VOLUME I SCIENCE SERIES NUMBER I

THE UNIVERSITY OF MISSOURI STUDIES

TOPOGRAPHY OF THE THORAX AND ABDOMEN

BY

PETER POTTER

Associate Professor of Anatomy St. Louis University sometime Instructor in Anatomy University of Missouri

PUBLISHED BY THE
UNIVERSITY OF MISSOURI
August, 1905

PRICE, $1.75

1

TOPOGRAPHY OF THE THORAX AND ABDOMEN

VOLUME I SCIENCE SERIES NUMBER 1

THE UNIVERSITY OF MISSOURI STUDIES.

TOPOGRAPHY OF THE THORAX AND ABDOMEN

BY

PETER POTTER

Associate Professor of Anatomy St. Louis University sometime Instructor in Anatomy University of Missouri

PUBLISHED BY THE
UNIVERSITY OF MISSOURI
August, 1905

COLUMBIA, MO.:
E. W. STEPHENS PUBLISHING CO.
1905

PREFACE

This paper is the revised and enlarged form of a thesis presented to the University of Missouri in June, 1903, for the degree of Master of Arts; and is based upon work begun in the anatomical laboratory of the University of Missouri in 1901.

The object of the paper is to add to the few detailed observations upon the interrelations of the organs as found in a single body.

For this purpose, therefore, a body has been studied by the method of sections, with reference to the more important thoracic and abdominal organs and systems which are described individually, giving in each case the topography of the part, its relations to surrounding structures, and a comparison with the literature of the subject. Although no attempt has been made to exhaust this literature, reference is made constantly to the text-books of descriptive anatomy, by Quain, Cunningham, Testut, Bardeleben, and Poirier and Charpy; the anatomical atlases of Braune, Toldt, Spalteholtz, Bardeleben and Haeckel; and the topographical anatomies of Joessel, Merkel, Hyrtl, and Ruedinger, and special articles and monographs by Henke, Toepken, Schiefferdecker, Addison and others. After each discussion, there is indicated, briefly, the more important points of difference between the relations of the organs found in the trunk described in this paper and those described by the authors named.

I have been at all times greatly assisted by the advice of Dr. C. M. Jackson, under whose direction the work was commenced and who has untiringly aided until its completion.

I am also under obligations to Dr. A. C. Eyclesheimer, of St. Louis University, Dr. D. D. Lewis, of the University of Chicago, and to Dr. L. F. Barker, of the Johns Hopkins University, for many helpful suggestions and encouragement.

I am greatly indebted to Mr. Roy Dimmitt, superintendent of Manual Arts, Birmingham Public Schools, Birmingham, Alabama, for lettering the plates; and to Mr. Alfred Streedain, artist to the department of Anatomy, St. Louis University, for lettering the projections.

TABLE OF CONTENTS

TOPOGRAPHY OF THE THORAX AND ABDOMEN

INTRODUCTION

THE use of sections in the study of human topographic anatomy can be traced back for several centuries. They were used to illustrate the works of Vesalius (1555), Eustachius (1564) and numerous anatomists of the seventeenth and eighteenth centuries. These illustrations consist chiefly of crude and schematic representations of head and pelvic sections.

De Riemer,[1] a Dutch anatomist, made sections of the frozen body in 1803 and published his atlas in 1818.

Froriep,[2] of Tübingen, made sections of frozen arms and legs in 1813 and of frozen female pelves in 1815. He announced as his most striking observation "the entirely new view of the relations of the parts given by the method." This view was so different from that obtained by the ordinary methods of study that he states: "It is necessary for one to feel one's way, as it were, among the parts."

[1] De Riemer, P., Exposition de la position exacte des parties internes du corps humain, tant par rapport à leur position mutuelle, que par leur contact aux parois des cavités ou elles se trouvent placées; avec une description explicative y relative. La Haye, 1818.

[2] Froriep, Ludwig Friedrich V., Ueber anatomie in beziehung auf chirurgie. Nebst einer darstellung der relativen dicke und lage der muskeln am ober-und unterschenkel. Weimar, 1813. Ueber die lage der eingeweide im becken, nebst einer neuen darstellung derselben. Weimar, 1815.

Pirogoff,[3] a Russian surgeon and anatomist, reinvented the method of frozen sections and used it very extensively. His work, in five large volumes, contains over 200 figures of sections through various parts of the body, illustrating both normal and pathological conditions.

Braune,[4] a German anatomist, used the method of frozen sections in his study of topographic anatomy. While his atlas is less extensive than that of Pirogoff it is far more accurate and his colored lithographic plates are (to this day) the best reproduction of sections through the human body.

I have not given the names of all of the workers along this line but have only indicated the main steps in the development of the use of sections in the study of topographic anatomy. Even though this method has been in use for several centuries it was not until recently that any marked advance was made. Each worker, when he first began the use of sections, expressed surprise at the great difference between the impressions obtained from the ordinary methods of study and those obtained from a study of sections. Yet many of these workers disregarded the results to be derived from the study of their sections and held to their ideas derived from other sources. In some instances the reproductions of the sections show wide deviations from the statements in the text.

It was not until Henke[5] suggested the construction,

[3] Pirogoff, Nicolas, Anatome topographica sectionibus per corpus humanum congelatum triplici directione ductis illustrata. Petropoli, 1852-9.

[4] Braune, W., Topographisch-anatomischer atlas. Nach durchschnitten an gefrorenen cadavern. 3 Aufl. Leipzig, 1886-8.

[5] Henke, W., Construction der lage des herzens in der leiche aus einer serie von horizontalschnitten. Tübingen, 1883.

from sections, of charts showing the positions of the organs of the body that there was any advance beyond what Froriep had announced nearly seventy years before.

Henke's method is, briefly, to establish a vertical line, representing the median sagittal plane of the body, crossed by horizontal lines representing the positions of the sections from which the projection is to be made. Any point in any section can be accurately projected upon the chart by using the vertical line and the proper horizontal line as coördinates.

This method of recording observations marks the beginning of a new epoch in topographic anatomy, because it puts each part into a concrete form and thus lessens the liability of error. At the present time, all writers on topographic anatomy give the section method a prominent place as a method of study.

Not only has the method of recording observations changed but also the method of preparation of the sections. The original method (that used by all the anatomists referred to) was to freeze the body thoroughly and while frozen to saw it into sections of the desired shape and thickness. The sections were then placed in strong alcohol and allowed to thaw slowly. The results were not entirely satisfactory since the organs did not always become sufficiently firm to retain their exact form and relations, and the shrinkage was unequal in the different organs. Moreover the surfaces were somewhat rough from the sawing so that it was difficult to recognize the finer structures.

A distinct step in advance was made when formalin, as a hardening reagent, was introduced into the methods of preparation. It was first employed, by F. Blum,[6] in microscopic technique and afterwards by Gerota in topographic anatomy. Gerota[7] suggested the injection of a five per cent solution of formalin into the arteries and the sectioning of the frozen body in the usual way. Jackson[8] has recently and independently shown that by the use of a fifty per cent solution of formalin it is not necessary to freeze the body before sectioning. The advantages of this method are that the organs, hardened in the exact form and position they were in at the time the body was injected, do not change after the sections are made; all parts except the bones can be cut with a knife, thus giving smooth, even surfaces. It is also possible to decalcify after hardening with formalin, but this is seldom necessary or desirable.

[6] Blum, F., Das formaldehyd als härtungsmittel. Vorläufige mitteilung. Zeitschrift f. wiss. mikroskopie, Bd. 10. 1893.

[7] Gerota, D., Ueber die anwendung des formols in der topographischen anatomie. Anat. anzeiger, Bd. 11. 1895.

[8] Jackson, C. M., A method of teaching relational anatomy. Journal of the american medical association, 1901.

MATERIAL AND METHODS

The sections upon which this paper is based were made, according to Jackson's method, from the body of a negro man about thirty years of age, six feet in height and about one hundred and ninety pounds in weight. The body was well proportioned, the muscles were well developed, there was no surplus fat and no external signs of abnormal or pathological conditions. Just after a full meal the man died from asphyxia while cleaning an old well. The body came into the anatomical laboratory of the University of Missouri a few hours after death and was at once injected, through the femoral artery, with about six quarts of fifty per cent formalin (twenty per cent formaldehyde).[1] Care was taken to have the body straight (in the dorsal position) and the limbs in their normal position. Within twelve hours after being injected the entire body was perfectly rigid. A few weeks later the trunk was cut into twenty-five cross-sections with a long knife and saw. It was the intention to have each cut pass through an intervertebral disc but this was not accomplished in every case. The surfaces of the sections should have been horizontal and parallel to each other, but those through the upper part of thorax are lower and thinner in front than behind. As each section was made the loose pieces and parts liable to be displaced were stitched in place with needle and thread. The body was so thor-

[1] A small quantity of a weak formalin solution had already been injected into the peritoneal cavity by an undertaker. This causes the abnormal dilatation of the peritoneal spaces seen between the organs in the abdominal sections.

oughly hardened that each organ shows the impressions made upon it by the adjacent organs and retains its form even though it is cut into relatively thin sections. The main structures in each section were identified without disturbing the relations of the parts.

While every part was yet in its normal position, a drawing was made of each section by placing a thin plate of glass on its upper surface and tracing the outline of the parts with a fine pen and India ink. The tracing was readily transferred to paper by placing the sheet on the glass over the drawing, holding them up to the light and retracing the outline on the paper. In making the tracings each line was drawn with the eye and pen directly over the same part, thus avoiding displacement on account of the thickness of the glass.

For the purpose of uniformity and in order to avoid unnecessary confusion all the plates represent the section as viewed from above with its posterior portion toward the top of the page.[2]

After the permanent outline records of the undisturbed parts had been thus obtained each section was studied in minute detail. Every part was followed from its beginning to its end through every section in which it appears. Vessels and other hollow structures were traced by passing a bristle through the lumen. Nerves, muscles, tendons, and all solid structures were traced by dissecting the connective tissue away from one side of each so that they could be followed through the section and definitely located in the next section.

[2] Jackson, C. M., Orientation of figures in topographical anatomy. nat. anzeiger, Bd. 20. 1901, s. 300.

In order to avoid errors, each plate was finished with the section from which it was taken before me. No attempt has been made to reproduce the parts in their natural colors or appearances. All finishing lines are more or less conventional and only attempt to give sufficient contrast so that the parts may be readily distinguished.

The bones are indicated by a central stippled area representing the cancellous bone, surrounded by a clear area representing the compact bone. The intervertebral discs and costal cartilages are white. The muscles are lined in one direction only, with the exception that the diaphragm and the walls of the heart are cross-lined. The arteries are red and the veins blue as are also the corresponding parts of the heart. The cavities of the body are black, except for a narrow white line around the boundary of each space. The nerves appear as circles. The spinal cord contains the sign H. The liver is lined with lines oblique to those of the muscles. The spleen and some of the lymph glands are filled in by circles. The lungs, thyreoid gland and pancreas are represented as composed of angular spaces. The irregular line in the suprarenal gland represents the medulla of the gland. The kidney shows the radiate appearance of the medullary substance. The ureter is shown as a small double walled tube with its inner wall wrinkled. The vas deferens is also double walled but the inner circle is very small. The sections of the alimentary canal are outlined only. The outer line represents the peritonaeal coat, the inner line the mucous coat and the interspace the remaining layers.

In a few sections uncut parts which lie near enough to the surface of the section to make it desirable to indicate their position are shown in the plates in dotted outlines.

The projections were made from careful measurements of the organs at the surface of the several sections. The measurements were made by means of a plate of glass, the surface of which was ruled with parallel lines 1 cm. apart. The center line and every fifth line was colored to facilitate the reading.

The ruled surface of the glass was placed upon the drawing so that the lines would be in immediate contact with the parts to be measured. To exclude errors, a duplicate set of measurements was taken in the same way directly from the sections. For projections upon the anterior and posterior surfaces of the body the middle line of the glass was always placed over the anteroposterior midline of the plate. This midline of the section was taken as a line through the middle of the sternum or linea alba anteriorly and the center of the centrum or intervertebral disc posteriorly. It does not pass through the spinous process in those cases where the latter is displaced to the right or left as sometimes happens.

The midline thus established was taken as the zero line of the section and the measurements were made to the right and left with it as the line of reference. Since the projection could only show the outline of an organ the point nearest the midline and the one farthest from the midline were the two measured. Where an organ crossed the midline, the points representing the two lateral extremities were taken. The same measurements were used for both projections. In the case of the lungs, however, two sets of measurements were taken, one for the anterior projection and the other for the posterior. The anterior margins and external surfaces were taken for the anterior projection (Plate XXVIII), and the most internal portions in the region of the posterior mediastinum (crista pulmonis of Merkel[1]) and the external surfaces for the posterior projection. This difference was made to show the more direct relations of the lungs to the sternum and to the vertebral column respectively.

The points measured upon any section were located on millimeter cross-section paper, on the horizontal line representing the upper surface of that section, at distances from the zero line equal respectively to their several distances from the midline of the section. In case the plane of the section was exactly horizontal, as in Plate XI, the points so located were points through which the outline of the corresponding organs must pass. But in those cases where the anterior and posterior margins of the section were at different levels, as in Plate VI, correction had to be made for the obliquity of the plane.

By careful dissections and comparison of the sections, the outline of each organ was made as nearly accurate as possible as to shape and size. When the outlines were penciled in and had been carefully compared with the organs, they were retraced with ink in the broken lines in which they appear in the plates.

It must be remembered in examining the projections that the cross-lines represent planes which are practically parallel and that the outline of any organ at a given level is as it would appear with the eye in that horizontal plane, and not as it would appear to the eye at any point outside of the

[1] Merkel, F., Bardeleben's Handbuch der anatomie. Bd. VI. Abthl. 1.

horizontal plane. Since every point upon the outline of an organ has been projected along a horizontal line parallel to the mid-plane from its position on the organ to the (anterior or posterior) surface of the body, it is necessary in order to see that point in its correct relations, to imagine that the eye is in the line of projection. The position of the eye must change, therefore, for every object viewed, and the projections do not represent exactly what would be seen if the body were transparent and viewed from a single point.

The nomenclature adopted by the German Anatomical Society at its meeting in Basel, 1895 [BNA] is used in Plates I to XXV. The intervertebral discs are designated by Roman numerals; the number in each case corresponding with the vertebra above.

The following topographic lines and directions are used:

The midline of a section is a line passing through the middle of the sternum or linea alba anteriorly and the center of the body of the vertebra posteriorly. The midplane of the body is a vertical plane which contains the midlines of the sections. Upon the anterior surface of the body this plane would appear as a line passing through the middle of the sternum and the linea alba (anterior midline "OO," Plate XXVIII) and upon the posterior surface as the posterior midline ("OO," Plate XXIX).

The midclavicular line is a vertical line through the middle of the clavicle, as seen in projection. It is about 8 cm. from the midplane.

The midaxillary line is a vertical line through the apex of the axilla when the arm is in its normal position ("OO," Plates XXX and XXXI). The plane connecting the two midaxillary lines is the midaxillary plane.

The terms right and left are used as applied to the body of the subject and not to that of the observer, e. g. the apex of the heart is on the left side of the subject and opposite the right side of the observer.

The term section refers to one of the parts into which the body is cut. A section is located by the level of its upper surface, as section X is through the seventh thoracic vertebra posteriorly and the third intercostal muscles anteriorly because in making this section these structures were cut by the knife and saw.

TOPOGRAPHY OF THE ORGANS

THE SKELETON

The vertebral column is about 4 cm. wide in the upper thoracic region. It decreases very slightly down to the middle of the thoracic region. From here downward it increases gradually until it is over 6 cm. wide at the sacrum. There is a gradual increase in the thickness of the centra. The first thoracic centrum is 1.5 cm., the third lumbar centrum is 2.7 cm. thick. The fourth and fifth lumbar centra are about the thickness of the first and second. The intervertebral discs correspond in width and thickness to the centra. The disc between the first and second thoracic vertebrae is only .5 cm. in thickness, while that between the third and fourth lumbar vertebrae is 1.2 cm., in thickness. The fourth and fifth lumbar discs are about the same thickness as the first and second. When seen from the side (Plates XXX and XXXI) the vertebral column is S-shaped. On account of a slight kyphosis the convexity in the upper thoracic region is a little greater than usual. For this same reason the spinous processes of the first three thoracic vertebrae are nearly horizontal.

The **sternum** extends from the level of the upper part of the third to the level of the lower part of the eleventh thoracic vertebra. The sternal angle is at the level of the lower border of the fourth thoracic vertebra. The **gladiolus** extends from the lower border of the fourth to the middle of the ninth thoracic vertebra. The **xiphoid process** is diamond-shaped and is located anterior to the lower half of the ninth and the tenth and eleventh vertebrae. It is inclined to the right of the midline, and is more firmly attached to the cartilage of the right seventh rib than to the gladiolus.

The **costochondral articulations** from the first to the tenth, lie in a straight line, oblique to the midline, which (in projection) is about 5 cm. from the midline at the first rib and about 13 cm. at the tenth rib. The **subcostal angle** is about 70^0. The sternal ends of the **clavicles** are in front of the second thoracic intervertebral disc and the upper half of the third vertebra. The **scapula** extends from the fifth cervical intervertebral disc to the lower part of the seventh thoracic vertebra. The glenoid cavity is opposite the first thoracic vertebra.

The highest point of the **crest of the ilium** is at the level of the fourth lumbar vertebra. The **tip of the coccyx** reaches the level of the middle of the symphysis pubis and the upper border of the great trochanters of the femur.

The right nipple is over the fifth rib. The left one is partly over the fifth rib and partly over the fourth intercostal space. Each one is about 11 cm. from the midline. The umbilicus is in front of the upper half of the fourth lumbar vertebra.

The majority of the texts consulted give insufficient data on the topography of the skeleton for a very satisfactory comparison. I believe, however, that the anterior thoracic wall is relatively low in this subject. The manubrium is more than 1 cm. below where it would be if found at the lower part of the second thoracic vertebra, as stated by Cunningham[1],

[1]Cunningham, D. J., A text book of anatomy. New York, 1903.

Poirier and Charpy[1], and Mehnert[2]. According to Mehnert, who has made a careful study of the topography of the thoracic organs, the upper border of the sternum in adults usually corresponds to the second thoracic vertebra or to the disc below. Occasionally it reaches the third as in this case. It is probable that the bending forward of the upper thoracic portion of the vertebral column has forced the manubrium down to the level of the third vertebra.

There seem to be several differences between the projections given by Hermann and Ruedel[3] and those given in this paper. But no definite conclusions can be drawn from their projections since they have not projected the skeleton and viscera in the same figure. There are no descriptions of the projections nor any explanation as to how they were made. Moreover the projections themselves do not appear to be very accurate. I made careful tracings of their projection of the skeleton upon the anterior surface of the body and placed it over the corresponding projections of the viscera. I found that the parts common to the projection of the skeleton and that of the organs (i. e., the cross-lines indicating the position of the surfaces of the sections, the body outline, the clavicles, the sternum and the subcostal angle, which are found in both projections) do not coincide as they should. Their table of levels may therefore be taken as of more value than their projections, and will be referred to as the various organs are discussed.

[1]Poirier, P. et Charpy, A., Traité d'anatomie humaine. I. Paris, 1899.

[2]Mehnert, E., Ueber topographische altersveränderungen des atmungsapparates. Jena, 1901.

[3]Hermann, F. und Ruedel, O., Die lage der eingeweide. Erlangen, 1895.

THE LUNGS

The lungs appear in Plates V to XIII and XXVIII to XXXV. While the left lung is adherent to the pleural wall throughout, its substance seems to be perfectly normal. The **apex** of the right lung is about 2 cm. and that of the left lung about 2.5 cm. above the upper border of the middle of the inner third of the clavicle, on a level with the middle of the first thoracic vertebra 3.5 cm. from the midline. By projecting up into the neck each apex comes into relations with the structures above the clavicle. The eighth cervical nerve and the lower trunk of the brachial plexus cross it from above outward and forward, while the sympathetic cord and inferior cervical ganglion rest upon it internally. The vertebral and ascending cervical vessels lie upon the anterior part of the pleural dome in their passage upward into the neck. The arch of the thoracic duct is separated from the left apex by these vessels (Plate IV). The subclavian artery arches across the apex less than 1 cm. from its highest point and separates the lung from the scalenus anterior muscle and the internal jugular vein. The innominate vein lies just below the subclavian artery and separates the lung and sternoclavicular articulation. When seen in anterior projection the apex of each lung is overlapped by the lower part of the corresponding lateral lobe of the thyreoid gland (Plates XXVIII and XXXII). The two organs are not in contact however (Plates XXX, XXXI, XXXIV and XXXV). The apex of the lung comes nearly to the surface of section IV in the quadrilateral space in front of the neck of the first rib where it is 6 or 7 cm. from the anterior surface of the neck and where it is separated from the thyreoid gland by the vertebral and ascending cervical vessels, and the internal part of the carotid sheath containing the common carotid artery. On the left side the thoracic duct is along with the ascending cervical vessels.

If a needle were inserted directly backward through the middle of the sternal head of the sternomastoid about 2 cm. above the clavicle it would enter the highest part of the apex of the lung. The needle would pass through the skin, platysma and sternomastoid muscles between the internal jugular vein and the thyreoid gland, through the common carotid artery and into the space containing the vertebral and ascending cervical vessels. On the left side it would pierce the thoracic duct. In each case the highest part of the apex lies a little internal to the interspace between the two heads of the sternomastoid.

The **anterior border of the right lung** is very indistinct above but is more plainly marked below. From the apex it passes downward behind the upper border of the sternum a little internal to the sternoclavicular articulation, and remains behind the right half of the sternum down to the sixth sternochondral articulation, where it becomes continuous with the inferior margin of the lung (Plates XXVIII and XXXII). The **anterior border of the left lung** is more plainly marked above than that of the right. It is deeply concave below where the heart encroaches upon this lung more than upon the right one (Plates XXVIII and XXXII). Beginning at the apex the anterior border may be traced downward and inward behind the left sternoclavicular and first sternochondral articulations. It passes to the left of the sternum in the first intercostal space and runs downward and outward to the middle of the fourth intercostal space in the midclavicular line. Here it turns inward, crosses the fifth rib 1 cm. internal to the midclavicular line and becomes continuous with the inferior margin of the lung in the fifth intercostal space.

The **posterior border** (or posterior surface) of each lung is separated from the corresponding internal surface by a ridge—**crista pulmonis** of Merkel—more plainly seen above the hilus than below it (Plates VI and VII). The crista of the right lung (seen in projection in Plates XXIX and XXXIII) lies anterior to the right half of the vertebral column from the second to the ninth thoracic vertebra. It becomes continuous with the posterior part of the inferior margin opposite the disc between the ninth and tenth vertebrae. The crista of the left lung lies a little farther from the midline and extends down to the side of the tenth vertebra where it turns outward to join the inferior margin in the tenth intercostal space, at the level of the disc between the tenth and eleventh vertebrae.

The **external surface** of each lung is convex in all directions and presents a regular curve from apex to base which follows the concave internal surfaces of the thoracic wall. These surfaces are crossed by oblique grooves which are the external limits of the fissures dividing the lungs into lobes. The lines in the projections indicating these fissures represent them as seen on the surfaces of the lungs. It must be borne in mind that the relations of a fissure to the ribs when seen from the front or back (Plates XXVIII, XXIX, XXXII and XXXIII) do not correspond exactly to those when seen from the sides, (Plates XXX, XXXI, XXXIV and XXXV).

The **great fissure of the right lung** begins behind, opposite the centrum of the fourth vertebra, between the spines of the third and fourth vertebrae, passes outward under cover of the fifth rib to cross the midaxillary line in the fifth intercostal space and ends in the inferior margin of the lung in the sixth intercostal space, about 1.5 cm. external to the midclavicular line. The **horizontal fissure** begins in the great fissure just posterior to the midaxillary line and runs inward and a little downward behind the third intercostal space to end in the anterior margin of the lung behind the fourth sternochondral articulation. The **great fissure of the left lung** begins behind, a little higher than that of the right lung. It is, at first, at the level of the disc between the third and fourth vertebrae and runs downward and outward across the fourth intercostal space and the fifth rib to cross the midaxillary line in the fifth intercostal space. Here it takes a more vertical direction and ends in the inferior margin of the lung at the upper border of the sixth rib a little external to the midclavicular line. A very narrow strip of the external part of the inferior lobe is seen, in the anterior view, near the outer part of the base of each lung. The remainder of the lung seen in anterior view is formed by the superior and middle lobes on the right side and the superior lobe on the left side (Plates XXVIII and XXXII). Posteriorly, the upper third is formed by the superior lobe in each case, while the remainder is formed by the inferior lobe.

The **internal surface** of each lung, which also extends from apex to base, is shorter and more irregular in contour than the external surface. It is concave in all directions. The concavity is more marked from before backwards than from above downwards, and in the lower two-thirds than in the upper third. That of the left lung is much more marked than the right (Plates X, XI, XII, XXVIII and XXXII). For convenience of description the internal surface of each lung may be divided into four areas. The first area may be made to include the hilus, the second, the region above the hilus, corresponding to the superior mediastinum, the third, posterior to the hilus, corresponding to the posterior mediastinum, and the fourth, anterior to the hilus, corresponding to the middle and anterior mediastinum.

The hilus is an area roughly oval in outline, much nearer the posterior than the anterior part of the middle of the inner surface of the lung, through which the root structures pass from the mediastinum to the lung. The **root of the right lung** begins above at a plane passed through the first intercostal space and the lower part of the fourth thoracic vertebra, and ends below at a plane passed through the upper part of the fourth sternochondral articulation and the lower border of the seventh thoracic vertebra. It lies between the vena cava superior and right auricle anteriorly and the vena azygos major and oesophagus posteriorly. The arrangement of the three main structures forming the root, from above downward is bronchus, artery, vein. The artery lies in a plane anterior to the bronchus and directly over the vein. The vena azygos major arches over the bronchus and empties into the vena cava superior opposite the middle of the fourth thoracic vertebra. The root is covered with pleura reflected from the mediastinum onto the inner surface of the lung. Anteriorly the reflection is from the vena cava superior to the pulmonary artery above and from the pericardium, at the level of the auricula, to the pulmonary vein below. Superiorly the pleura passes from the side of the trachea over the right bronchus onto the lung. The arch of the vena azygos major lies directly under the pleura covering this part of the root. Posteriorly the reflection is from the vena azygos major, except in the uppermost part, where that vein lies in the posterior part of the root. Here the reflection is from the side of the oesophagus. Inferiorly the pleura covering the root is prolonged downward from the pulmonary vein to the diaphragm, forming the ligamentum pulmonale connecting the inner surface of the lung to the mediastinal wall, (Plates XI, XII).

The **hilus of the left lung** is shorter and wider than that of the right lung. It extends from the lower border of the fourth to the lower border of the sixth thoracic vertebra. The **root structures** are in relation anteriorly with the pericardium over the left auricle, and posteriorly with the descending aorta and the oesophagus.

The aorta arches over the root of the left lung and lies in contact with the bronchus and the pulmonary artery. The bronchus, artery, and vein do not bear the same relation to each other as in the root of the right lung. The bronchus is above at first but in its downward course to pass under the arch of the aorta it also passes behind and below the pulmonary artery. The pulmonary vein lies below the artery but more anterior to it than on the other side. On the right side these structures are bronchus, artery, vein, from above downward; on this side they are more nearly bronchus, artery, vein, from before backward. On account of the pleural adhesions of this lung, it is difficult to determine the reflections of the pleura over the hilus.

In the **region of the superior mediastinum** the right lung is in relation with the trachea and oesophagus, and with the vena cava superior from its formation behind the first sternochondral articulation down to the right auricle. The crista pulmonis projects into the space between the oesophagus and the vertebral column. The vena cava superior makes a slight impression upon the lung near the anterior part of this surface. The innominate artery is in relation with this surface of the lung from the arch of the aorta up to where its subclavian branch arches across the anterior surface of the lung. The phrenic nerve is anterior to the lung above the first rib, but below this level it is between the lung and the vena cava superior. The vagus is also anterior to the lung above but at the sternoclavicular articulation it passes inward and backward between the lung and the trachea. In this region the left lung is deeply grooved by the arch of the aorta below and the subclavian artery and vertebral vein above. The groove for the subclavian extends from that for the aorta upward to the subclavian groove across the anterior surface of the apex. The crista pulmonis is in relation in this region with the thoracic duct and oesophagus anteriorly and the vertebral column posteriorly. The left lung does not enter into close relation with the trachea but is separated from it above by the subclavian artery, and the oesophagus which lies to the left of the midplane, and below by the arch of the aorta. The vagus and phrenic nerves of this side like those of the right side are at first anterior to the lung at the apex but pass internal to it just below. On both sides these nerves pass anterior to the arch of the subclavian. The left vagus follows the anterior surface of the left subclavian artery down to the arch of the aorta, the left side of which it crosses between the pleura and the artery. The phrenic nerve lies anterior to the vagus. It is between the lung and the innominate vein above, and is embedded below, in the mediastinal wall about half way from the sternum to the vertebral column (Plates V, VI, and VII).

In the **region of the posterior mediastinum** the internal surface of the inferior lobe of each lung presents a slight impression. The vena azygos major lies in the impression in the right lung. The descending aorta makes the impression in the left lung. This impression is not as deep as usual, and becomes less and less distinct from above downward. The oesophagus which lies a little anterior to these vessels is in contact with both lungs. It is partially separated from the left lung above by the aorta, but below where it crosses the anterior surface of the aorta it is in direct contact with this lung (Plates IX, X, XI, and XII). The lungs do not come into contact with the thoracic duct since that vessel lies between the vena azygos major and the aorta and behind the oesophagus.

In the **middle and anterior mediastinal regions** the internal surfaces of the lungs are in contact with the heart. When seen in anterior projection (Plates XXVIII and XXXII) the anterior border of the right lung overlaps the right border of the heart about 2 cm., while the anterior border of the left lung overlaps the left border of the heart less than 1 cm. at any point. All three lobes of the right and both lobes of the left lung touch the heart. The superior lobe of each lung is the only part in contact with the basal portion of the heart (Plates VIII and IX). These lobes present a triangular area in contact with the heart which may be bounded below by a line from the lower part of the sixth thoracic vertebra to the middle of the fourth sternochondral articulation on the right side and from the same vertebra to the sixth costochondral articulation on the left side. In each case this area touches both auricle and ventricle and on the left side the apex of the heart (Plates VIII to XII). The middle lobe of the right lung comes into contact with the right auricle near its upper and posterior part at the level of the disc between the sixth and seventh thoracic vertebrae and the third costal cartilage. The area covered by this lobe increases from above downward as that covered by the superior lobe decreases. At the level of the fourth cartilage and intercostal space it covers the anterior two-thirds of this side of the heart (Plate XI). The superior and middle lobes of the right lung together cover an area which corresponds very closely to that covered by the superior lobe of the left lung. The inferior lobe of each lung comes into contact with the posterior part of the left auricle near the disc between the sixth and seventh thoracic vertebrae. The surface of each of these lobes in contact with the heart becomes larger and larger from above downward. This is especially true of the left side where the heart encroaches more and more upon the internal surface of this lung (Plates XI and XII). The right phrenic nerve is in relation, in the superior mediastinum, with the superior lobe. About the level of the third costal cartilage it crosses the horizontal fissure and comes into relation with the middle lobe, which it crosses obliquely to reach the inferior lobe near the level of the fourth costal cartilage. It remains in contact with the inferior lobe down to its entrance into the diaphragm. The left phrenic is only in contact with the superior lobe of the left lung.

The **base** of each lung is deeply concave in all directions as may be seen from the height to which the dome of the diaphragm rises above the inferior margin of each lung (Plates XXVIII to XXXV). Its margin (margo inferior) is thin except internally, where it rests upon the central tendon of the diaphragm. The anterior part of the inferior margin of each lung is in the fifth intercostal space at the level of the xiphosternal articulation and the disc between the ninth and tenth thoracic vertebrae. The inferior margin of the right lung is nearly in a horizontal plane. It is behind the sixth right sternochondral articulation at the sternum, in the fifth intercostal space in the midclavicular line, at the upper border of the seventh rib in the midaxillary line, and over the head of the tenth rib at the side of the vertebral column. The inferior margin of the left lung begins anteriorly in the fifth intercostal space near the midclavicular line and passes behind the seventh rib in the midaxillary line to end in the tenth intercostal space at the side of the vertebral column.

The base of the **right lung** is separated by the right dome of the diaphragm from the right lobe of the liver. Since the middle lobe of the lung forms the anterior part of the base it enters into relation with a corresponding portion of the right lobe of the liver. The larger posterior part of the base of the lung is formed by the inferior lobe which is in relation with the remainder of the superior and a portion of the posterior surface of the right lobe of the liver. The inner and posterior part of the base is in relation with the vena cava inferior for the very short distance that that vessel is in the thoracic cavity between the vena caval opening through the diaphragm and that into the heart. Below the caval opening through the diaphragm the lung is separated from the vena cava inferior by the diaphragm (Plate XIII). The projections show the lung overlapping the liver only about 3 cm. This condition is probably due to the lung being in a condition of extreme expiration. During inspiration the lung margin may be pushed down into the costophrenic sinus several centimeters lower than is found in this subject.

The **base of the left lung** is in relation with the left lobe of the liver, the stomach, and the spleen. The liver extends from the midline of the body outward and a little backward, filling the central portion of the left dome of the diaphragm. It is in relation with the central portion of the base of the lung which is formed almost entirely by the inferior lobe of the lung. Since the inferior margin of the lung is below the level of the liver the peripheral portion of the base comes into relation with the fundus of the stomach from near the midclavicular line around to the vertebral column (Plates XIII, XXVIII and XXXII). The upper part of the spleen is interposed between the posterior part of the base of the lung and the posterior surface of the stomach below the level of the tenth vertebra. If the base of the lung were viewed from below, its gastric area would be roughly hourglass-shaped, being encroached upon by the liver from the front and right side and by the upper pole of the spleen from behind and the left. Plates XXVIII and XXXII show the superior lobe of the lung (in projection) in relation with the spleen but a reference to Plate XIII will show that this part of the lung is in reality separated from the spleen by a space 10 cm. in width containing the fundus of the stomach.

The lungs as found in this subject do not reach as low a level, especially upon the anterior thoracic wall, as is usually given in works on topographic anatomy. This difference is probably due to the lungs being in a condition of extreme expiration in this instance while the usual statements apply to a condition which is a mean between expiration and inspiration.

THE TRACHEA

The trachea begins opposite the lower part of the sixth cervical vertebra and bifurcates in front of the disc between the fourth and fifth thoracic vertebrae. Plates XXVIII, XXIX, XXXII and XXXIII show the first part of the trachea to the left of the midline, while Plate III shows it apparently to the right of the midplane. The measurements were made to the right and left of a line through the center of the centrum of the vertebra and the middle of the interspace between the hyoid muscles. From Plates I, II, and III it is evident that the neck is rotated to the right, hence the deviation from the midplane. Over the second thoracic vertebra the trachea is divided symmetrically by the median line, but deviates to the right in the region of the arch of the aorta (Plate VII). It rests upon the oesophagus posteriorly and to the left. It is in relation anteriorly, above the sternum, with the isthmus of the thyreoid gland and sternothyreoid muscles. Below the upper border of the sternum the trachea is crossed by the left innominate vein, which receives near the midline the inferior thyreoid veins. At about this same level the innominate artery is in contact with the right anterior part of the trachea separating it from the junction of the innominate veins. The ascending aorta and vena cava superior separate the remainder of the trachea from the sternum. In the region of the seventh cervical and the first thoracic vertebrae, the trachea is covered laterally by the lateral lobes of the thyreoid. At the lower extremity of the thyreoid the trachea comes into relation laterally with the common carotid arteries. The left carotid runs nearly parallel with the trachea down to the arch of the aorta, the right one down to the innominate artery. The lower half of the trachea is in contact laterally with the superior lobe of the right lung but is separated from the left lung by the oesophagus, common carotid and subclavian arteries above and the arch of the aorta below. In the upper part of the mediastinum the vagi nerves are separated from the trachea by the carotid arteries. Below, the left one is separated from the trachea by the aortic arch, while the right one lies between the trachea and the lung (Plates VI and VII). The right recurrent laryngeal nerve does not come into close relation with the trachea. The left recurrent lies in the left angle between the oesophagus and the trachea from the under part of the arch of the aorta to the larynx.

Mehnert[1] places the bifurcation of the trachea opposite the fifth or sixth thoracic vertebra and in old age as low as the seventh vertebra.

THE HEART

The heart is seen in section in Plates VIII to XII and in projection in Plates XXVIII, XXX, XXXI, XXXII, XXXIV and XXXV. The **base** lies between the second sternochondral articulations and the lower half of the fifth thoracic vertebra. The **apex** though poorly defined, may be located behind the fifth left costochondral articulation, about 7 cm. from the midline, at the level of the xiphosternal articulation and the lower border of the ninth thoracic vertebra. The **surface form** of the heart may be seen in Plate XXVIII. The base is represented by a line through the middle of the second sternochondral articulations. The right border lies entirely to the right of the sternum and extends from the lower part of the second right costal cartilage near the sternum, to the upper border of the fifth cartilage about 3 cm. from the midline. Its greatest distance to the right of the midline is at the lower end. The inferior border extends nearly in a straight line from the lower end of the right border to the apex point. It crosses the sternum from the lower part of the fifth right to the

[1] Loc. cit.

lower part of the sixth left sternochondral articulation. The left border extends upward, with a marked outward curve, from the apex point to the middle of the second left costal cartilage. Its greatest distance from the midline is about 9 cm. in the fourth intercostal space.

The outline as here mapped out is formed by all four chambers of the heart. The right auricle which is somewhat distended, forms the right half of the base, the entire right border and a small portion of the inferior border. The right ventricle forms the remainder of the inferior border, with the exception of a small strip near the apex which is formed by the left ventricle. It also forms the left half of the base and the upper portion of the left border, where the conus arteriosus rises above the left auricle. The left ventricle forms the small part of the inferior border about the apex and the lower two-thirds of the left border. The left auricle forms the short strip between the left ventricle and the conus arteriosus (Plate XXXII).

When viewed from the left side (Plates XXXI and XXXV) the main part of the heart is formed by the left ventricle with the left auricle above and behind it. The right ventricle forms the anterior boundary of the heart and separates the left ventricle from the sternum. The upper half of the posterior boundary is formed by the left auricle while the lower half is formed by the right auricle, with a small part of the left ventricle near the apex (Plates XI and XII).

