28,629,255	38,378,439	22,247,550	38,910,895.99
Sailing vessels	280,771	207,106	83,416	196,678	682,294	973,220	479,978	2,782,228.09
Total	13,559,283	17,580,915	19,764,028	23,533,348	29,311,549	39,351,659	22,727,528	41,693,124.08
Russian:								
Steam vessels	82,616	70,647	59,270	71,762	103,658	133,424	375,307	548,022.49
Sailing vessels	.....	3,983	118	8,882	22,321	65,238	62,724	39,769.97
Total	82,616	74,630	59,388	80,644	125,979	198,662	438,031	587,792.46
Norwegian:								
Steam vessels	590,444	962,936	4,158,097	4,262,246	4,979,413	4,641,408	3,817,127	3,520,628.25
Sailing vessels	28,847	.....	25,234	2,216	48,767	130,767	121,069	267.75
Total	619,291	962,936	4,183,331	4,264,462	5,028,180	4,772,175	3,938,196	3,520,896.00
All other:								
Steam vessels	1,957,651	1,655,036	1,734,945	971,863	4,724,076	6,959,760	5,337,393	6,355,954.97
Sailing vessels	10,218	20,163	25,365	8,449	32,500	28,557	80	110,688.26
Total	1,967,869	1,675,199	1,760,310	980,312	4,756,576	6,988,257	5,337,473	6,[illegible]
Total:								
Steam vessels	85,305,189	105,891,812	120,879,176	164,322,001	202,890,769	261,671,692	210,975,755	278,[illegible].74
Sailing vessels	2,069,826	3,385,219	3,635,234	5,589,548	8,153,241	8,309,387	5,725,796	11,379,987.51
Total	87,375,015	109,277,031	124,514,410	169,911,549	211,044,010	269,981,079	216,701,551	284,383,670.25
Flag unknown	849	1,955	4,163	2,828	2,924	4,205	79,344	227,846.86
Total	87,375,864	109,278,986	124,518,573	169,914,377	211,046,934	269,985,284	216,780,875	284,611,517.11

[a] Exclusive of imports for ship's use.

NUMBER OF JAPANESE HAVING AN OFFICIAL RESIDENCE ABROAD DECEMBER 31, 1899.

[From official reports of the Japanese Government.]

COUNTRIES IN WHICH RESIDING.	Persons in the service of the Government.	Students.	Merchants.	Other professions.	TOTAL.		
					Males.	Females.	Total.
China	146	49	1,726	521	1,886	556	2,442
Korea	400	15	7,828	6,825	8,507	6,561	15,068
Siam	6	5	31	31	52	24	76
England and colonies	69	35	287	5,290	5,113	568	5,681
Russia and colonies	16	37	255	3,713	2,019	2,002	4,021
France	63	17	14	18	99	13	112
Germany	51	147	4	5	204	6	210
Italy	10	1	2	5	14	4	18
Belgium	9	8	2	4	19	4	23
Austria	6	4	0	3	10	3	13
Netherlands	4	0	0	0	3	1	4
Portugal	0	1	0	6	1	6	7
United States	31	282	1,983	69,019	58,663	12,652	71,315
Mexico	8	3	5	22	35	3	38
Brazil	7	0	0	2	6	3	9
Spain	0	1	0	1	2	0	2
Total, 1899	829	605	12,140	85,465	76,633	22,406	[illegible]
1898	770	596	11,643	57,792	53,114	17,687	[illegible]
1897	718	2,465	9,573	46,029	43,707	15,078	[illegible]
1896	627	2,362	9,290	42,063	40,348	13,994	[illegible]

Number of Foreigners Residing in Japan December 31, 1899.

[From official reports of the Japanese Government.]

NATIONALITIES.	Diplomatic and consular corps and staff.	Foreigners in the public service.	Foreigners employed by private persons.	Merchants and other professions.	Total.
Chinese	13	5,011	1,348	6,350	6,372
Koreans	1	177	10	187	188
English	19	1,213	751	1,994	2,013
French	11	335	117	452	463
Germans	14	382	136	518	532
Russians	11	80	43	123	134
Italians	4	38	9	47	51
Belgians	6	15	5	20	26
Swiss	1	61	32	93	94
Dutch	4	52	29	81	85
Portuguese	3	99	56	155	158
Spanish	6	35	9	44	50
Austrians and Hungarians	2	54	27	81	83
Danish	4	40	15	55	59
Swedes and Norwegians	1	29	12	41	42
Greeks	0	1	0	1	1
Americans	14	750	532	1,282	1,296
Mexicans	3	0	0	0	3
Brazilians	1	0	0	0	1
Peruvians	2	1	0	1	3
All others	3	16	11	27	30
Total, 1899	123	8,419	3,142	11,561	11,684

Population of the Empire of Japan on December 31 of the Following Years.

[From official reports of the Japanese Government.]

YEARS.	Males.	Females.	Total.	Increase of population.			Average increase per 100 inhabitants.
				Excess of births over deaths.	Persons heretofore unknown who had registered.	Total.	
1898	22,072,758	21,688,057	43,760,815	475,119	56,833	531,952	1.23
1897	21,823,651	21,405,212	43,228,863	458,288	62,311	520,599	1.22
1896	21,561,023	21,147,241	42,708,264	369,356	68,288	437,644	1.04
1895	21,345,750	20,924,870	42,270,620	394,005	63,400	457,405	1.09
1894	21,122,899	20,690,316	41,813,215	368,215	56,687	424,902	1.03
1893	20,906,465	20,481,848	41,388,313	240,784	57,589	298,373	.73
1892	20,752,366	20,337,574	41,089,940	320,046	51,217	371,263	.91
1891	20,563,416	20,155,261	40,718,677	233,636	31,580	265,216	.66
1890	20,431,097	20,022,364	40,453,461	321,656	59,785	381,441	.95
1889	20,246,336	19,825,684	40,072,020	401,230	63,556	464,786	1.17
1888	20,008,445	19,598,789	39,607,234	419,895	117,648	537,543	1.38
1887	19,731,732	19,337,959	39,069,691	304,681	257,833	562,514	1.46

Population and Number of Families in Cities of Japan having More than 20,000 Inhabitants on December 31, 1898.

[From returns of the Japanese census.]

CITIES.	Number of families.	Population.	CITIES.	Number of families.	Population.
Tokyo (Tokyo)	316,527	1,440,121	Saga (Saga)	[illegible]	[illegible]
Osaka (Osaka)	185,847	821,235	Utsunomiya (Tochigi)	6,455	[illegible]
Kioto (Kioto)	66,999	353,139	Takaoka (Toyama)	6,507	[illegible]
Nagoya (Aichi)	56,680	244,145	Matsumota (Nagono)	6,326	[illegible]
Kobe (Hiogo)	59,032	215,780	Nagono (Nogona)	5,708	[illegible]
Yokohama (Kanagawa)	31,765	193,762	Gifu (Gifu)	6,361	[illegible]
Hiroshima (Hiroshima)	28,811	122,306	Takasaki (Gumma)	5,107	[illegible]
Nagasaki (Nagasaki)	16,559	107,422	Yonezawa (Yamagata)	5,453	[illegible]
Kanazawa (Ishikawa)	28,507	83,662	Nara (Nara)	5,618	[illegible]
Sendai (Mayagi)	14,390	83,325	Akita (Akita)	6,736	[illegible]
Hakodate (Hokkaido)	17,896	78,010	Wakamatsu (Fukushima)	4,785	[illegible]
Fukuoka (Fukuoda)	9,748	66,190	Kurume (Fukuoka)	4,819	[illegible]
Wakayama (Wakayama)	11,767	63,667	Tottori (Tottori)	5,947	[illegible]
Tokushima (Tokushima)	12,476	61,501	Awomori (Awomori)	6,177	[illegible]
Kumamoto (Kumamoto)	13,784	61,463	Ujigamada (Miye)	[illegible]	[illegible]
Toyama (Toyama)	13,883	59,558	Kokura (Fukuoka)	[illegible]	[illegible]
Okayama (Okayama)	11,987	58,025	Chiba (Chiba)	[illegible]	[illegible]
Otaru (Hokkaido)	7,723	56,961	Moji (Fukuoka)	[illegible]	[illegible]
Kagoshima (Kagoshima)	9,459	53,481	Yokkaichi (Miye)	[illegible]	[illegible]
Niigata (Niigata)	10,214	53,366	Marugame (Kagawa)	[illegible]	[illegible]
Sakai (Osaka)	9,311	50,203	Atsuta (Aichi)	[illegible]	[illegible]
Fukui (Fukui)	19,119	44,286	Yokosuka (Kanagawa)	[illegible]	[illegible]
Akamagesiki (Tamaguchi)	7,565	42,786	Shuri (Okinawa)	[illegible]	[illegible]
Shidzuoka (Shidzuoka)	8,691	42,172	Uyeda (Nagano)	[illegible]	[illegible]
Kofu (Tamanashi)	7,304	37,561	Kiriu (Gumma)	[illegible]	[illegible]
Sapporo (Hokkaido)	6,569	37,482	Hachioji (Tokyo)	[illegible]	[illegible]
Matsuyama (Ehime)	8,347	36,545	Tochigi (Tochigi)	[illegible]	[illegible]
Kochi (Kochi)	8,484	36,511	Onomichi (Hiroshima)	[illegible]	[illegible]
Naba (Okinawa)	7,548	35,453	Sakata (Yamagata)	[illegible]	[illegible]
Tamagata (Tamagata)	5,253	35,300	Toyohashi (Aichi)	[illegible]	[illegible]
Himeji (Hiogo)	9,153	35,282	Washo (Hiroshima)	[illegible]	[illegible]
Hirosaki (Awomori)	6,441	34,771	Fushima (Kioto)	[illegible]	[illegible]
Matsuye (Shimane)	7,936	34,651	Ashikaga (Tochigi)	[illegible]	[illegible]
Mayeboshi (Gumma)	6,448	34,495	Akashi (Hiogo)	[illegible]	[illegible]
Takamatsu (Kagawa)	7,844	34,416	Fukushima (Fukushima)	[illegible]	[illegible]
Otsu (Shiga)	5,832	34,225	Tsuruoka (Yamagata)	[illegible]	[illegible]
Mito (Ibaraki)	5,433	33,778	Toda (Kanagawa)	[illegible]	[illegible]
Tsu (Miye)	5,821	33,287	Takata (Niigata)	[illegible]	[illegible]
Morioka (Iwate)	5,433	32,989	Kuwana (Miye)	3,475	[illegible]

ESTIMATED ANNUAL AREA DEVOTED TO THE CULTIVATION OF RICE, BARLEY, ETC., ALSO TOTAL PRODUCTION.

[From official reports of the Japanese Government.]

[Koku=4.96 bushels. Cho C=2.45 acres.]

YEARS.	CULTIVATED AREA.				
	Rice.	Barley.	Rye.	Wheat.	Total.
	Cho C.	*Cho C.*	*Cho C.*	*Cho C.*	*Cho C.*
1899	2,832,550.2	654,852.3	680,215.5	459,544.6	1,794,612.4
1898	2,817,624.0	659,095.5	681,364.0	465,097.9	1,806,657.4
1897	2,788,845.2	629,884.0	651,448.5	458,269.2	1,749,571.7
1896	2,786,989.4	659,503.6	672,597.0	441,680.0	1,784,690.6
1895	2,779,227.1	653,204.5	671,794.3	446,024.8	1,771,023.6
1894	2,781,044.8	647,982.7	661,558.8	441,471.3	1,761,012.8
1893	2,769,478.9	653,443.4	654,111.4	433,455.5	1,744,010.3
1892	2,755,101.9	653,266.6	649,855.3	434,251.1	1,757,373.0

YEARS.	TOTAL PRODUCTION.					AVERAGE PRODUCT PER TAN.				
	Rice.	Barley.	Rye.	Wheat.	Total.	Rice.	Barley.	Rye.	Wheat.	Total.
	Koku.	*Koku.*	*Koku.*	*Koku.*	*Koku.*	*Koku.*	*Koku.*	*Koku.*	*Koku.*	*Koku.*
1899	39,590,322	8,407,263	6,605,277	4,057,670	19,0[illegible]	1.40	1.28	0.97	[illegible]	[illegible]
1898	47,387,696	8,913,560	7,366,605	4,181,888	20,402,[illegible]	1.68	1.35	1.08	[illegible]	[illegible]
1897	33,699,293	8,028,698	6,165,792	3,811,600	18,0[illegible]	1.18	1.25	.95	[illegible]	[illegible]
1896	36,199,771	7,849,285	5,923,247	3,552,789	17,325,[illegible]	1.30	1.21	.88	[illegible]	[illegible]
1895	39,922,882	8,536,770	7,015,709	3,973,641	19,526,122	1.44	1.31	1.04	[illegible]	[illegible]
1894	41,895,896	8,528,408	7,314,304	3,967,253	19,809,9[illegible]	1.53	1.32	1.11	[illegible]	[illegible]
1893	37,199,663	7,196,569	6,146,126	3,291,146	16,633,841	1.34	1.10	.94	.76	[illegible]
1892	41,378,956	6,809,275	6,057,134	3,074,867	15,941,276	1.50	1.04	.93	.71	.92

SILK CULTURE IN JAPAN.

[From official reports of the Japanese Government.]

[1 Kwan=8.28 pounds.]

YEARS.	Cards of silkworms' eggs.	Cocoons.	Raw silk.	Raw silk of inferior quality.	Waste.
	Number.	*Koku.*	*Kwan.*	*Kwan.*	*Kwan.*
1899	3,795,030	2,512,562	1,754,242	1,523,174	99,223
1898	3,936,909	2,027,342	1,479,747	655,118	64,301
1897	3,988,569	2,124,238	1,537,561	629,375	[illegible]
1896	3,746,139	1,836,672	1,442,720	610,083	58,[illegible]
1895	3,938,388	2,258,173	1,603,311	696,377	61,772
1894	3,334,294	1,890,596	1,295,783	599,801	54,257
1893	3,091,222	1,686,894	1,233,554	541,267	56,960
1892	2,831,159	1,480,705	1,096,088	522,544	57,121

DOMESTIC TEXTILE INDUSTRY IN JAPAN.

[From official reports of the Japanese Government.]

YEARS.	Number of manufacturing households.	Number of looms.	NUMBER OF WORKERS.		
			Males.	Females.	Total.
1[illegible]	654,196	946,418	[illegible]	[illegible]	[illegible]
1897	665,356	947,134	54,149	[illegible]	[illegible]
1896	687,523	964,291	57,[illegible]	[illegible]	[illegible]
1895	669,409	949,123	57,[illegible]	[illegible]	[illegible]
1894	699,441	829,585	48,176	[illegible]	[illegible]

QUANTITIES AND VALUES OF TEXTURES MANUFACTURED IN JAPAN, 1890 TO 1898.

[From official reports of the Japanese Government.]

FABRICS FOR CLOTHING.

YEARS.	SILK.		COTTON.		SILK AND COTTON MIXED.		HEMP.		[illegible]
	Pieces.	Value.	Pieces.	Value.	Pieces.	Value.	Pieces.	Value.	
		Yen.		*Yen.*		*Yen.*		*Yen.*	*Yen.*
1[illegible]	11,936,849	63,143,314	64,644,915	48,136,610	6,478,233	11,056,250	2,762,919	3,884,449	[illegible]
1[illegible]	11,248,510	54,937,876	60,831,060	40,894,304	5,448,064	8,561,166	4,748,884	4,824,881	[illegible]
1[illegible]	9,897,756	45,819,364	70,195,533	38,089,039	4,383,047	6,174,587	1,706,427	2,668,677	[illegible]
1[illegible]	[illegible]	41,063,194	63,422,144	35,080,778	3,975,602	5,982,376	2,035,728	2,270,805	[illegible]
1[illegible]	[illegible]	28,769,241	49,594,948	26,440,753	3,761,017	5,420,531	2,037,787	3,397,593	[illegible]
1[illegible]	[illegible]	20,893,512	43,622,964	21,691,824	3,691,563	5,422,815	2,238,323	3,267,466	[illegible]
1[illegible]	5,719,[illegible]	16,325,728	40,219,136	18,492,874	3,618,735	3,919,200	1,843,338	2,671,978	[illegible]
1[illegible]	4,832,296	12,543,066	36,175,902	16,344,908	3,340,809	5,167,785	3,860,997	6,361,583	[illegible]
1[illegible]	4,154,466	10,601,370	30,044,876	13,098,442	2,764,967	2,978,301	1,011,954	1,663,489	[illegible]

NOTE.—A piece of texture for clothing is, at an average, 11½ yards long and 3 yards and 5.6 inches wide.

Quantities and Values of Textures Manufactured in Japan, 1890 to 1898—Continued.

FABRICS FOR SASHES, GIRDLES, ETC.

YEARS.	SILK.		COTTON.		SILK AND COTTON MIXED.		Total value.
	Pieces.	Value.	Pieces.	Value.	Pieces.	Value.	
		Yen.		*Yen.*		*Yen.*	
1898	1,582,785	10,792,714	957,322	591,794	2,771,534	6,184,667	[illegible]
1897	1,282,710	8,710,898	1,761,665	1,359,043	2,130,232	3,163,[illegible]	[illegible]
1896	1,238,617	8,276,581	1,300,270	991,012	2,246,668	2,958,991	[illegible]
1895	805,480	5,408,207	2,109,679	1,402,979	2,716,262	4,[illegible]	[illegible]
1894	750,058	3,783,700	1,533,989	726,815	1,958,671	2,[illegible]	[illegible]
1893	521,215	2,904,771	1,212,329	618,117	1,540,383	3,825,317	[illegible]
1892	468,708	3,022,057	1,526,220	710,535	1,562,102	3,[illegible],194	[illegible]
1891	851,270	2,581,345	1,724,263	581,762	1,440,263	2,762,194	[illegible]
1890	639,485	2,131,360	2,189,742	465,161	1,638,940	2,332,020	[illegible]

Note.—A piece of fabric for sashes or girdles is, at an average, 41½ yards long. The width varies according to the sex and age of the respective persons for whom the goods are destined.

Cotton Spinning in Japan by Means of European Machinery.

[From official reports of the Japanese Government.]

[1 kwan=8.28 pounds; 1 sen=$\frac{1}{100}$ yen.]

YEARS.	Number of companies.	Number of spindles.	Quantities of cotton spun.	Quantities of cotton used.	Spinning waste.
			Kwan.	*Kwan.*	
1899	95	2,074,475	43,113,790	51,024,761	6,163,707
1898	72	1,027,817	32,163,239	42,544,656	4,980,687
1897	74	768,328	26,134,120	32,068,243	3,703,510
1896	63	692,384	20,585,485	24,875,087	2,923,729
1895	47	518,736	18,437,011	21,771,346	2,423,361
1894	45	476,123	14,620,008	17,179,274	1,816,333
1893	40	381,781	10,666,744	11,531,397	1,178,039
1892	39	385,314	9,977,208	12,249,793	906,116

YEARS.	Waste of cotton.	HORSE POWER OF MOTORS.		Coal consumed.	DAILY AVERAGE WAGES PER WORKER.	
		Steam.	Water.		Male.	Female.
	Kwan.			*Tons.*	*Sen.*	*Sen.*
1899	756,306	33,626	1,819	449,728	.....	.....
1898	558,409	.....	.....	370,056	.....	.....
1897	1,177,099	26,301	1,352	241,791	22.9	13.6
1896	328,666	19,244	660	216,142	19.7	12.0
1895	251,879	14,781	187	156,616	18.0	9.9
1894	192,017	12,439	317	132,120	17.1	8.9
1893	298,466	8,110	470	84,680	17.4	9.4
1892	304,851	8,604	435	90,389	17.4	3.9

Manufacture of Paper in Japan.

[From official reports of the Japanese Government.]

YEARS.	Manufacturing households.	JAPANESE PAPER CALLED "MINO."		JAPANESE PAPER CALLED "HANSHI."		Value of all other kinds.	EUROPEAN PAPER.		Total value.
		Quantity.	Value.	Quantity.	Value.		Quantity.	Value.	
		Shime.	*Yen.*	*Shime.*	*Yen.*	*Yen.*	*Kwan.*	*Yen.*	*Yen.*
1898	66,702	152,968	1,246,942	2,852,771	5,203,933	5,941,132	5,526,266	2,554,446	14,946,453
1897	66,363	155,303	1,412,584	2,743,669	5,162,095	6,005,509	5,072,476	2,694,722	15,284,910
1896	65,226	164,546	1,063,973	2,956,705	4,179,569	5,073,378	5,311,565	2,595,342	12,912,262
1895	65,213	154,799	835,559	2,530,525	3,779,288	4,511,888	5,121,925	2,295,914	11,522,659
1894	62,691	159,299	570,073	3,548,666	3,132,265	4,358,779	4,747,705	2,188,171	10,249,288
1892	.....	.....	488,467	.....	2,143,892	2,279,488	2,695,495	469,549	5,881,396
1887	.....	.....	538,639	.....	2,140,920	1,920,461	1,425,426	410,657	5,010,680

Note.—One shime of paper contains 10 soku, and each soku 10 jio. One jio of "mino" paper contains 48 sheets; 1 jio of hanshi paper 20 sheets.

MANUFACTURE OF MATTING AND MATS IN JAPAN.

[From official reports of the Japanese Government.]

YEARS.	Manufacturing households.	MATS.		MATS CALLED "GOZA."		MATTING CALLED "HANAGOZA."		Total value.
		Pieces.	Value.	Pieces.	Value.	Rolls.	Value.	
			Yen.		*Yen.*		*Yen.*	*Yen.*
1898	101,993	10,777,037	1,953,298	3,635,461	564,454	474,898	2,699,676	4,6[illegible].428
1897	109,100	5,510,855 [a]449,457	1,911,300	3,555,916	491,489	533,293 [b]5,046	3,217,482	5,650,271
1896	101,792	10,669,436	2,160,667	3,279,163	4[illegible],323	340,548 [b]361	2,189,586 3,195	4,832,711
1895	103,014	5,339,179	1,506,518	3,622,722	423,686	577,181 [b]8,610	3,787,289 3,096	5,729,499
1894	88,084	5,326,659	1,157,698	8,537,891	431,336	310,287 [b]5,154	2,096,894 1,394	3,627,322
1892	.....	.....	1,231,853	.....	449,192	.....	563,890	2,244,845
1887	.....	.....	617,664	.....	252,335	.....	.....	8[illegible],999

[a] Number of packages. [b] Number of pieces.

PRODUCTION OF TEA IN JAPAN.

[From official reports of the Japanese Government.]

[1 kwan=8.28 pounds.]

YEARS.	Number of households engaged.	Tea.	"Bancha" tea.	Total.	YEARS.	Number of households engaged.	Tea.	"Bancha" tea.	Total.
		Kwan.	*Kwan.*	*Kwan.*			*Kwan.*	*Kwan.*	*Kwan.*
1899	621,590	4,880,734	2,663,263	7,543,997	1895	736,775	6,248,813	2,450,468	8,698,781
1898	774,060	5,990,300	2,453,426	8,443,726	1894	705,928	5,259,135	2,623,097	7,882,232
1897	777,944	6,074,164	2,396,018	8,470,182	1893	.....	5,270,801	2,432,567	7,649,[illegible]
1896	762,634	6,044,549	2,456,196	8,500,745	1892	.....	4,986,468	2,225,397	7,211,[illegible]

VALUE OF THE PRODUCTS OF THE SEA AND RIVER FISHERIES OF JAPAN.

[From official reports of the Japanese Government.]

YEARS.	Fresh fish.	Dried fish.	Salted fish.	Seaweed.	Vegetable glue and candles manufactured of fish oil.	Manure.	Fish oil.
	Yen.	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*
1898	34,818,038	9,155,194	1,875,775	1,237,073	675,711	7,561,334	192,1[illegible]
1897	31,103,631	8,997,336	2,257,887	1,748,449	658,705	10,515,196	2[illegible]
1896	27,295,545	7,165,605	1,791,678	1,289,385	581,061	7,861,932	241,[illegible]
1895	14,489,146	6,164,778	1,450,860	1,340,279	337,236	7,403,519	147,[illegible]
1894	11,951,822	5,987,459	1,056,243	703,679	317,265	7,214,107	188,[illegible]
1893	(a)	8,102,703	2,699,951	1,922,418	514,110	6,712,072	348,[illegible]
1892	(a)	6,785,527	2,541,067	1,723,113	626,940	4,529,766	145,[illegible]
1891	(a)	6,465,902	1,800,241	1,202,594	222,750	5,171,518	1[illegible],7[illegible]
1890	(a)	7,069,740	1,920,054	1,075,755	191,585	5,086,941	1[illegible]

[a] No data.