When viewed from the right side (Plates XXX and XXXIV) the larger part is formed by the right auricle, with the right ventricle and its conus arteriosus forming the anterior boundary and the left auricle forming the upper half of the posterior boundary.

The positions of the orifices are indicated in Plates

XXVIII, XXX and XXXI. The **tricuspid** orifice is somewhat enlarged on account of the distention of the right auricle. It is oblong in outline, the long axis—superoinferior—being about 4.5 cm. and the short axis about 3.5 cm. in length. The long axis coincides roughly with that of the heart, and the plane of the orifice forms an angle of about 45 degrees with the midplane (Plates X and XI). The blood, in passing from the auricle into the ventricle, has a direction forward, to the left and a little downward. The orifice lies beneath the left half of the sternum extending from .5 cm. to the right of the midline, to the left border of the sternum. It extends from the level of the middle of the third to the upper part of the fifth sternochondral articulation or from the level of the upper border of the seventh to the lower border of the eighth thoracic vertebra.

The **pulmonary** orifice is behind the lower part of the second costal cartilage and the upper half of the second intercostal space at the left margin of the sternum. The plane of the orifice forms an angle of about 45 degrees with the coronal plane, so that the blood in passing into the pulmonary artery takes a direction upward, backward and a little to the left. The orifice is guarded by three semilunar valves, one of which is anterior, one internal and one posterior.

The **mitral** orifice is small and relatively wider than the tricuspid. Its long axis is nearly vertical, being about 4 cm. in length, while its short axis is about 3.5 cm. in length The blood takes a direction downward, forward and to the left in passing from the auricle into the ventricle. This orifice is located almost entirely to the left of the sternum behind the third costal cartilage, third intercostal space, and upper half of the fourth costal cartilage at the level of the seventh thoracic vertebra. Its center is about 1.5 cm. above, 3.5 cm. behind and 2 cm. to the left of the center of the tricuspid orifice.

The aortic orifice lies behind the left half of the sternum at the level of the upper border of the third costal cartilage and opposite the middle of the sixth thoracic vertebra. The plane of this orifice is more nearly horizontal than that of any of the other openings. It is about 2 cm. below and 2 cm. internal to the pulmonary orifice. The blood in passing into the aorta takes a direction upward, to the right and a little backward. The semilunar valves which guard the opening are one anterior and two posterior. The mesial posterior cusp is a little more anteriorly placed than the lateral (Plate IX).

The heart enters into relations with the surrounding organs through the pericardium which surrounds it and which will be considered as a part of the heart in this paragraph. The right auricle is separated from the anterior thoracic wall by the thin anterior part of the right lung. The right ventricle is in contact for the most part with the gladiolus throughout the entire extent of that bone, and with the second, third, fourth and fifth left costal cartilages and the intercostal muscles. Nearly half of the narrow strip of the left ventricle seen in the anterior projection is in direct contact with the ribs and intercostal muscles. The remainder of the ventricle together with the left auricle, is covered anteriorly by the anterior part of the left lung. Thus the greater part of the anterior surface of the heart is not covered by the lungs. This uncovered area which is about 10 cm. wide across at the fourth ribs is to be explained by the extreme contraction of the lungs and accompanying distention of the right auricle (Plates X and XI) and by the exclusion of the left lung from that part of the pleural cavity lying between the heart and the anterior thoracic wall by the adhesions of the mediastinal and costal pleurae.

Laterally the heart is in immediate contact with the anterior part of the internal surface of each lung. The right side of the heart may be divided into three areas each of which runs from above downward and forward and corresponds to one of the three lobes of the right lung. The upper area includes roughly the right auricula, and the conus arteriosus and is in relation with the superior lobe of the lung. The middle area includes the remainder of the right ventricle and the right auricle except the posteroinferior part near the opening of the vena cava inferior. It corresponds to the middle lobe of the lung. The lower area, which corresponds to the inferior lobe of the lung is small and includes a part of each auricle (Plates X, XI and XII).

The left surface of the heart may be divided in the same way into two areas, which correspond to the two lobes of the left lung. The upper area is the larger and includes the right ventricle, most of the left ventricle, and the superior and anterior part of the left auricle. This area corresponds very closely to the upper and middle areas of the right side. The lower area is a continuation outward of that part of the posterior surface of the heart in relation with the inferior lobe of the left lung. It includes the greater part of the left auricle and the postero-inferior part of the left ventricle.

The base of the heart is in relation with the great vessels which arise from it and with the large mediastinal lymph glands seen in Plate VII.

The heart is in relation, posteriorly, near the base, with the roots of the lungs. Below the roots of the lungs it is in contact with the oesophagus and descending aorta. A small part of the internal surface of each lung reaches the heart external to the oesophagus and aorta (Plates VIII and IX). Below the disc between the seventh and eighth thoracic vertebrae, the aorta is separated from the heart by the left half of the oesophagus. From above downward, more and more of the posterior surface of the heart is covered by the inferior lobe of the left lung.

Inferiorly, the right auricle and internal part of the right ventricle rest upon the central tendon of the diaphragm, while the remainder of the right ventricle and the left ventricle rest upon the internal muscular portion of the left dome. These portions of the heart are in relation through the diaphragm with the left lobe of the liver. They lie on a line which runs outward, forward and slightly downward from the disc between the eighth and ninth vertebrae to the anterior extremity of the left fifth rib. From Plates XXVIII and XXXII it appears that the heart is in relation with the fundus of the stomach, but Plate XIII shows that the lower part of the pericardial cavity is separated from the stomach by the left lobe of the liver. The apparent intimate relation between the apex of the heart and the upper pole of the spleen is of the same nature (Plates XIII, XXXI and XXXV).

The position and relations of the heart in this cadaver differ somewhat from those given in many topographic anatomies. Cunningham[1] gives photographs of formalin hardened bodies, with the heart exposed, which show the heart to be about 2 cm. lower on the anterior wall, than in these projections. Quain[2] gives practically the same posi-

[1] Loc. cit.

[2] Thane, G. D., Quain's Elements of anatomy. Angeiology, II. ii. London, 1896.

tion as Cunningham. Joessel[3] gives the same position for the heart but differs as to the location of the orifices. He places the tricuspid, pulmonary and aortic orifices lower than they, but the mitral as high or higher than found in this case. Hermann and Ruedel[4] project the heart at a higher level upon the ribs of the anterior wall of the thorax, but in their table of levels place it lower upon the vertebral column than found here. The valves are lower and the planes of the tricuspid and mitral are more oblique in their subject. Henke[5] and Toldt[6] also place the heart at a lower level. Deaver[7] and Merkel[8] locate it at nearly the same level as found here, but place the orifices differently. Deaver finds them lower and Merkel higher than here. Both however place the tricuspid orifice in a more oblique position with more of it to the right of the midplane than shown in Plate XXVIII. The heart in this subject is more horizontally placed with its valves more vertical than in any of the cases referred to above. The arch of the aorta is also higher than is given in any of the above works. The fact that the apex of the heart seems to be high would lead one to think that the apical portion has been raised, thus making the inferior border nearly horizontal and rotating the valve areas into a more vertical direction. The lower part of the margin of the tricuspid

[3] Joessel, G., Lehrbuch der topographisch-chirurgischen anatomie. Bonn, 1899.

[4] Loc. cit.

[5] Henke, W., Construction der lage des herzens in der leiche. Tübingen, 1883.

[6] Toldt, C., Anatomischer atlas. 2 Aufl. Berlin und Wien, 1900.

[7] Deaver, J. B., Surgical anatomy. Philadelphia, 1899-1903.

[8] Merkel. F., Handbuch der topographischen anatomie. Braunschweig, 1885-1899.

orifice may have been pushed to the left by the distention of the lower part of the right auricle (Plates X and XI). In this connection it will be noted that the left dome of the diaphragm is at nearly the same height as the right one. It is possible that the adhesions of the left lung to the pericardium and diaphragm, the moderate distention of the stomach and the intraperitonaeal injection may have raised the left dome of the diaphragm and carried the apical portion of the heart upward to a position higher than it originally occupied. However, it is not probable that these factors will account for the base of the heart and the arch of aorta being higher than usual.

AORTA AND VENAE CAVAE

The aorta lies entirely to the left of the midplane at its origin from the left ventricle behind the third left sternochondral articulation. The **ascending aorta** inclines to the right as it goes upward so that the base of the innominate artery is to the right of the midplane behind the first sternochondral articulation. The aortic arch lies behind the left half of the manubrium at the level of the disc between the third and fourth thoracic vertebrae, and the upper half of the fourth vertebra. Its highest point is less than 1 cm. below the upper border of the sternum. The artery reaches the left side of the vertebral column at the level of the fifth vertebra and remains in close relation with the left anterior aspect of the vertebral column down to the point of bifurcation over the disc between the third and fourth lumbar vertebrae (Plates VIII to XIX and XXVIII, XXIX, XXXI, XXXII, XXXIII and XXXV).

At its origin the aorta is in contact with the conus arteriosus anteriorly, with the left auricula and auricle to the left and posteriorly, and with the right auricle to the right (Plate IX). A little higher up, at the level of the fifth vertebra (Plate VIII), the left auricula has been replaced by the pulmonary artery, the left auricle by the right branch of the pulmonary artery, and the right auricle by the right auricula and vena cava superior. The remainder of the ascending aorta and the aortic arch are separated from the sternum and the left lung by large mediastinal lymph glands. The vena cava lies to the right of the ascending limb of the arch and is separated from it by the pericardium only (Plate VIII). The arch of the aorta is fitted closely around the left side of the trachea. The descending aorta is between the trachea and oesophagus internally and the internal surface of the left lung externally. The left bronchus passes under the arch of the aorta in contact with its concave surface and separates the descending limb from the pulmonary artery and the upper part of the left auricle. At the level of the fifth thoracic vertebra the oesophagus lies to the right of the aorta. It becomes gradually anterior to the aorta and crosses the artery in front of the ninth vertebra to reach the cardia of the stomach. The aorta makes a slight groove in the left lung posterior to the hilus but does not make an impression upon the lung near the base. The crura of the diaphragm cover the artery from the upper part of the tenth thoracic to the middle of the first lumbar vertebra, where the aorta pierces the diaphragm and comes into relation with the posterior surface of the pancreas. Just below the inferior border of the pancreas the artery is crossed by the left renal vein. At the level of the second lumbar vertebra the aorta passes behind the transverse portion of the duodenum. Below the duodenum the radix of the mesentery is attached to the posterior body wall over the aorta. From the arch to the disc between the first and second lumbar vertebrae, the thoracic duct lies along the right side of the aorta. The two vessels pierce the diaphragm together. The cisterna chyli lies to the left of the aorta over the second lumbar vertebra. The thoracic duct lies between the aorta and the vena azygos major. The aorta and vena cava inferior are separated near the heart by the oesophagus. After the oesophagus enters the stomach the vessels are separated by the right crus of the diaphragm, down to the aortic opening of the diaphragm. The last 5 cm. of the aorta are in direct relation with the left side of the vein. The left vagus nerve lies upon the anteroexternal part of the aorta down to the diaphragm. Its recurrent laryngeal branch passes between the bronchus and the under surface of the arch on its way back to the larynx.

The **vena cava superior** is formed behind the right border of the manubrium at the level of the first sternochondral articulation. It descends nearly vertically downward to empty into the right auricle at the level of the second intercostal space and the lower part of the fifth thoracic vertebra. It lies between the ascending aorta and the anterior part of the internal surface of the right lung. It is separated from the sternum by the lung, and passes behind the right auricula just before entering the heart. Behind the upper part of the vena cava superior is the trachea and behind the lower part, the right branch of the pulmonary artery. The right phrenic nerve runs between it and the pleura.

The **vena cava inferior** is formed in front of the lower part of the fourth lumbar vertebra a little to the right of the midplane and empties into the posteroinferior part of the right auricle (Plate XII) at the level of the disc between the eighth and ninth thoracic vertebrae. The opening, into the heart, of the vena cava inferior is vertically under that of the vena cava superior, and is also somewhat larger. At its origin the vein rests upon the anterior surface of the vertebral column and the right psoas major muscle. Over the second and first lumbar vertebrae, the right crus separates it from the vertebral column. From this level up to where it pierces the diaphragm it is separated from the centra by the lumbar portion of the diaphragm. It is crossed anteriorly by the third portion of the duodenum and the head of the pancreas and lies just internal to the first and second portions of the duodenum, and anterointernal to the right kidney, from which it is separated by the suprarenal gland. Above the level of these structures it is embedded in the posterior surface of the liver between the right and Spigelian lobes.

THE OESOPHAGUS

The oesophagus begins at the lower part of the sixth cervical vertebra and ends opposite the upper half of the tenth thoracic vertebra. It lies just anterior to the vertebral column near the midplane of the body. In the region of the last cervical and the first three thoracic vertebrae more than half of the oesophagus is to the left of the midplane. Over the fourth and fifth vertebrae it is pushed to the right of the midplane by the arch of the aorta. In the remainder of its course it deviates to the left and crosses the anterior surface of the aorta in front of the ninth vertebra. It pierces the diaphragm at this level and enters the cardiac portion of the stomach to the left of the tenth vertebra. Above the root of the lung it lies between the trachea and the vertebral column, with both of which it is in contact. It is in relation by its lateral surfaces above with the lateral lobes of the thyreoid gland

and below with the posterior part of the internal surface of each lung. The arch of the aorta separates it from the left lung at the level of the fourth vertebra. At the level of the fifth thoracic vertebra it is separated from the pulmonary artery by the bronchi and large bronchial lymph glands. At this same level the aorta lies to its left, the centrum of the vertebra behind it, and the vena azygos major to its right. Below this level it is separated from the vertebral column by the vena azygos major, the thoracic duct and the aorta, and is in contact anteriorly with the posterior surface of the heart down to the diaphragm. Below this it is in contact with the tuber omentale of the left lobe of the liver. It is in contact with the lung on either side in the region where it is anterior to the aorta and vena azygos major. The thoracic duct lies behind the oesophagus below the fourth thoracic vertebra, but crosses its left side and lies anteroexternal to it above the second thoracic vertebra.

STOMACH

The stomach lies in the left hypochondriac and epigastric regions. The fundus lies behind the left costal arch, and, in the midclavicular line, rises to the fifth rib on a level with the sixth sternochondral articulation. The **cardiac orifice** lies in the midaxillary plane about 2 cm. to the left of the midplane at the side of the upper half of the tenth thoracic vertebra, behind the sixth and seventh left costal cartilages near their junction with the sternum. The **pyloric orifice** is about 4 cm. to the right of the midplane at the level of the first lumbar vertebra. It is about 5 cm. in front of, 6 cm. to the right of, and 7 cm. below the cardiac orifice. The **lesser curvature,** which is a direct continuation of the right side of the oesophagus, lies to the left of the midplane at the eleventh vertebra and to the right at the twelfth vertebra. It is under cover of the inferior surface of the liver. The **greater curvature** of the stomach, which is a continuation of the left side of the oesophagus, passes upward and outward from the cardia under the fifth rib below the left dome of the diaphragm. It comes downward under the seventh rib, leaves the costal arch under the tenth costal cartilage, crosses the midplane at the upper part of the first lumbar vertebra and ends at the outer part of the pylorus just internal to the end of the right ninth cartilage. It lies in direct contact with the diaphragm and the anterior abdominal wall through the greater part of its course.

The **anterior surface** of the fundus and the body are in contact with the inferior surface of the left lobe of the liver, the diaphragm and anterior abdominal wall. The anterior border of the left lobe of the liver is relatively high so that the stomach comes into direct contact below the liver with the anterior abdominal wall internal to the costal arch and with the diaphragm external to the costal arch. That part of the anterior surface of the pyloric portion lying to the left of the midplane is in contact with the internal part of the inferior surface of the left lobe, but that part lying to the right of the midplane is in contact with the inferior surface of the quadrate lobe and the peritonaeal surface of the fundus of the gall bladder (Plates XVI and XVII).

The **posterior surface** of the stomach is in contact with the spleen which separates it from the diaphragm and base of the lungs below the level of the tenth thoracic vertebra. (See relations of lung to stomach.) The internal part of the posterior surface of the stomach is attached to the diaphragm above the disc between the eleventh and twelfth vertebrae, but below this level they are separated by the lienal recess of the lesser peritonaeal cavity. This peritonaeal portion of the posterior surface of the stomach is in relation with the pancreas, suprarenal gland, kidney and spleen. The superior border of the pancreas crosses the lower part of the stomach and separates it from a part of the suprarenal gland, kidney and spleen. (Plates XVI, XXVIII and XXXII.) Its anterior surface lies immediately below this part of the stomach. The upper half of the suprarenal gland, lies between the stomach and the vertebral column and the medial border of the kidney. Postero-external to the suprarenal area, also above the upper boundary of the pancreas, the upper pole of the kidney is in contact with the stomach. This area is bounded inferiorly by the pancreas, internally by the suprarenal gland, superiorly by the upper limit of the kidney between the suprarenal gland and the spleen, and externally by the spleen (Plates XXVIII and XXXII).

The **pyloric portion** of the stomach is in relation posteriorly with the neck and head of the pancreas, the hepatoduodenal ligament and the first portion of the duodenum. The greater curvature is bound closely to the transverse colon by the great omentum.

Cunningham, Addison[1] and Ruedinger,[2] place the cardiac orifice higher than found in this subject. Merkel places it at the level of the eleventh thoracic vertebra, which is several centimeters lower than most anatomists locate it. The difference seems to be more in its relation to the verte-

[1] Addison, C., On the topographical anatomy of the abdominal viscera in man. Journal of anat. & physiol., XXXIII, XXXIV and XXXV.

[2] Rüdinger, A., Cursus der topographischen anatomie. München, 1899.

bral column than to the anterior wall, since nearly every anatomist locates it near the seventh left sternochondral articulation. The pylorus in this subject is lower and further from the midplane than the above mentioned anatomists place it, but when it is remembered that the pylorus moves downward and to the right as the stomach is filled and that the stomach was moderately distended in this case, it will appear that the position of the pylorus as shown in these plates agrees more or less closely with the usual condition.

DUODENUM AND JEJUNOILEUM

The duodenum is seen in Plates XVII and XVIII. It begins at the pylorus opposite the first lumbar vertebra, rises about 1 cm. and turns backward and downward and runs by the side of the vertebral column as far as the disc between the second and third vertebrae. In its course upward and to the left it crosses the vertebral column opposite the lower half of the second and the upper half of the third lumbar vertebrae and ends about 5 cm. to the left of the midline opposite the first lumbar vertebra. The organ when viewed from the front (Plates XXVIII and XXXII) is roughly U-shaped with the right limb of the U nearly vertical, the two ends at about the same level and about 10 cm. apart. The lowest point of the U is in front of and a little to the right of the middle of the third lumbar vertebra.

The **first portion** lies between the liver externally, the head of the pancreas internally, the pylorus anteriorly and the kidney, suprarenal gland and vena cava inferior posteriorly. (Plate XVII). Above it, is the inferior surface of the right lobe of the liver, to which it is bound by the hepatoduodenal ligament, containing the root structures of the liver. The **second portion** is bound to the inner part of the anterior surface of the right kidney as far down as the lower margin of the hilus. For a very short space below the hilus the duodenum is internal to the kidney and rests upon the psoas major muscle and the ureter. Internally this second portion is attached to the vena cava inferior behind and the head of the pancreas in front. Anteriorly it is in relation to the antrum pyloricum and the beginning of the transverse colon. Externally it is in contact with the inferior surface of the liver above, and is attached to the hepatic flexure below (Plates XVII and XVIII). The third or **transverse portion** lies upon the vena cava inferior and aorta in front of the second and third vertebrae, and behind the lower part of the head of the pancreas which projects downward into the base of the mesentery attached to this part of the duodenum. The anterior surface of this transverse portion is crossed by the mesenteric vessels, and the large lymph glands which accompany them. The **fourth portion** of the duodenum is bound to the aorta, receptaculum chyli and left renal vessels posteriorly, and has the radix of the mesentery attached to it anteriorly. The head and neck of the pancreas are attached to the internal surface while the body of the pancreas passes outward above and behind the duodenojejunal angle. The lateral and anterior surfaces of this portion are in relation with coils of the jejunoileum.

The duodenum in this case corresponds closely with Schiefferdecker's[1] second position of the duodenum. However in the case of his figure as in the location given by

[1] Schiefferdecker, P., Beiträge zur topographie des darmes. Archiv für anatomie und entwickelungsgeschichte. 1886. Plate XVI, fig. 2.

most anatomists the duodenojejunal angle is at the level of the second instead of the first lumbar vertebra. Jonnesco[2] places the transverse portion across the fourth or fifth lumbar vertebra and the pylorus and duodenojejunal angle at the side of the first lumbar vertebra.

The **jejunoileum** begins at the duodenojejunal angle about 5 cm. to the left of the midplane at the level of the first lumbar vertebra, and ends at the ileocolic valve about 3 cm. to the right of the midplane over the right end of the disc between the fourth and fifth lumbar vertebrae. The coils of this part of the intestine are so variable in position and relations that they are not represented in the projections. The mesentery is attached to the posterior body wall along a line nearly straight from the duodenojejunal angle to the ileocolic valve. In the upper half this attachment is to the front of the fourth portion of the duodenum. In the lower half it is at first attached to the aorta, then to the vena cava inferior and right common iliac vessels.

THE LARGE INTESTINE

The **caecum** lies in the right iliac fossa and extends as far down as the promontory of the sacrum. Its **apex** is about 4 cm. below the ileocolic valve. The latter is anterior and to the right of the disc between the fourth and fifth lumbar vertebrae, about 1 cm. below a line connecting the highest points of the crests of the ilia and 3 or 4 cm. above a line connecting the anterior superior iliac spines.

The **vermiform appendix** arises from the posterior part of the internal surface of the caecum about midway between the ileocolic valve and the apex of the caecum, and extends

[2]Jonnesco, T., Poirier, P. et Charpy, A., Traité d'anatomie humaine, IV.

inward anterior to the right half of the fifth vertebra. It lies internal to the caecum and is connected to the intestine by a short mesoappendix. The appendix is about 9 cm. in length, .5 cm. in diameter, and with a lumen about .2 cm. in diameter. When seen from the front the first 7 cm. of the appendix form an irregular W-shaped figure, with the last 2 cm. lying between the W and the vertebral column (Plates XXVIII and XXXII). The caecum is almost entirely covered with peritonaeum, the upper part being slightly adherent to the psoas muscle posteriorly (Plate XXI). It lies in the lateral angle of the body cavity between the iliopsoas and transversus abdominus muscles. Internal to it are coils of the jejunoileum, and the appendix.

The **ascending colon** is considerably distended in its lower three-fourths, and fills a large part of the right lumbar region of the abdominal cavity. It ascends nearly vertically upward from the caecum to the inferior surface of the liver. It is covered with peritonaeum in front and on the two sides except where it comes into contact internally, near the hepatic flexure, with the duodenum (Plate XVIII). The lower half is in relation internally with the jejunoileum, anteriorly and externally with the body wall. Posteriorly it is attached to the quadratus and psoas muscles. The upper half is adherent internally to the second portion of the duodenum and posteriorly to the lower half of the kidney. Externally it is in contact with the liver and anteriorly with the beginning of the transverse colon. The ureter runs downward internal to the colon but does not enter into close relation with it as Plates XXVIII and XXXII might lead one to believe.

The **hepatic flexure** is at the level of the second lumbar vertebra about 7 cm. to the right of the midplane and 4 cm. in front of the midaxillary plane. Upon the anterior wall it may be located a little internal to the right tenth costal cartilage. It is anterior and external to the hilus of the kidney. It lies between the right lobe of the liver externally and the descending duodenum internally. The right lobe of the liver lies above the flexure while the fundus of the gall bladder is about 1 cm. above and in front of its highest point.

Quain[1] locates the hepatic flexure at the level of the first lumbar while Hermann and Ruedel[2] locate it as low as the upper part of the third lumbar vertebra.

The **transverse colon** is also distended near its beginning but the part lying to the left of the midline is contracted. At the hepatic flexure the colon turns forward, downward and to the left. The downward turn is small so that the colon soon takes a direction upward, backward and to the left (Plates XXVIII and XXXII) to reach the inferior pole of the spleen. The highest point reached by the colon is at the level of the upper border of the twelfth thoracic vertebra about 5 cm. to the left of the midplane and about 5 cm. in front of the midaxillary plane. From this highest point the colon descends rapidly, crosses the midaxillary plane at the level of the first lumbar vertebra and comes into contact with the lower end of the spleen (Plates XVI, XXVIII, XXIX, XXXI, XXXII, XXXIII and XXXV). This part of the colon is peritonaeal and is attached to the body wall by a mesocolon which arises from the anterior surface of the second portion of the duodenum and the head and anterior border of the pancreas. It is bound more or less closely to the greater curvature of the

[1] Thane, G. D. and Godlee, R. J., Quain's elements of anatomy. Appendix. Superficial and surgical anatomy. London, 1896.

[2] Loc. cit.

stomach by the great omentum. At the beginning it is in relation anteriorly with the anterior abdominal wall, externally and superiorly with the inferior surface of the right lobe of the liver, and posteriorly with the ascending colon, second portion of the duodenum and the head of the pancreas. A little higher up it is separated from the duodenum by the antrum pyloricum. The part of the colon lying to the left of the midplane is in relation with the body of the pancreas posteriorly, from the upper part of which it is separated by the greater curvature of the stomach. It arches over and is in contact with the duodenojejunal angle. At the level of the first lumbar vertebra it comes into contact with the inferior portion of the gastric surface of the spleen, and becomes retroperitonaeal.

The **splenic flexure** is in the midaxillary plane at the level of the first lumbar vertebra. It is separated from the ninth intercostal space by the diaphragm only, and from the kidney by the lower part of the tail of the pancreas.

The **descending colon** is more contracted than the other portions of the large intestine and extends from the splenic flexure to the crest of the ilium. It lies a little posterior to the midaxillary plane, and runs downward, inward and forward between the kidney and the lateral body wall above and the psoas and quadratus muscles and the body wall below. It is covered with peritonaeum on its anterior surface and a part of each lateral surface. Below the spleen and pancreas the colon lies upon the external (anterior) surface of the kidney (Plate XVIII). In the lower part of its course it lies in the groove between the psoas and quadratus muscles. Its peritonaeal surface is in contact with coils of the jejunoileum.

The **sigmoid colon** lies in the left iliac fossa and in the true pelvic cavity. It continues downward in the same direction as the descending colon from the iliac crest to the level of the first sacral vertebra where it turns horizontally inward and backward to pass over the brim of the pelvis (Plates XXVIII, XXIX, XXXII and XXXIII). The **pelvic portion** of the sigmoid is coiled upon itself and lies upon the anterior surface of the rectum in the region of the first four sacral vertebrae. The **iliac portion** of the sigmoid is contracted but soon after crossing the brim of the pelvis the colon becomes dilated. It turns downward for a short distance, separated from the anterior wall by the jejunoileum and its mesentery. Opposite the fourth sacral vertebra the colon turns upon itself in the anteroposterior direction and passes upward between the descending loop and the first part of the rectum. At the level of the second sacral vertebra the intestine makes another turn in the anteroposterior direction and joins the rectum. Thus there are two loops of the sigmoid and the first part of the rectum in the same anteroposterior plane anterior to the middle portion of the sacrum. The iliac portion of the sigmoid rests upon the iliopsoas. Its mesocolon is very short. The pelvic portion has a longer mesocolon which allows it to swing free in the pelvic cavity where it is in contact anteriorly and laterally with the jejunoileum.

The **rectum,** the remainder of the large intestine may be divided into two parts nearly equal in length. The upper part is covered upon its anterior surface with peritonaeum and extends from near the base of the sacrum to about 1 cm. above the tip of the coccyx. The lower part lies below the peritonaeal cavity. The **first portion** is greatly dilated and nearly fills the true pelvic cavity. It is covered with peritonaeum on its anterior surface and a part of each lateral surface. The posterior surface is attached to the concave anterior surface of the sacrum and coccyx by connective tissue containing nerves, blood vessels and lymph glands. On either side of the rectum are the large vessels and nerves which pass out through the great sacrosciatic notch (Plates XXII and XXIII). Anteriorly it is in relation above with the pelvic portion of the sigmoid colon and below with the bladder. The ureters and vasa deferentia pass across the lower part of the anterior surface to gain the posterior surface of the bladder (Plate XXIII). The lower half of the rectum is contracted. Its anterior wall is a vertical continuation of the anterior wall of the upper half. It is surrounded by the cone-shaped levator ani muscle with which its muscular coat becomes continuous near the anus (Plates XXIV and XXV). It is in contact above, anteriorly with the prostate gland and posteriorly wtih the tip of the coccyx. Its lower part is separated from the bulb of the urethra anteriorly by the perinaeal body. Its relation to the ischiorectal fossae posterolaterally is well shown in Plates XXIV and XXV.

THE LIVER

The liver is seen in section in Plates XII to XVIII and in projection in Plates XXVIII to XXXV. The greater part of it lies in the right hypochondriac region, but it crosses the epigastric into the left hypochondriac region. The **superior boundary of the surface outline** is nearly horizontal and crosses the sternum at the level of the fifth sternochondral articulations and the upper border of the ninth thoracic vertebra. In the midclavicular regions this boundary is in the fourth intercostal spaces only a few millimeters higher than at the midline. This slight difference is due to the fact that the left dome of the diaphragm is at nearly the same level as the right one. The **right boundary** of the surface outline is slightly convex outward following the lateral part of the diaphragm and body wall down to the level of the middle of the third lumbar vertebra about .5 cm. below the lowest point of the tenth rib. The **inferior boundary** crosses the anterior abdominal wall from the tip of the right tenth to the left seventh costal cartilage about 1 cm. above the tip of the eighth cartilage, and ends behind the left sixth rib about 3 cm. external to the midclavicular line. It crosses the anterior midline about 7 cm. below the xiphosternal articulation or about one-third of the distance from this articulation to the umbilicus. The inferior boundary is formed by the anterior border and when seen from behind it crosses the vertebral column from the right end of the disc between the twelfth thoracic and first lumbar vertebrae to the left end of the next disc above. The greatest lateral extent of the liver is across the sixth sternochondral articulations and tenth vertebra, where the organ extends nearly 12 cm. to either side of the midline.

When seen from the right side (Plates XXX and XXXIV) the liver fills the upper half of the abdominal cavity. Its highest point is about 5 cm. and its lowest 1 cm. anterior to the midaxillary line. It is about 18 cm. in its superoinferior length.

Plates XXXI and XXXV represent the **left lobe** of the liver only. Since this lobe is very thin near its tip, but enlarges rapidly near the midplane of the body a double projection is given in order to show the relation of the liver to the body wall and to the other organs in the region. The large outline is from measurements at the junction of the right and left lobes, the diagonal crossing this outline represents the course of the anterior border of the liver from the tip of the left lobe to where it crosses the midline of the body.

4

The liver is separated by the diaphragm from the heart and lungs. The **superior surface of the right lobe** is almost entirely under cover of the base of the right lung. Near the midplane it is overlaid by that part of the right auricle into which the vena cava inferior opens. The **superior surface of the left lobe** lies under the heart and the base of the left lung. The anterointernal part of the surface is in relation with the heart. In the region of the inferior caval opening, in common with the right lobe, the left lobe is in relation with the right auricle. This area is small and lies to the right of the midplane of the body. The remainder of the cardiac area is roughly quadrilateral in form and is divisible into an anterointernal and a postero-external triangle. The anterior triangle corresponds to the right ventricle, the posterior to the left ventricle. Posterior and external to the cardiac area the liver is in relation with the base of the left lung (see relations of lung and heart). Below the lungs and heart the superior surface of the liver is in contact with the diaphragm and abdominal wall.

The **posterior surface of the right lobe** is attached to the diaphragm. It is in relation through the diaphragm with the inner and posterior part of the base of the right lung. The nonperitonaeal upper pole of the suprarenal gland is interposed between this surface of the liver and the diaphragm opposite the disc between the eleventh and twelfth thoracic vertebrae (Plate XV). The inner part of the posterior surface is separated from the base of the Spigelian lobe by a deep groove containing the vena cava inferior (Plates XIII, XIV and XV). The **posterior surface of the left lobe** is narrow and triangular with its apex outward towards the beginning of the left triangular ligament. It lies in section XII (not shown in the plates) over the crura of the diaphragm which separates it from the oesophagus and aorta.

The **posterior surface of the Spigelian lobe** corresponds to the tenth, eleventh and upper half of the twelfth thoracic vertebrae. It is covered with peritonaeum and is separated by the right crus of the diaphragm from the base of the right lung and oesophagus above (Plate XIII) and from the vena azygos major, thoracic duct and aorta below (Plates XIV and XV).

The **inferior surface of the left lobe** is in contact with the anterior (superior) surface of the fundus, body and a small part of the pyloric portion of the stomach. The tuber omentale lies upon the cardia and crura of the diaphragm above and the lesser curvature and lesser omentum below (Plates XIII and XIV). This is the part of the liver in contact with the oesophagus from where the oesophagus passes through the diaphragm to where it enters the stomach.

That portion of the Spigelian lobe belonging to the inferior surface is separated from the tuber omentale of the left lobe of the liver and the anterior surface of the stomach by the lesser omentum. The left or free margin of the Spigelian lobe is in close relation with the lesser curvature of the stomach.

The right portion of the pars pylorica is in contact with the **quadrate lobe** and the gall bladder. In front of the lower part of the pyloric area of the quadrate lobe is a slight depression, continuous with a similar area on the right lobe in which the transverse colon is seen in Plates XVII and XVIII.

Anterior to the midaxillary plane the **inferior surface of the right lobe** is in relation with the root structures of the liver and the vena cava inferior in the upper part, the duodenum in the middle part and the hepatic flexure, ascending, and transverse colons in the lower part (Plates XVII and XVIII). Posterior to the midaxillary plane the right lobe is fitted over the upper half of the anterior surface of the right kidney (Plates XVI, XVII and XVIII). The peritonaeal portion of the right suprarenal gland comes into contact with this surface of the liver between the upper part of the kidney and vena cava inferior (Plate XVI). This area is continuous with the suprarenal area on the posterior surface seen in Plate XV. The liver does not come into contact with the jejunoileum at any point.

The **gall bladder** lies along the right costal margin with its right half under cover of the eighth and ninth costal cartilages. It is only moderately distended so that it is entirely under cover of the liver anteriorly. It lies in a shallow groove between the right and quadrate lobes and is in contact internally with the pylorus and first part of the duodenum (Plates XVI and XVII). The fundus is about 1 cm. above and in front of the highest part of the hepatic flexure. The neck is prolonged upward and inward as the **cystic duct** into the hepatoduodenal ligament. This ligament connects the liver, above the neck of the gall bladder, with the superior duodenum, pancreas, and pylorus and contains the bile duct, hepatic artery, portal vein and lymph glands, in their usual relations to each other. The root structures of the liver are separated from the vena cava inferior by a small peritonaeal pocket, the beginning of the vestibule of the lesser peritonaeal cavity (Foramen epiploicum [Winslowi], Plate XVI).

The main differences in position and relations of the liver as seen in these plates and that usually described seems to be due to two conditions: First, the left lobe is compressed in the superoinferior direction and extends far over into the left hypochondriac region; second, the left dome of the diaphragm is about as high as the right, permitting the left lobe of the liver to rise to the same level as the right lobe. The tip of the left lobe is from 2 to 5 cm. farther to the left of the midline than is figured in Toldt, Joessel, Hermann und Ruedel, Cunningham, and Quain. Deaver says that the left lobe rarely extends more than 5 cm. to the left of the sternum. The superior surface is more horizontal than shown in Merkel, Quain, Joessel, et al. The difference is due largely to the higher level of the upper border of the left lobe in this case. Joessel places the highest point of the left lobe nearly 2 cm. lower and much nearer the midplane than in this subject. The level of the upper border of the right lobe corresponds more closely to the locations given by the above anatomists than does that of the left lobe. Deaver places it at the lower border of the fifth rib in the mammary line, while Hermann and Ruedel place it at the upper margin of the fourth rib. However it is probable that this seemingly great difference is due to the differences in the relation of the sternum and ribs to the vertebral column in the two subjects. This is true with respect to the difference between Hermann and Ruedel's projections and those in this paper, since in both the upper boundary corresponds to the upper margin of the ninth thoracic vertebra. The only other difference to be noted is the obliquity of the anterior border. This is due to the left lobe being somewhat higher than usual and very thin in its superoinferior direction. This border as given by most anatomists crosses the anterior abdominal wall from the ninth right to the eighth left costal cartilage, or much more nearly horizontal than this one.

THE PANCREAS

The pancreas is seen in Plates XVI, XVII, XVIII, XXVIII and XXXII. The **head** lies anterior to the first two lumbar vertebrae. It fills the concavity of the duodenum, with its lower part lying upon the anterior surface of the transverse duodenum. The **body** of the gland extends outward from the upper and left part of the head to the lower part of the gastric surface of the spleen. It passes above and behind the duodenojejunal angle, between it and the hilus of the left kidney. The **tail** is the triangular pyramidal extremity of the gland, which turns upward from the outer end of the body into the space between the spleen, kidney and stomach.

The **head** is flat with its posterior surface bound tightly to the vena cava inferior and left renal vein above and the transverse duodenum below. The vena cava and renal vein separate it from the crura of the diaphragm. The anterior surface of the head is covered with peritonaeum and is in relation with the pylorus and the transverse colon. The right border of the head is attached to the left side of the descending duodenum and presents a groove in its upper half in which the common bile duct passes downward to open into the posterior part of the descending duodenum. The left border of the head is separated from the ascending duodenum by the superior mesenteric vessels. These vessels make a groove in the pancreas, which begins above near the posterior part of the left side and runs downward and forward across the left border to reach the base of the mesentery (Plates XVII and XVIII).

The **body** of the pancreas is prismatic in form. The **anterior surface** is peritonaeal, faces upward and forward and is in relation with the posterior surface of the stomach.

The **inferior surface** is also peritonaeal. It faces downward and a little forward and is in relation by its inner part with the duodenojejunal angle and by its outer part with coils of the jejunoileum. The **anterior border** which separates these two surfaces is very well marked in its outer two-thirds where it gives attachment to the transverse meso-colon.

The **posterior surface** is retroperitonaeal. It is in contact, near the midline of the body, with the coeliac axis and mesenteric vessels. The splenic vessels run across the posterior surface, in a shallow groove, from within outward and upward. The coeliac plexus and the semilunar ganglia surrounding these vessels separate the pancreas from the crura of the diaphragm in the region of the twelfth thoracic and first lumbar vertebrae (Plate XVI). The outer half of this surface rests upon the left suprarenal gland and kidney. The pancreas is in contact with the lower two-thirds of the suprarenal. Just external to the suprarenal the pancreas is bound to the kidney from about 2 cm. below the upper pole to the middle of the hilus. The outermost part of the posterior surface is in contact with the spleen. The part of the spleen in contact with the body of the pancreas is small and lies between the gastric and renal surfaces of the spleen, and below the splenic area in contact with the tail of the pancreas.

The **tail** of the pancreas is peritonaeal on its anterior surface only where it is in relation with the posterior surface of the stomach. Its inferior (external) surface is attached to the spleen, its posterior (internal) surface to the anteroexternal surface of the kidney. The splenic vessels run along its superior border and pass over its apex to reach the hilus of the spleen. The lowest portion of the tail, at its junction with the body, is in close relation anteroexternally with the splenic flexure of the colon (Plates XVI, XVII, XXVIII and XXXII).

THE SPLEEN

The spleen appears in Plates XIII to XVI and XXVIII, XXIX, XXXI, XXXII, XXXIII and XXXV. It lies in the left hypochondriac region upon the diaphragm and posterior abdominal wall opposite the ninth, tenth and eleventh ribs. The **upper pole** is at the level of the lower border of the ninth thoracic vertebra, and the **lower pole** at the level of the lower border of the first lumbar vertebra. Upon the anterior body wall the upper pole is at the level of the lower border of the fifth rib in the midclavicular line, 8 cm. from the midline, and the lower pole in the eighth intercostal space, about 11 cm. from the midline. The organ is ovoid in outline. Its long axis is 11 cm. in length and a little more nearly vertical than the tenth rib, inclining from above downward, outward and forward.

The **external or diaphragmatic surface** is directed backward in the upper half and outward in the lower half, and is in contact with the diaphragm (Plates XIV, XV and XVI). The upper part of this surface is in relation with the posterior part of the base of the left lung (Plate XIII).

The **upper pole** is separated from the posterior and external part of the inferior surface of the left lobe of the liver by a portion of the fundus of the stomach. The upper pole and the greater part of the external and gastric surfaces are covered with peritonaeum. The **posterior (internal) border** is bound to the diaphragm. The **anterior (external) border** is free in its upper three-fourths, and adherent to the splenic flexure in its lower fourth.

The **internal surface** may be divided into four areas corresponding to the four organs in contact with the spleen anterointernally. The gastric area includes a little more than the upper half of the spleen and may be bounded below by a line drawn from the middle of the posterior border to the junction of the upper three-fourths with the lower fourth of the anterior border. The upper and inner part of this area of the spleen is adherent to the stomach (Plate XIV). The remainder of the gastric area is separated from the stomach by the lesser peritonaeal cavity internal to the hilus of the spleen and by the gastrosplenic omentum and greater peritonaeal cavity external to the hilus. The posterior part of the internal surface below the gastric area is in contact with the posterior part of the anterior (external) surface and external border of the kidney. The pancreatic area is a small triangular space between the lower part of the gastric area anterosuperiorly, the renal area posteriorly and the posterior border of the spleen near the inferior pole, inferiorly. The remainder of the internal surface of the spleen, including the inferior pole, is in contact with the splenic flexure of the colon.

Quain places the upper pole of the spleen at the level of the disc between the tenth and eleventh vertebrae, and the lower pole at the first lumbar vertebra. Deaver places the upper limit at the ninth and the lower limit at the eleventh thoracic spine. Both of these measurements give a very much shorter spleen than is seen in this subject.

THE KIDNEYS

The kidneys appear in Plates XVI, XVII, XVIII, and XXVIII to XXXV. The two organs present many points in common but differ sufficiently in the details of their topography to require a separate discussion of each.

The **right kidney** is of a long oval shape with its two margins of nearly the same curvature. It lies upon the posterior body wall in the right lumbar region, and extends from the level of the middle of the twelfth thoracic to the middle of the third lumbar vertebra. Its long axis extends from below upward, backward and inward. and if prolonged upwards it would cross the midplane behind the middle of the tenth thoracic vertebra. The **upper pole** is about 3.5 cm. from the midplane and 2.5 cm. behind the midaxillary plane while the **lower pole** is about 9 cm. from the midline in the midaxillary plane. The supero-external half of the **posterior surface** lies over the eleventh intercostal space, and twelfth rib (Plates XXIX and XXXIII). The lower half of the organ lies below and internal to the twelfth rib. The kidney is separated from the vertebral column above the second lumbar vertebra by the diaphragm, and below this level by the psoas major.

The **anterior surface** of the right kidney is peritonaeal for the most part, and in relation with the posterior part of the inferior surface of the liver. When seen from the front the kidney is nearly covered by the eighth, ninth and tenth right costal cartilages (Plates XXVIII and XXXII). The lower half of the suprarenal fits over the upper part of the medial border and separates the kidney from the vena cava inferior (Plate XVI). The duodenum is bound to the medial border and anterior surface from the suprarenal down to the lower part of the hilus. From the hilus to the lower pole, external to the duodenum, the hepatic flexure and ascending colon cover the internal part of the anterior surface of the kidney. The **hilus** is opposite the second lumbar vertebra.

The left **kidney** is shorter, broader and thicker than the right. Its outer border is much more convex than its inner. The organ is located on the posterior abdominal wall in the left lumbar region extending from the disc between the eleventh and twelfth thoracic vertebrae to the disc between the second and third lumbar vertebrae. It is less inclined than the right kidney, in both the frontal and the sagittal plane. If its long axis were prolonged upward it would cross the midplane in the region of the sixth thoracic vertebra. The **upper pole** is about 4 cm. from the midplane while the lower pole is only about 7 cm. from it. The entire organ lies behind the midaxillary plane (Plates XXXI and XXXV), and at a slightly higher level than the right kidney (Plates XVI, XVII, XVIII and XXVIII to XXXV). Posteriorly it lies over the eleventh rib, eleventh intercostal space and the twelfth rib. It does not extend below the tip of the twelfth rib more than about 1 cm., while the right kidney extends nearly 4 cm. below the tip of the right twelfth rib. When seen from the front more than one-half of the left kidney is under cover of the costal arch extending as far outward as the seventh costochondral articulation. The **posterior surface** rests upon the diaphragm above and the psoas and quadratus muscles below.

The body of the pancreas crosses the **anterior surface** of the kidney in the region of the hilus dividing it into three areas. Above the pancreas the kidney is in relation with the suprarenal, stomach and spleen, and below the pancreas, with the colon and jejunoileum. The suprarenal fits over the upper pole and medial border down to the hilus. The lower part of the suprarenal separates a portion of the kidney from the pancreas (Plate XVI). The posterior part of this upper area and the lateral border are attached to the spleen. The remainder of this upper area is in relation with the stomach. It is small and bounded below by pancreas, in front by suprarenal, above by the upper pole of the kidney from the suprarenal to the splenic area, and externally by the spleen above and the tail of the pancreas below, (Plates XVI, XXVIII and XXXII). This gastric area is the only peritonaeal area of the left kidney above the lower border of the pancreas. Below the pancreas the external part of the anterior surface is bound to the descending colon. The internal part of this surface is covered with peritonaeum and is in relation with coils of the jejunoileum.

The **hilus** of the left kidney is also a little higher than that of the right. It is opposite the lower half of the first lumbar and the first lumbar intervertebral disc.

The upper poles of the kidneys are here from a half to an entire vertebra lower than the positions given by Thane and Godlee, Merkel and Deaver. The lower poles correspond more closely to their descriptions.

THE URETERS AND THE BLADDER

The ureters lie upon the psoas major muscles in the abdominal cavity and the obturator internus muscles in the pelvic cavity. At first each ureter is external to the psoas minor and its tendon, but crosses the tendon at the fourth lumbar vertebra. Near the brim of the pelvis each ureter comes into close relation with the anterior surface of the common iliac vein (Plate XXI). The ureters pass down the lateral pelvic walls in company with the internal iliac veins and their superior vesical branches (Plates XXII and XXIII). At the hilus of the kidney each ureter lies behind the renal vessels. From the renal vessels down to the brim of the pelvis the ureters lie behind the peritonaeum of the posterior abdominal wall and are in relation with coils of the jejunoileum. In the pelvic cavity they lie, at first, by the side of the rectum, but lower down pass across its anterior surface to reach the posterior surface of the bladder. In going from kidney to bladder each ureter inclines inward and forward (Plates XXVIII to XXXV).

The bladder was empty in this subject. It lies entirely within section XXIII, between the heads of the recti muscles and the upper half of pubic arch anteriorly and the rectum in the region of the coccyx posteriorly.

THE SUPRARENAL GLANDS

The right suprarenal gland extends from the lower part of the eleventh thoracic vertebra to the lower part of the first lumbar vertebra. It lies along the upper half of the medial border of the right kidney and extends above the kidney into the space between the posterior surface of the liver and the diaphragm (Plate XV). It is in contact posterointernally with the diaphragm and anterointernally with the vena cava inferior. The upper half is nonperitonaeal, the lower half is covered with peritonaeum on its anterior surface and is in contact with the inferior surface of the liver. The inferior pole lies posterior to the first part of the duodenum (Plate XVII).

The left suprarenal is shorter and broader than the right one. The upper pole is about .7 cm. lower than that of the right. It covers the medial border of the left kidney from the upper pole to the hilus. Its posterior (internal) surface lies upon the diaphragm. Its anterior (external) surface is covered with peritonaeum above the superior border of the pancreas, where it is in contact with the posterior surface of the stomach. The remainder of the anterior surface is in contact with the posterior surface of the pancreas. The lower pole lies just above the left renal vessels.

These suprarenal glands differ in their topography from what is given by topographic anatomists in about the same way as do the kidneys since the two organs are so intimately connected. They do not have the characteristic Y-shape in the projections because only the widest part of the outline was measured in each plane.

THE THYREOID GLAND

The thyreoid gland, while not belonging to the thoracic and abdominal viscera, was included in the projections in order to show its relation to the lungs, trachea, oesophagus, heart and great vessels.

The **left lateral lobe** of the thyreoid is the larger and extends from the middle of the ala of the thyreoid cartilage to the fifth ring of the trachea, or from the lower border of the fifth cervical to the middle of the second thoracic vertebra. It is in relation internally with the larynx and pharynx above, and with the trachea below; posterointernally with the longus colli above and the oesophagus below; posteroexternally with the common carotid artery and internal jugular vein; and anteroexternally with the sternothyreoid muscle, and near the apex with the omohyoid muscle.

The **right lateral lobe** is shorter and broader than the left. Its relation is about the same as that of the left lobe except that being the broader it projects backward over the side of the oesophagus more than the left one (Plate III).

The superior thyreoid vessels and recurrent laryngeal nerves are to be seen in Plates III and IV, between the surface of each lobe and the oesophagus. The lower part of each lobe is separated from the apex of the corresponding lung by the vessels and nerves of the region.

The lateral lobes are connected to each other in their lower halves by the **isthmus,** which lies upon the anterior surface of the trachea over the second, third and fourth tracheal rings. It is difficult to distinguish the lines of separation between the lateral lobes and the isthmus (Plate IV). From the upper border of the isthmus a small **pyramidal lobe** rises. It lies over the first tracheal ring and the arch of the cricoid cartilage.

TABLE OF LEVELS

In the following table of levels, the thoracic vertebrae are denoted by the letter T, with a subscript to indicate the particular vertebra in question. The lumbar vertebrae are denoted by the letter L in the same way. The intervertebral discs are denoted by the letter D with the subscripts 1 to 12, for those in the thoracic region, and 1 to 5 for those in the lumbar region. The number of the disc corresponds to the number of the vertebra immediately above. The tips of the spinous processes are denoted by the letter S. The same subscripts are used as in the case of the centra. R and C are the abbreviations used for rib, and costal cartilage. On account of the fact that the vertebral column is the axis of the skeleton, and especially on account of its being divided into alternate centra and discs which are convenient as points of reference it has been taken as the basis of this table. Only those points which are fixed and at the same time readily accessible, have been used in establishing levels upon the anterior body wall. The tips of the spinous processes have been used not because they are fixed and constant but because they are the only accessible points upon the posterior body wall.

The table is based upon imaginary horizontal sections through the middle of each thoracic or lumbar vertebra or intervertebral disc. Each part is given at the level which comes nearest to it. Thus the upper border of an organ may be at the level of the upper border of a centrum, but will appear in the table as if cut by the section through the disc above, because that level shows more accurately the position of the part than the level through the middle of the centrum.

The first column of the table shows the level of the section, upon the vertebral column, which would pass through the parts named in the second column. The third column is a condensation of Quain's[1] table of levels and is included in this table to show what each plane would pass through were all the parts in their average position.

The skeletal parts are named first in each column, beginning each time at the anterior midline and going around the lateral body wall to the vertebral column.

[1] Thane, G. D. and Godlee, R. J., Quain's elements of anatomy. Appendix. Superficial and surgical anatomy. London, 1896.

TABLE OF STRUCTURES FOUND AT VARIOUS LEVELS

Centra and Discs	In This Subject	In Quain's Table
T_1	R_1S_1. Apices of lungs. Summits of arches of subclavian arteries. Isthmus of thyreoid gland. Arch of thoracic duct.	R_1. Apices of lungs. Summits of arches of subclavian arteries.
D_1		
T_2	R_{1-2}. S_2. Lower limit of thyreoid gland. Formation of innominate veins. Bifurcation of innominate artery.	Inner end of clavicle. R_{1-2}. Bifurcation of innominate artery.
D_2	Upper border of sternal end of clavicle.	Upper edge of manubrium.
T_3	Upper border of sternum. Sternoclavicular articulations. R_{1-3}. S_3. Formation of vena cava superior. Origin of innominate, left subclavian and left common carotid arteries.	C_1. R_{1-3}. Innominate artery and veins. Formation of vena cava superior.
D_3	Upper border of first costal cartilages. Great fissure of left lung posteriorly. Highest point of pericardium.	Highest part of arch of aorta.
T_4	First sternochondral articulations. R_{2-4}. Arch of aorta. Great fissure of right lung posteriorly. Arch of azygos vein.	R_{2-4}. Arch of aorta.
D_4	Sternum across first intercostal spaces. Bifurcation of trachea. Upper limit of roots of lungs.	Bifurcation of trachea. Arch of azygos vein.

T_5	Second sternochondral articulations. R_{3-5}. S_4. Bronchi. Bifurcation of pulmonary artery. Pulmonary orifice. Highest part of right auricle.	Junction of manubrium with body of sternum. Second sternochondral articulations. C_2. R_{2-5}. Bronchi. Left pulmonary artery. Highest part of roots of lungs.
D_5	Sternum across second intercostal spaces. S_5. Bifurcation of fissure of right lung. Highest part of left auricle. End of vena cava superior.	Highesf part of heart.
T_6	Upper border of third costal cartilages. R_{3-6}. Aortic orifice. Upper part of mitral orifice.	R_{3-6}. Ascending aorta. Pulmonary orifice. Pulmonary artery. Left bronchus. End of vena cava superior.
D_6	Third sternochondral articulations. Highest part of tricuspid valve. Lower part of root of left lung.	Third sternochondral articulations.
T_7	Sternum across third intercostal spaces. R_{4-7}. S_6. Great fissure of left lung at midaxillary line.	R_{4-7}. Aortic orifice. Infundibulum of right ventricle. Lowest part of roots of lungs.
D_7	Fourth sternochondral articulations. Lower limit of mitral orifice. Lowest part of left auricle. Coronary sinus. Lowest point of superior lobe of right lung. Lower limit of root of right lung.	
T_8	Sternum at lower border of fourth costal cartilage. R_{5-8}. S_7. Left nipple.	Fourth sternochondral articutions. Nipple. C_4. R_{4-8}. Both auriculo-ventricular orifices.
D_8	Fifth sternochondral articulations. Lower limit of tricuspid orifice. Apex of left ventricular cavity. Right and	Right vault of diaphragm. Orifice of vena cava inferior. Right auriculo-ventricular orifice.

	left domes of diaphragm. Highest points of right and left lobes of the liver. Right nipple.	
T_9	Sixth and seventh sternochondral articulations. Xiphosternal articulation. C_{7-5}. R_{6-9}. S_8. Highest point of fundus of stomach. Lower border of heart in midline. Inferior vena caval opening through diaphragm.	Fifth and sixth sternochondral articulations. C_5. R_{5-9}. Liver. Left vault of diaphragm and fundus of stomach.
D_9	Base of xiphoid process. Apex of heart. Inferior margin of right lung and of left lung anteriorly. Upper pole of spleen. Oesophageal opening through diaphragm.	Xiphosternal articulation. Seventh sternochondral articulations. Lowest part of heart.
T_{10}	Middle of xiphoid process. C_{7-6}. R_{6-10}. S_9. Cardiac orifice of stomach.	Xiphoid process. C_{7-6}. R_{6-10}. Cardiac orifice of stomach.
D_{10}	Lower limit of left lung posteriorly.	Upper pole of spleen.
T_{11}	Apex of xiphoid process. C_7. R_{7-11}. S_{10}. Upper limit of hilus of spleen.	C_7. R_{7-11}. Lower margin of lung posteriorly. Upper end of left kidney. Suprarenal glands.
D_{11}	Junctions of seventh and eighth costal cartilages. S_{11}. Upper pole of left kidney. Apices of suprarenal glands.	Upper pole of right kidney.
T_{12}	C_{8-7}. R_{8-12}. S_{12}. Upper pole of right kidney. Upper border of body and tail of pancreas. Neck of gall bladder.	C_{8-7}. R_{7-12}. Foramen of Winslow. Pyloric orifice and first part of duodenum. Splenic flexure of colon.
D_{12}	Foramen of Winslow. Highest point of first part of duodenum.	Beginning of abdominal aorta and origin of coeliac axis.

L_1	Junctions of eighth and ninth costal cartilages. R_{8-12}. S_1. Inferior pole of spleen. Bases of suprarenal glands. Hilus of left kidney. Pyloric orifice. Duodenojejunal angle. Lower limit of body of pancreas. Fundus of gall bladder. Splenic flexure of colon. Beginning of abdominal aorta. Formation of portal vein.	C_8. R_{8-12}. Pyloric orifice and first part of duodenum. Hepatic flexure of colon. Pancreas. Receptaculum chyli. Hilus of kidneys. Renal arteries. Lower pole of spleen.
D_1		
L_2	C_9. R_{9-12}. S_2. Hilus of right kidney. Hepatic flexure of colon. Receptaculum chyli.	C_9. R_{9-11}. Head of pancreas. Duodenojejunal angle.
D_2	C_{10-12}. Transverse duodenum. Head of pancreas. Lower pole of left kidney.	Lower pole of left kidney.
L_3	S_3. Lowest point of transverse duodenum. Lowest point of head of pancreas. Lowest point of liver.	Infracostal plane. Third part of duodenum. Lower pole of right kidney. Lowest point of liver.
D_3	Lower pole of right kidney.	Umbilicus.
L_4	Umbilicus. S_4. Highest point of iliac crests. Bifurcation of aorta.	Highest point of iliac crest. Bifurcation of aorta.
D_4	Ileocolic valve. Formation of vena cava inferior.	
L_5	Caecum. Appendix. Bifurcation of common iliac arteries.	Formation of vena cava inferior.
D_5	Anterior superior iliac spines.	Anterior superior iliac spines. Bifurcation of common iliac arteries.

PLATES

EXPLANATION OF REFERENCE NUMBERS USED IN THE PLATES

[BNA] terms are used in the table. English equivalents are given in parentheses. A dash after a number indicates that there is no specific [BNA] term for the part.

2. N. phrenicus.
3. N. vagus.
3A. N. laryngeus inferior.
3B. Plexus oesophageus posterior.
3C. Plexus oesophageus anterior.
4. Truncus sympathicus.
5. V. jugularis externa.
6. A. et V. thyreoidea superior.
7. A. et V. vertebralis.
8. N. cervicalis V.
9. N. cervicalis VI.
10. N. cervicalis VII.
12. N. cervicalis VIII.
13. A. et V. transversa scapulae.
14. A. et V. transversa colli.
16. N. thoracalis I.
17. Plexus brachialis (upper trunk of brachial plexus).
18. Plexus brachialis (anterior division of upper trunk).
19. Plexus brachialis (posterior division of upper trunk).
20. A. et V. cervicalis ascendens.
21. A. thyreoidea inferior.
21A. V. thyreoidea inferior.
22. Ductus thoracicus.
23. A. subclavia.
24. A. et V. mammaria interna.
25. ——————(lateral infracostal vessels).
26. Fasciculus posterior (posterior cord of brachial plexus).
27. Fasciculus medialis (inner cord of brachial plexus).
28. Fasciculus lateralis (outer cord of brachial plexus).
29. N. cutaneus antibrachii medialis (internal cutaneous nerve).
30. N. radialis (musculospiral nerve).
31. N. cutaneus brachii posterior.
32. Ramus muscularis nervi radialis.
33. N. axillaris (circumflex nerve).
34. N. radialis (separated from main nerve by a small vein at this level).
35. A. axillaris.
36. V. brachialis (external vein of brachial venae comites).
37. A. et V. thoracalis lateralis.
38. V. cephalica.
41. N. musculocutaneus.
42. N. ulnaris.

43. N. medianus (outer head of median nerve).
44. N. medianus (inner head of median nerve).
45. N. medianus (median nerve).
46. A. subscapularis.
46A. A. thoracodorsalis (long thoracic artery).
47. A. circumflexa scapulae.
48. V. circumflexa humeri posterior.
49. V. azygos.
50. V. hemiazygos accessoria.
51. V. hemiazygos.
52. N. splanchnicus major.
53. A. phrenica inferior.
54. Ductus hepaticus.
55. Ductus cysticus.
56. Ductus choledochus.
58. A. hepatica propria.
59. A. gastrica dextra.
60. A. gastroduodenalis.
61. Ureter.
62. V. suprarenalis.
63. A. mesenterica superior.
64. V. mesenterica superior.
65. V. mesenterica inferior.
65A. A. mesenterica inferior.
66. A. et V. lienalis.
67. A. et V. spermatica interna.
68. N. thoracalis XII.
69. N. lumbalis I.
70. N. lumbalis II.
71. N. lumbalis III.
72. ——— (common trunk formed by second and third lumbar nerves).
73. N. lumbalis IV.
74. N. obturatorius.
75. N. femoralis (anterior crural).
76. N. lumbalis V.
77. Truncus lumbosacralis.
77A. ———(branch of fourth lumbar nerve to lumbosacral cord).
78. N. sacralis I.
79. N. sacralis II.
80. N. sacralis III.
81. Funiculus spermaticus (spermatic cord).
82. Sinus coronarius.
83. A. coronaria [cordis] dextra.
84. Ramus descendens anterior arteriæ coronariæ [cordis] sinistræ.
84A. Ramus circumflexus arteriæ coronariæ [cordis] sinistræ.
85. Ductus deferens.

PLATE I

PLATE I

Plate I is from the upper surface of section I which passes through the intervertebral disc (Fibrocartilago intervertebralis IV) between the fourth and fifth cervical vertebrae posteriorly and through the thyreoid and arytenoid cartilages anteriorly. The dotted line is the outline of section II which is 1.3 cm. below this plane and shows how rapidly the body expands in this region.

The plane of the section is not horizontal but is 4.4 cm. lower in front than behind, and is a little lower on the right than on the left side.

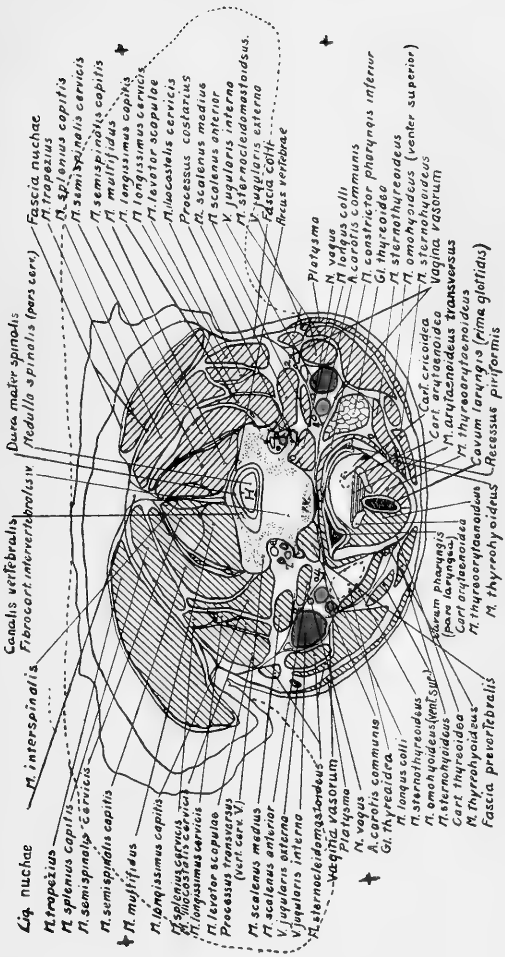

Fascia nuchae
M. trapezius
M. splenius capitis
M. semispinalis cervicis
M. semispinalis capitis
M. multifidus
M. longissimus capitis
M. longissimus cervicis
M. levator scapulae
M. iliocostalis cervicis
Processus costarius
M. scalenus medius
M. scalenus anterior
V. jugularis interna
M. sternocleidomastoidsus.
V. jugularis externa
Fascia colli
Arcus vertebrae
Platysma
N. vagus
M. longus colli
A. carotis communis
M. constrictor pharyngis inferior
Gl. thyreoidea
M. sternothyreoideus
M. omohyoideus (venter superior)
M. sternohyoideus
Vagina vasorum
Cart. cricoidea
Cart. arytaenoidea
M. arytaenoideus transversus
M. thyreoarytaenoideus
Cavum laryngis (rima glottidis)
Recessus piriformis
Dura mater spinalis
Medulla spinalis (pars cerv.)
Canalis vertebralis
Fibrocart. intervertebralis IV
M. interspinalis
Lig. nuchae
M. trapezius
M. splenius capitis
M. semispinalis cervicis
M. semispinalis capitis
M. multifidus
M. longissimus capitis
M. splenius cervicis
M. iliocostalis cervicis
M. longissimus cervicis
M. levator scapulae
Processus transversus (vert. cerv. V)
M. scalenus medius
M. scalenus anterior
V. jugularis externa
V. jugularis interna
M. sternocleidomastoideus
Vagina vasorum
Platysma
N. vagus
A. carotis communis
Gl. thyreoidea
M. longus colli
M. sternothyreoideus
M. omohyoideus (vent. sup.)
M. sternohyoideus
Cart. thyreoidea
M. thyreohyoideus
Fascia prevertebralis
Cavum pharyngis (pars laryngea)
Cart. arytaenoidea
M. thyreoarytaenoideus
M. thyreohyoideus

PLATE II

PLATE II

Plate II is from a section through the intervertebral disc (Fibrocartilago intervertebralis V) between the fifth and sixth cervical vertebrae posteriorly, the upper part of the lamina of the cricoid cartilage anteriorly and the upper surface of the acromial end of the clavicles laterally. The upper surface of this section is 1.3 cm. posteriorly and .4 cm. anteriorly below that of section I, so that the anterior margin is 3.5 cm. below the posterior.

The right lobe of the thyreoid gland is small at the surface of the section but enlarges a little lower down and projects backward and inward into the space, indicated by the dotted outline, between the pharynx and the prevertebral fascia.

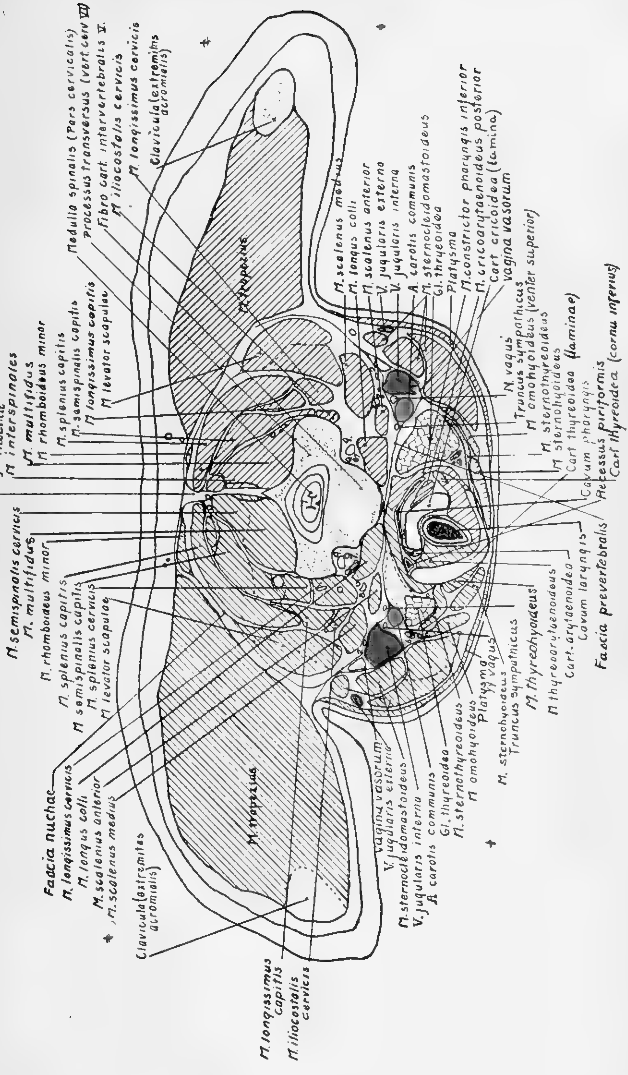
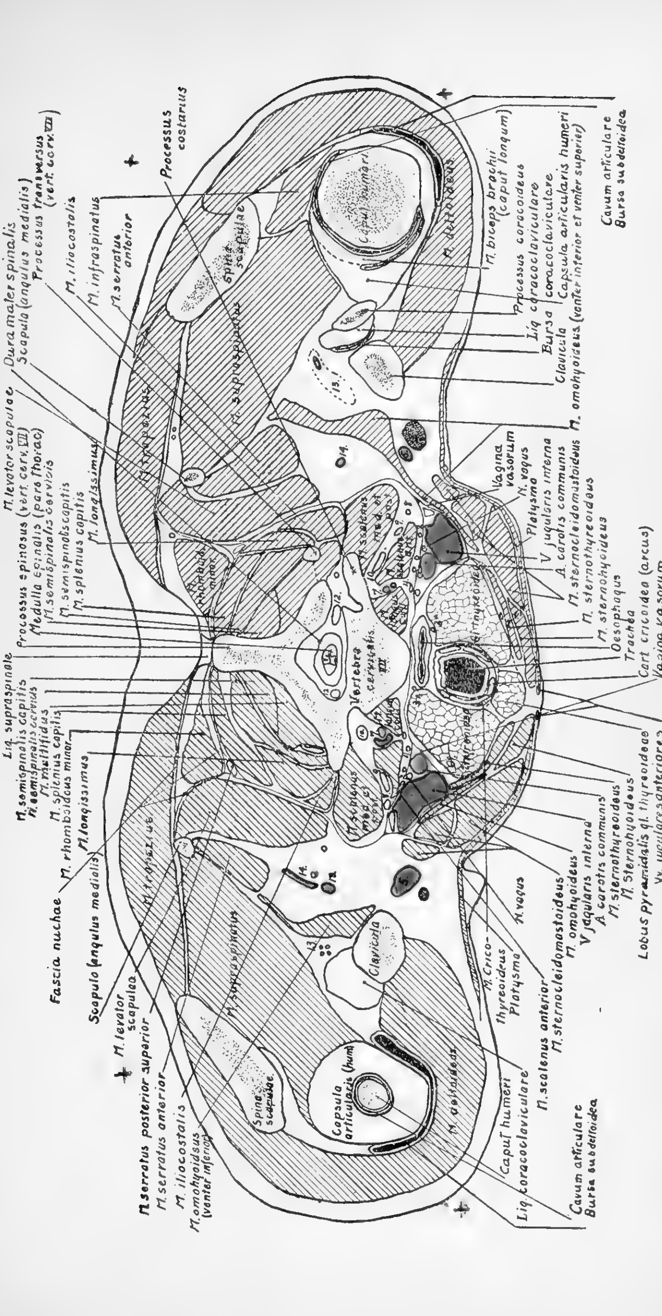

Lig. nuchae
M. interspinales
M. multifidus
M. rhomboideus minor
M. splenius capitis
M. semispinalis capitis
M. longissimus capitis
M. levator scapulae
Medulla spinalis (Pars cervicalis)
Processus transversus (vert. cerv. VI)
Fibro cart. intervertebralis V.
M. iliocostalis cervicis
M. longissimus cervicis
Clavicula (extremitas acromialis)
M. trapezius
M. scalenus medius
M. longus colli
M. scalenus anterior
V. jugularis externa
V. jugularis interna
A. carotis communis
M. sternocleidomastoideus
Gl. thryeoidea
Platysma
M. constrictor pharyngis inferior
M. cricoarytaenoideus posterior
Cart. cricoidea (lamina)
Vagina vasorum
N. vagus
Truncus sympathicus
M. omohyoideus (venter superior)
M. sternothyreoideus
M. sternohyoideus
Cart. thyreoidea (laminae)
Cavum pharyngis
Recessus piriformis
Cart. thyreoidea (cornu inferius)
M. semispinalis cervicis
M. multifidus
M. rhomboideus minor
M. splenius capitis
M. semispinalis capitis
M. splenius cervicis
M. levator scapulae
Fascia nuchae
M. longissimus cervicis
M. longus colli
M. scalenus anterior
M. scalenus medius
Clavicula (extremitas acromialis)
M. trapezius
M. longissimus capitis
M. iliocostalis cervicis
Vagina vasorum
V. jugularis externa
M. sternocleidomastoideus
V. jugularis interna
A. carotis communis
Gl. thyreoidea
M. sternothyreoideus
M. omohyoideus
M. sternohyoideus
Truncus sympathicus
Platysma
N. vagus
M. thyreohyoideus
M. thyreoarytaenoideus
Cart. arytaenoidea
Cavum laryngis
Fascia prevertebralis

PLATE III

PLATE III

Plate III is from a section through the upper part of the seventh cervical vertebra posteriorly, the arch of the cricoid cartilage (Arcus cart. cricoideae) anteriorly and the upper part of the heads of the humeri laterally. The plane of section is 1.8 cm. posteriorly and 1.1 cm. anteriorly below section II so that the anterior margin is 2.8 cm. below the posterior.



Processus costarius
Processus transversus (vert. cerv. VII)
Scapula (angulus medialis)
Dura mater spinalis
M. iliocostalis
M. infraspinatus
M. serratus anterior
M. levator scapulae
Processus spinosus (vert. cerv. VII)
Medulla spinalis (pars thorac)
M. semispinalis cervicis
M. semispinalis capitis
M. splenius capitis
M. longissimus
M. biceps brachii (caput longum)
Processus coracoideus
Lig. coracoclaviculare
Bursa coracoclaviculare
Capsula articularis humeri
Clavicula
M. omohyoideus (venter inferior et venter superior)
Cavum articulare
Bursa subdeltoidea
Vagina vasorum
N. vagus
Platysma
V. jugularis interna
A. carotis communis
M. sternocleidomastoideus
M. sternothyreoideus
M. sternohyoideus
Oesophagus
Trachea
Cart. cricoidea (arcus)
Vagina vasorum
Lig. supraspinale
M. semispinalis capitis
M. semispinalis cervicis
M. multifidus
M. splenius capitis
M. rhomboideus minor
M. longissimus
M. rhomboideus (angulus medialis)
Fascia nuchae
Scapula (angulus medialis)
M. levator scapulae
M. serratus posterior superior
M. serratus anterior
M. iliocostalis
M. omohyoideus (venter inferior)
M. crico-thyreoideus
Platysma
M. scalenus anterior
M. sternocleidomastoideus
M. omohyoideus
V. jugularis interna
A. carotis communis
M. sternothyreoideus
M. sternohyoideus
Lobus pyramidalis gl. thyreoideae
Vv. jugulares anteriores
N. vagus
Capsula articularis (hum)
Caput humeri
Lig. coracoclaviculare
Cavum articulare
Bursa subdeltoidea
M. deltoideus
M. supraspinatus
M. trapezius
Spina scapulae
Clavicula
Vertebra cervicalis VII
M. scalenus med. et post.

PLATE IV

PLATE IV

Plate IV is from a section through the upper half of the first thoracic vertebra posteriorly, the middle of the clavicles anteriorly and the middle of the glenoid cavities of the scapulae laterally. The plane of the section is 1.3 cm. posteriorly and 1.1 cm. anteriorly below that of section III so that the anterior margin is 2.6 cm. below the posterior.

The thoracic duct is cut through the uppermost part of the arch. The internal part is the ascending limb, the external the descending limb. A valve is present at the junction of the two limbs.