WAGES PAID IN THE PRINCIPAL OCCUPATIONS IN JAPAN DURING THE YEARS FROM 1892 TO 1898.

[From official reports of the Japanese Government.]

OCCUPATIONS.	1898							AVERAGE WAGES.					
	Niphon.				Shikoku.	Kiushiu.	Hokkaido or Yezo.	1892	1894	1895	1896	1897	1898
	Central.		Northern part.	Western part.									
	Tokyo.	Other localties.											
	Yen.	Yen.	Yen.	Yen.	Yen.	Yen.	Yen.	Yen.	Yen.	Yen.	Yen.	Yen.	Yen.
Carpenters	0.74	0.52	0.53	0.59	0.52	0.51	0.70	0.32	0.35	0.36	0.43	0.49	0.54
Plasterers	.75	.51	.54	.57	.51	.48	.50	.32	.35	.37	.43	.50	.53
Stonecutters	.88	.55	.60	.66	.56	.50	.80	.36	.40	.42	.47	.55	.58
Sawyers	.65	.53	.48	.60	.58	.47	.70	.31	.35	.37	.42	.50	.54
Roofers (thatch, shingles, etc.)	.70	.55	.48	.56	.48	.45	.50	.30	.33	.34	.41	.48	.52
Tilers	.78	.58	.50	.62	.57	.46	.50	.34	.38	.38	.47	.54	.56
Bricklayers	.70	.58	.61	.49	.80	.52	.50	.....	.44	.47	.46	.56	.57
Mat makers	.67	.47	.48	.49	.44	.41	.50	.30	.33	.35	.38	.44	.47
Screen and door makers, etc	.74	.50	.51	.52	.50	.47	.70	.30	.33	.36	.40	.46	.51
Paper hangers	.75	.50	.49	.53	.46	.43	.50	.32	.33	.33	.40	.45	.50
Joiners	.64	.48	.48	.52	.49	.49	.70	.30	.33	.35	.39	.45	.50
Coopers	.62	.42	.39	.41	.42	.42	.70	.....	.29	.30	.35	.38	.43
Clog makers	.54	.37	.39	.44	.45	.42	.55	.....	.29	.30	.33	.38	.41
Shoe and boot makers	.69	.53	.48	.51	.54	.49	.60	.....	.39	.39	.41	.46	.51
Saddlers and harness makers	.67	.46	.40	.64	.34	.49	.50	.....	.35	.36	.40	.46	.49
Wheelwrights	.51	.48	.47	.50	.44	.48	.60	.....	.32	.33	.36	.41	.48
Tailors (Japan dress)	.65	.43	.36	.40	.35	.39	.50	.28	.31	.31	.36	.37	.41
Tailors (European dress)	.71	.66	.51	.74	.49	.55	.70	.49	.50	.51	.57	.58	.61
Pocketbook makers	.59	.38	.35	.45	.46	.41	.40	.....	.29	.33	.34	.41	.41
Dyers	.43	.39	.30	.38	.41	.35	.50	.25	.28	.29	.31	.35	.37
Cotton beaters	.42	.37	.35	.38	.32	.35	.55	.24	.26	.27	.30	.35	.37
Blacksmiths	.62	.48	.42	.56	.45	.48	.50	.31	.36	.35	.42	.48	.49
Jewelers, diamond workers, etc	.62	.45	.49	.47	.34	.42	.50	.....	.33	.37	.38	.42	.45
Metal workers	.55	.52	.49	.58	.49	.48	.50	.....	.26	.37	.41	.48	.52
Earthenware workers	.....	.49	.30	.45	.37	.41	.50	.30	.27	.27	.32	.38	.42
Workers of varnished goods	.69	.49	.38	.51	.43	.44	.50	.30	.35	.35	.38	.45	.47
Gum gatherers	.53	.42	.31	.34	.....	.50	.....	.....	.26	.25	.27	.38	.39
Oil pressers	.50	.44	.34	.42	.48	.47	.....	.26	.28	.29	.31	.37	.44
Paper workers	.52	.32	.38	.69	.36	.43	.50	.....	.22	.22	.26	.35	.37
Tobacco workers	.59	.40	.43	.47	.46	.42	.40	.27	.29	.30	.34	.42	.43
Compositors	.49	.39	.38	.40	.32	.38	.66	.29	.29	.33	.34	.36	.39
Printers	.52	.36	.35	.39	.33	.36	.45	.27	.28	.30	.34	.35	.37
Shipwrights	.70	.58	.52	.62	.41	.51	.90	.34	.36	.38	.44	.50	.58
Gardeners	.56	.51	.59	.54	.43	.46	.60	.....	.34	.34	.38	.47	.53
Agricultural day laborers:													
Men	.34	.31	.32	.32	.39	.32	.45	.19	.21	.22	.25	.30	.33
Women	.20	.20	.22	.20	.23	.24	.30	.12	.13	.14	.16	.19	.22
Silkworm raisers:													
Men	.34	.33	.28	.34	.48	.36	.35	.22	.22	.24	.27	.33	.35
Women	.20	.22	.21	.24	.34	.25	.20	.15	.14	.15	.18	.21	.24
Silk spinners, women	.25	.21	.25	.24	.31	.28	.30	.17	.17	.18	.21	.23	.24
Weavers:													
Men	.44	.30	.35	.42	.55	.39	.50	.16	.21	.22	.24	.27	.38
Women	.29	.20	.24	.22	.29	.27	.35	.11	.14	.15	.16	.19	.23
Tea workers	.70	.54	.37	.55	.50	.40	.....	.31	.34	.37	.42	.45	.48
Fishers	.47	.39	.42	.40	.48	.36	.26	.....	.26	.29	.33	.39	.40
Miners	.....	.59	.43	.40	.44	.69	.70	.....	.34	.38	.39	.48	.53
Day laborers	.47	.36	.37	.39	.39	.37	.55	.22	.24	.26	.30	.34	.38
Wages per month:													
Makers of "sake"	8.40	12.15	8.21	11.86	15.69	11.20	11.00	8.88	7.87	8.33	8.72	9.94	11.47
Makers of "soy"	9.00	9.17	7.45	9.64	12.31	8.66	11.00	7.23	6.16	6.84	7.77	8.40	9.27
Confectioners	14.70	11.77	13.07	11.87	10.84	10.79	13.50	5.74	7.62	7.76	9.26	9.69	11.85
Domestics	4.25	2.53	3.14	2.31	4.15	3.98	6.00	2.12	2.16	2.20	2.58	2.88	2.96
Servants	3.63	1.45	1.84	1.35	2.00	2.19	3.25	1.16	1.23	1.27	1.44	1.60	1.74
Farm hands—													
Men	45.00	37.17	31.55	38.00	40.83	45.34	60.00	.....	24.54	28.04	32.12	35.59	38.92
Women	20.00	20.66	17.47	19.83	24.17	25.57	42.00	.....	13.13	15.24	16.61	19.65	21.48

NOTE.—This table shows the average wages calculated for the months of March and September in certain localities of each district. For those laborers that are at work but a certain period during the year, as tea and "sake" workers, figures relating to the respective periods are given.

CURRENT PRICES OF PRINCIPAL ARTICLES IN THE CITY OF TOKYO DURING THE YEARS 1890–1899.

[From official reports of the Japanese Government.]

ARTICLES.	Unit of quantity.	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899
		Yen.	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*
Rice	Koku	8.84	7.35	7.47	7.49	8.93	8.63	10.19	12.22	[illegible]	[illegible]
Barley	do	3.94	3.46	3.28	3.07	3.72	3.51	2.99	4.68	[illegible]	[illegible]
Rye	do					5.34	4.51	5.20	6.89	[illegible]	[illegible]
Wheat	do	4.98	5.27	5.21	5.15	5.58	4.60	5.99	8.26	[illegible]	7.45
Peas	do	5.32	4.91	4.81	5.69	5.90	5.81	6.29	6.94	[illegible]	[illegible]
Salt	do	1.85	1.25	1.19	1.14	.81	1.69	2.47	2.46	[illegible]	[illegible]
Soy (Japanese sauce)	do	9.23	10.72	10.08	10.36	10.73	10.72	11.09	15.58	[illegible]	[illegible]
Sake, common (rice wine)	do	12.83	11.58	12.36	13.60	16.58	13.92	13.93	24.56	[illegible]	[illegible]
Tea	100 kin	23.54	21.68	28.77	27.72	27.25	22.13	27.77	30.08	[illegible]	[illegible]
Tobacco:											
Leaf	do	18.33	11.15	13.92	15.61	20.63	23.75	12.35	23.86	37.67	[illegible]
Cut	do	39.29	19.13	25.33	23.68	25.75	31.75	12.35	36.13	46.60	[illegible]
Bonitos	Kwan	1.39	1.52	1.84	1.44	1.76	2.66	2.28	3.39	3.58	[illegible]
Beef	100 kin					11.63	13.75	15.75	19.83	15.92	[illegible]
Sugar:											
White, Japanese	do	7.18	7.28	7.10	9.19	8.04	7.44	8.32	12.17	15.05	[illegible]
White, foreign	do	7.47	6.45	7.12	8.22	9.05	9.08	8.92	8.04	8.99	[illegible]
Brown, Japanese	do	6.87	5.78	6.74	7.70	7.75	6.98	8.09	8.21	8.40	7.84
Brown, foreign	do	16.97	4.42	4.39	5.31	4.72	3.82	4.46	5.18	5.85	7.14
Cotton:											
Raw, Japanese	do	21.13	18.05	18.15	19.23	20.40	21.78	22.78	21.51	20.19	29.67
Raw, foreign	do	18.18	17.38	17.31	17.86	18.88	20.25	22.04	22.79	19.38	[illegible]
Spun, Japanese	do		21.27	24.23	26.30	28.97	28.82	30.83	28.73	24.50	[illegible]
Spun, foreign	do	31.93	30.65	29.31	32.86	39.15	38.92	38.63	36.81	34.85	102.97
Bleached	Piece			.25	.24	.25	.30	.28	.27	.25	.27
Texture	do	.25	.28	.26	.30	.38	.38	.32	3.26	.37	[illegible]
Goods, white	do	.27	.30	.28	.30	.39	.39	.34	3.43	[illegible]	[illegible]
Silk, raw:											
Superior quality	100 kin					747.50	705.83	795.00	878.75	[illegible]	[illegible]
Middle quality	do					727.50	649.31	732.50	843.75	[illegible]	[illegible]
Inferior quality	do					707.50	599.31	689.25	808.75	[illegible]	[illegible]
Texture, silk, called "hanairo"	Piece	3.12	1.93	2.42	2.68	3.03	4.22	4.42	3.49	[illegible]	[illegible]
Taffetas ("kaiki")	do	2.70	2.10	2.53	2.67	3.25	3.94	6.56	3.96	[illegible]	[illegible]
Flax	100 kin	20.00	19.19	22.26	26.37	26.00	33.24	29.55	28.68	[illegible]	[illegible]
Indigo, dry	Kwan	.85	1.69	2.67	1.57	1.38	1.95	2.03	1.89	[illegible]	2.06
Iron:											
Japanese	do	.26	.37	.29	.11	.37	.35	.37	.27	.48	.12
European	do	.20	.23			.25	.24	.25	.28	[illegible]	.17
Pine wood (1 sq. "shaku" by 2 "ken" long)	Piece	2.05	2.10	2.54	3.22	2.88	3.40	4.36	4.70	[illegible]	[illegible]
Cypress, Japanese (same dimensions)	do	2.24	2.01	2.07	2.62	2.66	2.39	4.10	5.70	[illegible]	[illegible]
Pine boards (6 "bu" thick)	Tsubo	.20	.40	.35	.37	.42	.54	.67	.79	[illegible]	[illegible]
Cypress boards (4 "bu" thick)	do	.24	.21	.32	.29	.26	.39	.52	.60	[illegible]	[illegible]
Oil for burning	Koku	24.19	23.25	18.62	22.10	23.85	27.08	29.76	32.72	[illegible]	[illegible]
Petroleum	Cask	1.86	1.67	1.68	1.75	1.77	2.23	2.20	2.10	[illegible]	[illegible]
Coal	Ton			4.54	4.54	6.80	7.05	5.93	9.16	9.77	[illegible]
Wood (for burning)	10 kwan	.12	.20	.23	.23	.19	.20	.22	.30	[illegible]	[illegible]
Charcoal	do	.43	.54	.60	.61	.51	.89	1.10	1.17	[illegible]	[illegible]
Paper, Japanese:											
Called "mino"	480 leaves	.81	.91	.83	.86	.89	.96	.86	1.34	[illegible]	[illegible]
Called "hanshi"	200 leaves	.13	.15	.15	.15	.17	.21	.19	.25	[illegible]	[illegible]
Manure:											
Dried sardines	10 kwan	1.71	1.59	1.95	1.73	2.02	1.64	2.35	2.39	[illegible]	[illegible]
Refuse of herrings	do	2.42	2.29	2.16	2.22	2.29	2.48	2.98	2.95	[illegible]	[illegible]
Residuum of vegetable oil	do					1.59	1.71	1.79	1.93	[illegible]	[illegible]

NOTE.—The prices of the above table are average prices, calculated on the basis of prices current during the months of March, June, September, and December. For years prior to 1894 the averages are based on current quotations returned three times a month. For 1899 the prices relate to the second half year.