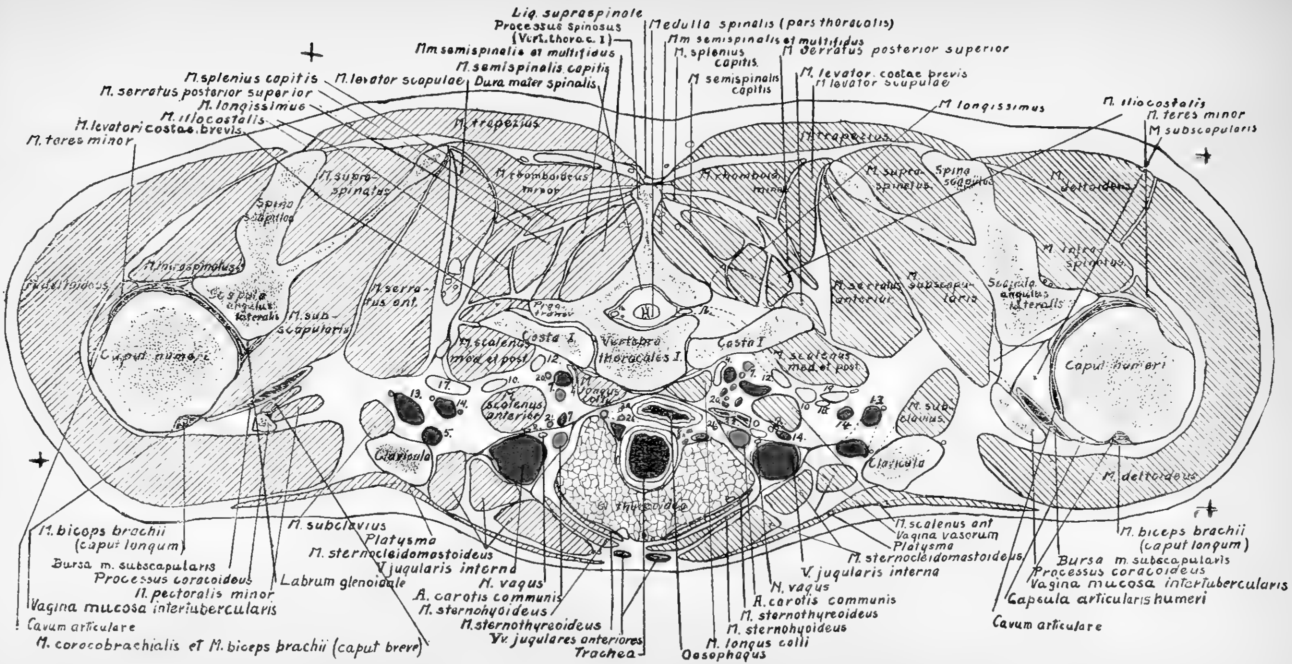

Lig. supraspinale
Processus spinosus (Vert. thorac. I)
Medulla spinalis (pars thoracalis)
Mm semispinalis et multifidus
M. semispinalis capitis
Dura mater spinalis
M. levator scapulae
M. splenius capitis
M. serratus posterior superior
M. longissimus
M. iliocostalis
M. levator costae brevis
M. teres minor
Mm semispinalis et multifidus
M. splenius capitis
M semispinalis capitis
M serratus posterior superior
M. levator costae brevis
M levator scapulae
M longissimus
M. iliocostalis
M. teres minor
M subscapularis
M. trapezius
M. rhomboideus minor
M. supraspinatus
Spina scapulae
M. infraspinatus
M. deltoideus
Scapula angulus lateralis
M. subscapularis
M. serratus ant.
M. serratus anterior
M. subscapularis
Caput humeri
Costa I
Vertebra thoracales I
M. scalenus med et post
M. scalenus anterior
M. longus colli
M. subclavius
Clavicula
Gl. thyreoidea
M. deltoideus
M. biceps brachii (caput longum)
Bursa m. subscapularis
Processus coracoideus
M. pectoralis minor
Vagina mucosa intertubercularis
Cavum articulare
M. coracobrachialis et M. biceps brachii (caput breve)
Labrum glenoidale
M. subclavius
Platysma
M. sternocleidomastoideus
V. jugularis interna
N. vagus
A. carotis communis
M. sternohyoideus
M. sternothyreoideus
Vv. jugulares anteriores
Trachea
Oesophagus
M. longus colli
M. sternohyoideus
M. sternothyreoideus
A. carotis communis
N. vagus
V. jugularis interna
M. sternocleidomastoideus
Platysma
Vagina vasorum
M. scalenus ant
M. biceps brachii (caput longum)
Bursa m. subscapularis
Processus coracoideus
Vagina mucosa intertubercularis
Capsula articularis humeri
Cavum articulare

PLATE V.

PLATE V

Plate V is from a section through the intervertebral disc (Fibrocartilago intervertebralis I) between the first and second thoracic vertebrae posteriorly, through the inner third of the clavicles anteriorly, and through the lower part of the glenoid cavities of the scapulae laterally. The plane of the section is 1.7 cm. anteriorly and 1.1 cm. posteriorly below section IV, hence the anterior margin is 3.2 cm. lower than the posterior.

The axillary veins are not cut except where other veins open into them, but each is easily traced at the surface of the section, and is indicated in the plate by dotted lines.

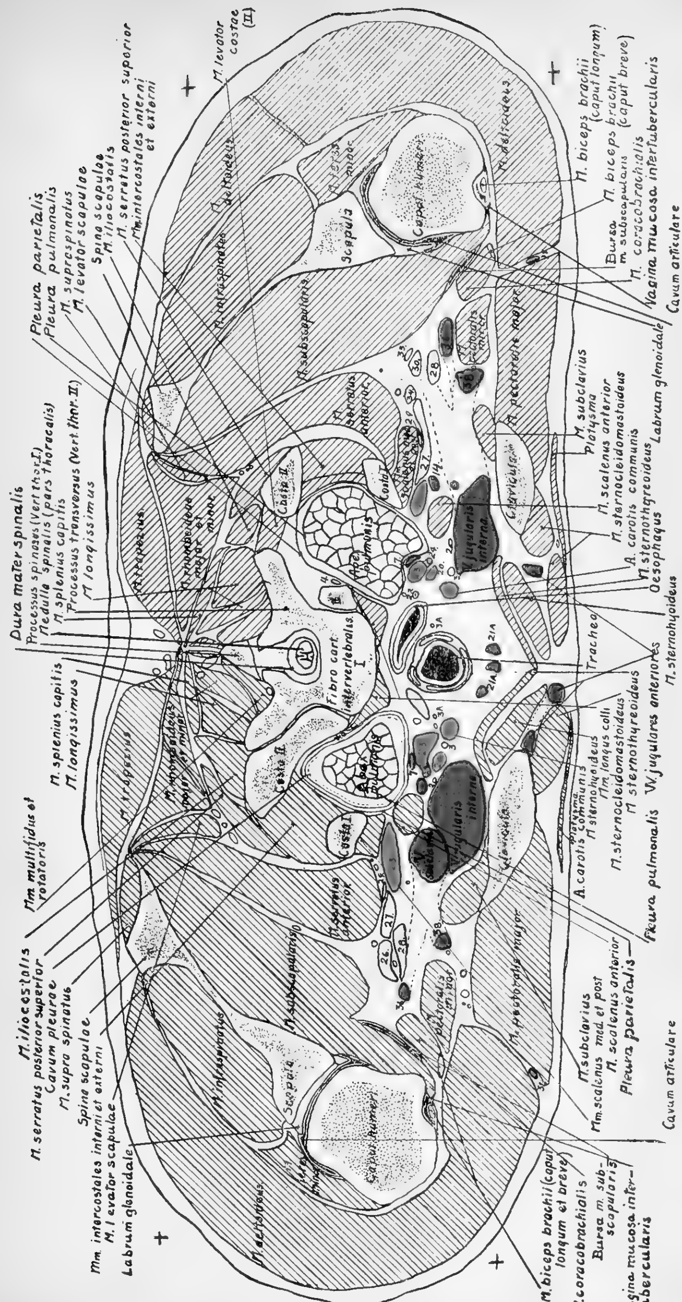

Pleura parietalis
Pleura pulmonalis
M. supraspinatus
M. levator scapulae
Spina scapulae
M. iliocostalis
M. serratus posterior superior
Mm. intercostales interni et externi
M. levator costae
(II)
Dura mater spinalis
Processus spinosus (Vert. thor. I.)
Medulla spinalis (pars thoracalis)
M. splenius capitis
Processus transversus (Vert. thor. II.)
M. longissimus
M. splenius capitis
M. longissimus
Mm. multifidus et rotatoris
M. iliocostalis
M. serratus posterior superior
Cavum pleurae
M. supra spinatus
Spina scapulae
Mm. intercostales interni et externi
M. levator scapulae
Labrum glenoidale
M. biceps brachii (caput longum)
M. biceps brachii (caput breve)
Bursa m. subscapularis
M. coracobrachialis
Vagina mucosa intertubercularis
Cavum articulare
Labrum glenoidale
M. subclavius
Platysma
M. scalenus anterior
M. sternocleidomastoideus
A. carotis communis
M. sternothyreoideus
A. carotis communis
M. sternothyreoideus
M. sternohyoideus
Oesophagus
Trachea
M. sternohyoideus
Vv. jugulares anteriores
A. carotis communis
M. sternohyoideus
Mm. longus colli
M. sternocleidomastoideus
M. sternothyreoideus
Pleura pulmonalis
M. subclavius
Mm. scalenus med. et post
M. scalenus anterior
Pleura parietalis
Cavum articulare
M. biceps brachii (caput longum et breve)
M. coracobrachialis
Bursa m. subscapularis
Vagina mucosa intertubercularis
M. deltoideus
M. infraspinatus
M. teres minor
Scapula
Caput humeri
M. subscapularis
M. serratus anterior
M. pectoralis minor
M. pectoralis major
Clavicula
V. jugularis interna
V. subclavia
Costa I
Costa II
Apex pulmonis
Fibro cart. intervertebralis I
M. rhomboideus major et minor
M. trapezius

PLATE VI

PLATE VI

Plate VI is from a section through the lower part of the second thoracic vertebra posteriorly, the sternoclavicular articulations anteriorly, and through the infraglenoid tubercles, and below the spines of the scapulae laterally. The plane of the section is 1.7 cm. anteriorly and 2 cm. posteriorly below section V so that the anterior margin is 2.9 cm. lower than the posterior.

The left innominate vein (V. anonyma sinistra) crosses the median line in this section and unites with the right innominate vein (V. anonyma dextra) about 2 cm. to the right of the midline. Its course across the mediastinal space is indicated by dotted lines.

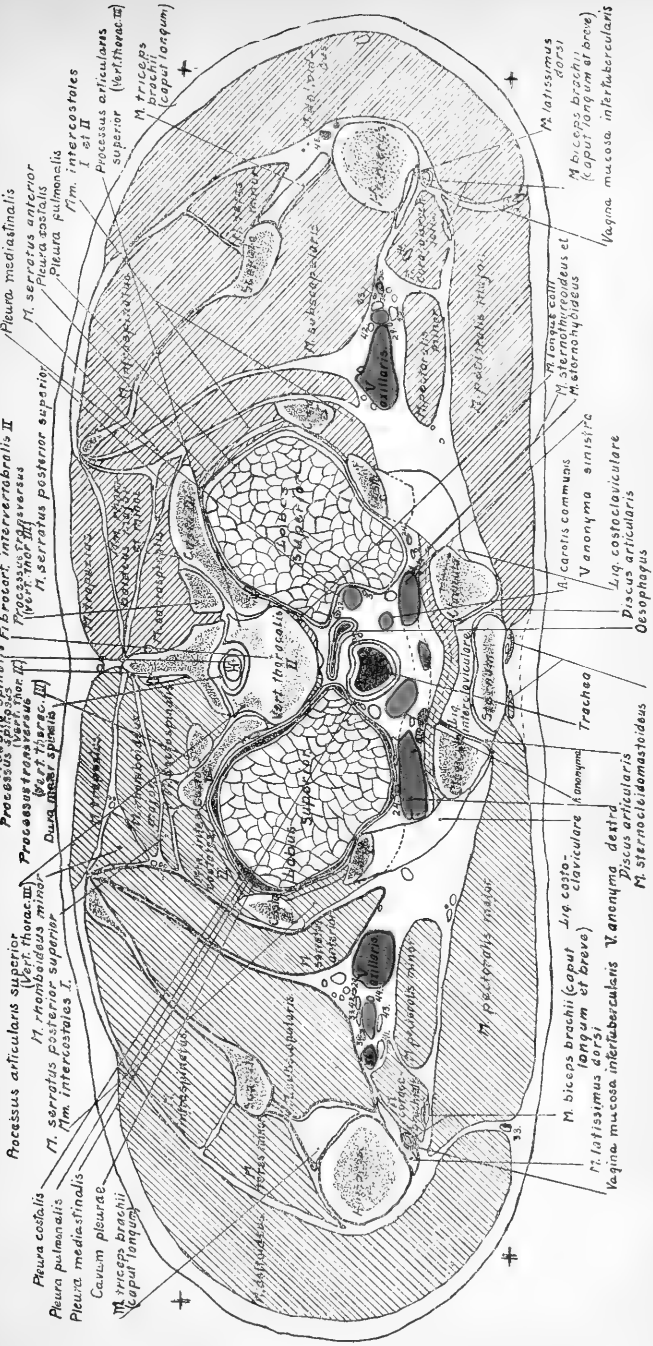

Processus articularis superior (Vert. thorac. III)
M. rhomboideus minor
M. serratus posterior superior
Mm. intercostales I.
Pleura costalis
Pleura pulmonalis
Pleura mediastinalis
Cavum pleurae
M. triceps brachii (caput longum)
Processus spinosus (Vert. thor. II)
Processus transversus (Vert. thorac. III)
Dura mater spinalis
Medulla spinalis
Fibrocart. intervertebralis II
Processus transversus (Vert. thor. III)
M. serratus posterior superior
Pleura mediastinalis
M. serratus anterior
Pleura costalis
Pleura pulmonalis
Mm. intercostales I et II
Processus articularis superior (Vert. thorac. III)
M. triceps brachii (caput longum)
M. latissimus dorsi
M. biceps brachii (kaput longum et breve)
Vagina mucosa intertubercularis
M. longus colli
M. sternothyreoideus et
M. sternohyoideus
A. carotis communis
V. anonyma sinistra
Lig. costoclaviculare
Discus articularis
Oesophagus
Trachea
A. anonyma
V. anonyma dextra
Discus articularis
M. sternocleidomastoideus
Lig. costo-claviculare
M. biceps brachii (caput longum et breve)
M. latissimus dorsi
Vagina mucosa intertubercularis
Vert. thoracalis II
Lobus superior
V. axillaris
M. subscapularis
M. pectoralis minor
M. pectoralis major
Lig. interclaviculare
Sternum
Clavicula
M. infraspinatus
M. teres minor
M. trapezius
M. rhomboideus minor
M. serratus anterior
Mm. intercostales I et II

PLATE VII

PLATE VII

Plate VII is from a section through the uppermost part of the fourth thoracic vertebra posteriorly and the upper part of the first intercostal spaces anteriorly. The plane of the section is 2.1 cm. anteriorly and 2.8 cm. posteriorly below the last section. The anterior margin is 2.2 cm. lower than the posterior.

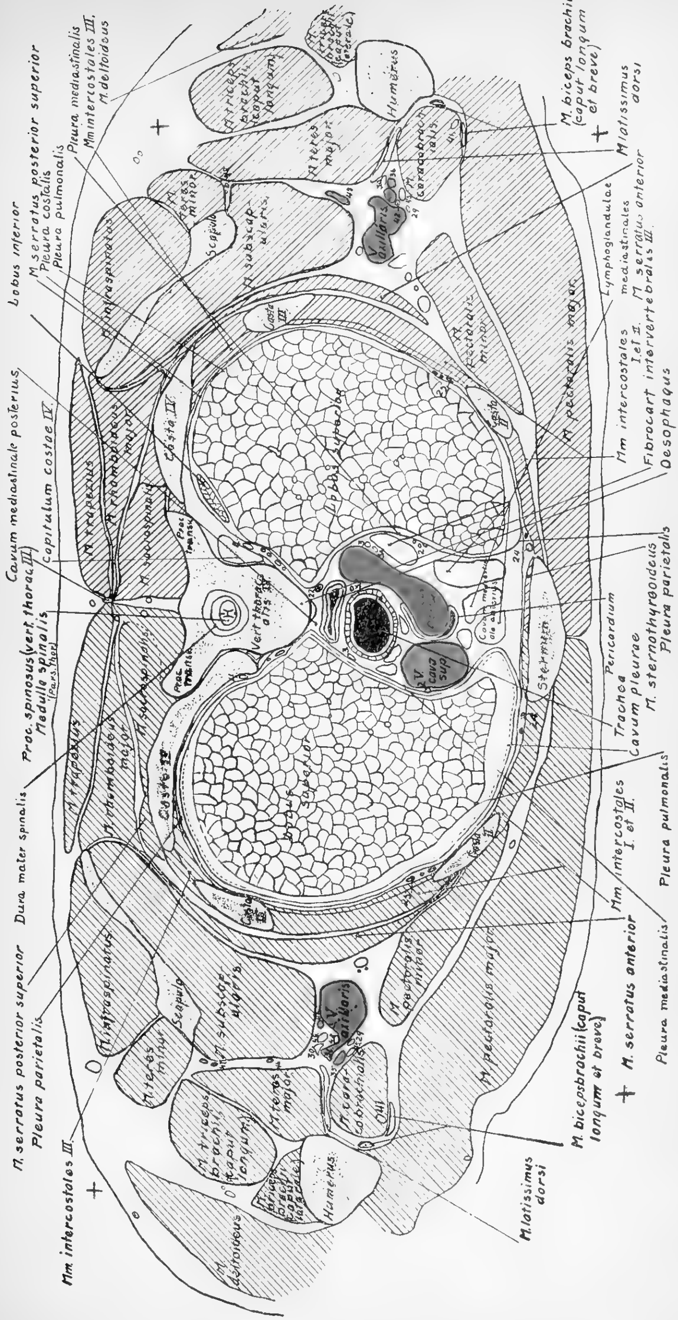

Pleura mediastinalis
Mm intercostales III.
M. deltoideus
M. serratus posterior superior
Pleura costalis
Pleura pulmonalis
Lobus inferior
Cavum mediastinale posterius
Capitulum costae IV.
Proc. spinosus (vert. thorac. III)
Medulla spinalis (Pars. thor.)
Dura mater spinalis
M. serratus posterior superior
Pleura parietalis
Mm. intercostales III.
M. biceps brachii (caput longum et breve)
M. latissimus dorsi
M. latissimus dorsi
Lymphoglandulae mediastinales
M. serratus anterior
Mm intercostales I. et II.
Fibrocart intervertebralis III.
Oesophagus
Pericardium
M. sternothyreoideus
Pleura parietalis
Trachea
Cavum pleurae
Mm intercostales I. et II.
Pleura pulmonalis
M. serratus anterior
Pleura mediastinalis
M. bicepsbrachii (caput longum et breve)
M. latissimus dorsi
M. triceps brachii caput longum
Humerus
M. teres major
M. coracobrachialis
M. teres minor
Scapula
M. subscapularis
M. infraspinatus
V. axillaris
Costa III
M. pectoralis minor
M. pectoralis major
Costa II
Lobus superior
Costa IV
M. rhomboideus major
M. trapezius
M. supraspinatus
Proc. transv.
Vert. thoracalis III.
V. cava sup.
Sternum
Cavum mediastinale anterius
Costa I
M. deltoideus
M. triceps brachii caput laterale

PLATE VIII

PLATE VIII

Plate VIII is from the upper surface of a section through the upper third of the body of the fifth thoracic vertebra posteriorly, and the lower part of the second intercostal space anteriorly. The plane of the section is 2.8 cm. below that of the preceding section. The anterior margin is 2.2 cm. lower than the posterior.

The posterior semilunar valve of the pulmonary orifice is left in this section, the right and left anterior semilunar valves were removed with the section above. The pulmonary artery lies almost entirely in the section above this.

The pericardial cavity, though wide in this section, is very shallow, being filled by the widening out of the right auricle and ventricle at a slightly lower level, and the appearance of the left auricular appendix in the left posterior part of the cavity.

The vena cava superior enters the right auricle (Atrium dextrum) about .5 cm. below the surface of the section. The section is through the apex of the right auricular appendix.

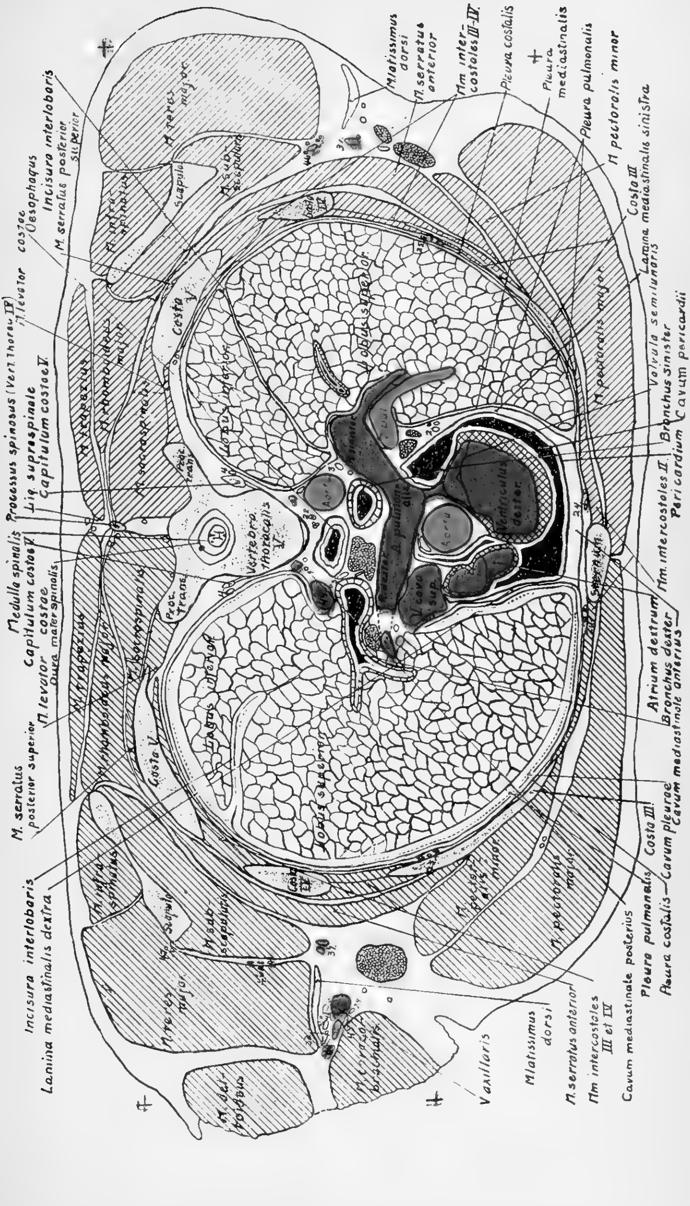

Incisura interlobaris
Lamina mediastinalis dextra
M. serratus posterior superior
M. levator costae
Dura mater spinalis
Capitulum costae V
Medulla spinalis
Processus spinosus (Vert. Thorac. IV)
Lig. supraspinale
Capitulum costae V
M. levator costae
Oesophagus
Incisura interlobaris
M. serratus posterior superior
M. latissimus dorsi
M. serratus anterior
Mm intercostales III-IV
Pleura costalis
Pleura mediastinalis
Pleura pulmonalis
M pectoralis minor
Costa III
Lamina mediastinalis sinistra
Valvula semilunaris
Bronchus sinister
Cavum pericardii
Pericardium
Mm intercostales II
Mm. intercostales
Atrium dextrum
Bronchus dexter
Cavum mediastinale anterius
Cavum pleurae
Costa III
Cavum pleurae
Pleura pulmonalis
Pleura costalis
Cavum mediastinale posterius
Mm intercostales III et IV
M. serratus anterior
M latissimus dorsi
V axillaris
M. trapezius
M. rhomboideus major
M. sacrospinalis
Costa V
Proc. trans.
Vertebra thoracalis V
Lobus inferior
Lobus superior
Aorta
A. pulmonalis
Ventriculus dexter
V. cava sup.
M. teres major
M. infraspinatus
Scapula
M. subscapularis
M. pectoralis major
M. pectoralis minor
M. deltoideus
M. coracobrachialis

PLATE IX

PLATE IX

Plate IX is from the upper surface of a section through the upper third of the body of the sixth thoracic vertebra posteriorly and the upper part of the articulations of the third costal cartilages with the sternum anteriorly. The plane of the section is 1.8 cm. anteriorly and 2.2 cm. posteriorly, below the plane of the last section. The anterior margin is 1.8 cm. lower than the posterior.

The cavity of the left auricle is divided into an anterior and a posterior chamber by a peculiar thin fibrous septum, perforated by several foramina, which permitted the free passage of blood through the auricle. The lower portion of the septum is shown in Plate X. This anomaly is fully described in the Journal of Anatomy and Physiology, XXXIX. p. 69.

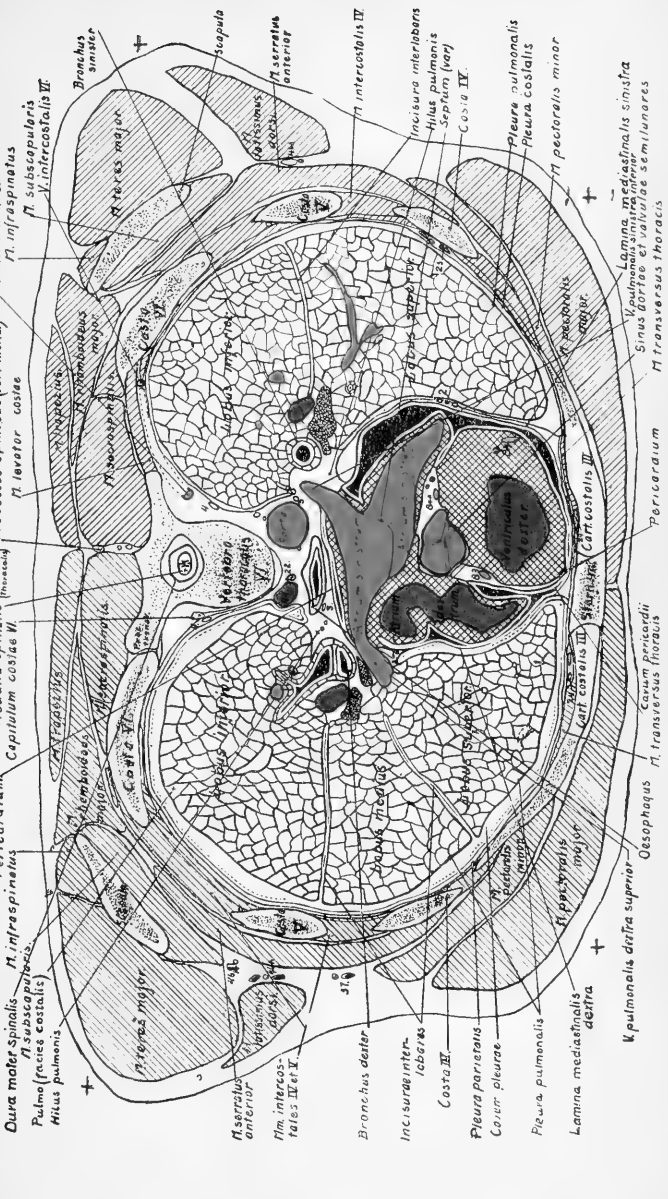

Dura mater spinalis
M. subscapularis
Pulmo (facies costalis)
Hilus pulmonis
M. infraspinatus
Pericardium
Pericardium
Medulla spinalis (Pars thoracalis)
Capitulum costae VI.
Processus spinosus (vert. thor. V.)
M. levator costae
A. intercostalis VI.
M. infraspinatus
M. subscapularis
V. intercostalis VI.
Bronchus sinister
Scapula
M. serratus anterior
M. intercostalis V.
Incisura interlobaris
Hilus pulmonis
Septum (var)
Costa IV.
Pleura pulmonalis
Pleura costalis
M. pectoralis minor
Lamina mediastinalis sinistra
V. pulmonalis sinistra interior
Sinus aortae et valvulae semilunares
M. transversus thoracis
Pericardium
Carvum pericardii
M. transversus thoracis
Oesophagus
V. pulmonalis dextra superior
Lamina mediastinalis dextra
Pleura pulmonalis
Cavum pleurae
Pleura parietalis
Costa III.
Incisurae interlobares
Bronchus dexter
Mm. intercostales IV et V.
M. serratus anterior
M. teres major
M. teres major
M. latissimus dorsi
M. trapezius
M. rhomboideus major
M. sacrospinalis
Costa VI.
Costa V.
Lobus inferior
Lobus superior
Lobus medius
Vertebra thoracalis VI.
Ventriculus dexter
Atrium
Cart. costalis III
Sternum
M. pectoralis major
M. pectoralis minor

PLATE X

PLATE X

Plate X is from the upper surface of a section through the upper third of the body of the seventh thoracic vertebra posteriorly and the lower part of the third intercostal space anteriorly. The plane of the section is 1.3 cm. anteriorly and 2.2 cm. posteriorly below that of the last section, making the anterior margin of the section .9 cm. lower than the posterior.

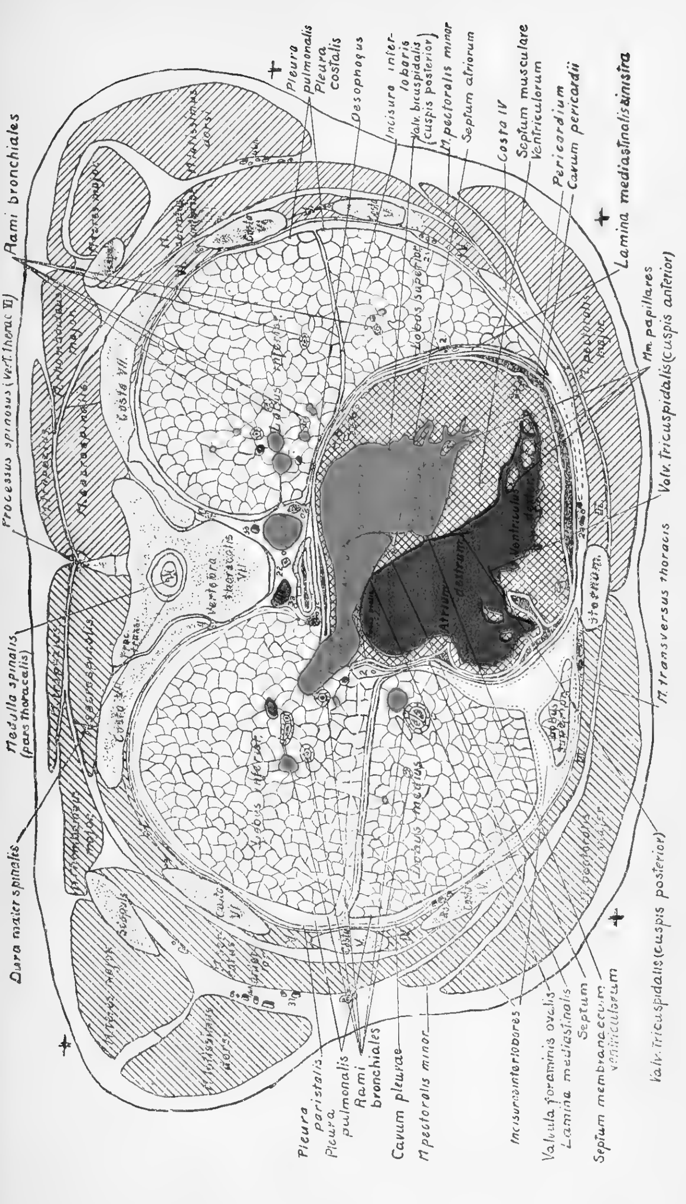

Rami bronchiales
Processus spinosus (Vert. thorac VI)
Medulla spinalis (pars thoracalis)
Dura mater spinalis
Pleura pulmonalis
Pleura costalis
Oesophagus
Incisura interlobaris
Valv. bicuspidalis (cuspis posterior)
M. pectoralis minor
Septum atriorum
Costa IV
Septum musculare ventriculorum
Pericardium
Cavum pericardii
Lamina mediastinalis sinistra
Mm. papillares
Valv. tricuspidalis (cuspis anterior)
M. transversus thoracis
Valv. tricuspidalis (cuspis posterior)
Septum membranaceum ventriculorum
Septum
Lamina mediastinalis
Valvula foraminis ovalis
Incisura interlobares
M. pectoralis minor
Cavum pleurae
Rami bronchiales
Pleura pulmonalis
Pleura parietalis
Atrium dextrum
Ventriculus dexter
Lobus superior
Lobus medius
Lobus inferior
Vertebra thoracalis VII
Costa VII
Costa VI
Sternum

PLATE XI

PLATE XI

Plate XI is from the upper surface of a section through the intervertebral disc (Fibrocartilago intervertebralis VII) between the seventh and eighth thoracic vertebrae posteriorly and through the fourth sternochondral articulations anteriorly. The plane of the section is 1.5 cm. anteriorly and 2.4 cm. posteriorly below that of the last section, so that it is horizontal.

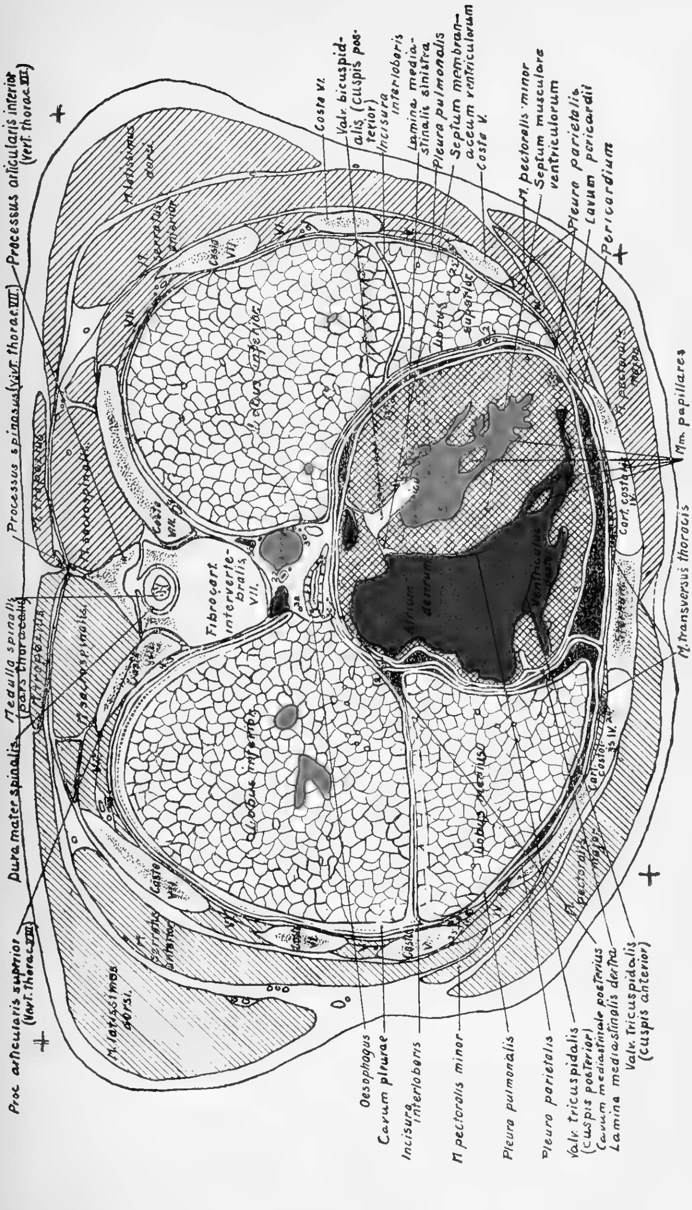

Proc. articularis superior (Vert. thorac. VIII)
Dura mater spinalis
Medulla spinalis (pars thoracalis)
Processus spinosus (vert. thorac. VIII)
Processus articularis inferior (vert. thorac. VII)
Costa VI.
Valv. bicuspidalis (cuspis posterior)
Incisura interloboris
Lamina mediastinalis sinistra
Pleura pulmonalis
Septum membranaceum ventriculorum
Costa V.
M. pectoralis minor
Septum musculare ventriculorum
Pleura parietalis
Cavum pericardii
Pericardium
Mm. papillares
M. transversus thoracis
Oesophagus
Cavum pleurae
Incisura interloboris
M. pectoralis minor
Pleura pulmonalis
Pleura parietalis
Valv. tricuspidalis (cuspis posterior)
Cavum mediastinale posterius
Lamina mediastinalis dextra
Valv. tricuspidalis (cuspis anterior)
M. latissimus dorsi
Lobus inferior
Lobus medius
Lobus superior
Fibrocart. intervertebralis VII.
Atrium dextrum
Sternum
Cart. costal. IV

PLATE XII

PLATE XII

Plate XII is from the upper surface of a section through the uppermost part of the disc between the eighth and ninth thoracic vertebrae posteriorly and the articulations of the fifth costal cartilages with the sternum anteriorly. The plane of the section is 2.5 cm. below that of the last section and is horizontal.

The vena cava inferior pierces the diaphragm and enters the inferior and posterior part of the right auricle (Atrium dextrum) near the upper surface of this section. What is labeled vena cava inferior in the plate is in reality the lowest part of the auricle into which the vein opens about .5 cm. below the surface of the section.

The right pleural cavity appears exaggerated in size in this figure, on account of the great width of the shallow space between the base of the lung and the superior surface of the diaphragm. A similar exaggeration is seen in the pericardial cavity.

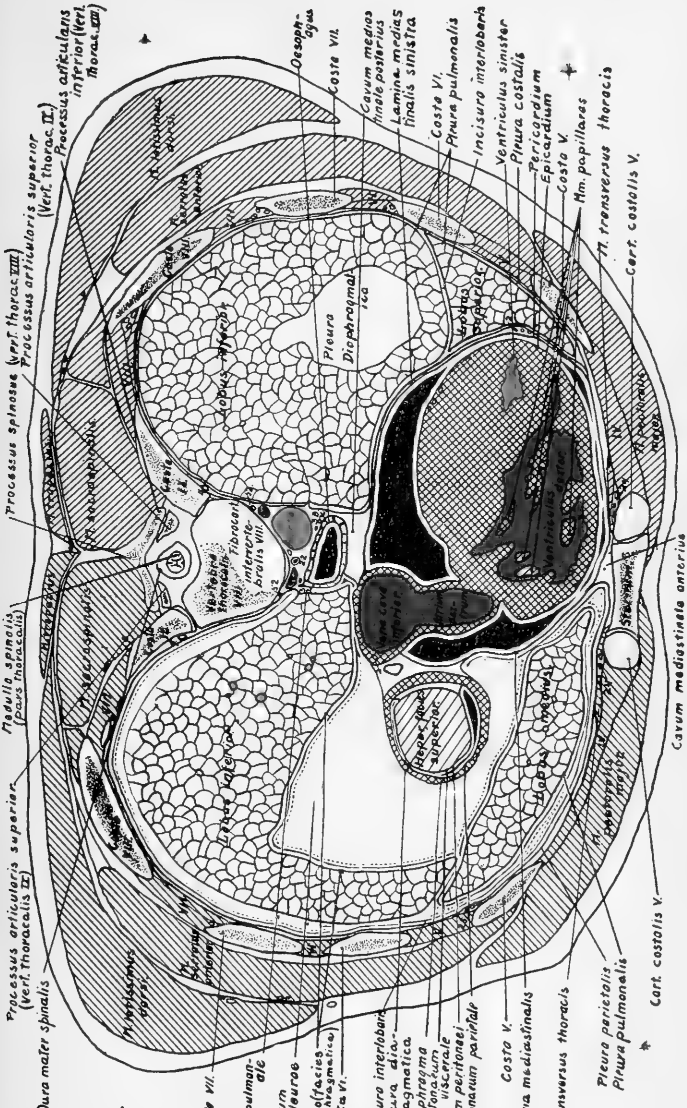

Processus articularis superior (Vert. Thoracalis IX)
Medulla spinalis (pars thoracalis)
Processus spinosus (Vert. thorac. VIII)
Processus articularis superior (Vert. thorac. IX.)
Processus articularis inferior (Vert. Thorac. VIII)
Oesophagus
Costa VII.
Cavum mediastinale posterius
Lamina mediastinalis sinistra
Costa VI.
Pleura pulmonalis
Incisura interlobaris
Ventriculus sinister
Pleura costalis
Pericardium
Epicardium
Costa V.
Mm. papillares
M. transversus thoracis
Cart. costalis V.
Cavum mediastinale anterius
Cart. costalis V.
Pleura parietalis
Pleura pulmonalis
M. transversus thoracis
Lamina mediastinalis
Costa V.
Peritonaeum parietale
Cavum peritonaei
Peritonaeum viscerale
Diaphragma
Pleura diaphragmatica
Incisura interlobaris
Costa VI.
Pulmo (facies diaphragmatica)
Cavum pleurae
Lig. pulmonale
Costa VII.
Dura mater spinalis
Lobus inferior
Pleura Diaphragmatica
Lobus superior
Vertebra thoracalis VIII.
Fibrocartilago intervertebralis VIII.
Vena cava inferior
Atrium dextrum
Ventriculus dexter
Hepar lobus superior
Lobus medius
M. pectoralis major
Sternum

PLATE XIII

PLATE XIII

Plate XIII is from the upper surface of a section through the intervertebral disc (Fibrocartilago intervertebralis IX) between the ninth and tenth thoracic vertebrae posteriorly and the sternoxiphoid articulation anteriorly. The plane of the section is 1.9 cm. anteriorly and 2.1 cm. posteriorly below that of the last section, and is .2 cm. lower behind than in front.

The lowest portion of the pericardial cavity appears as a shallow space separating the diaphragm from the fifth left costal cartilage. In reality this space is occupied by the tip of the apex of the heart, which by an oversight was omitted from the plate.

The oesophagus is turning to the left of the midplane preparatory to entering the stomach in this section. The upper pole of the spleen (Lien) comes nearly to the surface of the section between the posterior surface of the stomach and the diaphragm.

PLATE XIII.

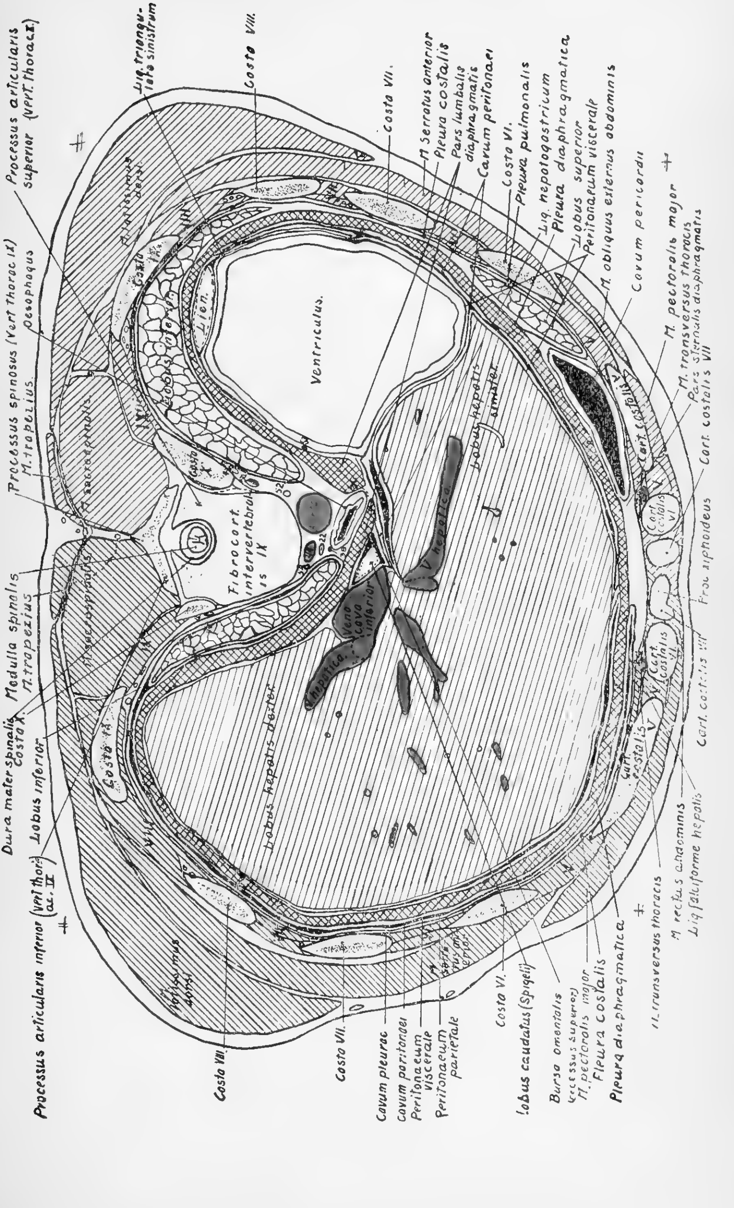

Processus articularis superior (Vert. thorac. X)
Lig. triangulare sinistrum
Costa VIII.
Costa VII.
M. Serratus anterior
Pleura costalis
Pars lumbalis diaphragmatis
Cavum peritonaei
Costa VI.
Pleura pulmonalis
Lig. hepatogastricum
Pleura diaphragmatica
Lobus superior
Peritonaeum viscerale
M. obliquus externus abdominis
Cavum pericardii
M. pectoralis major
M. transversus thoracis
Pars sternalis diaphragmatis
Cart. costalis VII
Proc. xiphoideus
Cart. costalis VII
M. rectus abdominis
Lig. falciforme hepatis
M. transversus thoracis
Pleura diaphragmatica
Pleura costalis
M. pectoralis major
Recessus superior
Bursa omentalis
Lobus caudatus (Spigeli)
Costa VI.
Peritonaeum parietale
Peritonaeum viscerale
Cavum peritonaei
Cavum pleurae
Costa VII.
Costa VIII.
Processus articularis inferior (Vert. thorac. IX)
Lobus inferior
Dura mater spinalis
Costa X.
Medulla spinalis
M. trapezius
Processus spinosus (Vert. thorac. IX)
M. trapezius
Oesophagus
Ventriculus.
Lien.
Lobus inferior
Lobus hepatis sinister
V. hepatica
Vena cava inferior
V. hepatica
Lobus hepatis dexter
Fibrocart. intervertebralis IX
Cart. costalis VI
M. latissimus dorsi
M. sacrospinalis

PLATE XIV.

PLATE XIV

Plate XIV is from the upper surface of a section through the intervertebral disc (Fibrocartilago intervertebralis X) between the tenth and eleventh thoracic vertebrae posteriorly and the middle of the xiphoid process anteriorly. The plane of the section is 2.0 cm. anteriorly and 2.8 cm. posteriorly below that of the last section, so that it is 1 cm. lower posteriorly than anteriorly.

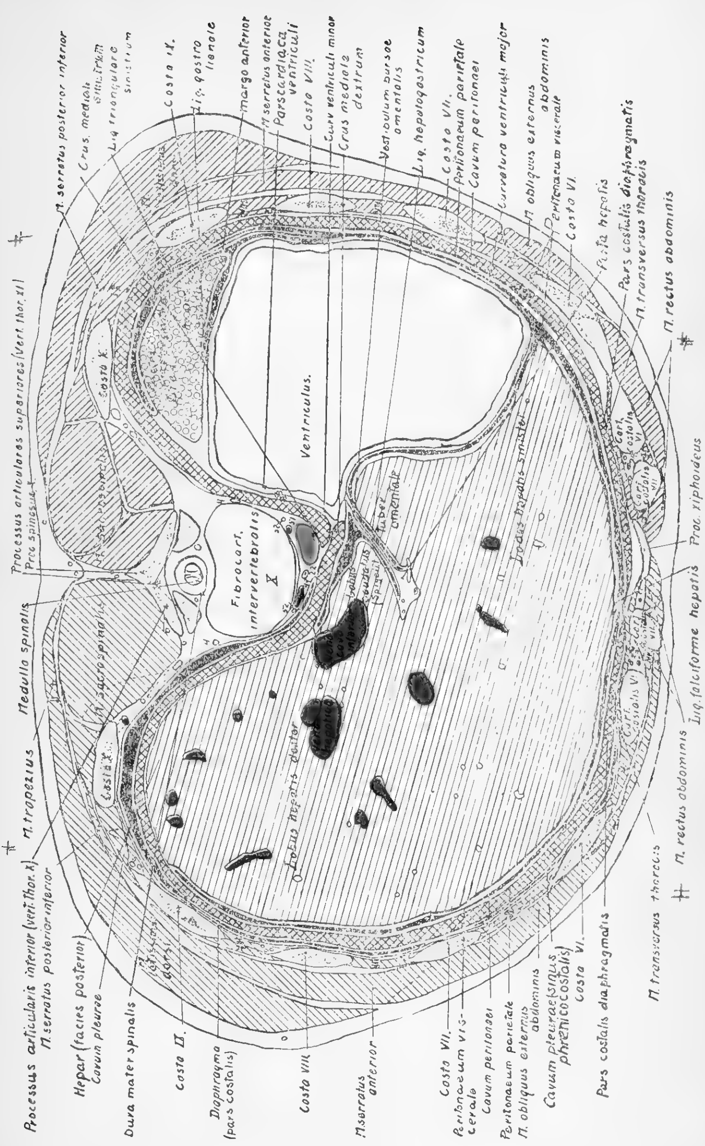
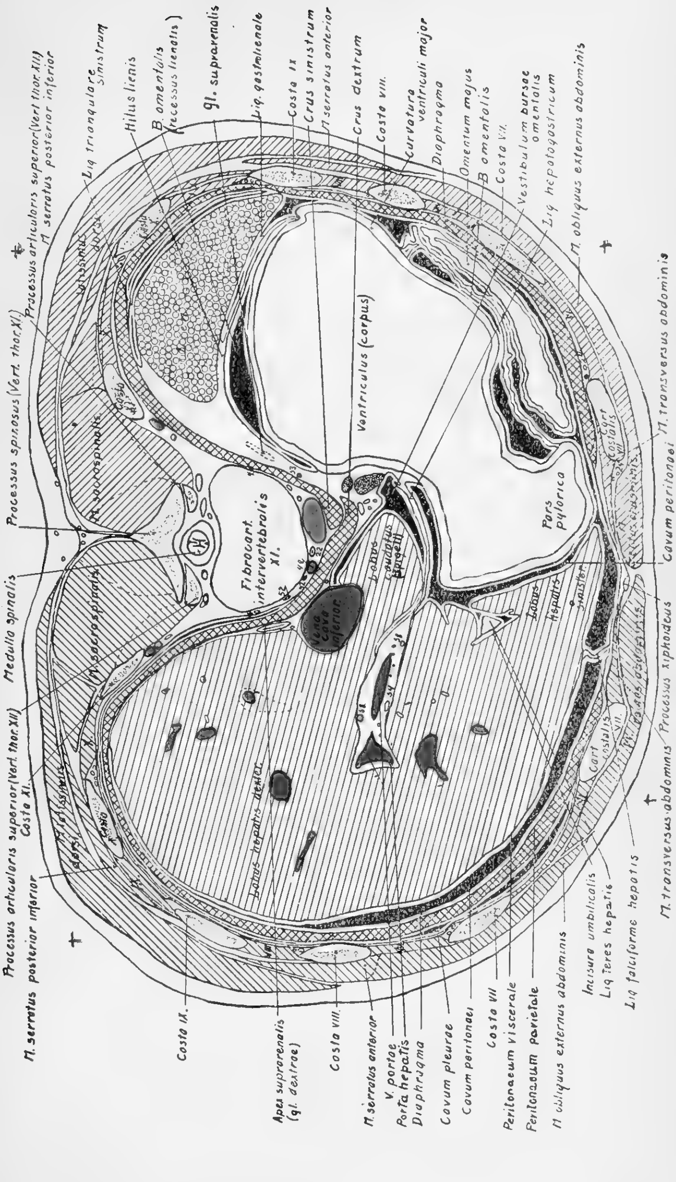

Processus articularis inferior (vert. thor. X)
M. serratus posterior inferior
M. trapezius
Medulla spinalis
Processus articulares superiores (Vert. thor. XI)
Proc. spinosus
M. serratus posterior inferior
Crus mediale sinistrum
Lig. triangulare sinistrum
Costa IX.
Lig. gastro lienale
margo anterior
M. serratus anterior
Pars cardiaca ventriculi
Costa VIII.
Curv. ventriculi minor
Crus mediale dextrum
Vestibulum bursae omentalis
Lig. hepatogastricum
Costa VII.
Peritonaeum parietale
Cavum peritonaei
Curvatura ventriculi major
M. obliquus externus abdominis
Peritonaeum viscerale
Costa VI.
Pars costalis diaphragmatis
M. transversus thoracis
M. rectus abdominis
Proc. xiphoideus
Lig. falciforme hepatis
M. rectus abdominis
M. transversus thoracis
Pars costalis diaphragmatis
Costa VI.
Cavum pleurae (sinus phrenicocostalis)
M. obliquus externus abdominis
Peritonaeum parietale
Cavum peritonaei
Peritonaeum viscerale
Costa VII.
M. serratus anterior
Costa VIII.
Diaphragma (pars costalis)
Costa IX.
Dura mater spinalis
Hepar (facies posterior)
Cavum pleurae
M. sacrospinalis
Ventriculus.
Fibrocart. intervertebralis X
Lobus hepatis dexter
Lobus hepatis sinister
Tuber omentale
Lobus caudatus (Spigeli)
Vena cava inferior
Costa X.
Costa XI.

PLATE XV

PLATE XV

Plate XV is from the upper surface of a section through the intervertebral disc (Fibrocartilago intervertebralis XI) between the eleventh and twelfth thoracic vertebrae posteriorly, and the tip of the xiphoid process anteriorly. The plane of the section is 2.7 cm. posteriorly and 3 cm. anteriorly below that of the last section. Its posterior margin is .7 cm. lower than its anterior.

The stomach and spleen are separated from each other by a recess of the lesser peritonaeal cavity (Recessus lienalis bursae omentalis). This recess of the lesser cavity is continuous slightly below the surface of the section with the vestibule of the lesser cavity by a passage way (sometimes called "Huschke's foramen") bounded by the lesser curvature of the stomach anteriorly, and the plica gastropancreatica posteriorly.



Processus articularis inferior
M. serratus posterior inferior
Processus articularis superior (Vert. thor. XII)
Costa XI.
Medulla spinalis
Processus spinosus (Vert. thor. XI.)
Processus articularis superior (Vert. thor. XII)
M. serratus posterior inferior
Lig. triangulare sinistrum
Hilus lienis
B. omentalis (recessus lienalis)
gl. suprarenalis
Lig. gastrolienale
Costa IX
Crus sinistrum
M. serratus anterior
Crus dextrum
Costa VIII.
Curvatura ventriculi major
Diaphragma
Omentum majus
B. omentalis
Costa VII.
Vestibulum bursae omentalis
Lig. hepatogastricum
M. obliquus externus abdominis
M. transversus abdominis
Cavum peritonaei
Processus xiphoideus
M. transversus abdominis
Ventriculus (corpus)
Pars pylorica
Fibrocart. intervertebralis XI.
Lobus caudatus (Spigelii)
Vena cava inferior
Lobus hepatis dexter
Lobus hepatis sinister
M. sacrospinalis
Costa IX.
Apex suprarenalis (gl. dextrae)
Costa VIII.
M. serratus anterior
V. portae
Porta hepatis
Diaphragma
Cavum pleurae
Cavum peritonaei
Costa VII
Peritonaeum viscerale
Peritonaeum parietale
M. obliquus externus abdominis
Incisura umbilicalis
Lig. teres hepatis
Lig. falciforme hepatis
M. transversus abdominis

PLATE XVI

PLATE XVI

Plate XVI is from the upper surface of a section through the lowermost portion of the twelfth thoracic vertebra posteriorly and the costal cartilages of the eighth ribs anteriorly. The section is 2.5 cm. anteriorly and 2 cm. posteriorly below the plane of the last section. The posterior margin is .2 cm. lower than the anterior.

The common bile duct (56) lies external to the portal vein and the hepatic artery. The cystic duct (55) is cut at its origin at the neck of the gall bladder (Collum vesicae felleae). The cystic and hepatic ducts unite in the lower part of the section above to form the common bile duct. The sections of the intestine are numbered consecutively, as they would be encountered in passing down the alimentary canal. The letter is the initial letter of the name of the part and the subscript denotes the number of the serial section. The letter I has been used to denote jejunum as well as ileum.

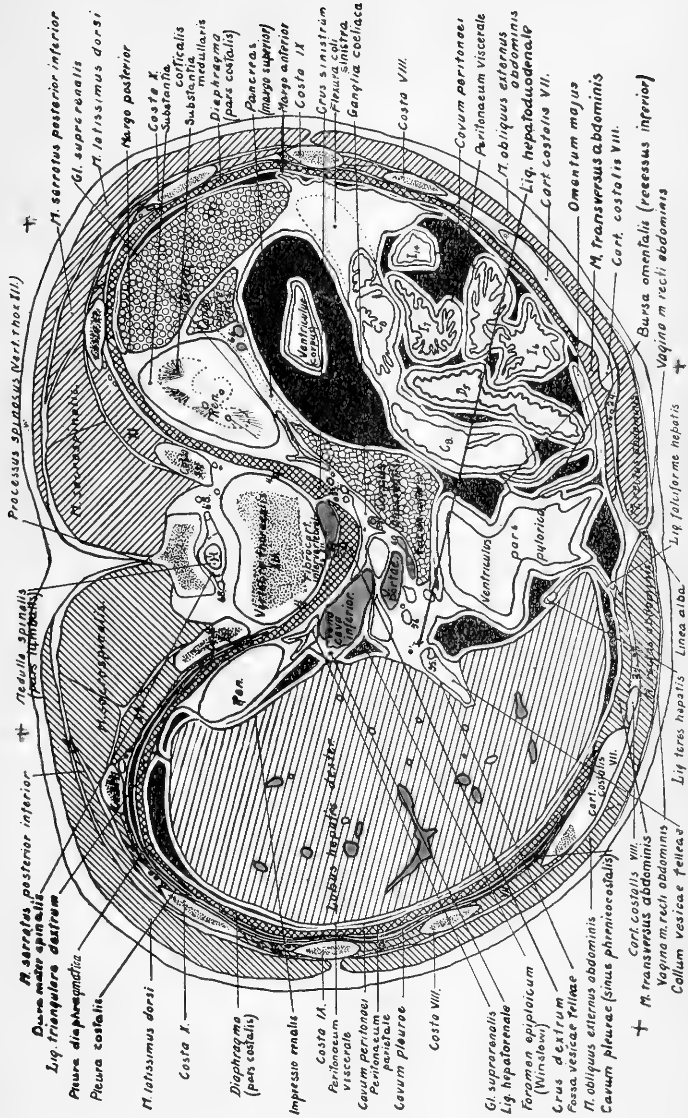

Medulla spinalis
(pars lumbalis)
Processus spinosus (Vert. thor. XII.)
M. serratus posterior inferior
Gl. suprarenalis
M. latissimus dorsi
Margo posterior
Costa X.
Substantia corticalis
Substantia medullaris
Diaphragma
(pars costalis)
Pancreas
(margo superior)
Margo anterior
Costa IX
Crus sinistrum
Flexura coli sinistra
Ganglia coeliaca
Costa VIII.
Cavum peritonaei
Peritonaeum viscerale
M. obliquus externus abdominis
Lig. hepatoduodenale
Cart. costalis VII.
Omentum majus
M. transversus abdominis
Cart. costalis VIII.
Bursa omentalis (recessus inferior)
Vagina m. recti abdominis
Lig. falciforme hepatis
Linea alba
Lig. teres hepatis
Cart. costalis VII.
M. serratus posterior inferior
Dura mater spinalis
Lig. triangulare dextrum
Pleura diaphragmatica
Pleura costalis
M. latissimus dorsi
Costa X.
Diaphragma
(pars costalis)
Impressio renalis
Costa IX.
Peritonaeum viscerale
Cavum peritonaei
Peritonaeum parietale
Cavum pleurae
Costa VIII.
Gl. suprarenalis
Lig. hepatorenale
Foramen epiploicum
(Winslowi)
Crus dextrum
Fossa vesicae felleae
M. obliquus externus abdominis
Cavum pleurae (sinus phrenicocostalis)
Cart. costalis VIII.
M. transversus abdominis
Vagina m. recti abdominis
Collum vesicae felleae
Ventriculus
corpus
Ren
Vena cava inferior
Aorta
Ventriculus
pars pylorica
Lobus hepatis dexter

PLATE XVII

PLATE XVII

Plate XVII is from a section through the lower third of the first lumbar vertebra. The plane of the section is 2.8 cm. anteriorly and 2.7 cm. posteriorly below that of Plate XVI so that the posterior margin is .1 cm. lower than the anterior.

The left renal vein empties into the vena cava inferior near the surface of the section. Its course is indicated in the plate. It receives the suprarenal vein (62) from above.

The lower part of the first portion of the duodenum (D_1) is attached to the posterior part of the stomach. The posterior of the two segments marked (D_1) continues downward as the descending duodenum. The last portion of the duodenum (D_4) lies to the left of the midline opposite the first portion.

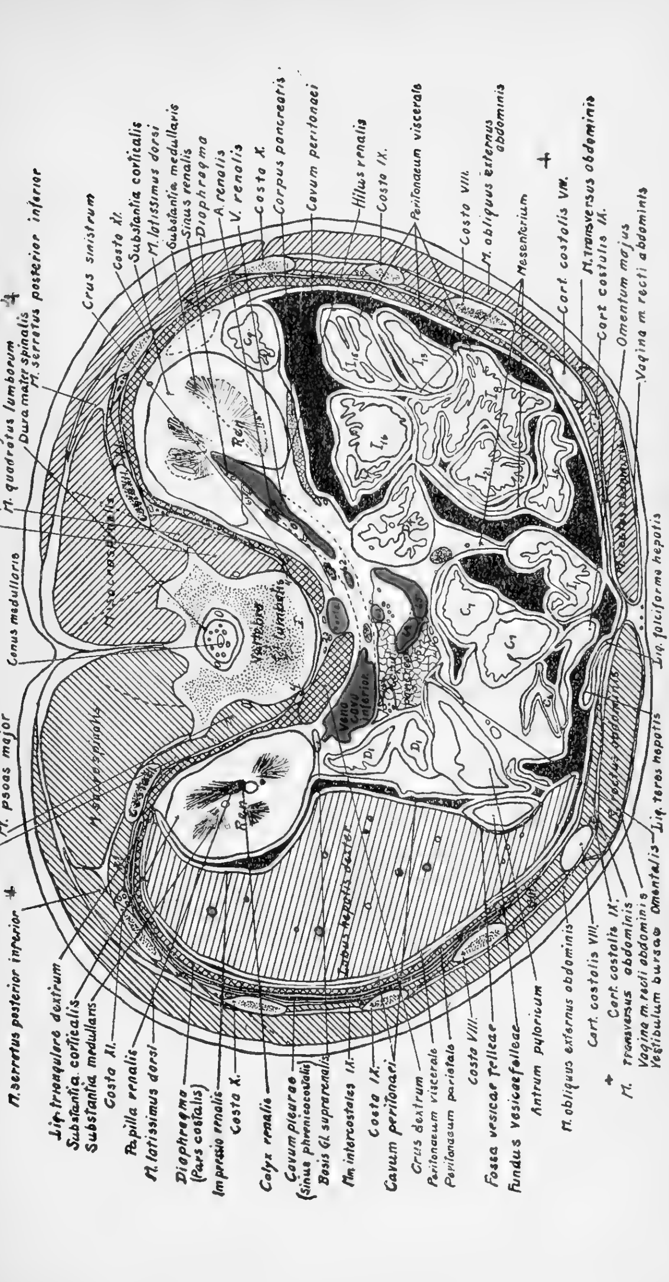
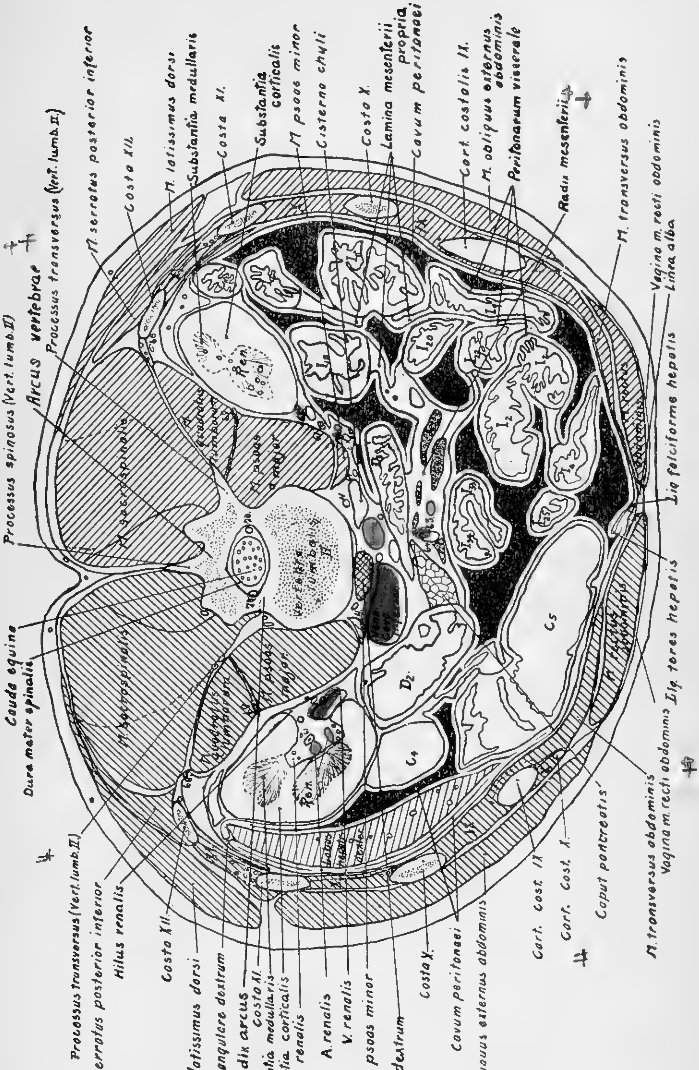

M. quadratus lumborum
M. psoas major
Conus medullaris
M. psoas major
M. quadratus lumborum
Dura mater spinalis
M. serratus posterior inferior
Crus sinistrum
Costa XI.
Substantia corticalis
M. latissimus dorsi
Substantia medullaris
Sinus renalis
Diaphragma
A. renalis
V. renalis
Costa X.
Corpus pancreatis
Cavum peritonaei
Hilus renalis
Costa IX.
Peritonaeum viscerale
Costa VIII.
M. obliquus externus abdominis
Mesenterium
Cart. costalis VIII.
M. transversus abdominis
Cart. costalis IX.
Omentum majus
Vagina m. recti abdominis
Lig. falciforme hepatis
Lig. teres hepatis
M. serratus posterior inferior
Lig. triangulare dextrum
Substantia corticalis
Substantia medullaris
Costa XI.
Papilla renalis
M. latissimus dorsi
Diaphragma (Pars costalis)
Impressio renalis
Costa X.
Calyx renalis
Cavum pleurae (Sinus phrenicocostalis)
Basis Gl. suprarenalis
Mm. intercostales IX.
Costa IX.
Cavum peritonaei
Crus dextrum
Peritonaeum viscerale
Peritonaeum parietale
Costa VIII.
Fossa vesicae felleae
Fundus vesicae felleae
Antrum pyloricum
M. obliquus externus abdominis
Cart. costalis VIII.
Cart. costalis IX.
M. transversus abdominis
Vagina m. recti abdominis
Vestibulum bursae omentalis
Ren
Ren
Vertebra lumbalis I.
Vena cava inferior
Aorta
Pancreas
M. sacrospinalis
Lobus hepatis dexter

PLATE XVIII

PLATE XVIII

Plate XVIII is from the upper surface of a section through the lower half of the body of the second lumbar vertebra. The plane of the section is 3.3 cm. anteriorly and 2.8 cm. posteriorly below that of the last section hence its anterior margin is .4 cm. lower than its posterior.

PLATE XVIII.



Cauda equina
Dura mater spinalis
Processus spinosus (Vert. lumb. II)
Arcus vertebrae
Processus transversus (Vert. lumb. II)
M. serratus posterior inferior
Costa XII.
M. latissimus dorsi
Substantia medullaris
Costa XI.
Substantia corticalis
M. psoas minor
Cisterna chyli
Costa X.
Lamina mesenterii propria
Cavum peritonaei
Cart. costalis IX.
M. obliquus externus abdominis
Peritonaeum viscerale
Radix mesenterii
M. transversus abdominis
Vagina m. recti abdominis
Linea alba
Lig. falciforme hepatis
Lig. teres hepatis
M. transversus abdominis
Vagina m. recti abdominis
Caput pancreatis
Cart. Cost. X
Cart. Cost. IX
M. obliquus externus abdominis
Cavum peritonaei
Costa X.
Crus dextrum
M. psoas minor
V. renalis
A. renalis
Sinus renalis
Substantia corticalis
Substantia medullaris
Costa XI.
Radix arcus
Lig. triangulare dextrum
M. latissimus dorsi
Costa XII
Hilus renalis
M. serratus posterior inferior
Processus transversus (Vert. lumb. II)

PLATE XIX

PLATE XIX

Plate XIX is from the upper surface of a section through the lower third of the third lumbar vertebra. The plane of the section is 3.7 cm. anteriorly and 3.8 cm. posteriorly below that of the last section, so that the anterior margin is .3 cm. below the posterior.

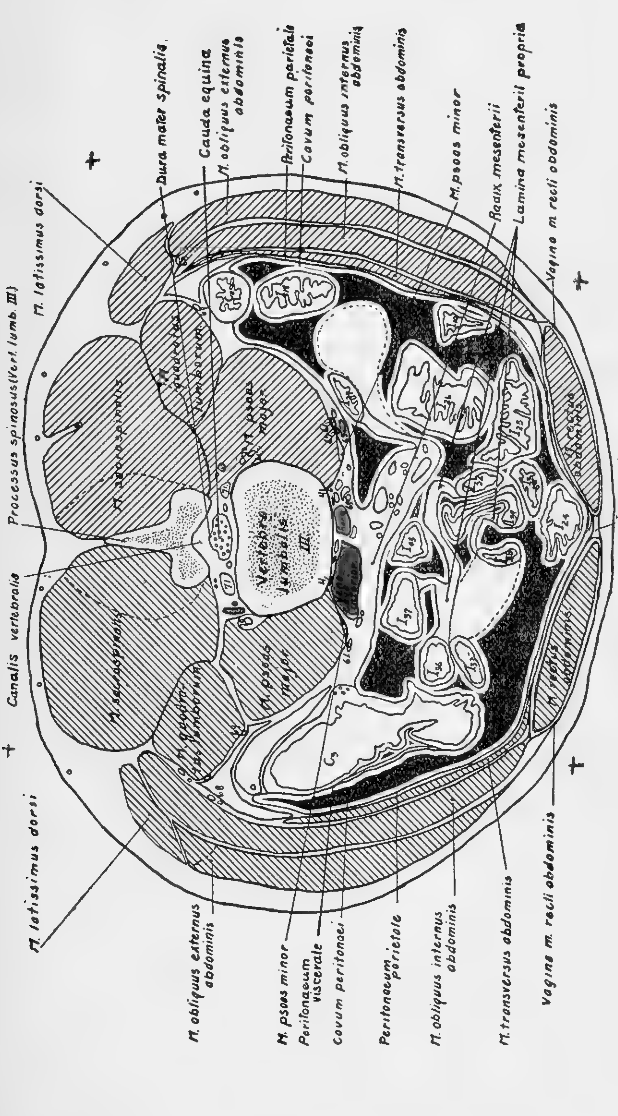

M. latissimus dorsi
Canalis vertebralis
Processus spinosus (Vert. lumb. III)
M. latissimus dorsi
Dura mater spinalis
Cauda equina
M. obliquus externus abdominis
Peritonaeum parietale
Cavum peritonaei
M. obliquus internus abdominis
M. transversus abdominis
M. psoas minor
Radix mesenterii
Lamina mesenterii propria
Vagina m. recti abdominis
Linea alba
M. sacrospinalis
M. quadratus lumborum
M. psoas major
Vertebra lumbalis III
M. rectus abdominis
M. obliquus externus abdominis
M. psoas minor
Peritonaeum viscerale
Cavum peritonaei
Peritonaeum parietale
M. obliquus internus abdominis
M. transversus abdominis
Vagina m. recti abdominis

PLATE XX

PLATE XX

Plate XX is from the upper surface of a section through the middle of the body of the fourth lumbar vertebra. The plane of the section is 2.8 cm. anteriorly and 3.1 cm. posteriorly below that of the last section and is horizontal. It passes just above the highest point of the crest of the ilium.

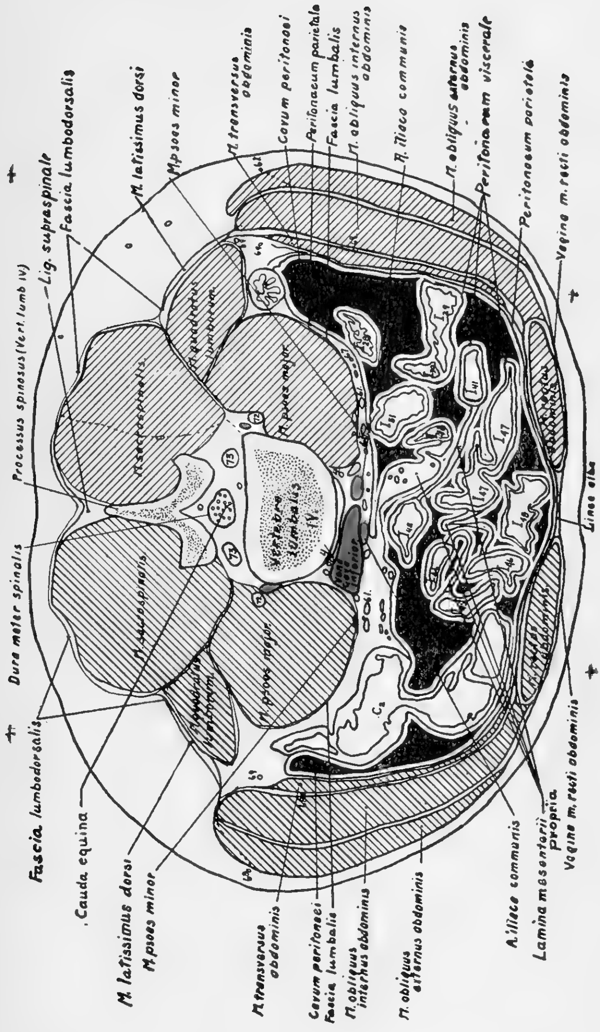

Fascia lumbodorsalis
Cauda equina
M. latissimus dorsi
M. psoas minor
M. transversus abdominis
Cavum peritonaei
Fascia lumbalis
M. obliquus internus abdominis
M. obliquus externus abdominis
A. iliaca communis
Lamina mesenterii propria
Vagina m. recti abdominis
Dura mater spinalis
Processus spinosus (Vert. lumb. IV)
Lig. supraspinale
Fascia lumbodorsalis
M. latissimus dorsi
M. psoas minor
M. transversus abdominis
Cavum peritonaei
Peritonaeum parietale
Fascia lumbalis
M. obliquus internus abdominis
A. iliaca communis
M. obliquus externus abdominis
Peritonaeum viscerale
Peritonaeum parietale
Vagina m. recti abdominis
Linea alba
M. sacrospinalis
M. quadratus lumborum
M. psoas major
Vertebra lumbalis IV
Vena cava inferior
M. rectus abdominis

PLATE XXI

PLATE XXI

Plate XXI is from the upper surface of a section through the lowermost part of the fifth lumbar vertebra. The plane of the section is 4.3 cm. anteriorly and 3 cm. posteriorly below that of the last section. Its anterior margin is 1.3 cm. lower than its posterior.

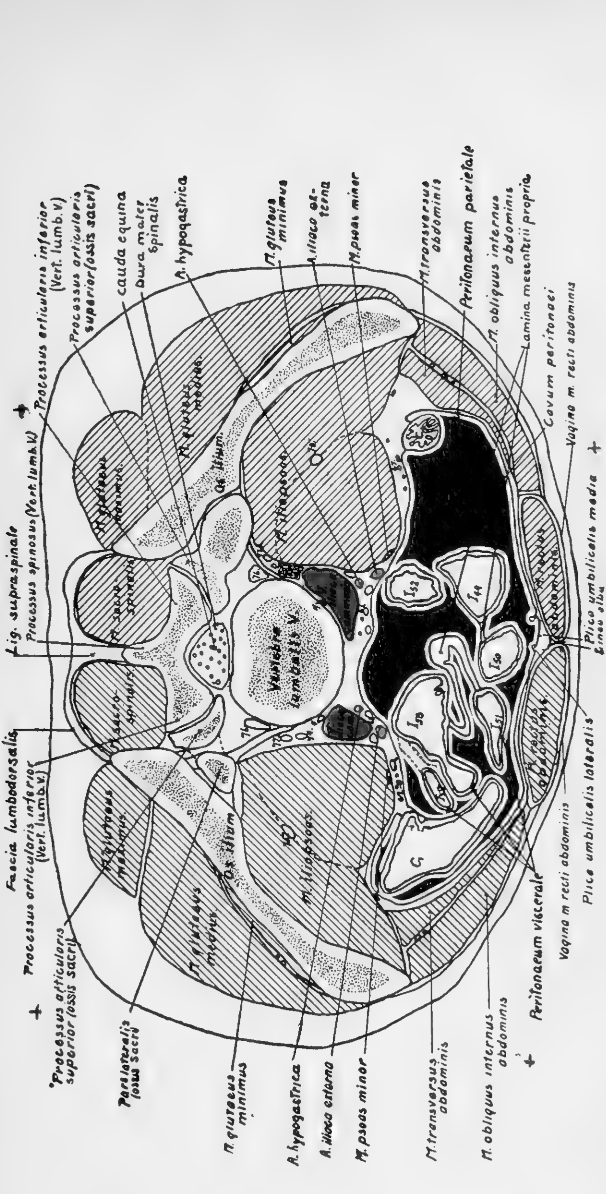

Fascia lumbodorsalis
Processus articularis inferior (Vert. lumb.V)
Lig. supraspinale
Processus spinosus (Vert. lumb.V)
Processus articularis inferior (Vert. lumb.V)
Processus articularis superior (ossis sacri)
cauda equina
Dura mater spinalis
A. hypogastrica
M. gluteus minimus
A. iliaca externa
M. psoas minor
M. transversus abdominis
Peritonaeum parietale
M. obliquus internus abdominis
Lamina mesenterii propria
Cavum peritonaei
Vagina m. recti abdominis
Plica umbilicalis media
Linea alba
Plica umbilicalis lateralis
Vagina m. recti abdominis
Peritonaeum viscerale
Processus articularis superior (ossis Sacri)
Pars lateralis (ossis Sacri)
M. gluteus minimus
A. hypogastrica
A. iliaca externa
M. psoas minor
M. transversus abdominis
M. obliquus internus abdominis
M. gluteus maximus
M. sacro spinalis
M. gluteus medius
Os ilium
M. iliopsoas
Vertebra lumbalis V.
M. rectus abdominis
C

PLATE XXII

PLATE XXII

Plate XXII is from the upper surface of a section through the middle of the sacrum. The plane of the section is 4 cm. anteriorly, and 3.1 cm. posteriorly below that of the last section, so that the anterior margin is 2.2 cm. lower than the posterior.