Koku=4.9629 bushels; kin=1.3251 pounds; kwan=8.2817 pounds; tsubo=3.9533 square yards.

TOTAL PRODUCT OF MINES OPERATED IN JAPAN BY THE STATE AND PRIVATE INDIVIDUALS DURING THE YEARS FROM 1891 TO 1898.

[From official reports of the Japanese Government.]

NAMES OF MINERALS.	1891	1892	1893	1894	1895	1896	1897	1898
Metallic substances, melted or prepared quantities:	*Ounces.*	*Ounces.*	*Ounces.*	*Ounces.*	*Ounces.*	*Ounces.*	[illegible]	[illegible]
Gold	22,518	21,510	24,150	25,553	29,101	[illegible]	[illegible]	[illegible]
Silver	1,890,010	1,916,549	2,229,906	2,338,229	2,326,699	[illegible]	1,74[illegible]	[illegible]
	Kwan.	*Kwan.*	*Kwan.*	*Kwan.*	*Kwan.*	[illegible]	[illegible]	[illegible]
Copper	5,064,631	5,536,061	4,797,809	5,308,840	5,098,085	[illegible]	[illegible]	[illegible]
Iron	4,616,785	5,031,466	4,535,396	5,182,427	6,879,366	[illegible]	[illegible]	[illegible]
Lead	213,735	236,859	293,653	389,943	519,133	[illegible]	[illegible]	[illegible]
Antimony	16,656	11,232	32,511	107,366	170,518	[illegible]	[illegible]	[illegible]
	[a]586,978	[a]357,637	[a]405,486	[a]311,692	[a]278,368	[illegible]	[illegible]	[illegible]
Tin	11,807	11,011	10,145	10,301	12,833	[illegible]	[illegible]	[illegible]
Manganese	[b]859,521	[b]1,388,200	[b]3,771,842	[b]3,558,518	[b]4,553,209	[illegible]	[illegible]	[illegible]
Tin powder	1,293							
Arsenic	2	273	885	1,434	1,955	[illegible]	[illegible]	[illegible]
Copperas	151,521		204,046	249,767	222,343	[illegible]	[illegible]	[illegible]
Sulphate of copper	6,018	16,905						
Mercury	[b]45	[b]3,955	[b]570	412	128	[illegible]	[illegible]	[illegible]
Red ocher	4,520		434			[illegible]	[illegible]	[illegible]
Sulphurated iron			[b]116,531	[b]1,374,256	[b]1,686,519	[illegible]		
Nonmetallic substances, gross quantities:	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	[illegible]	[illegible]	[illegible]
Coal	3,168,875	3,176,840	3,317,104	4,261,218	4,766,670	[illegible]	[illegible]	[illegible]
	Kwan.	*Kwan.*	*Kwan.*	*Kwan.*	*Kwan.*	[illegible]	[illegible]	[illegible]
Petroleum	[b]520,480	[b]537,640	[b]437,640	[b]6,079,440	[b]5,979,880	[illegible]	[illegible]	[illegible]
Brimstone	[b]5,817,746	[b]5,462,818	[b]6,370,302	[b]5,601,147	[b]4,141,489	[illegible]	[illegible]	[illegible]
Graphite	655,851	160,071	6,906	290,400	20,412	[illegible]	[illegible]	[illegible]
Asphalt	[illegible]							
Mica	[illegible]							
Crystal	[illegible]							

[a] Sulphur. [b] Gross quantities.

Domestic Postal Orders Issued and Paid in the Japanese Postal Service, 1891 to 1900.

[From official reports of the Japanese Government.]

YEARS.	Number of post-offices selling postal orders.	POSTAL ORDERS SOLD.		Charges collected for advertisements of payment.	POSTAL ORDERS PAID.		Charges collected on orders.	AVERAGE AMOUNT OF ORDER.	
		Number.	Amount.		Number.	Amount.		Postal orders sold.	Postal orders paid.
			Yen.	*Yen.*		*Yen.*	*Yen.*	*Yen.*	*Yen.*
1899-1900	4,539	6,786,583	68,874,271	539,510	6,779,799	68,748,520	2,198	10.15	10.14
1898-99	3,466	6,338,469	56,201,432	471,374	6,317,516	56,227,075	1,229	8.87	8.90
1897-98	3,231	5,793,401	54,541,423	439,766	5,778,005	54,492,570	1,020	9.41	9.43
1896-97	3,124	4,931,694	45,687,907	361,096	4,903,224	45,552,947	930	9.26	9.28
1895-96	2,500	4,486,346	42,410,621	330,866	4,476,934	42,316,361	660	9.45	9.45
1894-95	2,495	4,022,903	34,013,447	279,179	4,000,715	33,903,499	616	8.45	8.47
1893-94	2,488	3,372,036	28,560,744	228,059	3,365,904	28,463,815	526	8.47	8.46
1892-93	2,276	2,944,622	23,872,453	190,301	2,935,297	23,825,165	309	8.11	8.12
1891-92	2,124	2,605,116	20,715,040	164,208	2,599,889	20,691,015	118	7.95	7.96

Number of Post and Telegraph Offices and Persons Employed in Japan.

[From official reports of the Japanese Government.]

YEARS.	Combined post and telegraph offices.	Post-offices.	Branch post-offices.	Telegraph offices.	Branch telegraph offices.	Letter-boxes, public and private.
1899-1900	1,200	2,613	651	36	206	41,183
1898-99	1,086	2,668	571	38	132	39,191
1897-98	1,086	2,659	540	40	129	38,131
1896-97	965	2,770	535	37	112	36,184
1895-96	648	3,076	523	41	96	35,023
1894-95	638	3,080	535	42	80	34,344
1893-94	590	3,128	563	46	80	33,260
1892	535	3,169	554	32	64	31,9[illegible]
1891	340	3,256	544	41	55	27,710
1890	219	3,411	.....	.....	.....	.....

NUMBER OF EMPLOYEES.

YEARS.	NUMBER OF PERSONS EMPLOYED IN COMBINED POST AND TELEGRAPH OFFICES.		POST-OFFICES.		TELEGRAPH OFFICES.	
	Employees.	Messengers.	Employees.	Messengers.	Employees.	Messengers.
1899-1900	14,772	11,810	6,353	7,830	194	95
1898-99	13,439	10,285	6,292	7,532	179	100
1897-98	12,166	9,615	6,129	7,591	169	1[illegible]
1896-97	10,684	8,373	6,241	7,824	125	[illegible]
1895-96	8,389	6,591	6,914	8,573	147	110
1894-95	7,872	6,510	6,861	8,502	136	93
1893-94	7,393	6,116	6,908	8,225	154	118
1892	5,052	2,926	3,291	13	136	116
1891	3,804	2,377	3,410	11	134	104

NOTE.—The number of telegraph offices and branches for the years 1891 and 1892 is that for the end of the fiscal year, i. e., March 31; for the other years, that for December 31.

INTERNATIONAL POSTAL SERVICE IN JAPAN, 1892 TO 1897.

NUMBER OF LETTERS, POSTAL CARDS, PAPERS, PACKAGES, ETC., RECEIVED FROM AND SENT TO PRINCIPAL COUNTRIES.

[From official reports of the Japanese Government.]