The left plica umbilicalis lateralis extends across the corner of the peritonaeal cavity in the section cutting off a small pocket as indicated by the dotted line.

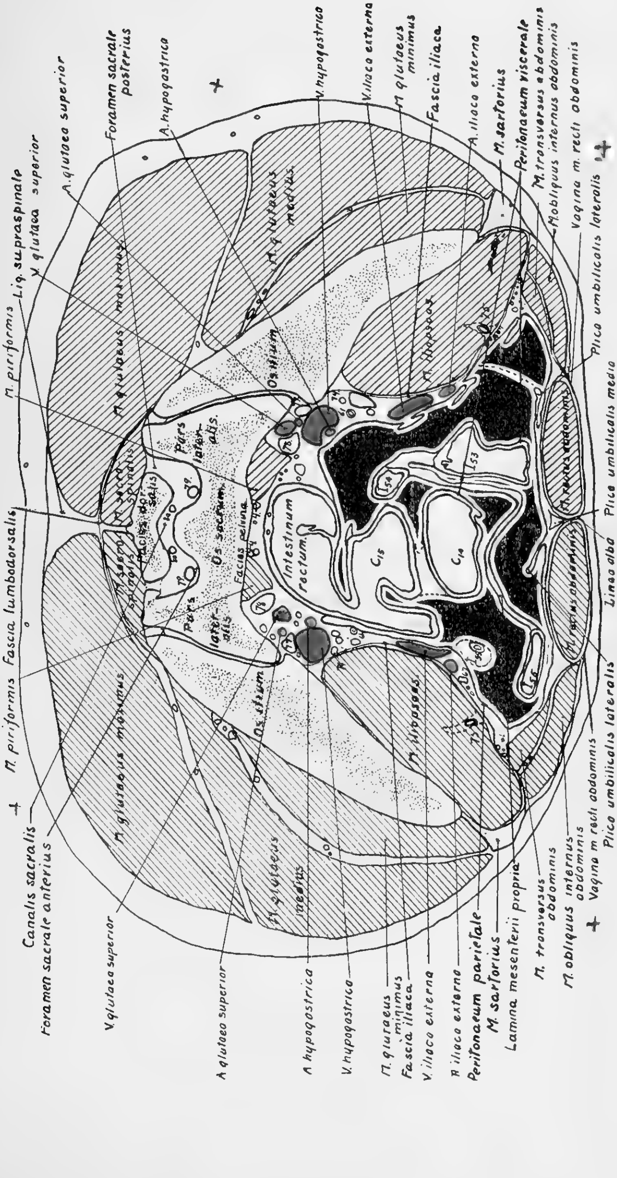

M. piriformis
Fascia lumbodorsalis
Canalis sacralis
Foramen sacrale anterius
M. glutaeus maximus
V. glutaea superior
A. glutaea superior
A. hypogastrica
V. hypogastrica
M. glutaeus minimus
Fascia iliaca
V. iliaca externa
A. iliaca externa
Peritonaeum parietale
M. sartorius
Lamina mesenterii propria
M. transversus abdominis
M. obliquus internus abdominis
Vagina m. recti abdominis
Plica umbilicalis lateralis
Linea alba
Plica umbilicalis media
Lig. supraspinale
Foramen sacrale posterius
Peritonaeum viscerale
M. glutaeus medius
M. iliopsoas
Os ilium
Os sacrum
Pars lateralis
Facies pelvina
Intestinum rectum
M. rectus abdominis

PLATE XXIII

PLATE XXIII

Plate XXIII is from the upper surface of a section through the first coccygeal vertebra posteriorly and the acetabular cavities of the ilia laterally. The plane of the section is 3.8 cm. anteriorly and 4.2 cm. posteriorly below that of the last section. The anterior margin is 1.8 cm. lower than the posterior.

The right plica umbilicalis lateralis stretches across the corner of the cavity cutting off a pocket like the one indicated on left side of section XXII. These two spaces are conical in form, about 4 cm. deep and closed everywhere except at the top.

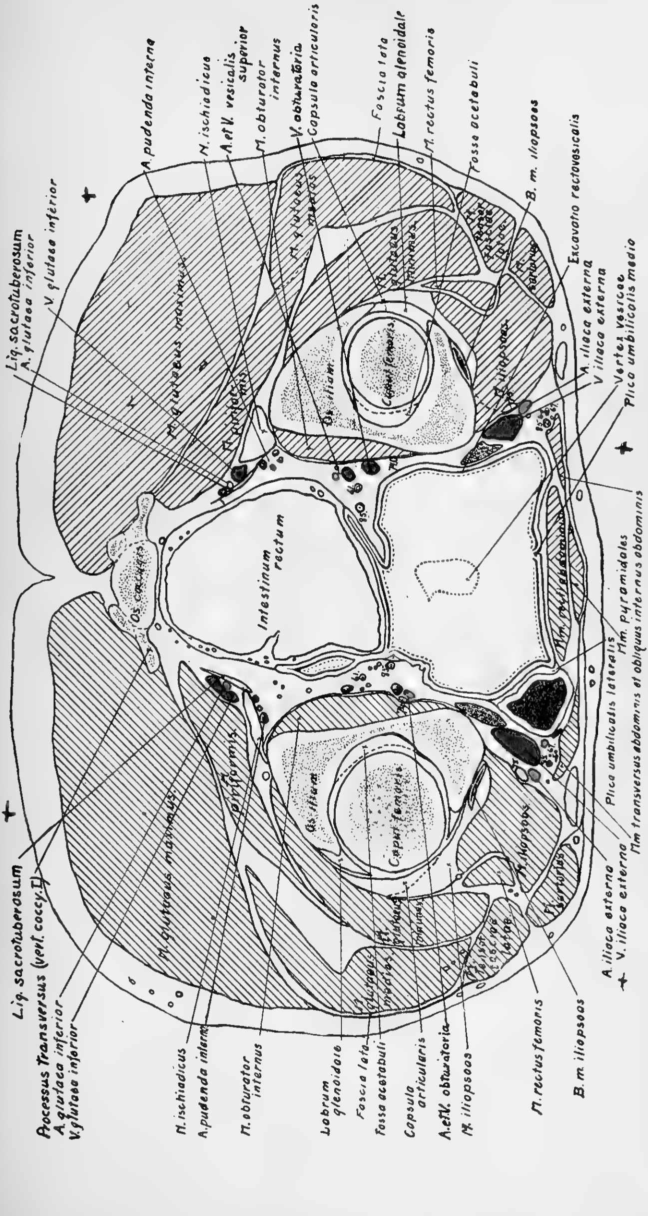

Lig. sacrotuberosum
A. glutaea inferior
V. glutaea inferior
A. pudenda interna
N. ischiadicus
A. et V. vesicalis superior
M. obturator internus
V. obturatoria
Capsula articularis
Fascia lata
Labrum glenoidale
M. rectus femoris
Fossa acetabuli
B. m. iliopsoas
Excavatio rectovesicalis
A. iliaca externa
V. iliaca externa
Vertex vesicae
Plica umbilicalis media
Mm. pyramidales
Mm. transversus abdominis et obliquus internus abdominis
Plica umbilicalis lateralis
Mm. recti abdominis
M. glutaeus maximus
M. piriformis
M. glutaeus medius
M. glutaeus minimus
M. tensor fasciae latae
M. sartorius
M. iliopsoas
Os ilium
Caput femoris
Os coccygis
Intestinum rectum
Processus Transversus (vert. coccy. I)
A. pudenda interna
Labrum glenoidale
Fossa acetabuli
Capsula articularis
A. et V. obturatoria
M. iliopsoas
M. rectus femoris
B. m. iliopsoas
A. iliaca externa
V. iliaca externa

PLATE XXIV

PLATE XXIV

Plate XXIV is from a section through the tip of the coccyx posteriorly, the middle of the body of the os pubis anteriorly and the superior rami of the ischia. The plane of the section is 4.3 cm. anteriorly and 4.5 cm. posteriorly below that of section XXIII so that the anterior margin is 1.3 cm. below the posterior.

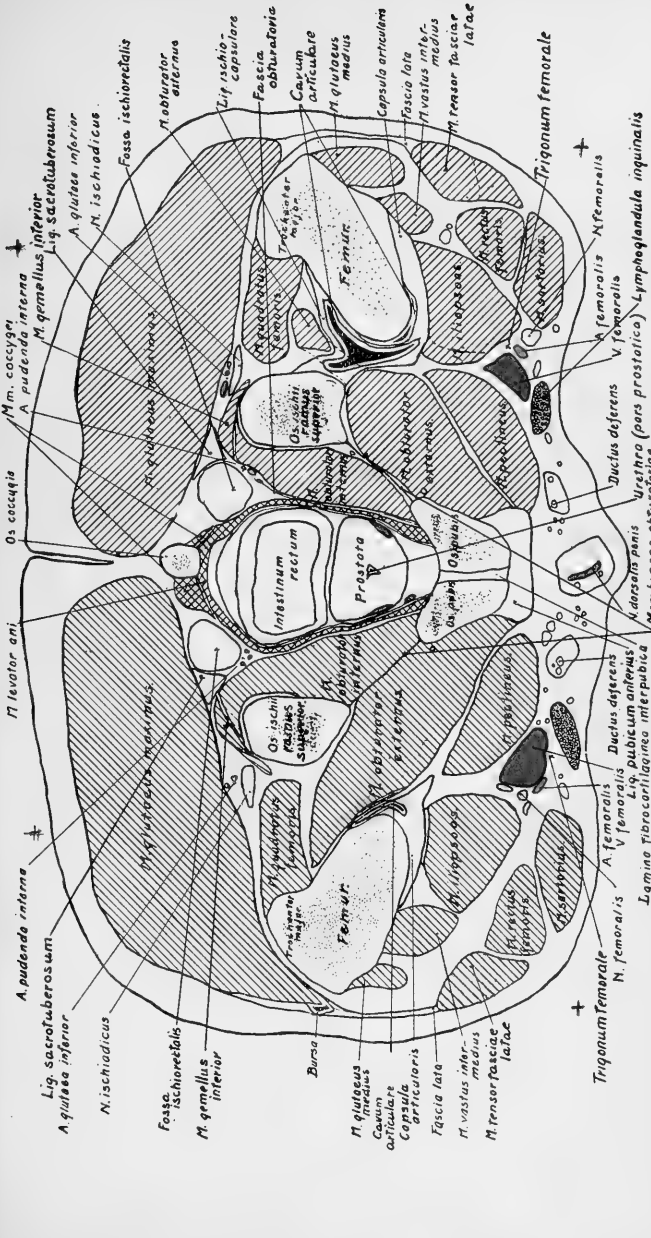

M levator ani
Os coccygis
Mm. coccygei
A pudenda interna
M. gemellus interior
Lig. sacrotuberosum
A. glutaea inferior
N. ischiadicus
Fossa ischiorectalis
M. obturator externus
Lig. ischio-capsulare
Fascia obturatoria
Cavum articulare
M. glutaeus medius
Capsula articularis
Fascia lata
M. vastus intermedius
M. tensor fasciae latae
Trigonum femorale
N. femoralis
A. femoralis
V. femoralis
Lymphoglandula inguinalis
Ductus deferens
Urethra (pars prostatica)
Membranae obturatoriae
N. dorsalis penis
Lig. pubicum anterius
Lamina fibrocartilaginea interpubica
Intestinum rectum
Prostata
Os pubis
Os ischii ramus superior
M. obturator internus
M. obturator externus
M. pectineus
M. iliopsoas
M. sartorius
M. rectus femoris
M. quadratus femoris
M. glutaeus maximus
Trochanter major
Femur
A. pudenda interna
Lig. sacrotuberosum
A. glutaea inferior
N. ischiadicus
Fossa ischiorectalis
M. gemellus interior
Bursa
M. glutaeus medius
Cavum articulare
Capsula articularis
Fascia lata
M. vastus intermedius
M. tensor fasciae latae
Trigonum femorale
N. femoralis

PLATE XXV

PLATE XXV

Plate XXV is from a section through the ischial tuberosities and the lesser trochanters of the femurs. The section is 4.3 cm. anteriorly and 5.4 cm. posteriorly below the last section. The anterior margin is .2 cm. below the posterior. This is about 4.5 cm. below the tip of the coccyx and 2.3 cm. below the inferior margin of the symphysis pubis.

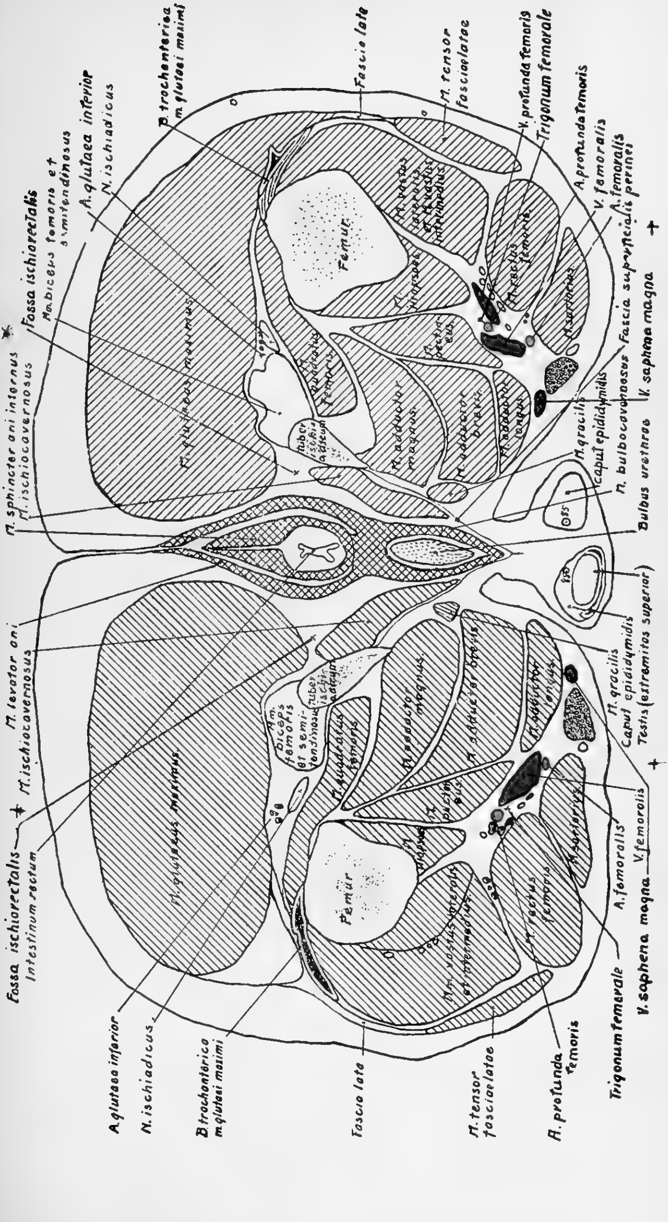

Fossa ischiorectalis
Intestinum rectum
M. ischiocavernosus
M. levator ani
A. glutaea inferior
N. ischiadicus
B. trochanterica m. glutaei maximi
Fascia lata
M. tensor fasciae latae
A. profunda femoris
Trigonum femorale
V. saphena magna
A. femoralis
V. femoralis
M. gracilis
Caput epididymidis
Testis (extremitas superior)
Bulbus urethrae
M. bulbocavernosus
V. saphena magna
Fascia superficialis perinei
A. femoralis
V. femoralis
A. profunda femoris
V. profunda femoris
M. sphincter ani internus
M. ischiocavernosus
Fossa ischiorectalis
M. biceps femoris et semitendinosus
A. glutaea inferior
N. ischiadicus
B. trochanterica m. glutaei maximi
M. gluteus maximus
Femur
M. adductor magnus
M. adductor brevis
M. adductor longus
M. quadratus femoris
M. pectineus
M. sartorius
M. rectus femoris
Tuber ischiadicum

PLATE XXVI

PLATE XXVI

Plate XXVI is from a photograph of the anterior surface of the trunk, reconstructed by piling up the sections in their proper order, and is reduced to about one-fourth life size.


IV
V
VI
VII
VIII
IX
X
XI
XII
XIII
XIV
XV
XVI
XVII
XVIII
XIX
XX
XXI
XXII
XXIII
XXIV
XXV

PLATE XXVII

PLATE XXVII

Plate XXVII is from a photograph of the posterior surface of the trunk, shown in Plate XXVI and reduced in the same proportion.

The photographs were taken, in order to show the exact position of each section and its relations to the various landmarks of the body.

The number on each section corresponds to the number of the plate showing the upper surface of that section.


III
V
VIII
XI
XII
XIII
XIV
XV
XVI
XVII
XVIII
XIX
XX
XXI
XXIII
XXV

PLATE XXVIII

PLATE XXVIII

Plate XXVIII represents a projection of the various internal organs upon the anterior surface of the body reduced to one-half life size. The body outline was obtained by enlarging to life size, with a pantograph, the photographs used in making Plates XXVI and XXVII. The errors of proportion produced by the photographic lens were corrected by measurements of the body at the surface of each section. The section lines seen in Plate XXVI are represented in this plate by the horizontal black lines which run across the body. The exact position of these lines was obtained by placing the sections one upon the other in their proper position as was done to take the photographs shown in Plates XXVI and XXVII. A meter stick was then placed perpendicularly, parallel to the anterior midline of the body and the position of the upper surface of each section was measured by running a straight edge horizontally outward from the section to the meter stick.

The vertical line marked OO in this plate and in Plate XXIX is the midline of the body. In the anterior projection it connects the anterior ends of the midlines of the sections. In the posterior projection it connects the posterior ends of these same midlines.

The various organs are outlined in broken lines of sufficiently different character so that each organ may be traced without any difficulty. (These lines are explained on the plates.

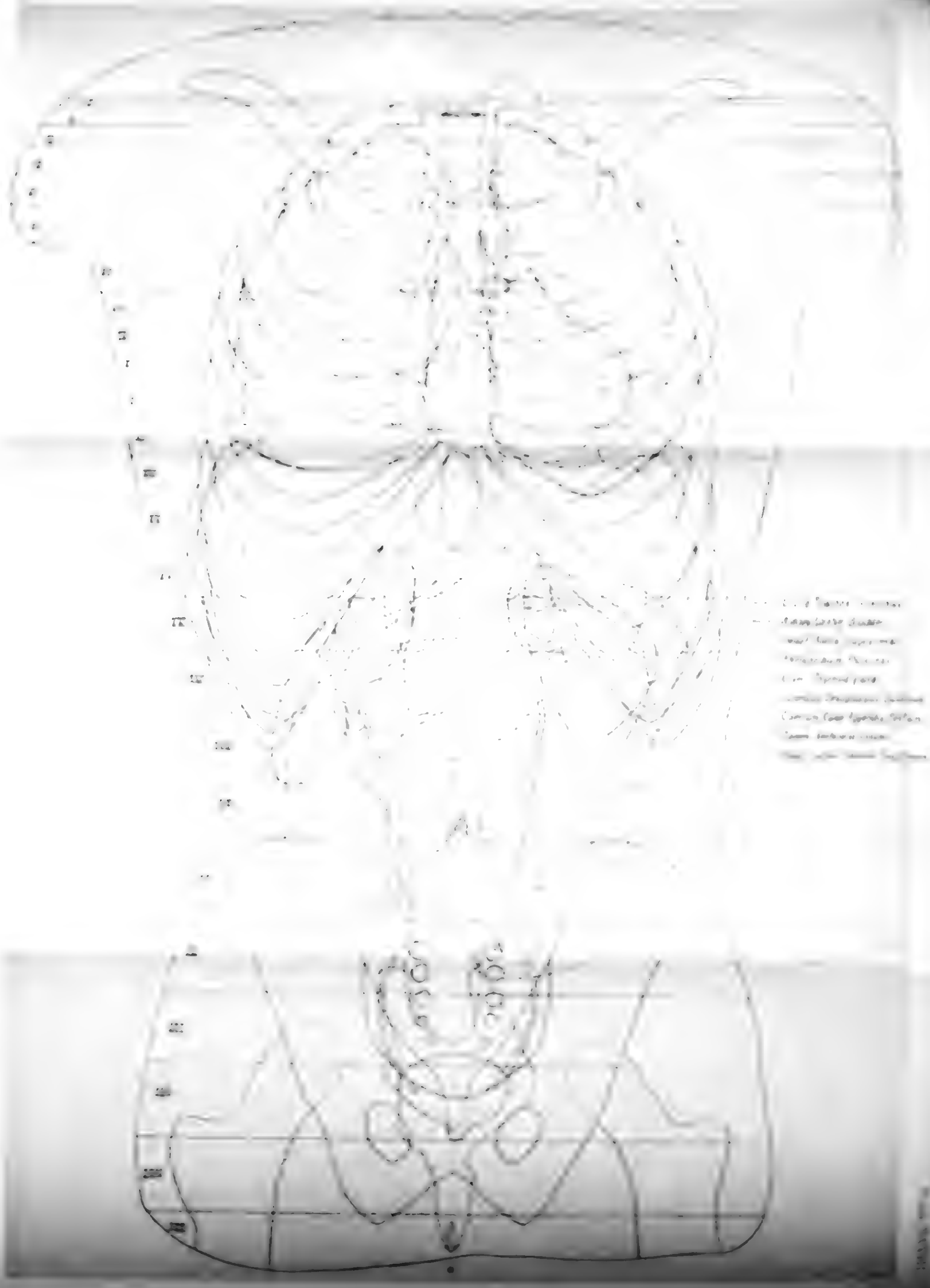


PLATE XXIX

PLATE XXIX

Plate XXIX represents a projection of the same structures upon the posterior surface of the body, also reduced to one-half life size. The body outline was obtained in the same way as in Plate XXVIII. The section lines correspond to those in Plate XXVII and were located in the same way as those in Plate XXVIII. The positions of the section lines are not exactly the same in this plate as in Plate XXVIII since many of the sections differ in thickness at their anterior and posterior surfaces.

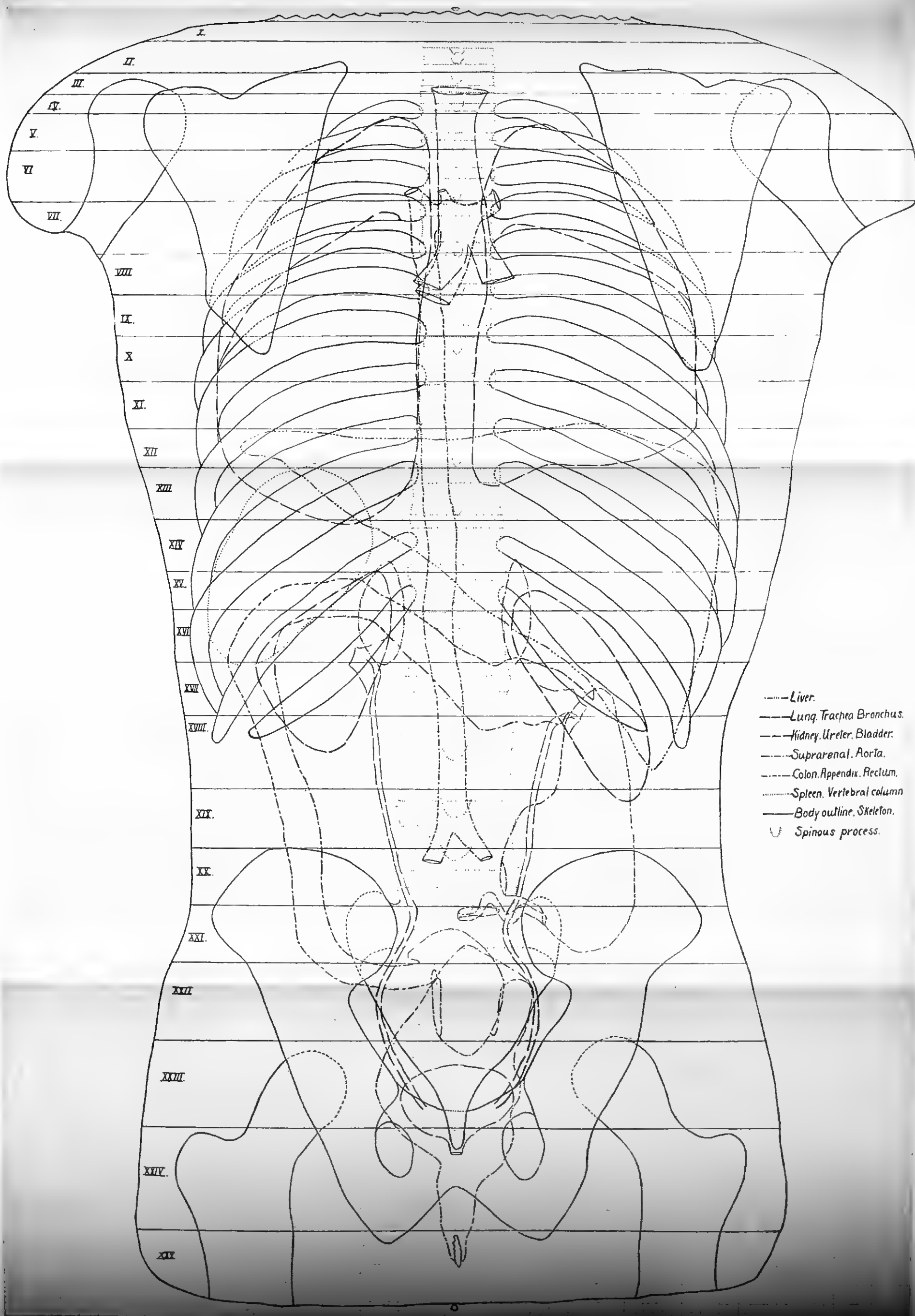

I.
II.
III.
IV.
V.
VI
VII.
VIII
IX.
X
XI.
XII
XIII
XIV
XV.
XVI
XVII
XVIII.
XIX.
XX.
XXI.
XXII
XXIII.
XXIV.
XXV
Liver.
Lung. Trachea Bronchus.
Kidney. Ureter. Bladder.
Suprarenal. Aorta.
Colon. Appendix. Rectum.
Spleen. Vertebral column
Body outline. Skeleton.
Spinous process.

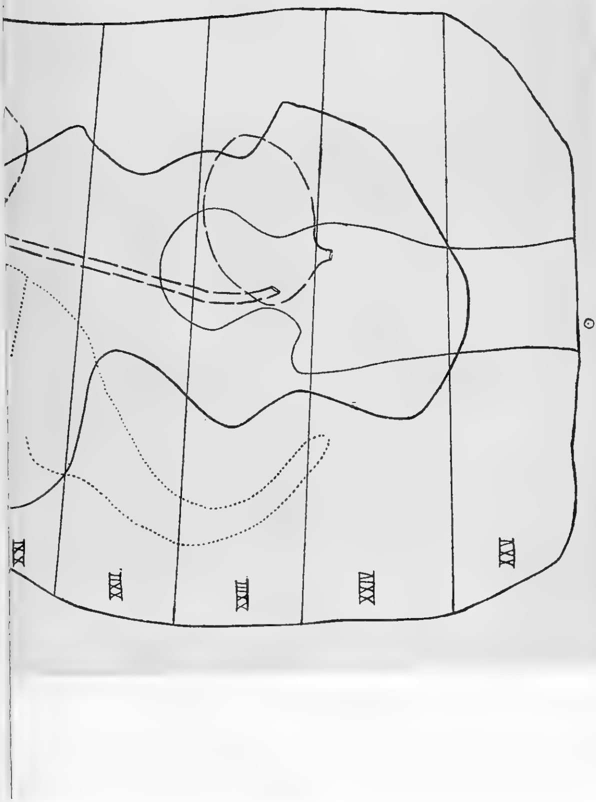
PLATE XXIX.

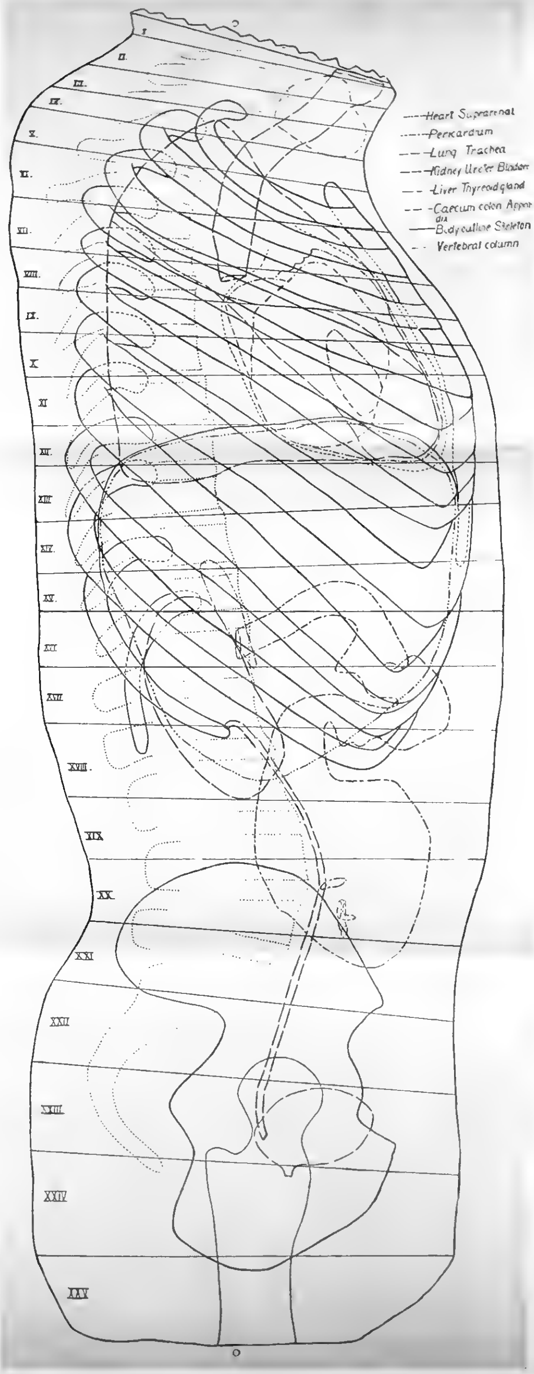
PLATE XXX

PLATE XXX

Plate XXX represents a projection of the internal structures upon the right lateral surface of the body reduced to one-half life size. The OO line is the mid-axillary line which was determined by placing the sections in their normal positions, as in obtaining Plates XXVI and XXVII, and drawing a vertical line down through the middle of the axilla. The section lines correspond to those seen in the preceding plates.

PLATE XXX.





Heart Suprarenal
Pericardium
Lung Trachea
Kidney Ureter Bladder
Liver Thyreoid gland
Caecum colon Appendix
Body outline Skeleton
Vertebral column
I
II.
III.
IV.
V.
VI.
VII.
VIII.
IX.
X
XI
XII.
XIII
XIV.
XV.
XVI
XVII
XVIII.
XIX
XX
XXI
XXII
XXIII
XXIV
XXV

Plate XXX

PLATE XXXI

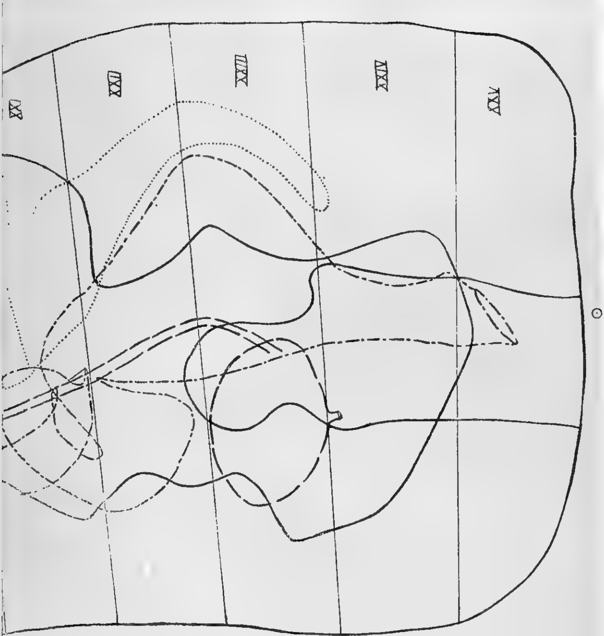
PLATE XXXI

Plate XXXI represents a projection of the same structures upon the left lateral surface of the body, also reduced to one-half life size. The OO line in this plate is the left midaxillary line.

The measurements for the lateral projections were made in the same way as for the anterior and posterior, using the midaxillary plane instead of the midplane. In this case, however, it was not necessary to make corrections for the obliquity of the surfaces, except in one or two cases. Each organ is outlined in the same character of line in the lateral projections as in the anterior and posterior projections.

The ruled lines of the green background in Plates XXVIII to XXXI represent the millimeter spaces on the life size chart, reduced to the same scale as the figures.

PLATE XXXI



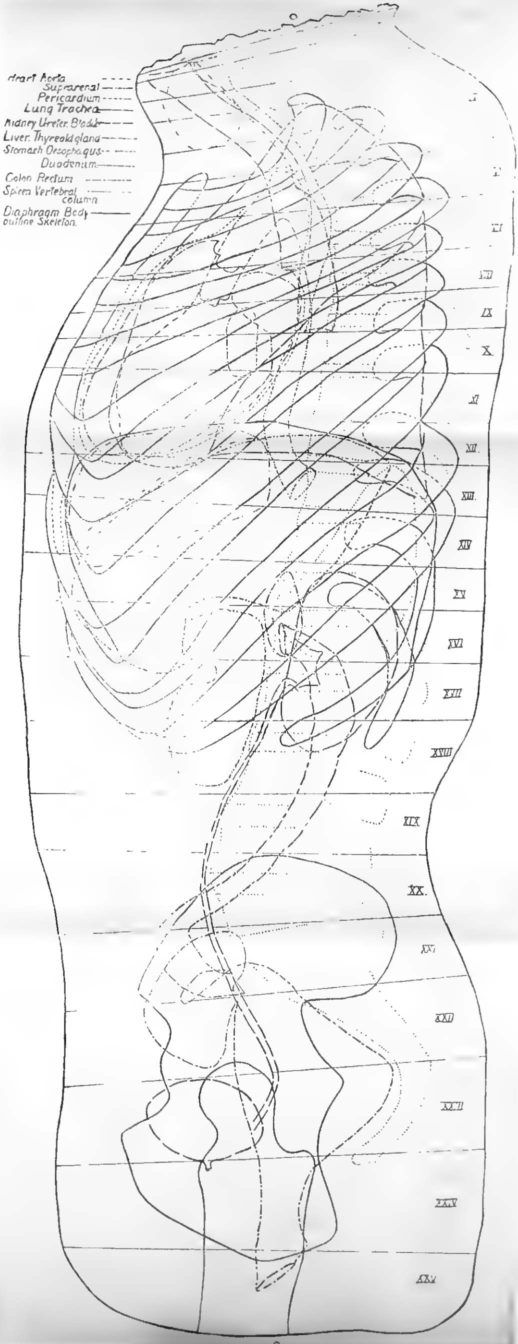

Heart Aorta
Suprarenal
Pericardium
Lung Trachea
Kidney Ureter Bladder
Liver Thyreoid gland
Stomach Oesophagus
Duodenum
Colon Rectum
Spleen Vertebral column
Diaphragm Body outline Skeleton
IX
X
XII.
XIII.
XIV
XV
XVI
XVII
XVIII
XX.

Plate XXXI

PLATE XXXII

PLATE XXXII

Plate XXXII is a reduced copy in colors of Plate XXVIII which represents the organs as projected upon the anterior surface of the body.

This Plate and the three following Plates are all reduced to about one-fourth life size. In order to bring out more clearly the intricate relations of the various organs shown in outline in Plates XXVIII to XXXI each organ is shown in a distinctive color in Plates XXXII to XXXV. The colors used for the various organs are indicated on the plates.

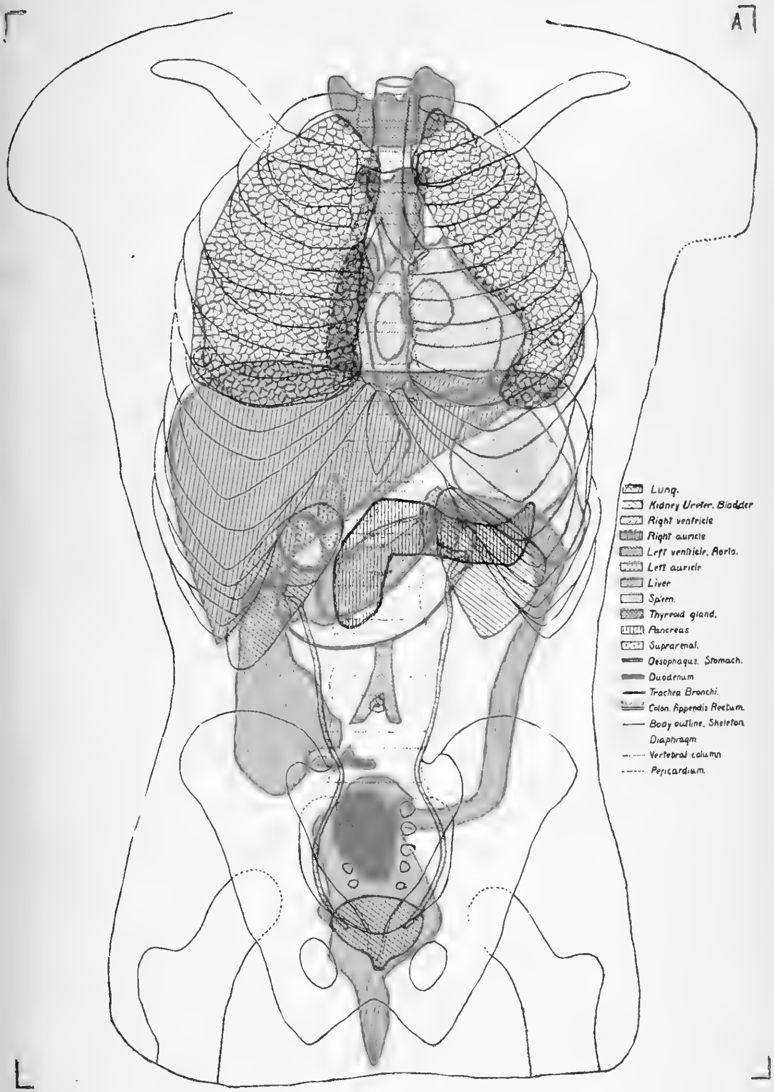

A
Lung.
Kidney Ureter. Bladder
Right ventricle
Right auricle
Left ventricle. Aorta.
Left auricle
Liver
Spleen.
Thyroid gland.
Pancreas
Suprarenal.
Oesophagus. Stomach.
Duodenum
Trachea Bronchi.
Colon. Appendix Rectum.
Body outline. Skeleton
Diaphragm
Vertebral column
Pericardium.