COUNTRIES TO WHICH FORWARDED.	FORWARDED.								RECEIVED.							
	Letters.	Postal cards.	Printed matter.	Samples and commercial articles.	Franked matter.	Registered matter.	Parcels.	Total.	Letters.	Postal cards.	Printed matter.	Samples and commercial articles.	Franked matter.	Registered matter.	Parcels.	Total.
ASIA:																
Korea	391,153	216,462	499,068	6,498	11,995	11,993	.....	1,137,169	335,419	188,404	56,022	2,535	.....	40,210	.....	[illegible]
China	162,862	10,900	165,462	272	6,869	15,179	.....	361,544	153,123	24,057	54,586	2,074	17,175	14,[illegible]	.....	[illegible]
Siam	1,755	260	3,692	117	.....	268	.....	6,092	1,872	949	1,846	.....	4,630	[illegible]	.....	[illegible]
Russia	28,418	2,704	34,528	208	78	2,898	.....	68,834	14,131	1,924	5,967	.....	.....	4,916	.....	[illegible]
British India	11,833	637	12,753	871	.....	2,934	.....	32,028	22,958	1,638	10,842	1,846	26	[illegible]	.....	[illegible]
English colonies	100,100	2,262	54,535	1,196	533	5,808	.....	164,434	94,198	5,850	57,720	1,261	39	6,[illegible]	.....	[illegible]
Spanish colonies	5,005	494	4,745	130	26	737	.....	11,137	4,485	1,495	2,678	.....	871	[illegible]	.....	[illegible]
French colonies	2,873	104	1,261	13	.....	389	.....	4,640	3,432	491	3,445	.....	39	571	.....	[illegible]
Dutch colonies	1,807	143	520	.....	.....	444	.....	2,914	3,939	117	1,105	1,157	182	1,571	.....	[illegible]
Portuguese colonies	1,131	78	884	39	.....	597	.....	2,729	1,742	52	1,014	39	.....	351	.....	[illegible]
All other countries	624	13	234	.....	.....	39	.....	910	130	.....	52	.....	.....	35	.....	217
Total	710,561	234,057	777,682	9,344	19,501	41,286	.....	1,792,431	635,429	224,980	195,277	8,912	22,963	70,063	.....	[illegible]
EUROPE:																
Great Britain	200,564	7,124	119,418	5,317	299	13,536	4,186	350,414	156,611	13,806	214,942	35,633	442	15,072	5,224	[illegible]
Germany	105,547	59,475	35,932	4,251	897	13,518	358	219,978	69,810	16,913	112,112	18,538	2[illegible]	19,287	1,8[illegible]	[illegible]
France	75,530	1,976	26,962	1,339	520	5,701	502	112,530	39,715	4,186	72,748	1,521	1[illegible]	7,1[illegible]	1,0[illegible]	[illegible]
Italy	4,394	468	3,809	533	78	1,645	.....	10,927	5,681	689	5,304	871	14[illegible]	1,5[illegible]	.....	[illegible]
Switzerland	7,085	1,157	3,848	351	13	1,314	.....	13,768	5,161	715	2,028	286	104	1,117	.....	[illegible]
Austria-Hungary	10,478	5,148	3,653	299	91	1,836	.....	21,505	6,682	2,041	5,282	481	13	1,5[illegible]	.....	[illegible]
Roumania	832	26	78	.....	13	52	.....	1,001	117	13	403	.....	.....	[illegible]	.....	[illegible]
Turkey	585	130	247	39	.....	173	.....	1,174	442	65	182	.....	.....	52	.....	741
Russia	24,505	1,950	4,095	169	13	4,637	.....	35,369	14,014	780	24,622	65	.....	3,[illegible]	.....	43,177
Spain	1,703	377	767	247	13	596	.....	3,703	2,496	156	2,379	260	.....	577	.....	[illegible]
Netherlands	4,342	884	1,690	130	39	541	.....	7,626	3,432	221	4,550	.....	13	[illegible]	.....	[illegible]
Belgium	4,706	1,036	2,392	273	.....	635	.....	9,072	4,290	1,092	3,562	312	13	[illegible]	.....	[illegible]
Sweden	884	273	338	52	.....	135	.....	1,682	845	52	520	.....	.....	30	.....	1,447
Norway	2,600	156	260	.....	.....	110	.....	3,126	2,483	130	1,092	.....	.....	40	.....	[illegible]
Denmark	1,612	234	390	52	.....	297	.....	2,585	2,028	65	728	.....	.....	263	.....	[illegible]
All other countries	1,001	286	455	78	26	152	.....	1,998	2,054	637	1,859	104	.....	102	.....	[illegible]
Total	446,368	80,739	204,334	13,130	2,002	41,848	5,046	796,458	315,861	41,561	452,413	58,071	1,157	51,288	8,133	[illegible]
AMERICA:																
United States	288,093	18,642	166,622	11,362	1,378	13,592	.....	500,689	388,063	37,674	385,255	14,196	494	7,021	.....	[illegible]
Mexico	845	247	1,586	377	.....	306	.....	3,361	1,131	104	1,261	.....	13	142	.....	[illegible]
Canada	42,185	1,365	16,718	1,105	91	1,293	304	63,061	26,013	3,562	14,235	2,054	52	1,071	291	[illegible]
Brazil	767	78	1,261	.....	.....	182	.....	2,288	572	91	689	.....	13	[illegible]	.....	1,474
French colonies	702	.....	156	234	.....	18	.....	1,110	364	.....	.....	.....	.....	15	.....	[illegible]
All other countries	1,586	234	936	65	26	434	.....	3,281	1,521	13	403	.....	.....	188	.....	2,125
Total	334,178	20,566	187,279	13,143	1,495	15,825	304	573,790	417,664	41,444	401,843	16,250	572	[illegible]	291	[illegible]
AFRICA:																
Egypt	1,404	169	377	65	13	297	.....	2,325	2,704	611	1,235	.....	13	[illegible]	.....	[illegible]
British colonies	676	78	221	.....	.....	121	.....	1,096	702	195	325	.....	.....	[illegible]	.....	[illegible]
All other countries	429	.....	143	.....	.....	26	.....	598	442	26	13	.....	.....	24	.....	[illegible]
Total	2,509	247	741	65	13	444	.....	4,019	3,848	832	1,573	.....	13	[illegible]	.....	[illegible]
OCEANIA:																
Hawaii	163,860	9,243	25,909	1,560	65	5,311	.....	205,888	138,060	18,681	41,756	637	.....	3,127	.....	[illegible]
British colonies	38,922	767	15,340	1,326	117	2,851	.....	59,323	34,060	1,053	8,567	116	.....	[illegible]	.....	[illegible]
Spanish colonies	1,118	130	130	13	.....	13	.....	1,404	65	13	26	.....	.....	[illegible]	.....	[illegible]
All other countries	26	.....	.....	.....	.....	53	.....	79	91	26	182	.....	13	14	.....	[illegible]
Total	203,866	10,140	41,379	2,899	182	8,228	.....	266,694	172,276	19,773	50,531	1,[illegible]	13	[illegible]	.....	[illegible]
Grand total	1,697,482	345,740	1,212,415	38,581	23,195	110,631	5,350	3,433,392	1,545,078	328,590	1,101,657	84,286	24,713	157,614	[illegible]	[illegible]
Total:																
1899-1900	1,697,482	345,740	1,212,415	38,581	23,195	110,631	5,350	3,433,392	1,545,078	328,590	1,101,657	84,286	24,713	157,614	[illegible]	[illegible]
1898-99	1,503,877	262,851	1,028,313	23,556	14,929	84,559	4,578	2,922,663	1,375,183	144,943	1,056,410	59,787	10,868	96,339	[illegible]	[illegible]
1897-98	1,474,120	177,705	[illegible]	59,097	12,544	94,481	4,635	2,811,218	1,378,[illegible]	344,[illegible]	837,[illegible]	23,129	[illegible]	82,110	[illegible]	[illegible]
1896-97	1,173,380	322,686	918,437	42,642	32,110	70,887	1,271	2,560,816	1,193,751	222,287	840,242	61,386	115,362	80,409	[illegible]	[illegible]
1895-96	1,016,132	201,341	736,086	25,207	33,263	69,672	358	2,082,092	1,202,970	316,944	709,889	25,857	120,185	85,944	[illegible]	[illegible]
1894-95	718,639	93,899	472,992	25,961	15,481	58,926	190	1,414,088	899,701	105,976	686,088	29,289	18,005	74,206	[illegible]	[illegible]
1893-94	700,726	58,877	311,584	21,736	7,592	54,822	101	1,155,438	749,502	71,942	687,858	15,665	8,073	50,471	[illegible]	[illegible]
1892-93	505,557	34,177	304,889	16,861	6,968	35,881	73	994,406	704,509	51,961	662,246	16,705	6,227	44,596	[illegible]	[illegible]

LENGTH OF POSTAL ROUTES IN JAPAN.

[From official reports of the Japanese Government.]

YEARS.	Land routes.	Railroads.	River routes.	Sea routes.
	Ri.	*English miles.*	*Marine ri.*	[illegible]
1899-1900	11,831.46	3,003.48	[illegible]	[illegible]
1898-99	11,635.06	3,438.06	[illegible]	[illegible]
1897-98	11,499.65	2,863.85	[illegible]	[illegible]
1896-97	11,769.19	2,389.35	[illegible]	[illegible]
1895-96	11,577.21	2,238.92	[illegible]	[illegible]
1894-95	11,676.32	2,004.86	[illegible]	[illegible]
1893-94	11,759.92	1,861.66	[illegible]	[illegible]
1892-93	11,543.57	1,794.09	[illegible]	[illegible]

Ri=2.4403 miles. Marine ri=1.1507 miles.

Domestic and International Mail Matter Forwarded in Japan.

[From official reports of the Japanese Government.]

YEARS.	Letters.	Postal cards.	Journals and pamphlets.	Books.	Samples and seeds.	Franked articles.	Registered mail.	Parcels.	Total.	Number of articles forwarded per [illegible]
1899-1900	145,233,511	330,824,967	109,023,612	8,000,883	1,337,059	18,937,560	8,127,975	5,838,336	627,323,993	14.35
1898-99	154,309,696	327,215,215	90,867,742	7,601,036	1,160,530	17,043,197	7,119,138	4,911,919	610,258,473	13.96
1897-98	112,862,727	287,062,803	88,264,125	7,327,299	1,047,625	18,110,775	[illegible]	[illegible]	[illegible]	[illegible]
1896-97	122,351,940	262,861,315	86,801,875	6,617,114	898,190	18,645,357	[illegible]	[illegible]	[illegible]	[illegible]
1895-96	109,401,244	228,502,113	78,962,299	5,917,775	683,923	18,237,885	4,679,471	1,686,977	448,071,687	10.61
1894-95	94,453,978	190,691,321	80,415,390	5,257,376	484,634	17,165,830	4,019,933	1,266,849	393,725,311	9.44
1893-94	80,604,706	158,146,818	56,968,379	5,391,852	421,243	15,822,191	3,540,704	734,615	321,630,508	7.66
1892-93	72,122,576	133,260,175	50,829,700	5,087,360	325,064	12,929,437	3,251,431	40,682	277,846,425	6.66

International Postal Orders Sold and Paid in Japan, 1891–1897.

[From official reports of the Japanese Government.]

YEARS.	Orders sold.		Charges collected on orders.	Orders paid.		Average amount of order.	
	Number.	Amount.		Number.	Amount.	Order sold.	Order paid.
1899-1900	5,222	$137,984	1,508	23,651	1,547,431	26.42	65.43
1898-99	4,381	112,678	1,336	15,051	869,346	25.72	57.76
1897-98	3,960	108,816	1,280	12,953	729,883	27.48	56.34
1896-97	3,581	93,828	1,177	11,097	580,649	26.20	52.32
1895-96	3,319	91,610	1,145	10,226	[illegible]	[illegible]	[illegible]
1894-95	2,442	79,464	829	7,314	379,411	32.54	51.87
1893-94	2,429	68,799	784	5,100	240,626	28.32	47.18
1892-93	2,309	59,938	780	3,957	167,699	25.96	42.38
1891-92	2,432	64,729	932	2,980	109,270	26.62	36.67

Extent of Telegraph System of Japan and Number of Domestic Telegrams Forwarded.

[From official reports of the Japanese Government.]

YEARS.	Length of lines, ri.[a]	Length of wires, ri.[a]	Number of telegrams forwarded.			Number of telegrams per 100 of population.
			Paid.	Franked.	Total.	
1899-1900	5,688.23	24,342.73	12,929,887	1,637,329	14,567,216	31.39
1898-99	5,295.91	20,561.91	14,129,286	1,213,249	15,342,535	33.06
1897-98	5,139.03	18,360.94	12,998,679	981,193	13,979,872	30.41
1896-97	4,720.27	15,431.86	10,199,184	658,469	10,857,653	24.96
1895-96	3,881.49	12,212.29	8,628,264	468,838	9,097,102	21.13
1894-95	3,846.05	11,592.79	7,730,711	390,251	8,120,962	19.24
1893-94	3,709.46	10,232.06	6,158,158	286,305	6,444,463	15.32
1892-93	3,455.77	9,920.99	5,132,427	228,025	5,360,452	12.86

[a] Ri=2.44 miles.

Note.—The figures in this table do not include submarine and subfluvial cables, 1,555 miles in length, with wires 1,690 miles long.

Number of Foreign Telegrams Sent from and Received in Japan, 1892–1900.

[From official reports of the Japanese Government.]

FISCAL YEARS.	Telegrams sent.			Telegrams received.		
	Paid.	Franked.	Total.	Paid.	Franked.	Total.
1899-1900	178,122	18,439	196,561	179,589	26,128	205,717
1898-99	147,507	13,658	161,165	148,660	17,962	166,622
1897-98	144,304	11,836	156,140	142,724	17,642	160,366
1896-97	109,745	10,755	120,500	107,960	13,037	120,997
1895-96	136,297	11,774	148,071	132,161	32,892	165,053
1894-95	103,034	7,823	110,857	99,517	28,438	127,955
1893-94	49,586	3,279	52,865	48,514	10,267	58,781
1892-93	47,791	3,509	51,300	47,327	7,016	54,343

RECEIPTS AND EXPENDITURES OF POST-OFFICE AND TELEGRAPH DEPARTMENTS OF JAPAN, 1892–1899.

[From official reports of the Japanese Government.]

FISCAL YEARS ENDING MARCH 31—	RECEIPTS.			EXPENDITURES.		
	Post-Office Department.	Telegraphs and telephones.	Total.	Operating expenses.	Other.	Total.
	Yen.	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*
1898-99	8,589,990	3,829,049	12,419,039	7,641,471	2,338,683	9,980,154
1897-98	7,689,312	3,336,180	11,025,492	6,[illegible]	1,[illegible]	8,[illegible]
1896-97	6,772,645	2,599,632	9,372,277	5,115,577	1,622,257	6,737,834
1895-96	5,820,680	2,520,362	8,341,042	4,[illegible]	1,[illegible]	5,433,825
1894-95	5,186,957	3,194,092	8,381,049	4,471,354	1,339,706	5,811,060
1893-94	4,426,398	2,061,290	6,487,688	3,[illegible]	1,[illegible]	5,087,047
1892-93	3,835,839	1,683,074	5,518,913	3,358,935	1,142,092	4,499,027

NUMBER OF TELEPHONE STATIONS AND EXTENT OF TELEPHONE SYSTEM, RECEIPTS AND EXPENDITURES, 1891–1900.

YEARS.	Number of offices.	Number of branches.	Number of employees.	Length of lines.	Length of wires.	Cost of construction.	Number of subscribers.	Receipts.	Expenditures.
				Ri.	*Ri.*	*Yen.*		*Yen.*	*Yen.*
1899-1900	20	52	1,118	651.52	11,703.83	No data.	11,813	No data.	No data.
1898-99	13	40	778	610.11	12,816.77	1,896,119	8,064	574,332	324,038
1897-98	8	30	472	315.81	6,732.45	2,460,641	5,326	228,505	179,612
1896-97	6	25	311	216.54	2,822.66	594,201	3,232	150,444	112,109
1895-96	4	24	201	177.51	2,156.18	40,897	2,858	142,431	90,117
1894-95	4	24	190	176.03	1,894.19	101,428	2,843	132,967	71,590
1893-94	4	24	165	165.46	1,804.08	159,068	6,672	94,959	52,849
1892-93	4	20	100	153.64	1,325.13	136,555	1,504	48,069	32,722
1891-92	2	18	51	92.07	644.76	64,287	821	30,121	21,840

NUMBER, CAPITAL, DIVIDENDS, ETC., OF JAPANESE BANKS.

[From official reports of the Japanese Government.]

BANKS.	Number.	Paid-in capital.	Revenue.	Net earnings.	Dividends.	FOR EVERY 100 YEN OF CAPITAL.	
						Net earnings.	Dividends.
		Yen.	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*
Nippon Ginko (Bank of Japan)	1	30,000,000	13,320,000	5,356,870	3,600,000	17.86	12.00
Yokohama Shokin Ginko (Bank of Issue)	1	12,000,000	8,016,638	6,184,561	4,687,500	51.54	39.06
Nippon Kwangio Ginko (Bank of Industry of Japan)	1	2,500,000	.....	238,126	170,000	9.53	6.80
Noko Ginko (Bank of Agriculture and Industry)	45	15,980,365	74,221	948,067	712,371	5.93	4.46
Ordinary banks	1,526	207,565,381	27,553,216	29,903,856	16,732,810	14.41	8.06
Savings banks	531	19,979,151	2,188,683	2,357,267	1,209,266	15.28	7.84
Total (1899)	2,105	288,024,897	51,151,558	44,988,747	27,111,947	15.87	9.76
1898	1,875	257,447,002	40,795,138	38,277,336	20,946,022	15.41	8.25
1897	1,594	211,047,470	36,116,252	44,622,320	18,748,876	21.77	8.[illegible]
1896	1,321	167,271,483	55,353,268	46,422,600	14,559,163	27.[illegible]	9.[illegible]
1895	1,019	127,807,715	31,623,518	26,282,162	16,576,158	20.[illegible]	1[illegible]
1894	866	101,409,881	30,231,153	17,453,796	10,204,116	17.22	10.[illegible]

SPECIE PUT IN CIRCULATION IN JAPAN FROM 1870 TO 1899–1900.

[From official reports of the Japanese Government.]

FISCAL YEARS.	Gold coin.	Silver coin.	Nickel coin.	Copper coin.	Total.
	Yen.	*Yen.*	*Yen.*	*Yen.*	*Yen.*
1899-1900	16,491,270	5,500,000	300,000	65,000	22,356,270
1898-99	21,385,797	17,000,000	750,000	100,000	39,235,797
1897-98	76,824,311	10,238,085	600,000	.....	87,722,396
1896-97	952,433	12,927,934	680,000	.....	14,520,367
1895-96	1,423,730	20,007,377	51,500	.....	21,482,627
1894-95	1,583,088	28,539,445	350,000	.....	30,472,533
1893-94	1,364,612	13,177,375	720,000	.....	15,261,987
1870 to 1892-93	64,781,625	125,608,710	4,767,349	12,418,051	207,575,735

Paper Money in Circulation in Japan from 1893 to 1898.

[From official reports of the Japanese Government.]

DATES.	Treasury certificates.	National-bank notes.	Dakan ginken.[a]	Total.
	Yen.	*Yen.*	*Yen.*	*Yen.*
On April 1, 1900	2,199,453	594,476	219,741,090	222,535,019
On April 1, 1899	5,112,265	1,632,818	179,769,782	186,514,865
On April 1, 1898	6,995,374	4,099,370	189,421,770	200,516,514
On April 1, 1897	9,045,082	13,610,995	173,473,749	196,129,826
On April 1, 1896	10,679,236	20,293,887	149,085,640	180,058,763
On April 1, 1895	13,020,517	21,360,375	124,524,560	158,845,452
On April 1, 1894	15,704,773	22,285,739	110,493,394	148,483,906
On April 1, 1893	19,200,044	23,625,657	100,230,963	143,054,664

[a] Notes issued by the Bank of Japan and payable to the holder in silver (in gold since October 1, 1897).

Number of Companies, Corporations, etc., and Their Paid-in Capital, in Japan from 1894 to 1898.

[From official reports of the Japanese Government.]

YEARS.	AGRICULTURAL COMPANIES.		MANUFACTURING COMPANIES.		COMMERCIAL COMPANIES.		TRANSPORTATION COMPANIES, LAND, SEA, ETC.		TOTAL.	
	Number.	Paid-in capital.	Number.	Paid-in capital.	Number.	Paid-in capital.	Number.	Paid-in capital.	Number.	Paid-in capital.
		Yen.		*Yen.*		*Yen.*		*Yen.*		*Yen.*
1898	166	2,336,720	2,164	122,066,653	4,178	300,039,664	536	197,233,421	7,044	621,676,458
1897	148	2,229,627	1,881	105,381,106	3,630	260,227,479	454	164,684,165	6,113	532,522,377
1896	[a]117	1,666,160	1,366	89,900,900	[b]2,778	[b]192,780,712	334	113,216,760	[b]4,595	[b]397,564,532
1895	[a]126	1,522,409	944	58,728,656	[a]1,151	[a]23,835,358	337	89,960,835	2,458	174,047,258
1894	[a]118	1,188,203	778	44,589,762	[a]998	[a]20,014,874	210	82,560,279	2,104	148,353,118

[a] Exclusive of banks, for which see table relative to banks.
[b] Including number of banks and their paid-in capital. Thus the figures for 1896 for commercial companies, as well as the totals for that year, are not commensurate with the corresponding ones of the preceding years.

Number and Paid-up Capital of Corporations in Japan on December 31, 1894 to 1898.

[From official reports of the Japanese Government.]

CLASSES OF CORPORATIONS.	1894		1895		1896		1897		1898	
	Number of corporations	Paid-up capital.	Number of corporations	Paid-up capital.	Number of corporations	Paid-up capital.	Number of corporations	Paid-up capital.	Number of corporations	Paid up capital.
Agricultural:		*Yen.*		*Yen.*		*Yen.*		*Yen.*		*Yen.*
Raising of silkworms	31	190,038	29	104,991	31	177,435	48	421,867	53	118,399
Pasturing	21	108,103	26	227,725	20	179,875	21	112,351	20	101,900
Fishing	23	245,136	15	177,765	19	600,678	29	613,225	38	673,557
All other	43	644,926	56	1,011,928	47	708,172	56	1,080,984	55	1,442,804
Total	118	1,188,203	126	1,522,409	117	1,666,160	148	2,229,627	[illegible]	[illegible]
Manufacturing:										
Silk	158	2,064,174	185	2,300,917	259	3,869,877	274	3,222,877	[illegible]	[illegible]
Spinning	53	14,337,596	64	19,612,622	76	28,770,847	85	34,166,683	[illegible]	[illegible]
Weaving	48	3,915,752	60	3,595,876	103	4,204,949	187	9,171,[illegible]	[illegible]	[illegible]
Mining	30	7,234,080	33	11,513,121	34	8,585,560	35	[illegible]	[illegible]	[illegible]
Alcoholic beverages	38	1,255,630	36	1,322,300	62	2,056,895	125	[illegible]	[illegible]	[illegible]
Sugar	7	705,395	7	666,621	9	1,474,[illegible]	5	[illegible]	[illegible]	[illegible]
Salt making	12	244,268	15	333,455	10	257,[illegible]	9	[illegible]	[illegible]	[illegible]
Drugs	15	1,210,662	20	1,514,100	25	2,249,734	33	[illegible]	[illegible]	[illegible]
Paper	19	2,780,480	24	2,590,320	28	2,872,793	31	[illegible]	[illegible]	[illegible]
Printing	34	576,215	46	649,320	63	690,067	72	[illegible]	[illegible]	[illegible]
Petroleum	70	619,476	67	926,382	88	1,754,339	70	[illegible]	[illegible]	[illegible]
Coal	9	973,664	10	1,012,974	17	9,500,000	28	[illegible]	[illegible]	[illegible]
Cement	11	1,267,570	11	1,302,355	14	1,330,000	16	[illegible]	[illegible]	[illegible]
Electrical lamps	22	2,379,193	26	3,152,165	37	4,624,097	42	[illegible]	[illegible]	[illegible]
All other	252	5,027,697	340	8,206,128	541	17,660,576	869	[illegible]	[illegible]	[illegible]
Total	778	44,589,762	944	58,728,656	1,366	89,900,900	1,881	105,381,106	[illegible]	[illegible]
Commercial:										
Dry goods	27	815,683	30	1,202,830	51	1,476,355	89	3,271,887	109	[illegible]
Raw cotton	5	486,000	5	324,500	28	1,420,191	33	2,739,600	[illegible]	[illegible]
Warehouses	38	919,861	52	1,287,750	42	1,630,270	110	[illegible]	[illegible]	[illegible]
Foreign commerce	12	915,000	13	1,465,348	17	2,157,250	24	2,040,650	[illegible]	[illegible]
Banks and credit institutions	232	3,895,850	222	3,554,240	1,277	146,008,482	1,583	203,657,778	1,806	[illegible]
Insurance	56	3,753,581	102	4,473,235	120	7,495,741	103	10,314,371	94	9,247,725
All other	628	9,193,899	727	11,527,455	1,243	32,682,423	1,688	31,195,036	1,992	36,157,726
Total	998	20,014,874	1,151	23,835,358	2,778	192,780,712	3,630	260,227,479	4,178	300,039,664
Transportation:										
Sea and river transportation	81	13,887,310	97	13,695,009	101	20,232,475	148	31,654,388	196	38,398,588
Railways	32	65,973,398	30	73,252,797	57	90,103,971	64	130,633,015	64	155,881,965
All other	97	2,699,571	110	3,013,029	176	2,880,311	242	2,366,762	276	2,952,868
Total	210	82,560,279	237	89,960,835	334	113,216,760	454	164,684,165	536	197,233,421
Total	2,104	148,353,118	2,458	174,047,258	4,595	397,564,532	6,113	532,522,377	7,044	621,676,458

STATISTICS OF LIFE INSURANCE COMPANIES IN JAPAN.

[From official reports of the Japanese Government.]

YEARS.	Number of companies.	Number of main offices and branches.	Number of stock-holders.	Paid-up capital.	Accumulated funds held according to law.	Receipts.
				Yen.	*Yen.*	*Yen.*
1899	25	10,178	4,809	2,052,500	9,566,114 [a] 644,636	9,587,627
1898	26	8,762	5,208	1,952,500	7,210,550 [a] 531,449	7,545,718
1897	25	6,822	4,995	1,880,000	5,157,785 [a] 417,771	5,752,718
1896	23	4,764	3,735	1,752,500	3,987,334	4,045,171
1895	9	1,828	1,386	721,000	2,781,657	1,674,353
1894	8	1,156	1,270	539,010	2,075,348	1,256,225
1893	4	523	778	305,000	1,458,008	1,089,214
1892	4	428	827	245,000	1,091,542	749,092
1891	4	332	860	230,000	690,851	566,918

YEARS.	Expenditures.	Number of lives insured.	Amount of insurance.	Amount of premiums.	Average amount of insurance.	FUNDS FOR THE INSTRUCTION OF CHILDREN.		
						Number of depositors.	Funds subscribed.	Premiums.
	Yen.		*Yen.*	*Yen.*	*Yen.*		*Yen.*	*Yen.*
1899	7,424,436	688,053	166,831,987	5,612,756	242	6,369	1,319,900	59,062
1898	5,374,317	645,986	152,194,277	4,898,116	236	6,506	1,336,700	56,457
1897	4,012,181	510,250	119,662,936	3,837,818	235	4,423	978,700	40,742
1896	2,931,336	347,391	83,185,107	2,712,555	239	3,174	785,650	28,116
1895	905,614	157,098	44,551,332	1,499,756	284	2,506	678,500	28,384
1894	609,393	103,827	31,909,250	1,080,128	307	2,174	625,100	27,392
1893	382,567	70,218	23,013,650	734,334	328	1,815	566,500	25,898
1892	292,640	51,898	17,548,600	549,871	338	1,705	546,000	23,392
1891	216,024	36,662	13,175,820	391,045	359	1,496	470,700	25,963

[a] Accumulated surplus.