PLATE XXXIII

PLATE XXXIII

Plate XXXIII is a reduced copy in colors of Plate XXIX which represent the organs as projected upon the posterior surface of the body. One-fourth life size.

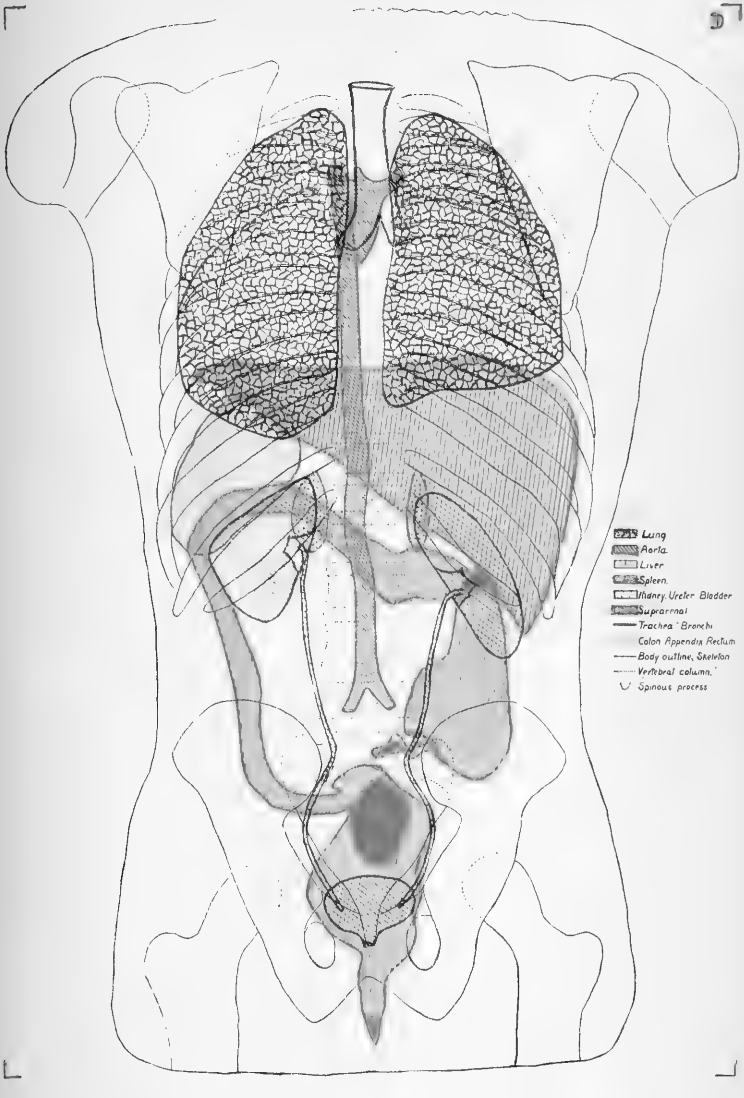

D
Lung
Aorta
Liver
Spleen.
Kidney. Ureter Bladder
Suprarenal
Trachea · Bronchi
Colon Appendix Rectum
Body outline, Skeleton
Vertebral column.
Spinous process

PLATE XXXIV

PLATE XXXIV

Plate XXXIV is a reduced copy in colors of Plate XXX which represents the organs projected upon the right lateral surface of the body. One-fourth life size.

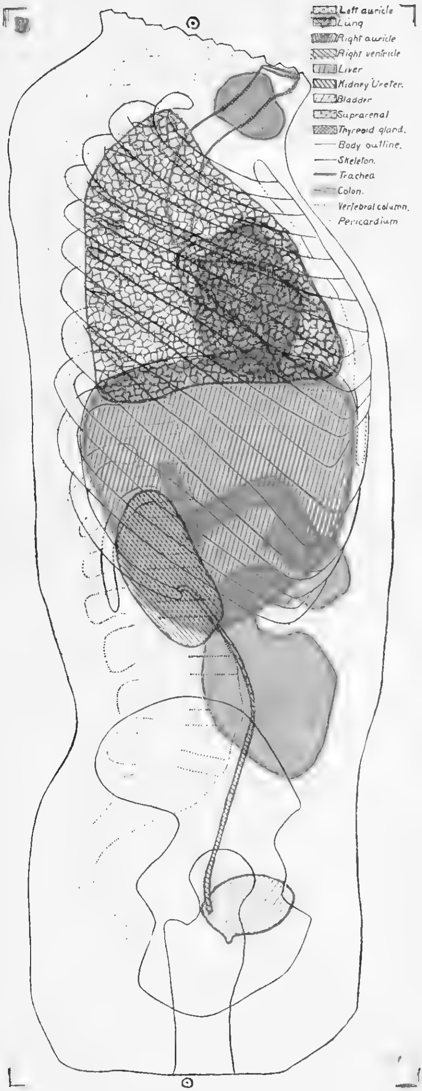
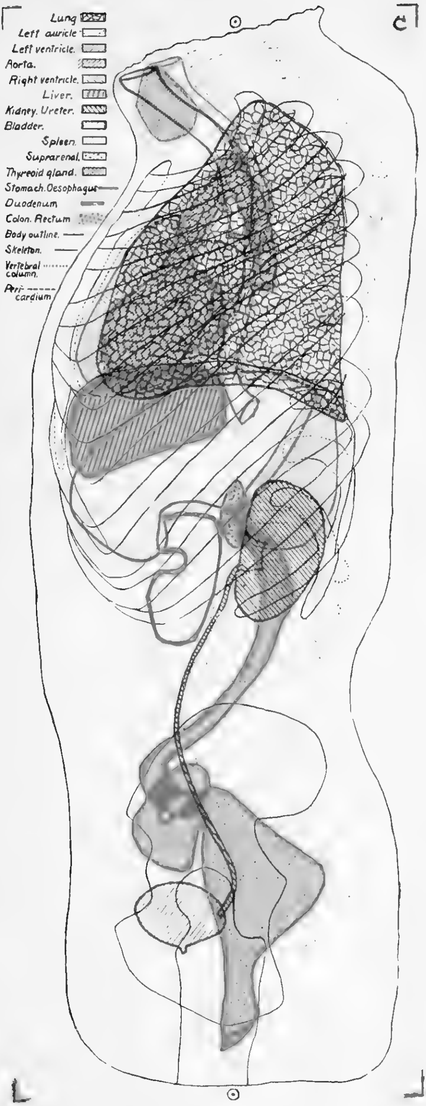

Left auricle
Lung
Right auricle
Right ventricle
Liver
Kidney Ureter.
Bladder
Suprarenal
Thyreoid gland.
Body outline.
Skeleton.
Trachea
Colon.
Vertebral column.
Pericardium

PLATE XXXV

PLATE XXXV

Plate XXXV is a reduced copy in colors of Plate XXXI which represents the organs projected upon the left lateral surface of the body. One-fourth life size.


Lung
Left auricle
Left ventricle.
Aorta.
Right ventricle.
Liver.
Kidney. Ureter.
Bladder.
Spleen.
Suprarenal.
Thyreoid gland.
Stomach. Oesophagus
Duodenum
Colon. Rectum
Body outline.
Skeleton.
Vertebral column.
Pericardium

UNIVERSITY OF MISSOURI STUDIES

VOLUME I

UNIVERSITY OF MISSOURI STUDIES

VOLUME II

NUMBER 1

Ithaca or Leucas? by WILLIAM GWATHMEY MANLY, A. M., Professor of Greek Language and Literature. pp. VI, 52. $1.00.

NUMBER 2

Public Relief and Private Charity in England, by CHARLES A. ELLWOOD, Ph. D., Professor of Sociology. pp. VIII, 96. 75 cents.

NUMBER 3

The Process of Inductive Inference, by FRANK THILLY, Ph. D., Professor of Philosophy. pp. V, 40. 35 cents.

NUMBER 4

Regeneration of Crayfish Appendages, by MARY I. STEELE, M. A. pp. VIII, 47. 75 cents.

NUMBER 5

The Spermatogenesis of Anax Junius, by CAROLINE MCGILL. pp. VIII, 15. 75 cents.

VOLUME I SCIENCE SERIES

NUMBER 1

Topography of the Thorax and Abdomen, by PETER POTTER, M. A., M. D., Associate Professor of Anatomy, St. Louis University. pp. VII, 142. $1.75.

VOLUME I SOCIAL SCIENCE SERIES

The Clothing Industry in New York, by JESSE E. POPE, Ph. D., Professor of Economics and Finance. *In the Press.*

VOLUME I SCIENCE SERIES NUMBER 2

THE UNIVERSITY OF MISSOURI STUDIES

THE FLORA OF COLUMBIA MISSOURI AND VICINITY

AN ECOLOGICAL AND SYSTEMATIC STUDY OF A LOCAL FLORA

BY

FRANCIS POTTER DANIELS

PUBLISHED BY THE
UNIVERSITY OF MISSOURI
January, 1907

2

THE FLORA OF COLUMBIA MISSOURI AND VICINITY

Volume I SCIENCE SERIES Number 2

THE UNIVERSITY OF MISSOURI STUDIES

THE FLORA OF COLUMBIA MISSOURI AND VICINITY

An Ecological and Systematic Study of a Local Flora

BY

FRANCIS POTTER DANIELS

PUBLISHED BY THE
UNIVERSITY OF MISSOURI
January, 1907

COLUMBIA, MO.:
E. W. STEPHENS PUBLISHING COMPANY,
1907

TO

PROFESSOR DR. OSKAR DRUDE

THIS STUDY IS RESPECTFULLY DEDICATED

PREFACE

This paper contains a systematic catalogue of the native and introduced plants of the vicinity of Columbia, Missouri, and is the result of researches carried on during 1896-7 and again from 1902 to the present time.

While it deals chiefly with the systematic relationships of this flora it is an endeavor, not only to list, but also to describe as fully as seems necessary the higher orders—the ferns and flowering plants of the locality. The lower orders will be described, when studies upon them—which are being made here—are completed.

The paper is, however, not only a systematic catalogue of native and introduced plants, it is also an ecological study of them, and the attempt has been made to indicate the social relationships of the flora ; to determine the external factors of these associations ; and to ascertain the physiological adaptations of the plants themselves to their environment. And, as an account of plant association and distribution, as well as of the composition of the flora, it claims a certain finality.

The method of study has been, essentially, the careful collection of plants from typical localities ; the study of their nature ; their relative abundance ; and the manner of their association. The physical condition of these localities has been investigated, and notes made of what changes are going on, and how these affect the vegetation.

With the exception of the determination of the plants, all the work has been done in the field.

It has been hitherto impossible, owing to lack of suitable facilities, to submit the work to laboratory tests. This, then, remains for the future. A suitable geological map has been a desideratum during the main course of the investigations, but latterly has been provided.

In connection with the field-work extensive collections have been made. From these and for the purpose of the study of the local flora an herbarium of Boone county has been formed during the last few years, scarcely a score of sheets dating before 1896. Besides the collections of the author, the chief have been those of Mr. E. H. Favor, those of Dr. Charles Thom and his pupils, consisting almost wholly of vernal plants, and those of Dr. B. M. Duggar and his assistants, which include an extensive and valuable collection of fungi.

It is with sincere pleasure that the author acknowledges his obligations to Dr. B. M. Duggar, whose inspiring helpfulness during these studies justifies more than this passing word.

To Professor C. F. Marbut is due the map which accompanies this paper, and to him the author gives his heartiest thanks.

TABLE OF CONTENTS

Addenda, Corrigenda and Errata

Page 8, l. 14, dichotomus read dichotomous.

Page 25, l. 22, read Carpinus Caroliniana.

Page 29, l. 4, insert e. **Paludosae rudbeckioides** from line 10 below.

Page 42, l. 9, read ε. **Vitices.**

Page 43, l. 25, read Panax quinquefolium.

Page 55, l. 8, read *V. altissima* for *V. maxima*.

Page 58, l. 9, follow read follows.

Page 70, l. 20, read *Sicyos angulatus.*

Page 76, l. 14, read 107 families.

Page 123, l. 24, read **Q. tinctoria** Michx.

Page 123, l. 25, read *Q. Leana* Nutt.

Page 125, l. 8, afford read affords.

Page 149, l. 11, add synonym *Opulaster Missouriensis* Daniels.

Page 149, l. 36, add synonym *Opulaster Michiganensis* Daniels.

Page 151, l. 31, read 474 instead of 475.

Page 200, l. 30-31, read as range, EUROPE, thence to NORTH AMERICA.

Page 223, l. 14, for *V. maxima* Small, read *V. altissima* Nutt.

Page 227, l. 3, add, Common in the prairies about Centralia.

Page 231, l. 23, add, Common in the prairies about Centralia.

Page 237, l. 25, for **millefolium** read **Millefolium.**

Page 265, l. 8, for 47 read 46.

Page 275, l. 4, for 10 read 9.

Page 275, l. 8, for 47 read 46.

THE FLORA OF COLUMBIA AND VICINITY

PART I.

ECOLOGY.

1. GENERAL VIEW OF THE VEGETATION.

The vegetation of the region about Columbia is prevailingly mesophytic. It may be briefly characterized as an oak forest, in which many other trees, however, find place. As a deciduous forest, with the various oaks as dominant, the region has the aspect of an upland, or at least midland, rather than of a lowland, or alluvial, vegetation. The general physiographic features add to this impression, much of the ground is high and broken, the cliffs stand often close to the streams, and no extensive tracts of marsh land occur.

But such a general characterization only brings us to the threshold of our study, and serves only to indicate where the emphasis of any ecological treatment of the flora should be placed. While the oak forest sets the character of the region, and while its influence is profoundly felt everywhere, yet other distinct plant societies exist within it.

Along the streams, willows, birches, cottonwoods, and sycamores form a noticeable fringe. In places alluvial flats are covered with elms, soft maples, basswoods and other bottoms' trees. In all these the oaks occupy a subordinate position, though they are by no means uncommon. There are also treeless marsh meadows, and ragweed flats, where a paludose and subaquatic flora exists, and in the ponds, lakes and streams there is a strictly aquatic vegetation.

In the other direction on the hills and cliffs, while the oaks are still in a measure dominant, the herbs and shrubs are quite different from those of the forest plain. The vegetation frequently assumes xerophytic forms, while on the rocks and ledges rupestrine plants form a very distinct society.

The forest plain is now poorly preserved. Its adaptability to agriculture has caused most of it to be cleared into fields and pastures. Between the cultivated field and the virgin forest—and none of the present forests are strictly virgin—lie all stages of primitiveness. There are pastured forests where the flora of the forest floor is ruined; there are underbrushed tracts, either lapsing back into forest, or becoming half-wild pastures. There are large park-like areas, where numerous trees, especially species of *Juglans* and *Carya,* are left, and where patches of *Symphoricarpos vulgaris* and *Ribes Missouriense* are forming the nuclei of thickets, or where species of *Vernonia, Rudbeckia* and *Teucrium* give the appearance of a prairie. There are also hawthorn glades of considerable extent, especially in the northern portion of the region.

2. FLORISTIC POSITION OF THE FLORA.

Before entering into details in regard to the ecology of the region, it is profitable to consider the floristic position of the flora. Disregarding weeds and other introduced plants the vegetation has a fivefold origin. Columbia lies on the boundary between two geological formations, that of the coal measures to the north, and that of the lower carboniferous limestone to the south. The flora of the coal measures is properly prairie, while that of the limestone is the deciduous forest of the Ozark plateau. The flora is then one of tension between forest and prairie. The prairie vegetation is that of Illinois and Iowa; the forest vegetation is that of the Ozark plateau of Missouri and northern Arkansas, which is much like that of Indiana, Ohio and southern Michigan except that the beech and pine are absent.

Besides these two great floras there are three others, which are subordinate. The bottoms of the Missouri bring hither the alluvial flora of the great rivers of the central plain. In the ponds and marshes occurs the hydrophytic flora of the eastern United States, many species of which cross the continent. On the cliffs and ledges is the limestone rupestrine flora. Other elements may be described as accidental. The floods of the Missouri bring waifs from the great plains, others come along the railroads; while man has brought with him the weeds and cultivated plants from over the sea.

3. THE PHYSIOGRAPHY OF THE REGION.

The geology of the region about Columbia is simple. All to the south, southwest, west and northwest belongs to the lower carboniferous limestone, all to the north and east to the coal measures covered with glacial clay. The rocks dip to the north. Where the clay has been eroded, as in the valleys and along the streams, the limestone ledges appear. Southward near the Missouri the loess formation occurs, where the Missouri appears to have been the southern boundary of the glacial ice sheet. Geologically the area is divided into a northern and a southern realm. While in the vegetation there is no sharp division to correspond, the flora of the northern portion is much poorer in species, hawthorn glades are more frequent, and the vegetation in general is of a more lowland type than that of the southern. The rupestrine flora is inconspicuous, while the riparian is more noticeable. The swamp black oak (*Quercus palustris*) which is almost absent from the region south, becomes common here. It is probable that formerly much of the plains north were once prairie, though now the forest is in control. The prairies now begin between Columbia and Centralia in the north of Boone county.

Hinkson creek drains the region to the northeast, east, south and southwest of Columbia. Roche Perche creek drains the west and northwest. Of minor streams only Grindstone creek and Bear creek need to be mentioned. The one drains the region east and southeast and flows ultimately into Hinkson creek; the other drains the country to the north. Hinkson creek empties into Roche Perche creek just below Turner. Brushwood lake is an abandoned channel of Roche Perche creek. The Missouri, scarcely ten miles away to the southwest, is the controlling factor in the physiography of the region. Its cliffs and bottoms have, however, been only casually studied.

1. **The region north.**—This may be described as a plain slightly broken with ravines, through which small rills ("branches"), or rather winter torrents, flow. These for the greater part of the year are dry, though a few springs keep portions of them moist. Bear creek introduces the chief elements of unevenness in the surface. Its south bank lies close to a wall of rock, which rises to a height of from forty to ninety feet. Ponds of considerable size are frequent, though all, with perhaps one or two exceptions, are of artificial origin. More's lake,

which ecologically must be considered a pond, since no vegetation of a strictly lacustrine type has yet been developed, is also of artificial origin. While gradually gathering to itself an aquatic and amphibious flora, its influence on the vegetation is still slight. The Wabash railroad crosses this region. Farther north—approaching Centralia—the prairies begin, but have not yet been studied.

2. **The Hinkson region east.**—The most striking feature here is also artificial, the waterworks dam. North of the dam the cliffs are for the most part low, though south of the dam, and as far as the Ashland road, they become bold and precipitous. They stand on the east side of the stream at the dam and for a short distance southwest of the dam where, however, they are not especially high. The immediate country is broken by valleys and streamlets into hills, but farther back the plain is gently undulating. The dam has developed extensive muddy, occasionally sandy, flats.

3. **The Grindstone region southeast.**—Grindstone creek makes a feint of joining the Hinkson just east of where the Ashland road crosses the latter stream. A little tongue of high land scarcely a rod in breadth separates the valleys of the two streams. This slight elevation soon rises into a narrow, but high and precipitous, wall of rock, which, making a curve concave to the northeast, finally disappears near where Black's Mill road crosses the Hinkson due south of Columbia, and allows the Grindstone to join the Hinkson at that point. The general trend of the valley of the Grindstone is northeast-southwest, flanked on either side by steep cliffs or high bluffs and is usually narrow. These and the plain, back of the cliffs are better wooded than any other portion of the area.

4. **The Hinkson region south.**—Immediately south

of the Ashland bridge, Hinkson creek turns abruptly westward and for some distance the valley winds back and forth, across a belt about half a mile wide, in a series of very symmetrical meanders, with cliffs on both sides of the valley, the maximum steepness alternating between the right and left sides according to the position in the meander. An especially striking bow of cliffs stands directly south of Columbia. The region between this point and Columbia is broken into hills. South of Hinkson creek there are several deep valleys with streams fed by never failing springs. A barren hill of red clay forms a bold tongue in one of the meanders of Hinkson creek just across Black's Mill ford.

5. **The Hinkson region southwest.**—West of the Providence bridge Hinkson creek again turns south and shortly afterwards bends toward the west, and after several similar bends it empties into Roche Perche creek a mile beyond Turner. The bluffs for the most part stand on the south side of the stream, but they are seldom high. The valley to the north is an alluvial flat, whose outer rim consists of low hills, which connect it with the upland plain. Flat Branch flows from the western part of the city southward into Hinkson creek, and through its valley the Missouri, Kansas & Texas railroad takes its course southwestward to McBaine. The Hinkson valley terminates in that of Roche Perche creek, which continues southwestward till Brushwood lake is met. At this point the valley is just above the level of the Missouri, and after a few horseshoe-like curves, it enters the Missouri valley.

6. **The Roche Perche region west.**—The country to the west consists of the upland plain, scarcely any of which is left in forest. At the covered bridge on the Rocheport road Roche

Perche creek is met. Its banks are mainly low and swampy, its cliffs are either low ledges, or wanting altogether.

4. SOIL.

The usual soil is a fine silt loam, sticky when wet, but soon drying under the influence of the wind. The alluvial flats are composed of a dark soil, often enriched by humus. Along the streams sandy, gravelly, and pebbly flats are not uncommon. In the swales and about old ponds a black muck is found. The soil of the ravines and hill-slopes is composed of limestone detritus and plant-remains. It is rich, but is eroded easily, and where the slopes are not left in forest, there soon remains little but barren rock. A few hills have a peculiar red clay soil, which is manifestly sterile, and supports, wherever it occurs, a xerophytic vegetation. Finally there are the ledges and rocks, bearing ferns and cliff-plants in their crevices, and lichens and other lowly plants on their naked surfaces. It is to be added that the loess occurs to the southward and westward, but I know little of its edaphic possibilities.

5. CLIMATE.

The climate of Missouri is essentially continental. From its location it receives the warm winds from the Gulf of Mexico and the cold blasts from the plains of the northwest. The prevailing winds are southerly, and to this fact is due the high annual mean temperature, 54.6° F. The storm winds are apt, however, to be westerly or northerly.

In the following tables are given the mean, the maximum, and the minimum temperatures, of all the months for the nine years during which investigations have been going on, or material collected. Practically the main portion of the existing vegetation, with the exception of the ligneous element, has come into being during this period. The most aberrant years have been 1901, when the precipitation was but one-half of the normal amount, and 1904, which was the coldest and most backward year under review. The sudden extremes, especially as to temperature in winter, and as to precipitation in summer and autumn, are peculiarly trying to the vegetation. Snows, in general, soon thaw, and plants thus undergo a severe process of alternate freezing and thawing in winter and early spring.

The winds are strong and leave a marked impress upon the vegetation. Thus the trees are round-topped, and the American elm, *Ulmus Americana,* for instance, seldom exhibits that graceful dichotomus forking so characteristic of it in Michigan and New England. The strong winds also favor the distribution and multiplication of such plants, notably the composite, as have seeds fitted for wind dispersal. The winds also dry the surface of the ground quickly after showers, and such plants as the heaths and the orchids which require a soil uniformly cold and soggy, are absent almost entirely.

The appended tables, compiled from the annual summaries of the Missouri section of the climate and crop service of the United States Weather Bureau, will furnish the data requisite for an understanding of the climate of the region.

TABLE I—TEMPERATURES (F°) 1896-1904

	Jan.			Feb.			Mar.			Apr.			May			June		
	Ave.	Max.	Min.	Ave.	Max.	Min.	Ave.	Max.	Min.	Ave.	Max.	Min.	Ave.	Max.	Min.	Ave.	Max.	Min.
1896	33.0	63	2	36.0	76	5	39.8	81	11	63.6	90	21	71.2	90	48	72.8	93	49
1897	28.8	69	-4	35.4	68	4	44.8	72	10	55.4	84	29	62.7	86	38	73.4	96	42
1898	34.2	63	8	35.7	67	2	45.4	73	20	52.2	84	21	64.7	89	39	75.6	92	56
1899	30.1	66	-14	19.8	59	-26	37.2	72	0	54.2	88	18	66.6	89	41	74.5	90	52
1900	34.1	65	0	25.6	61	-4	39.5	76	1	56.2	85	28	66.8	89	37	73.6	93	51
1901	34.7	71	0	26.6	52	4	41.7	74	14	53.1	88	30	63.5	89	34	78.4	104	48
1902	29.2	63	-9	22.1	60	-11	44.4	74	12	53.1	88	26	68.8	92	46	69.8	94	43
1903	30.6	66	-3	28.8	63	-15	46.4	79	15	54.9	83	29	65.0	86	30	66.4	90	42
1904	25.8	63	-14	28.5	67	2	43.8	83	15	47.9	79	27	62.6	87	43	69.8	88	55
Ave	31.1			28.7			42.5			54.6			65.7			72.7		

	July			Aug.			Sept.			Oct.			Nov.			Dec.			Annual	Departure
	Ave.	Max.	Min.	Ave.	Max.	Min.	Ave.	Max.	Min.	Ave.	Max.	Min.	Ave.	Max.	Min.	Ave.	Max.	Min.		
1896	77.4	97	53	77.6	104	49	66.8	97	33	55.0	82	23	43.1	77	6	39.3	72	12	56.3	+1.8
1897	78.8	100	51	73.8	102	48	75.8	102	35	64.1	94	27	43.5	80	8	29.4	66	5	55.5	+0.7
1898	76.3	97	52	77.0	99	52	72.2	98	43	53.5	87	22	40.2	76	6	28.2	66	-12	54.6	—0.2
1899	75.3	95	52	78.8	100	59	67.1	103	28	63.4	95	29	50.2	77	20	28.8	61	-6	53.8	—0.9
1900	76.6	95	55	81.2	100	62	71.0	93	43	62.1	89	33	43.0	73	17	35.0	63	6	55.4	+0.7
1901	85.2	111	58	78.8	102	59	69.4	98	32	60.2	89	31	42.4	75	13	26.9	62	-23	55.1	+0.3
1902	76.6	94	55	73.6	93	52	62.4	85	33	59.5	82	28	50.6	79	25	30.0	57	0	53.3	—1.6
1903	77.3	95	57	73.9	94	49	66.4	92	37	57.0	86	26	39.9	75	11	28.4	62	-4	52.9	—1.6
1904	73.8	94	52	73.0	92	50	69.2	92	38	57.1	85	28	45.5	75	19	32.4	66	-1	52.4	—2.2
Ave	77.4			76.6			68.9			59.1			44.2			30.9			54.3	—0.3

TABLE II—KILLING FROST, 1896-1904

	1896	1897	1898	1899	1900	1901	1902	1903	1904
Last in spring	Apr. 3	Apr. 17	Apr. 7	Apr. 16	Apr. 4	Apr. 18	Apr. 8	May 1	Apr. 17
First in fall	*	Oct. 29	Oct. 23	Sept. 29	Oct. 18	Oct. 4	Oct. 14	Oct. 18	Oct. 23

*Date not given.

TABLE III—PRECIPITATION (INCHES) 1896-1904

	January	February	March	April	May	June	July	August	September	October	November	December	Total	Departure	Total Snowfall	Number Rainy Days	Number Clear Days	Number Partly Cloudy Days	Number Cloudy Days	Prevailing Wind
1896	1.03	1.58	1.13	3.08	5.61	4.33	3.79	1.85	3.61	2.45	1.61	1.11	31.18	—7.20	19.4	112	107	99	160	s. e.
1897	6.87	1.22	5.33	4.83	3.19	6.59	4.28	1.89	0.51	0.69	2.55	2.20	40.15	+0.22	14.6	111	121	107	137	s. e.
1898	3.37	1.84	4.41	2.76	8.39	9.02	4.60	0.47	5.43	2.61	2.29	1.52	46.71	+7.89	13.8	131	125	102	138	s.
1899	0.71	2.19	2.71	2.61	4.89	4.95	3.75	3.21	3.55	2.73	1.22	2.29	34.81	—3.69	35.0	121	116	126	123	s. e
1900	1.46	3.76	1.51	3.02	1.75	5.02	2.94	4.05	3.14	7.73	1.24	0.38	36.00	—2.30	26.2	118	124	112	129	s.
1901	2.32	1.79	3.25	2.38	0.35	1.23	2.74	1.67	1.37	1.16	0.80	2.29	21.35	—15.75	17.3	82	162	86	117	n.w.
1902	1.04	0.90	3.58	3.42	4.33	6.56	7.66	6.64	2.60	2.52	2.89	2.20	44.34	+7.56	16.9	117	117	109	139	s.
1903	1.90	2.66	3.46	4.66	5.26	2.16	2.36	5.09	5.24	2.41	0.71	0.87	36.78	0.00	23.7	131	117	100	148	s. e.
1904	2.09	1.01	3.69	7.35	5.39	5.56	2.42	6.17	5.79	1.36	0.28	1.96	43.07	+6.37	24.7	110	150	113	103	s.
Ave. '96-'04	2.31	1.88	3.23	3.79	4.35	5.04	3.83	3.44	3.47	2.62	1.51	1.63	37.15	+0.45	21.2	115	126	106	132	

6. CONTROLLING FACTORS OF PLANT-ASSOCIATION.

Since meteorological factors are common to the whole region, the primary divisions of the flora must rest on other grounds. If water be regarded as the dominant factor in plant life, since the rainfall is uniform, its effect is dependent solely upon the drainage. Hills and steep cliffs retain the rainfall least, hence are clothed with a vegetation more or less xerophytic, while the valleys and swales receive the surplus waters and retain them as streams and ponds, hence support a hydrophytic flora. But drainage conditions do not enable us to come to a full understanding of the flora. The rupestrine vegetation must be treated as a unit, and here the controlling factor is the presence of limestone rock. In the mesophytic forest plain light and shade appear largely decisive. Moreover the region is one of tension between forest and prairie, the forest being, however, normally dominant.

There is usually a correspondence between definite plant-associations and edaphic conditions. Thus the palustrous vegetation needs not only an abundance of water, it must have a soil rich in organic materials, if it is to thrive. There are to be seen vast marshes, the humus of whose soil has been burned by forest fires, which have supported nothing for years but a thin layer of *Marchantia polymorpha* and a few dwarf willows and now and then a clump of *Polygonum* or *Bidens.* About artificial ponds, which here are in all stages of development both as to soil and vegetation, only a few semimarsh plants, the polygonums, *Bidens, Juncus,* occur at first. As the soil becomes richer. *Heleocharis* is frequent, then *Alismaceae, Typha* and *Acorus* come in. If flats are sandy and pebbly, the vegetation becomes semixerophytic in spite of an abundant water supply. A hillside covered with a rich soil has an altogether different flora from that of the slope which has been denuded of its soil.

In that portion of a region that is of economic use, man is the dominant factor in plant life, and ruderal and cultural types take the place of the old indigenous societies.

7. THE PLANT-SOCIETY.

A plant-society is a community of species living together under like conditions, the members of which may be mutually helpful—the larger forming shade for the smaller—or there may be intense competition for control or even for existence. A stable society is one in which the various species have found their appropriate habitats and the competition is restricted to narrow limits. An unstable society is one in which the various members, either through some important change in the environment, or on account of the coming in of new floral elements, are undergoing a process of breaking apart or of coming together. The felling and underbrushing of a forest break up a sylvan association. In the new adjustment some plants tend to become extinct, and plants, fitted to open conditions come in. In some cases a plant-community consists wholly of one species or of several closely related species. Thus whole flats are occupied by the giant ragweed (*Ambrosia trifida*), and the June-grass (*Poa pratensis*) covers pastures many acres in extent. The smartweed communities include usually six or more species of *Polygonum*.

If certain species are gregarious, others occur singly and at distant intervals. Thus orchids are seldom found in any abundance. As plants become rare, they verge upon extinction, for in general an abundance of individuals of a species in a region gives that species a momentum, a power of survival, that the singly growing species do not have. Fertilization is more surely effected, and reproduction more certainly insured.

In every complex plant-society some members are dependent upon other members. In the case of parasites this dependence is complete, often to the great injury of the host. Vines are dependent upon other plants for support, and trees, thus burdened, become dwarfed, misshapen, or even in course of time are strangled to death. Perhaps in a forest this dependence of some species upon others is best seen. The trees are in control, then follow a succession of shrubs, undershrubs and herbs. Why one species tolerates some species and not others is not clearly known. Partly it may be explained by assuming different edaphic needs. One plant may take chiefly one element from the soil, another another. Certain plants appear intolerant of all others. Thus the poke (*Phytolacca decandra*) usually stands with a vacant space around it.

The presence of a plant in a certain society is occasionally accidental. If a plant is thus out of place, it is often characterized by a spindling development and by failure to come to flower and fruit. On the other hand occasional individuals are met out of their normal habitat, which in robustness excel those of their congeners growing in normal situations. Thus oaks are very scarce in the beech and maple timberlands, but when found are of gigantic size. The timberland soil appears to be too wet to keep over winter the acorns of most species of oak without rotting. Maples, when transplanted to oak-openings, do well, but their seedlings, because of the dry soil, rarely amount to anything. Thus it appears that a suitable environment is affected by seeds germinating mainly, or only, under certain favorable conditions. The secret of distribution of many species seems to lie here, and one of the most fertile fields of ecological research would be that of testing the germination of seeds in properly equipped laboratories.

Certain species seem normally to occur in places where they never reach their perfection of symmetry and size. Thus the red cedar (*Juniperus Virginiana*) is frequent on the extreme edges of cliffs, where it is dwarfed, misshapen and often half-dead, while the finest specimens of the species here, occur along a small stream north. Doubtless upon the cliffs the red cedar grows in the region of least tension, its competitors there being few and principally herbs.

Again the same species occasionally assumes various vegetation forms according to circumstances. Thus the poison ivy (*Rhus Toxicodendron*) is a trailer or creeper on the ground, when no support is found; and when the herbage begins to grow rank, it often sends up branches which grow erect and show no tendency to creep or climb. On cliffs it is a clinger, mantling the ledges in the manner of the ivy. On trees it becomes a true vine and ascends to their summits with great ease. These differences appear so marked that some authors have based specific distinctions upon them. The Virginia creeper (*Quinaria quinquefolia*) behaves similarly, except that it does not send up erect shoots when trailing on the ground. The bittersweet (*Celastrus scandens*), on the other hand, seeks always a support, and if none offers, it twines around itself in large rope-like strands.

8. PLANT SOCIETIES OF THE REGION.

The indigenous vegetation of the region falls into three primary divisions or provinces:[1] I. The hydrophytic, consisting

[1]The divisions are as follows:

Primary division, or province, I. Hydrophytes.
Zone, or secondary division, A. Aquatiles.
Sub-zone, or plant formation, 1. Natantes.
Association, or plant community, a. Nymphæoides.
Sub-association, i. Carpininæ.
Vegetation-forms, *a*. Arbores.
Time successions, *a*. Vernales.

of water-plants; II. The mesophytic, consisting of plants growing in soil neither excessively moist nor dry; III. The xerophytic, consisting of dry-soil plants. To these two other classes are to be added; IV. The parasitic and saprophytic higher plants; and V. The anthropophytic plants, consisting of those cultivated and the weeds that accompany human activity.

I. HYDROPHYTES.

The hydrophytic flora is not strictly a unit, but includes several distinct societies. These in the main are composed of plants that need water in abundance, but a natural classification based on the factor of water alone will not hold. It is well known that shore-plants are xerophytic rather than hydrophytic, yet treating the lowland flora as a whole, the littoral vegetation, at all times very near the limose and the amphibious, cannot well be separated. And so the riparian vegetation, while hydrophytic as to its trees and shrubs, often includes a considerable number of mesophytic herbs. A willow on a clay bank has roots long enough to reach the water of the stream, while the herbs under its shade may be of mesophytic types. The riparian flora, like the littoral, while extremely natural in itself, cannot in exactness be reckoned as a wholly hydrophytic flora, though it forms a prominent part of the lowland vegetation. The hydrophytic province embraces, then, all waters, swamps, swales and marshes, and the shores and low banks of streams. The wooded bottom lands, however, are more naturally treated as the lowland portion of the great mesophytic forest. The fontinal flora of moist limestone banks and of dripping rocks is similarly to be treated as a part of the rupestrine vegetation.

The hydrophytic flora may most conveniently be divided into four zones: A. The aquatic; B. The marginal; C. The fluvial; D. The palustrous. These zones tend to blend into one another, but they stand for natural plant groupings.

A. Aquatiles. Plants of the aquatic zone.

Aquatic plants inhabit ponds, lakes, and flowing waters, but inasmuch as the lakes, being artificial, have produced no lacustrine aquatic types, and as the streams have no aquatic higher plants, this portion of the flora is restricted to plants dwelling in stagnant waters. They belong to three chief types according as the plants swim freely on the surface, or being fixed by roots float upon the water, or are wholly submerged except at anthesis.