STATISTICS OF FIRE AND MARINE INSURANCE COMPANIES IN JAPAN.

[From official reports of the Japanese Government.]

YEARS.	Number of companies.	Number of main offices and branches.	Number of stockholders.	Paid-up capital.	Accumulated funds held according to law.
FIRE INSURANCE COMPANIES.				*Yen.*	*Yen.*
1899	7	1,624	3,841	3,460,000	1,315,845 [a] 198,144
1898-1899	7	1,394	3,929	3,400,000	1,096,960 [a] 113,644
1897-1898	6	1,222	2,172	2,150,000	713,205 3,326
1896-1897	6	970	2,181	2,150,000	469,715
1895-1896	4	693	1,749	1,799,998	161,947
1894-1895	3	490	823	700,000	67,863
1893-1894	3	171	800	600,000	27,553
1892-1893	3	100	736	600,000	7,809
1891	2	62	323	281,180	6,355
MARINE INSURANCE COMPANIES.					
1899	3	833	2,198	2,500,000	290,000
1898	4	928	4,475	3,250,000	407,900
1897	4	856	2,483	3,000,000	345,100
1896	3	548	1,899	2,100,000	475,228
1895	3	427	1,940	2,100,000	362,000
1894	3	288	1,410	1,710,000	316,000
1893	2	136	1,165	960,000	510,000
1892	1	53	235	600,000	455,380
1891	1	45	241	600,000	331,564

STATISTICS OF FIRE AND MARINE INSURANCE COMPANIES IN JAPAN—Continued.

YEARS.	Receipts.	Expenditures.	Number of contracts.	Amount of insurance.	Amount of premiums.	Average amount of insurance.
FIRE INSURANCE COMPANIES.	*Yen.*	*Yen.*		*Yen.*	*Yen.*	*Yen.*
1899	2,999,430	1,980,486	111,991	236,361,182	[illegible]	.....
1898-99	2,163,057	914,875	88,871	142,486,077	[illegible]	.....
1897-98	1,755,567	740,529	74,488	108,098,954	[illegible]	.....
1896-97	1,314,901	556,381	56,365	73,391,164	[illegible]	[illegible]
1895-96	786,651	325,118	33,269	42,152,869	[illegible]	[illegible]
1894-95	559,764	280,916	23,776	23,796,697	[illegible]	[illegible]
1893-94	446,192	252,074	19,653	21,501,663	[illegible]	[illegible]
1892-93	206,351	145,442	11,437	12,631,316	[illegible]	[illegible]
1891-92	95,835	48,739	4,808	4,914,947	[illegible]	[illegible]
MARINE INSURANCE COMPANIES.						
1899	3,469,589	3,027,461	495,904	453,145,489	2,714,190	.....
1898	5,979,275	5,661,685	693,807	794,058,296	4,722,019	.....
1897	4,684,438	4,119,265	559,238	743,347,152	3,900,325	.....
1896	3,111,652	2,925,188	374,219	442,164,566	2,298,746	1,182
1895	2,425,077	2,237,746	215,983	283,504,316	1,837,517	1,313
1894	2,027,988	1,844,284	98,822	201,480,066	1,545,738	2,039
1893	1,731,631	1,251,973	60,313	129,992,573	1,417,169	2,321
1892	892,108	145,873	33,944	81,020,020	893,785	2,387
1891	488,344	69,945	21,482	47,550,791	409,768	2,214

[a] Special accumulated funds.

STATISTICS OF PRIVATE AND STATE EDUCATIONAL INSTITUTIONS IN JAPAN, DECEMBER 31, 1897.

[From official reports of the Japanese Government.]

DESCRIPTION.	Number of institutions.	TEACHING STAFF.			STUDENTS OR PUPILS.			GRADUATES.			Per cent of graduates to total number of pupils.
		Males.	Females.	Total.	Boys.	Girls.	Total.	Boys.	Girls.	Total.	
Primary schools	26,860	70,618	8,681	79,299	2,570,878	1,423,948	3,994,826	393,904	155,799	549,703	13.76
Ordinary grammar schools	159	2,285	23	2,308	53,332	359	53,691	2,484	7	[illegible]	[illegible]
Superior schools or colleges	6	243	.....	343	4,436	.....	4,436	971	.....	971	21.89
Imperial universities	2	198	.....	198	2,255	.....	2,255	386	.....	386	17.12
Superior military and naval schools	2	44	.....	44	129	.....	129	30	.....	30	23.25
Ordinary normal schools	47	677	43	720	8,020	810	8,830	1,497	243	1,740	19.71
Superior normal schools	2	85	18	103	436	208	644	26	44	70	10.87
Special and technical schools	272	2,532	57	2,589	33,904	2,710	36,614	10,294	338	10,632	29.04
Superior schools for girls	26	94	216	310	.....	6,799	6,799	.....	631	631	9.28
All other schools	1,132	2,295	725	3,180	53,316	18,671	71,987	8,114	2,266	10,380	14.42
Total (1897)	28,508	79,171	9,763	89,094	2,726,706	1,453,505	4,180,211	417,716	159,328	577,044	13.80
1896	28,427	76,158	8,816	84,974	2,669,752	1,369,075	4,038,827	393,099	138,719	531,818	13.17
1895	28,185	73,347	7,707	81,054	2,545,494	1,180,303	3,628,725	356,866	112,574	469,240	12.45
1894	25,640	64,784	5,574	70,358	2,443,422	1,090,987	3,459,448	342,843	100,245	443,088	12.81
1893	25,611	64,306	4,819	69,125	2,368,459	987,764	3,290,313	323,231	90,023	413,254	12.56
1892	25,404	63,410	4,278	67,688	2,302,549	965,122	3,285,394	295,258	78,105	373,363	11.36
1891	27,289	72,925	5,044	77,969	2,320,272	935,589	3,224,014	258,338	63,938	322,276	10.00
1890	27,898	71,186	4,540	75,726	2,288,425	998,826	3,155,560	221,100	53,350	277,450	8.79
1889	28,052	69,668	4,142	73,810	2,246,734	885,813	3,055,380	178,670	39,582	218,252	7.14
1888	27,946	66,063	3,754	69,817	2,169,567	817,962	2,823,350	156,683	37,437	194,120	6.85
1887	27,500	60,342	2,892	63,234	2,015,388	826,503	2,995,890	203,623	52,275	255,898	8.81
1886	30,388	81,575	3,874	85,449	2,079,387	951,066	3,200,170	116,579	40,367	156,946	4.90
Primary schools 1898	26,824	73,665	9,991	83,556	2,582,577	1,480,141	4,062,418	(a)	(a)	(a)	(a)

[a] No data

EDUCATIONAL INSTITUTIONS MAINTAINED BY THE STATE IN JAPAN, 1892 TO 1899.

[From official reports of the Japanese Government.]

NAMES OF INSTITUTIONS AND MINISTRY IN CHARGE.	TEACHING STAFF.		STUDENTS.		
	Japanese.	Foreigners.	Free scholars.	Paying students.	Total.
Ministry of public instruction:					
Imperial University of Tokyo	205	17	118	2,578	2,696
Agricultural normal school	5		41		41
Imperial University of Kioto	49	1		217	217
Superior normal school	81	2	354	24	378
Ordinary grammar school, attached to the superior normal school	18	1		294	294
Superior normal school for girls	29				
	[a]7		192	10	202
	2				
Superior school for girls, attached to the superior normal school for girls	[a]17			383	383
Agricultural school of Sapporo	30		27	263	290
Superior commercial school	40	7	7	582	589
Commercial normal school	19		25		25
Superior schools or colleges	337	16	18	5,071	5,089
School of arts and trades at Tokyo	48		10	337	347
Apprenticeship school, attached to the school of arts and trades at Tokyo	10			110	110
Normal school of arts and trades	21		75		75
Preparatory school of arts and trades, attached to the normal school of arts and trades	3			30	30
School of foreign languages at Tokyo	24	12		473	473
School of fine arts at Tokyo	46			300	300
School of music at Tokyo	29	1		72	72
	[a]11			143	143
School of arts and trades at Osaka	25			196	196
Institution for deaf-mutes at Tokyo	11		5	139	144
	[a]1		3	63	66
Total	1,033	57	681	10,615	11,296
	[a]36		195	539	734
Ministry of imperial household:					
Gakushia-in (special school for nobles)	59	3		65	65
School for noble girls	19				
	[a]22			450	450
Total	78	3		65	65
	[a]22			450	450
Ministry of war:					
Superior Military School	39		136		136
School of Artillery and Military Engineering	40		26		26
Military school	143		677		677
Central Military "Prytaneum"	75		[b]322	20	342
Local Military "Prytanea"	159		[b]135	745	880
Toyama Gakko (school for officers-monitors)	68		90		90
School for noncommissioned officers	23		145		145
School of administrators and stewardship	27		4		4
Other schools	91		1,645		1,645
Total	665		[illegible]	[illegible]	[illegible]
Minister of the navy:					
Superior School of Marine Science	24	2			25
Naval school	33	2	[illegible]		[illegible]
School of Mechanics	25	2	108		108
Medical School of the Navy	15				[illegible]
School of accounting officers	14				[illegible]
School for work in naval construction	12				[illegible]
Total	163	6	[illegible]		[illegible]
Ministry of communication:					
Naval Commercial School of Tokyo	18		294	118	412
Naval Commercial School of Osaka, attached to that of Tokyo	3			239	239
Naval Commercial School of Hakodate, attached to that of Tokyo	4			327	327
School of Postal and Telegraph Matters	11		1,184		1,184
Total	36		1,478	734	2,212
Government of Taiwan:					
School of Japanese language	35				[illegible]
	[a]2				[illegible]
Preparatory schools of Japanese language	19				[illegible]
Primary schools	11				[illegible]
Total	67				1,187
1899 (total number of institutions, 61)	2,039	68	5,[illegible]	[illegible]	[illegible]
	[illegible]		[illegible]	1,[illegible]	2,[illegible]
1898 (total number of institutions, 55)	2,[illegible]	[illegible]	[illegible]	11,[illegible]	[illegible]
	[illegible]		[illegible]	[illegible]	[illegible]
1897 (total number of institutions, 41)	1,[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]		[illegible]	[illegible]	[illegible]
1896 (total number of institutions, 41)	[illegible]	41	[illegible]	[illegible]	[illegible]
	[illegible]		207	818	[illegible]
1895 (total number of institutions, 42)	1,[illegible]	41	2,[illegible]	[illegible]	11,[illegible]
	[illegible]		[illegible]	715	[illegible]
1894 (total number of institutions, 43)	1,[illegible]	44	2,[illegible]	8,114	11,[illegible]
	[a]31	1	[illegible]	[illegible]	[illegible]
1893 (total number of institutions, 44)	1,[illegible]	32	2,[illegible]	[illegible]	11,[illegible]
	[a]33	1	[illegible]	[illegible]	[illegible]
1892 (total number of institutions, 41)	1,41[illegible]	[illegible]	2,[illegible]	7,[illegible]	[illegible]
	[a]29	1	[illegible]	[illegible]	[illegible]

[a] Girls.

[b] Includes scholars and fellows.

Finances of the Japanese Government.

[From official sources of the Japanese Government.]

RECEIPTS OF THE TREASURY.

RECEIPTS FROM VARIOUS SOURCES.	CLOSED ACCOUNTS.					OPEN ACCOUNTS.		BUDGET ESTIMATES
	1893-94	1894-95	1895-96	1896-97	1897-98	1898-99	1899-1900	1900-1901
Ordinary receipts:	Yen.	Yen.	Yen.	Yen.	Yen.	Yen.	Yen.	Yen.
Land tax	38,808,680	39,291,495	38,622,868	37,640,235	37,964,727	38,440,980	44,797,669	[illegible]
Income tax	1,238,763	1,353,518	1,497,095	1,810,212	2,095,092	2,351,420	4,756,867	[illegible]
Patents	.....	.....	.....	52	4,416,246	5,478,935	[illegible]	[illegible]
Tax on the manufacture of sake	16,637,436	16,130,471	17,748,735	19,476,404	31,105,172	32,959,996	48,689,268	[illegible]
Other internal imposts	8,194,512	8,755,639	9,973,286	10,732,060	11,311,098	9,306,413	5,826,990	[illegible]
Custom duties	5,125,372	5,755,456	6,785,640	6,728,323	8,020,513	9,092,592	15,995,791	[illegible]
Public domain and industrial undertakings	11,743,268	14,116,733	15,951,093	17,768,679	19,772,916	25,410,061	34,709,059	[illegible]
Stamp duties	.....	.....	.....	5,377,106	5,970,689	6,163,095	11,995,531	[illegible]
Sundry receipts	3,221,835	3,308,534	3,727,878	1,108,435	2,080,830	2,548,045	2,552,284	[illegible]
Interest on deposits	913,214	1,036,608	1,068,057	1,548,193	1,535,679	1,699,000	2,024,281	[illegible]
Funds devoted to the reduction of the debt incurred for public works of Taiwan	.....	.....	.....	.....	.....	.....	23,333	[illegible]
Revenues of Taiwan	.....	.....	.....	2,711,823	.....	.....	.....	.....
Funds devoted to public instruction	.....	.....	.....	.....	.....	.....	.....	[illegible]
Total	85,883,080	89,748,454	95,444,652	104,901,522	124,222,964	132,849,617	176,749,819	192,760,180
Extraordinary receipts:								
Proceeds of gifts made by private individuals	19,115	150	28,900	19,676	.....	.....	20,000	215,000
Proceeds of the sale of public domain	678,968	655,683	645,356	1,111,031	922,500	820,147	827,800	816,916
Sundry receipts	346,031	156,718	294,157	1,398,703	3,862,263	622,136	391,464	825,579
Amount assigned to defray the expense of printing and issuing Government bonds	78,060	.....	488	1,685	1,074	.....	.....	.....
Supplementary credit for the construction of men-of-war	1,646,492	1,715,348	1,822,714	1,781,771	836,907	1,507	.....	.....
Indemnity received from the Chinese Government for garrison of Wei-Hai-Wei	.....	.....	.....	741,430	822,524	816,148	.....	.....
Amount turned over to the central treasury by the districts for local public works	.....	.....	.....	324,400	398,200	664,859	637,282	1,246,976
Loans	.....	.....	.....	2,976,600	36,389,874	35,352,806	35,172,362	32,183,650
Chinese indemnity	.....	.....	.....	11,789,389	40,360,796	46,187,071	32,638,620	23,752,739
Funds of the central institution to help the famine-stricken districts	390,464	145,252	155,069	1,439,790	410,106	28,551	51,576	.....
Amount destined for the special account of the indemnity	.....	.....	.....	.....	.....	.....	[illegible]	.....
Funds devoted to administrative expenses of State forests	.....	.....	.....	.....	.....	.....	347,337	1,778,778
Amount destined for army matters	.....	.....	.....	27,411,910	.....	.....	.....	.....
Amount destined for insurance losses	.....	.....	.....	.....	.....	.....	[illegible]	.....
Amount destined for conversion of the public debt	.....	.....	.....	.....	.....	.....	7,300	.....
Temporary loan	.....	.....	.....	.....	.....	.....	[illegible]	.....
Balance of funds destined to the redemption of the paper money of closed banks	.....	.....	.....	.....	.....	.....	4,728	.....
Amount left over from the preceding fiscal year	24,727,171	5,748,423	20,041,385	33,115,535	18,162,915	2,711,279	296,558	.....
Total	27,886,301	8,421,574	22,988,069	82,111,920	102,167,159	87,204,504	76,962,567	60,819,638
Total	113,769,381	98,170,028	118,432,721	187,013,442	226,390,123	220,054,121	253,682,556	254,549,818

EXPENDITURES OF THE TREASURY.

CLASSIFICATION OF EXPENDITURE.	CLOSED ACCOUNTS.					OPEN ACCOUNTS.		BUDGET ESTIMATES.
	1893-94	1894-95	1895-96	1896-97	1897-98	1898-99	1899-1900.	1900-1901
Ordinary expenditures:	Yen.	Yen.	Yen.	Yen.	Yen.	Yen.	Yen.	Yen.
Civil list	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000
Public debt	19,455,918	19,721,143	24,190,858	30,504,172	29,504,731	28,379,828	34,278,956	35,098,193
Imperial cabinet and privy council	472,221	427,790	487,993	513,729	464,579	466,660	387,483	358,683
Chambers of peers and of deputies	394,753	610,951	551,647	555,313	416,817	705,730	1,251,713	1,277,913
Ministry of—								
Foreign affairs	623,982	718,627	1,047,050	1,216,104	1,445,849	1,641,557	1,929,427	2,189,823
Interior	2,904,834	2,820,589	2,852,265	1,544,468	1,581,695	1,874,761	4,555,312	7,527,222
Finance	4,429,240	4,539,428	4,539,783	6,635,465	8,[illegible]70,272	9,002,239	10,849,104	9,764,086
War	12,419,829	7,828,074	8,410,212	22,613,590	28,746,263	32,562,072	35,422,674	37,309,975
Marine	5,141,475	4,573,605	4,913,244	7,351,330	9,543,889	11,191,475	14,572,638	17,513,554
Justice	3,451,911	3,387,668	3,339,512	3,452,933	3,543,489	3,825,687	4,962,178	4,882,118
Public instruction	932,562	923,384	1,047,010	1,422,389	1,985,729	2,336,691	3,062,753	4,178,278
Agriculture and commerce	928,912	862,344	909,745	1,142,498	1,364,923	1,644,371	1,777,[illegible]	[illegible]
Communication	5,469,524	6,171,236	7,043,250	8,262,078	10,629,496	14,515,660	14,[illegible],731	17,307,312
Colonies	.....	.....	.....	7,583,928	1,817,024	1,915,751	.....	.....
Board of auditors	125,815	126,716	126,188	144,966	193,583	200,465	200,067	202,131
Court of administrative litigation	37,321	36,514	39,255	40,237	40,797	39,376	43,031	44,095
Provincial administration	4,757,272	4,673,337	4,649,965	4,732,687	4,945,991	5,830,541	6,140,186	6,004,836
Reserve of the treasury	.....	.....	.....	.....	.....	.....	.....	[illegible]
Total	64,545,599	60,421,346	67,148,007	100,715,887	107,695,127	119,072,144	137,314,631	150,408,534
Extraordinary expenditures:								
Civil list	.....	.....	.....	700,000	.....	.....	.....	.....
Ministry of—								
Foreign affairs	19,264	311,888	300,986	173,674	118,459	125,185	101,932	81,388
Interior	11,465,283	2,426,552	3,668,978	11,025,291	10,325,660	7,159,596	17,251,226	15,041,460
Finance	1,185,170	4,748,561	2,051,804	2,579,837	10,224,769	6,143,094	6,761,053	5,229,385
War	2,301,397	2,580,862	1,605,723	30,628,934	31,401,725	21,335,581	16,876,232	15,625,910
Marine	2,959,446	5,679,549	8,607,025	12,654,428	40,850,645	47,338,427	47,066,796	23,409,626
Justice	75,561	51,648	77,259	162,896	215,016	310,088	480,458	357,726
Public instruction	135,241	125,305	106,105	327,095	626,870	658,706	1,189,741	2,010,616
Agriculture and commerce	493,177	333,905	325,975	488,032	1,514,188	2,312,004	4,918,965	10,520,646
Communication	1,401,734	1,449,027	1,425,317	4,738,173	11,475,956	9,406,803	21,088,812	29,864,327
Colonies	.....	.....	.....	4,662,262	9,230,429	5,895,947	.....	.....
Total	20,036,273	17,707,297	18,169,172	68,140,622	115,983,717	100,685,425	116,348,210	102,141,284
Total	84,581,872	78,128,643	85,317,179	168,856,509	223,678,844	219,757,569	253,662,841	254,549,818

PUBLIC DEBT OF JAPAN, 1890-91 TO 1899-1900.

[From official sources. End of the fiscal year, i. e., March 31.]

DESCRIPTION OF DEBT.	1890-91	1891-92	1892-93	1893-94	1894-95	1895-96	1896-97	1897-98	1898-99	1899-1900
	Yen.	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*
Loan called "Kiukosai," or "old debt." Without interest (debt of the old "Han" or "Daimio")	6,803,090	6,583,635	6,364,181	6,144,726	5,925,272	5,705,817	5,486,363	5,266,908	5,047,454	4,827,999
Loan called "Shinkosai," or "new debt" (id.), 4 per cent	10,541,275	10,535,925	10,525,925	8,530,375	7,831,100	4,178,200	.....	.....	.....	.....
Loan for retiring the "Kinsatsu," 6 per cent.	11,890,000	11,850,600	1,955,800	.....	.....	.....	.....	.....	.....	.....
Loan called "Kinroku" (for redeeming the feudal pensions), 5 per cent	30,760,020	30,750,020	30,740,020	30,730,020	30,297,120	30,211,120	29,823,520	29,453,820	26,046,920	25,428,650
Loan called "Kinroku" (for redeeming the feudal pensions), 6 per cent	24,102,405	24,082,705	8,328,530	.....	.....	.....	.....	.....	.....	.....
Loan called "Kinroku" (for redeeming the feudal pensions), 7 per cent	16,091,245	.....	.....	.....	.....	.....	.....	.....	.....	.....
Loan for public undertakings, 6 per cent	10,700,200	10,680,200	.....	.....	.....	.....	.....	.....	.....	.....
Loan for the construction of the Nakasendo railways, 7 per cent	19,980,000	13,923,900	.....	.....	.....	.....	.....	.....	.....	.....
Loan for naval armaments, 5 per cent	17,000,000	16,990,000	16,980,000	16,970,000	16,960,000	16,950,000	15,036,000	9,288,000	9,222,000	8,708,000
Converted debt, 5 per cent	88,182,300	109,858,100	154,483,000	166,182,450	166,182,450	168,472,450	172,061,700	173,857,250	180,223,050	185,045,000
Loan for covering additional expediture in the construction of railways, 5 per cent	2,000,000	2,000,000	2,000,000	2,000,000	.....	.....	.....	.....	.....	.....
Loan for the construction of railways, 5 per cent	.....	.....	.....	2,000,999	4,000,000	6,000,000	10,000,000	17,807,850	17,807,850	24,042,700
Loan for the Hokkaido Railway, 5 per cent.	.....	.....	.....	.....	.....	.....	.....	1,000,000	1,000,000	3,419,950
Loan for the war, 5 per cent	.....	.....	.....	.....	20,161,250	160,044,000	121,724,000	121,572,000	122,865,750	118,578,450
Loan for communication works, 5 per cent	.....	.....	.....	.....	.....	.....	3,000,000	38,000,000	37,900,000	119,181,000
New foreign loan, 7 per cent	5,180,120	4,488,624	3,748,816	2,957,280	2,110,112	1,203,408	235,752	.....	.....	.....
Total	243,230,655	241,743,709	235,126,272	235,814,851	263,807,284	341,759,905	357,335,135	439,245,928	461,253,124	[illegible]
Loan for the suppression of the revolt, 7½ per cent	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	8,000,000	4,000,000	.....	.....	.....
Loan for the redemption of the paper money (without interest)	22,000,000	22,000,000	22,000,000	22,000,000	22,000,000	22,000,000	22,000,000	22,000,000	22,000,000	22,000,000
Loan for army purposes, 5 per cent	.....	.....	.....	.....	20,500,000	37,900,000	27,000,000	.....	.....	.....
Paper money in circulation	31,370,072	25,702,384	19,200,044	15,704,773	13,020,517	10,679,236	9,045,082	6,995,374	5,112,295	2,[illegible]
Total	306,600,727	299,446,093	286,326,316	283,519,624	329,327,801	420,339,241	419,380,217	492,241,302	488,365,419	[illegible]

NOTE.—The above statement relates to conditions at the close of the fiscal year which ends March 31.

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