1. **Aquatiles natantes.** There is but one association of free swimming plants, **Natantes lemnoides,** the duckweed association of minute thalloid plants, either with or without rootlets, and seldom flowering and fruiting in this latitude. They cover thickly the surfaces of all stagnant ponds and pools, and the backwaters of streams. There are but four species:

Spirodela polyrrhiza	L. minor
Lemna Valdiviana	Wolffia papulifera

2. **Aquatiles fluitantes.** There are two well marked associations of fixed floating aquatics:

a. **Fluitantes nymphaeoides,** the water-lily association. This attains its best development in lakes, the large floating leaves being admirably adapted to withstand the shock of waves. The water-lily association occurs very rarely. *Nymphaea odorata* grew till a few years ago in a pond on the University Farm. *Nuphar advena* was listed from Boone county by Tracy in 1885. *Nelumbo lutea* occurs in a pond near Rocheport. This plant, interesting because of its intricate root-system and its putting forth both erect and floating leaves, is in some respects intermediate between aquatic and amphibious plants.

b. **Fluitantes potamogetonoides.** The pondweed association of ribbon-leaved aquatics finds its best development in slow-flowing streams, the leaves floating in the direction of the current. In ponds and the quiet waters of lakes this association is found mingled with the next. There are but two species, the first of which is restricted to a few old ponds:

Potamogeton fluitans	P. hybridus

3. **Aquatiles demersae.** There is but one association of submersed aquatics; **Demersae ceratophylloides,** the hornwort association. There are five species, all of which are local, except the first:

Potamogeton Hillii	Elodea minor
P. pusillus	Ceratophyllum demersum
Naias flexilis (More's lake)	

B. MARGINALES. PLANTS OF THE MARGINAL ZONE.

Marginal plants occupy the shores and shallow waters of ponds, lakes and streams, or are central in the wettest places of swales and swamps. While in the main the marginal zone is well defined, it merges into all the other hydrophytic zones. In low water the true aquatics are sometimes forced to assume a terrestrial existence. Even *Lemnaceae,* at the drying up of ponds and puddles, root feebly in the soft earth. The marginal zone is divisible into three subzones: 1. The amphibious; 2. The limose; 3. The littoral.

1. **Marginales amphibiae. Plants of the amphibious subzone.**

The amphibious vegetation is fitted both to an aquatic and a terrestrial life. This class is therefore intermediate between the true aquatics and all other hydrophytic plants. The close relationship to the former is shown by the development of true floating leaves, as in *Alisma,* or by heterophylly as in *Cicuta,* where the immersed foliage becomes much dissected. Some characteristic species, like *Typha latifolia,* by occurring in the wettest portions of swamps and swales, are integral parts of the palustrous flora. There are six main associations:

a. **Amphibiae alismoides.** The water-plantain association consists of broad-leaved amphibious plants with thick spongy petioles, some leaves floating, others erect, while the immersed leaves are reduced to bladeless phyllodes. There are four characteristic species:

Alisma Plantago	Sagittaria variabilis
Lophotocarpus calycinus	S. platyphylla

(Swale near the covered bridge on the Rocheport road.)

These often form dense masses at the margins of ponds, and to them old ponds, as they fill up with the debris of aquatic vegetation, fall naturally a prey.

b. **Amphibiae typhoides.** The cat-tail association of tall plants with grass-like or equitant leaves stands in dense ranks at the margins of ponds and in the wettest parts of swamps. It is especially near to the palustrous vegetation. The following are characteristic species:

Typha latifolia	Iris foliosa
Acorus Calamus	I. Virginica

c. **Amphibiae scirpoides.** The bulrush association of plants with almost, or altogether, naked culms, reaches its best development in lakes, where the great bulrush, *Scirpus lacustris,* is wont to stand in water of much depth. More's lake is developing such a flora, and thus exhibits a tendency toward a proper lacustrine vegetation. In ponds this association passes, through the various species of *Heleocharis,* into the limose spikerush association. These are typical species:

Scirpus Americanus	Heleocharis palustris
S. lacustris	H. ovata
S. fluviatilis (rare)	Juncus effusus (local)

d. **Amphibiae glycerioides.** The reed association of amphibious grasses and grass-like sedges is but feebly developed, the two most typical reed grasses, *Zizania aquatica* and *Phragmites communis,* not being known in the region. Besides certain carices, which are better regarded as belonging to the paludose subzone, the following are the chief species:

Leersia oryzoides	Dulichium spathaceum (local)
Spartina cynosuroides (rare)	Eriophorum lineatum
Glyceria nervata	Scirpus atrovirens
G. fluitans (rare)	

e. **Amphibiae cicutoides.** The cowbane association of tall, rather bushy plants, which are seldom gregarious, consists mainly of *Umbelliferae* and *Polygonaceae.* A partial list follows:

Rumex crispus	Cicuta maculata
R. verticillatus	Sium cicutaefolium

f. **Amphibiae jussieuoides.** The primrose-willow association consists of recumbent, partly floating amphibious plants, which, when terrestrial, are creeping or decumbent. There are but three plants that behave thus. *Polygonum emersum* is confined to the wettest parts of swamps. *Jussieua diffusa* is local in ponds, and *Bacopa rotundifolia* occurs with *Nelumbo lutea* in a pond near Rocheport.

2. **Marginales limosae. Plants of the limose subzone.** The limose subzone comprises muddy shores and low alluvial flats which are subject to more or less frequent inundation. The plants are partly of amphibious and partly of littoral types, while at the outer rim of their subzone they often coalesce with

the palustrous or riparian floras. The plant-growth is usually slight; it looks weedy and is often filthy. Owing to high water this vegetation has no, or but slight, vernal development. It is best seen in late summer, while in autumn protracted drouths allow a weedy uliginose vegetation, consisting of species of *Polygonum, Coreopsis* and *Bidens,* to hide it mostly from view. Obviously a limose plant is subjected to great and violent extremes. Hence the vegetation mainly either grows in dense wiry tufts, or consists of succulent creeping plants. In spite of the plants being under water for a part of the year, they exhibit certain xerophytic adaptations. The mud of the shore bakes into hard lumps in times of drouth, and the vegetation, till autumn, is seldom shaded much from the sun. Omitting the autumnal uliginose plants, there are six limose associations:

a. **Limosae heleocharidoides.** The spike-rush association consists of low densely tufted leafless plants with wiry culms and of a peculiar dark green color. They stand often in shallow water, the larger species being truly amphibious plants. They are as follows:

Heleocharis acuminata
H. tenuis
H. intermedia
H. glaucescens
H. palustris
H. Engelmanni
H. ovata

b. **Limosae cyperoides.** The galingale association of limose sedges and grasses consists of somewhat larger plants than those of the preceding. In late summer the larger galingales (*Cyperus* spp.) are especially prominent. Excluding these as being, rather, uliginose species, the following are characteristic:

Alopecurus geniculatus	C. diandrus
fulvus	C. acuminatus
Eragrostis hypnoides	Carex Frankii
Cyperus flavescens	

c. **Limosae juncoides.** The rush association of sparingly leaved grass-like plants, seldom growing in dense mats, but rather in stools at intervals of several inches, occurs not only at the water-line, but also in flats subject to inundation. They stand in a cold sour soil, which often produces little else, except the autumnal smartweeds. The larger rushes are more properly classed with the palustrous vegetation. Excluding these, the limose species are three:

Juncus acuminatus	J. nodosus
J. scirpoides	

d. **Limosae heterantheroides.** The mud-plantain association of broad-leaved shore plants consists chiefly of *Heteranthera reniformis* together with *Alisma Plantago* and the Sagittarias. *Plantago cordata* also occurs locally.

e. **Limosae ludwigioides.** The water-purslane association of creeping, often succulent plants of muddy shores is found not only at the shore-line, but also in the beds of dried up puddles and pools, or in similar streambeds with mucky bottoms. Of the following only the first is vernal:

Ranunculus septentrionalis	Rotala ramosior
Callitriche Austini (waterworks reservoir)	Ammannia coccinea
	Ludwigia palustris

f. **Limosae gratioloides.** The false pimpernel association of low diffuse herbs, which occupy the spaces left vacant by the rushes and spike-rushes, forms a slight, but well-marked vegetation. These are characteristic:

Ranunculus abortivus	N. palustre
Nasturtium sinuatum (Missouri river.)	N. sessiliflorum

Cardamine Pennsylvanica
Potentilla paradoxa
(Missouri river)
Centunculus minimus
(rare)
Gratiola Virginiana
Conobea multifida
Ilysanthes gratioloides
Gerardia Besseyana
Valerianella radiata
Eclipta alba

3. **Marginales littorales. Plants of the littoral sub-zone.** The littoral vegetation proper is but scantily developed in the region. There are, however, two kinds of soil along streams, less often about ponds, which support a sparse littoral xerophytic growth, but consisting in the main of dwarfed and depauperate limose species.

a. **Littorales xanthioides.** The first kind of soil consists of the shingle and pebbles of old creekbeds, or of creeks dry the greater part of the year. Most of this soil is absolutely barren of vegetation. A few plants, mainly species of *Polygonum, Bidens, Heleocharis,* and *Xanthium,* come up among the stones.

b. **Littorales molluginoides.** The other soil consists of the shore-sands. These occur at the head of the Hinkson reservoir, and in certain flats of Grindstone creek and other streams. Here there is a thin covering of small creeping plants, which may be called the carpet-weed association. *Mollugo verticillata, Euphorbia maculata* and *E. nutans* are the chief species.

c. **Littorales salicoides.** The thicker sandbars are covered with willows, mainly *Salix longifolia* and *S. cordata* which assume a peculiar recumbent form.

d. **Littorales equisetoides.** The only other well-marked plant-group is that of the littoral horsetail association, consisting of *Equisetum arvense* and *E. hiemale,* which often prick up through the sand in almost pure communities.

C. Fluviales. Plants of the fluvial zone.

The fluvial zone consists of the associations peculiar to streams. Excluding the fontinal and the alluvial, there are two fluvial subzones: 1. The rival, or stream-bed; 2. The riparian.

1. **Fluviales rivales. Plants of the rival subzone.** We have said that all the streams are devoid of phanerogamic aquatics. This appears partly due to the rapidity of the streams and to the turbidity of the water, which holds inorganic, rather than organic matter in suspension, but is perhaps chiefly due both to the rocky beds which are in continual process of scouring, and to the fact that all the creeks go dry in large part in times of drouth. There is but one stream-bed association.

a. **Rivales justicioides.** The water-willow association consists quite wholly of the water-willow, *Justicia Americana,* or with some admixture of *Scirpus Americana, Heleocharis ovata, H. glaucescens, H. palustris,* and *Equisetum hiemale* next the shore. The stream is often completely choked up with these plants. The favorite haunt is where the stream pours over narrow ledges, but patches are common in all shallow places. With the *Justicia,* but next the bank, is usually a line of the shrubby *Amorpha fruticosa.* The water-cress (*Nasturtium officinale*) similarly chokes up springs at Rocheport.

2. **Fluviales ripariae. Plants of the riparian subzone.** The riparian flora accompanies all the streams, but is best developed along those with low banks. Where the banks are rocky and cliff-like, they support mainly a rupestrine flora. The riparian vegetation is marked by a light-green tint which flashes silvery in the wind, the foliage commonly being whitened underneath. The riparian flora is partly arboreal, partly arborescent and fruticose, and partly herbaceous. In general the herbs are much less characteristic than the trees and shrubs.

If the banks are low and moist, the herbs belong to the limose and palustrous associations; if they are high and dry, the herbs belong to mesophytic types. There are five riparian associations, of which the first is primary:

a. **Ripariae salicoides.** The willow association of trees and shrubs is the most characteristic riparian plant-group. Only the shrubby willows grow in close formation, the others being often separated by wide intervals. Here occur the largest trees, the sycamore, *Platanus occidentalis,* and the cottonwood, *Populus monilifera,* often attaining a diameter of four feet and more, but arborescent and fruticose species are more common. The following species are characteristic:

Juglans cinerea	Quercus platanoides
Carya amara	Ulmus fulva
Populus monilifera	U. racemosa (local)
Salix nigra	U. Americana
S. longipes	Celtis occidentalis
S. amygdaloides	Morus rubra
S. longifolia	Platanus occidentalis
S. cordata	Acer dasycarpum
S. Missouriensis	A. Negundo
Carpinus Carolinianus	A. nigrum
Ostrya Virginica	Aesculus glabra
Betula nigra	Fraxinus lanceolata
Alnus serrulata (rare)	

b. **Ripariae vitoides.** The grape association of trailing and climbing plants is best developed on high moist banks, though trees burdened with them are frequent in all situations. The best examples of bank-lianas occur along Hinkson creek southwest. The principal plants are:

Clematis Virginiana (rare)	Celastrus scandens
Menispermum Canadense	Vitis cinerea
Rhus Toxicodendron	V. cordifolia

V. riparia	Campsis radicans
Quinaria quinquefolia	Lonicera glauca (rare)
Ampelopsis cordata	

c. **Ripariae equisetoides.** The riparian horsetail community commonly occurs along all the streams, especially on low clay or sandy banks. Along the Missouri river large tracts are covered with the leafless and branchless stems of *Equisetum hiemale,* or less frequently, *E. variegatum. E. arvense* is frequent also along moist banks.

d. **Ripariae elymoides.** The lyme grass, or wild rye, association forms a noticeable fringe of tall coarse grasses along the banks of streams both in and out of shade. Besides the more or less amphibious grasses such as *Eatonia Pennsylvanica* and *Glyceria nervata,* the following are characteristic:

Bromus ciliatus	E. Canadensis
B. purgans	E. glaucifolius
Elymus striatus	Asprella Hystrix
E. Virginicus	

On low banks certain sedges are also common:

Cyperus erythrorhizos	C. Shortiana
Eriophorum lineatum	C. Frankii
Scirpus atrovirens	C. vulpinoidea
Carex conjuncta	

It should be added that all but the last of these occur rather with *Glyceria nervata* than with the lyme grasses and might well form a subassociation of their own, **Ripariae elymoides caricinae.**

e. **Ripariae silphioides.** The cup-plant association of tall, mostly composite plants is found mainly on open stream banks. Besides the typical *Silphium perfoliatum,* a large number of bone-sets (*Eupatorium* spp.), ironweeds (*Vernonia* spp.), golden-rods (*Solidago* spp.), asters (*Aster* spp.), cone-flowers (*Rudbeckia* spp.), and sunflowers (*Helianthus* spp.) are present, but these are seldom purely riparian. More truly so are *Elephantopus Carolinianus* and *Actinomeris squarrosa.* In open places the ragweeds (*Ambrosia* spp.), and tick-seeds and sticktights (*Coreopsis* and *Bidens* spp.) are very abundant. Along the Missouri river *Senecio lobatus* is common.

D. PALUSTRES. PLANTS OF THE PALUSTROUS ZONE.

Of the three sub-floras that belong to this zone there are members of but two, the paludose and the uliginose, the third, that of the peat and sphagnous bogs, being wholly absent. The distinction between the paludose or wet swamp, and the uliginose or dry marsh, floras is often not clear. The palustrous vegetation is rich in species, which are often of wide range. *Gramineae, Cyperaceae, Juncaceae, Polygonaceae,* and *Compositae* are especially common. The plants possess a soil exceedingly rich in humus, but often cold and soggy from imperfect drainage. The vegetation is rank and coarse, the annual herbs often exceeding a man's height. With the exception of the carices the blooming is chiefly aestival and autumnal.

1. **Palustres paludosae. Plants of the paludose subzone.** The paludose flora occupies wet and covered swamps. The best examples lie along Roche Perche creek and at Brushwood lake, but one, more accessible, occurs across Hinkson creek south. This has of late been drained and denuded of trees, and is hence gradually coalescing with the uliginose flats around it. It occupies several successive old beds of Hinkson creek, the stream being now far to the north. Since the intervening ground is higher, the surface water tends to collect and thus form a swamp, which until it was drained, had considerable water. The flora is not uniform, the southern portion of the

swamp having a more purely paludose vegetation than the northern, where the uliginose types prevail.

a. **Paludosae caricoides.** At the nucleus of the swamp there is a scant society of amphibious plants, such as *Typha latifolia, Lophotocarpus calycinus, Alisma plantago, Heleocharis palustris* and *Iris foliosa.* Scattered among these are tussocks of coarse sedges. These together with certain non-tussock forming sedges, constitute the chief sward of the swamp. The most frequent are given in the following list:

Carex conjuncta	C. squarrosa
C. tribuloides	C. typhinoides
C. tenera	C. aristata
C. crinita	C. Shortiana
C. lupulina	C. stipata.
C. Frankii	

b. **Paludosae cornoides.** Around this nucleus are the remnants of a ligneous society, consisting of *Cornus sericea, Cephalanthus occidentalis, Fraxinus nigra, Acer dasycarpum,* and *Quercus palustris.*

c. **Paludosae lobelioides.** In the open spaces among these, and where there is some freedom from the coarse sedges and grasses, grows the lobelia association, consisting mainly of *Lobelia cardinalis* and *L. syphilitica, Mimulus alatus,* and species of *Lycopus.*

d. **Paludosae leersioides.** The low levels of the southern portion of the swamp are occupied by the rice cut-grass association, which forms an almost impenetrable tangle four to six feet high in autumn. The plants have rough stems and cutting leaves, or are twining or recumbent. The following are the chief species:

Leersia oryzoides	Apios tuberosus
Polygonum emersum	Galium tinctorium
P. sagittatum	

The northern portion has a more varied flora, the substratum of which consists often of *Onoclea sensibilis*. Certain plants, such as *Agrimonia parviflora*, grow in dense patches, others are distributed pretty evenly throughout, still others stand in little clumps, or are solitary. As a whole only one association is discernible, the swamp coneflower association, **Paludosae rudbeckioides.** There is a carpet of rushes, sedges, and coarse grasses, through which the tall herbs make their way, and form a complete superstratum in late summer and autumn. These are characteristic plants:

Onoclea sensibilis	Lythrum alatum
Leersia Virginica	Epilobium adenocaulon
Glyceria nervata	Gentiana Andrewsii (rare)
Eriophorum lineatum	Asclepias incarnata
Scirpus atrovirens	Vernonia Drummondii
Carex conjuncta	Eupatorium purpureum
C. vulpinoidea	E. maculatum
C. Sartwellii	E. perfoliatum
Rumex crispus	Silphium perfoliatum
Penthorum sedoides	Rudbeckia subtomentosa
Agrimonia parviflora	Helenium autumnale

Intermediate between the paludose and the uliginose vegetations is that of the swales. Often a single species occupies a whole swale, but usually there is a brief series of plants with *Typha latifolia* in the nucleus, then a few broad-leaved amphibiae, such as *Alisma* or *Sagittaria.* A swale near More's lake consists quite wholly of *Typha* and *Equisetum pratense,* the only station for this northern plant. An interesting swale along the Wabash railroad has *Juncus effusus* in the nucleus with the following associates:

J. marginatus
J. aristulatus
J. tenuis
J. tenuis anthelatus
J. dichotomus
J. acuminatus

But the commoner types are either the grassy swale with *Glyceria nervata* in the nucleus and *Agrostis alba* or *A. vulgaris* as the chief associate; or the sedgy swale with *Carex vulpinoides* and *C. conjuncta* as chief species, and with other marsh sedges and galingales (*Cyperus* spp.) as associates. The black elderberry, *Sambucus Canadensis,* is common in the swales north.

2. **Palustres uliginosae. Plants of the uliginose subzone.** Six open marsh societies are discernible: a. The marsh meadow society, with various grasses as dominant plants. b. The sedge-bog society with the coarse sedges dominant. c. The rush-marsh society, the true rushes (*junci*) being dominant. d. The smartweed community. e. The tickseed society with the various species of *Coreopsis* and *Bidens* in control. f. The ragweed community. The first three associations constitute the uliginose flora proper, the other three are lowland groups of alluvial and low prairie origin. Often it is impossible to tell to which of the six types a marshy flat belongs, grasses, sedges, rushes, smartweeds and tickseeds forming a complex group. This is especially true of recently drained land, no one type having yet become established.

a. **Uliginosae agrostidoides.** The red-top association is found in all grassy marsh meadows. Those about the waterworks reservoir are the best examples. The chief grasses are:

Panicum clandestinum
Leersia Virginica
L. oryzoides (in wet nuclei)
Muhlenbergia Mexicana
M. racemosa
Agrostis alba

A. vulgaris	Glyceria nervata
Eatonia Pennsylvanica	Festuca elatior

With these grow many marsh herbs, species of *Lycopus, Mentha, Mimulus, Lobelia,* and *Aster.* Certain sedges, notably *Carex tribuloides, C. cristatella, C. scoparia,* and *C. straminea,* and the true rushes (*Juncus* spp.) are frequent.

b. **Uliginosae caricoides.** The sedge association occupies usually the wettest portion of a marsh, and its vegetation is marked by a deeper green than that of the grasses.

It has two sub-associations according as the species of *Carex* or of *Cyperus* are dominant:

i. **Uliginosae caricoides caricinae.**

Eriophorum lineatum	C. tribuloides
Scirpus atrovirens	C. cristatella
Heleocharis tenuis	C. scoparia
H. intermedia	C. straminea
Carex Sartwellii	C. tenera
C. vulpinoidea	C. Davisii
C. interior	C. Frankii

ii. **Uliginosae caricoides cyperinae.**

Cyperus inflexus	C. erythrorhizos
C. acuminatus	C. speciosus parvus
C. Hallii (rare)	C. strigosus
C. esculentus	

c. **Uliginosae juncoides.** The true rushes occupy the zone of cold barren soil. Here the vegetation is much thinner than elsewhere. Ordinarily the spike-rushes (*Heleocharis* spp.) are frequent also. The lists of species of *Juncus* and *Heleocharis* already given[1] will do also for this association, which is found everywhere in springy soil.

d. **Uliginosae polygonioides.** The smartweed com-

[1] Supra, pp. 21, 22, 30.

munity is most frequent in flats which are overflowed in spring and early summer. The grasses and sedges are thus kept out, against which these herbs cannot compete. The smartweeds seize also low cultivated and waste grounds, such as cornfields which have suffered from floods. This community infests muddy shores, sandy stream-flats, and even waste places about barnyards and houses. The following are the prevailing species:

Polygonum hydropiperoides	P. Pennsylvanicum
P. incarnatum	P. lapathifolium
P. acre	P. nodosum
P. Hydropiper	P. Persicaria

e. **Uliginosae coreopsidoides.** The tickseed association covers acre upon acre of lowlands, transforming these into seas of gold in autumn. This is the flora proper to low prairie flats. The aestival vegetation consists mainly of various *Labiatae, Verbenaceae and Scrophulariaceae* (*Stachys, Lycopus, Mentha, Blephilia, Verbena, Lippia, Mimulus, Scrophularia, Veronica,* etc.). The autumnal vegetation consists prevailingly of *Compositae* (*Eupatorium, Silphium, Rudbeckia, Helianthus*). Among non-composites *Gerardia Besseyana* and *Lobelia syphilitica* are conspicuous. Perhaps no other association consists so wholly of *Gamopetalae* as this. The typical members of this group with forked achenes or hooked burs are:

Xanthium Pennsylvanicum	Bidens frondosa
X. speciosum	B. connata
X. commune	B. comosa
X. glabratum	B. cernua
Coreopsis involucrata	B. bipinnata
C. discoidea	

f. **Uliginosae ambrosioides.** The ragweed community, consisting wholly of *Ambrosia trifida,* with *A. artemisiaefolia* frequent at the edges, the various plants being bound together often by *Polygonum scandens,* occupies whole rich flats. No other herbaceous vegetation can compare with this in height, the giant ragweed, *Ambrosia trifida,* often growing to a height of from eight to fifteen feet. There is a brief vernal vegetation upon these flats, which consists of *Ranunculus abortivus, R. septentrionalis, Cerastium nutans, Veronica serpyllifolia* and *V. peregrina.* Certain violets are frequent also, as *Viola papilionacea, V. scabriuscula,* and locally, *V. striata.*

II. MESOPHYTES.

The Mesophytic vegetation coincides with the midlands, the fertile uplands, and such lowlands as have not a hydrophytic flora. It includes six plant-societies: A. The alluvial. B. The sylvan. C. The thicket, or brush flora. D. The flora of the hawthorn glades. E. The flora of bramble and brier thickets. F. The pseudo-prairie flora of wild fields.

A. Alluviales. Plants of the alluvial zone.

In the immediate vicinity of Columbia there are but scant traces of the alluvial forest, and there has been no opportunity to study the wooded bottoms of the Missouri. The alluvial vegetation is intermediate in character between the hydrophytic and mesophytic, having, however, its nearest affinities to the riparian. The soil is very rich, and the vegetation in open places is very rank. The alluvial forest casts a dense shade, and its floor is but scantily covered with shade-loving plants. The herbs are prevailingly urticaceous. When light is let into the forest, a uliginose, or low flat, vegetation springs up, but even so the nettles hold their own well. The alluvial forest has two types of trees. In the first type, which represents the alluvial forest of the central United States, trees nearer akin to those of the maple timberlands than to the trees of the oak openings prevail, in the other the lowland oaks are dominant.

a. **Alluviales tilioides.** The basswood association of bottoms' trees occurs in the wooded flats of the streams. The following are the chief trees:

Juglans cinerea	Platanus occidentalis
Carya sulcata	Acer dasycarpum
C. amara	A. nigrum
Ostrya Virginica	A. Negundo
Ulmus fulva	Aesculus glabra
U. racemosa (rare)	A. lutea
U. Americana	Tilia Americana
Celtis occidentalis	Fraxinus Americana
Morus rubra	F. lanceolata
Asimina triloba	F. nigra

The following lianas are common in the trees:

Smilax hispida	Quinaria quinquefolia.
S. rotundifolia	Ampelopsis cordata
Menispermum Canadense	Rhus Toxicodendron
Vitis riparia	Campsis radicans
V. cordifolia	

Sambucus Canadensis is common about the borders of alluvial woods.

b. **Alluviales quercoides.** The swamp oak association, consisting of *Quercus palustris* and *Q. platanoides* as primary and *Q. macrocarpa* as secondary timber trees, occurs mainly in the low plains north, but there is a creek bottom east covered quite wholly with *Q. platanoides.* The floor of these forests has the usual lowland vegetation.

c. **Alluviales violoides.** The violet association of vernal alluvial herbs consists chiefly of *Violaceae, Ranunculaceae, Papaveraceae, Liliaceae,* and *Umbelliferae.* The plants are low for the most part and consist of species inhabiting rich hillsides and deep ravines. The following is a partial list:

Arisaema atrorubens
A. Dracontium
Erythronium albidum
Claytonia Virginica
Cerastium brachypodum
C. nutans
Isopyrum biternatum
Ranunculus abortivus
R. septentrionalis
Thalictrum purpurascens
Leontice thalictroides
Dicentra Canadensis (rare)
D. Cucullaria
Corydalis montana
Dentaria laciniata
Geum vernum
Viola papilionacea
V. cucullata
V. striata
V. scabriuscula
Chaerophyllum procumbens
Osmorrhiza brevistylis
O. longistylis
Erigenia bulbosa
Phlox divaricata
Polemonium reptans
Mertensia Virginica
Collinsia verna

d. **Alluviales hydrophylloides.** The waterleaf association of early summer alluvial herbs occurs in dense masses. The chief plants are:

Commelina nudiflora
Tradescantia reflexa
T. pilosa
Hybanthus concolor
Hydrophyllum appendiculatum
H. Virginicum
Ellisia Nyctelea
Phacelia Purshii
Scutellaria versicolor
Blephilia hirsuta
Galium Aparine
Erigeron Philadelphicus

e. **Alluviales impatientoides.** The touch-me-not association of summer and autumn herbs is found chiefly about the streams and the borders of alluvial woods. These are the characteristic species:

Asplenium pycnocarpon	I. biflora
Impatiens aurea	Cacalia reniformis

f. **Alluviales urticoides.** The nettle association of alluvial herbs, composed of shade-loving, often stinging plants, may be considered the herbaceous flora proper to the alluvial forest. With the nettles occur a few other herbs, mainly of weedy types, only a few, such as *Campanula Americana* and *Eupatorium ageratoides,* are of any beauty:

Urtica gracilis	Circaea Lutetiana
Laportea Canadensis	Scrophularia Marylandica
Pilea pumila	Phryma Leptostachya
Boehmeria cylindrica	Campanula Americana
Parietaria Pennsylvanica	Eupatorium ageratoides
Polygonum Virginianum	Solidago flexicaulis
P. scandens	Polymnia Canadensis (local)
Chenopodium hybridum	
Geum Canadense	Ambrosia trifida
Amphicarpa monoica	Actinomeris squarrosa
Hypericum corymbosum	Mulgedium leucophaeum
H. mutilum	

In places the alluvial forests have a noticeable sward in autumn, composed chiefly of *Leersia Virginica* and *Muhlenbergia Mexicana* and *M. racemosa.* Other grasses, notably *Cinna arundinacea, Diarrhena Americana,* and *Uniola latifolia,* are occasional.

B. SYLVALES. PLANTS OF THE MESOPHYTIC FOREST ZONE.

The sylvan flora finds its best development in the virgin forest of the midlands. Such tracts, however, are hard to find. If by virgin is meant the forest as it was before the advent of civilized man, then there is none such. All the forests have been more or less pastured, the first-growth timber has been largely removed, and roads and paths have opened them up to weeds and light-loving plants. But if we call virgin those forests that have never been underbrushed, and which still bear a certain percentage of full-grown timber, especially, too, those which have not been excessively pastured and preserve yet a number of rare and local plants, there are still a few secluded localities, which retain in some degree of purity the normal flora of the midland forest. One such tract lies south of Grindstone creek and follows it for a considerable distance. Another is situated across Hinkson creek south, and encloses several deep valleys with spring-fed streams. The flora of these two regions is much alike, both tracts preserving with considerable distinctness the same forest floor.

The conditions for a forest floor of genuinely sylvan plants are these: 1. A shade sufficient to keep out sun-loving intruders. 2. Light enough to make growth possible. 3. The forest-covering of dead leaves, which rot into a rich, though sour, humus, must be preserved intact. As very practical requirements, freedom from severe pasturing and from fires is necessary. The chief harm from light forest fires comes from the burning up of the rich mulching of leaves and other forest debris. Portions of the forests are burned over every year in the hope of securing better pasturage, but with the immediate result that the vegetation, either through the damage done to the roots of perennials or to the destruction of seeds and seedlings, is sparse the whole year through. Such a course, persisted in year after year, obliterates finally the true sylvan societies, and by killing the underbrush and by the partial destruction of the trees allows a weedy light-loving herbage to come in, which is more or less mingled with *Poa pratensis.* The forest thence becomes a permanent pasture.

The mesophytic sylvan flora consists of a mixture of arboreal, fruticose, and herbaceous elements. These are not uniform in their distribution or in their composition, though in general the same species are found in the various situations, but in such diverse proportions that the aspect often is quite different. The mesophytic forest has a wide range of physiographic conditions, of soils, of density and of openness. The character of the forest floor differs also according to the season, the vernal flora being mainly of northern origin and of strictly sylvan species, the autumnal consisting largely of *Compositae* of southwestern origin and of prairie species. It must be borne in mind, however, that there are certain herbs, notably the grasses, sedges and ferns, that remain as dominant factors throughout the year. These give unity to the herbaceous flora and together with the trees and shrubs form the permanent characteristics of the sylva.

Before entering into detailed descriptions of minor plant groupings, it is well to consider the sylva as a whole. Only one plant society is present, though there are a number of subassociations.

a. **Sylvales quercoides.** The oak society of the sylva consists of the various species of oak (*Quercus*) as primary, the various hickories (*Carya*) and the walnut (*Juglans nigra*) being next in importance. Other trees occurring in more or less abundance are species of *Fraxinus, Acer, Ulmus, Celtis, Gymnocladus, Gleditschia, Aesculus,* and *Diospyros.* Of small trees, or arborescent plants, *Ostrya, Carpinus, Cornus, Cercis, Viburnum, Sassafras,* and *Mespilus* are common, some in one portion of the sylva, others in another. The lianas consist of species of *Smilax, Vitis, Quinaria, Rhus, Menispermum, Celastrus,* and *Campsis.* The shrubs include species of *Corylus, Rhus, Viburnum, Mespilus, Staphylaea, Asimina, Rhamnus, Ptelea,* and *Sambucus.* Of undershrubs there are species of *Rosa, Rubus, Ribes, Hypericum,* and *Symphoricarpos.* The ordinary sward of the forest floor is composed of *Carex Pennsylvanica* as primary, with *C. Jamesii, C. oligocarpa, C. rosea, C. Texensis, C. gravida,* and *C. Hitchcockiana* as secondary. Of *Gramineae* the most important are the species of *Muhlenbergia, Brachyelytrum, Panicum, Bromus, Elymus,* and *Asprella.* The typical ferns are *Polystichum acrostichoides, Adiantum pedatum, Cystopteris fragilis,* and *Botrychium Virginianum.* The vernal plants belong to such genera as *Thalictrum, Claytonia, Dicentra, Trillium, Uvularia, Phlox, Polemonium, Ranunculus,* and *Viola.* The aestival plants consist of species of *Potentilla, Geranium, Taenidia, Zizia, Cryptotaenia, Sanicula, Blephilia, Agrimonia,* and *Galium.* The autumnal herbs include species of *Desmodium, Lespedeza, Seymeria, Gerardia, Rudbeckia, Heliopsis, Helianthus, Eupatorium, Solidago,* and *Aster.*

The white oak, *Quercus alba,* has a wide range of soils, and may be regarded as the tree most characteristic of the sylva. Though it reaches its best development in the forest plain, it is common in all parts of the forest. It must be said, however, that in the wooded portions of the district underlaid by the coal-measures, the white oak is less frequent than elsewhere. This comparative rarity of occurrence has its explanation in the fact that the region of the coal-measures is properly prairie, and that the forest developed upon it in recent times is of riparian origin. Hence there is seen there the spectacle, nowhere else presented in the region, of swamp and lowland oaks dominant in the upland plain.

The bur oak (*Quercus macrocarpa*) prefers the heavier soils, and occurs in the swamps and along the streams, though it is properly a mesophytic tree. In the forest on the coal measures it is the most abundant oak, but with it there is common the swamp oak (*Q. platanoides*), though its natural home is the swamp. The pin oak (*Q. palustris*) is, except in a few swamps in the limestone district, restricted to the coal measures, where it is a common and characteristic tree.

The red oaks (*Quercus Schneckii* and *Q. rubra*) have a wide distribution, but show a preference for either light or heavy wet soil, and are rarest in the midland plain. The Texan red oak (*Q. Schneckii*) is common also in park-like areas, resembling in this respect the shingle oak (*Q. imbricaria*), which is the commonest black oak as the sylva meets the prairie.

The chestnut oak (*Q. acuminata*) is a common companion of the white oak, but has a decided preference for rocky soils. It is very characteristic of the cliffs and of rocky ravines. The black oak (*Q. tinctoria*) is common in similar places, but is the typical oak in dry oak forests, especially in light soils. The forests south of the Pinnacles are good examples. The post oak (*Q. obtusiloba*) and the black jack (*Q. Marylandica*) occur only on the summits of the cliffs, and in the red clay barrens, and are the representative xerophytic oaks.

The following plants are characteristic of the sylva:

a. **Arbores.**

Juglans nigra	C. tomentosa
Carya alba	C. porcina
C. sulcata	C. amara

Quercus imbricaria
Q. rubra
Q. Schneckii
Q. tinctoria
Q. alba
Q. macrocarpa
Q. acuminata
Ulmus fulva
U. Americana
Celtis occidentalis
Prunus serotina
Gleditschia triacanthos
Gymnocladus dioica
Acer saccharinum
A. nigrum
Aesculus glabra
Diospyros Virginiana
Fraxinus Americana

β. Arborescentes.

Carpinus Carolinianum
Ostrya Virginica
Morus rubra
Sassafras officinale
Pyrus angustifolia
Mespilus coccinea
M. macracantha
M. mollis
M. tomentosa
Prunus Americana
P. hortulana
Cercis Canadensis
Aesculus arguta
Cornus florida (very rare)

γ. Frutices.

Corylus Americana
Asimina triloba
Mespilus Crus-galli
Xanthoxylum fraxineum
Ptelea trifoliata
Rhus glabra
R. copallina
Euonymus atropurpureus
Staphylea trifolia
Rhamnus lanceolata
Cornus asperifolia
C. Drummondii
C. candidissima
Sambucus Canadensis
Viburnum prunifolium
V. rufotomentosum

δ. Suffrutices.

Ribes gracile
R. Missouriense
Rubus occidentalis
R. nigrobaccus
R. procumbens
Rosa setigera
R. humilis
R. Woodsii
Rhus aromatica
Ceanothus Americana
C. pubescens
Hypericum prolificum
Symphoricarpos vulgaris

Vitices.

Smilax rotundifolia
S. hispida
Menispermum Canadensis
Rhus Toxicodendron
Celastrus scandens
Vitis aestivalis
V. cordifolia
V. riparia
V. rubra
Quinaria quinquefolia
Campsis radicans

ζ. Herbae.

a. Vernales.

Carex Pennsylvanica
Trillium sessile
Claytonia Virginica
Ranunculus abortivus
R. micranthus
Thalictrum anemonioides
Podophyllum peltatum
Dentaria laciniata
Oxalis violacea
Viola palmata
V. papilionacea
V. cuspidata
V. Missouriensis
V. pubescens
Asclepias quadrifolia
Phlox pilosa
P. divaricata
Polemonium reptans
Pedicularis Canadensis
Antennaria plantaginifolia

b. Aestivales.

Adiantum pedatum
Cystopteris fragilis
Polystichum acrostichoides

Botrychium Virginianum
Muhlenbergia sylvatica
M. diffusa
Brachyelytrum aristatum
Agrostis perennans
Carex retroflexa
C. Texensis
C. rosea
C. Jamesii
C. blanda
C. laxiflora
C. Hitchcockiana
C. oligocarpa
Sisyrinchium graminoides
Anychia Canadensis
Arabis Canadensis
Fragaria Virginiana
Potentilla Canadensis
Agrimonia striata
A. mollis
Cassia Marylandica
Geranium maculatum
Hypericum subpetiolatum
Aralia racemosa
Panax quinquefolia
Sanicula gregaria
S. Canadensis
Zizia aurea
Cryptotaenia Canadensis
Taenidia integerrima
Thaspium aureum
Cynoglossum Virginicum
Lappula Virginiana
Verbena Aubletia
Brunella vulgaris
Monarda fistulosa
M. mollis
Blephilia ciliata
Scrophularia Marylandica
Pentstemon hirsutus
Veronica Virginica
Ruellia strepens
Galium concinnum
G. trifidum
G. triflorum
G. circaezans
G. pilosum
Triosteum perfoliatum
Erigeron pulchellus
Heliopsis scabra
Rudbeckia purpurea
Coreopsis tripteris
Cacalia atriplicifolia
Krigia amplexicaulis

c. Serotinales.

Polygonum scandens
Desmodium nudiflorum
D. pauciflorum
D. Michauxii
D. canescens
D. bracteosum

D. paniculatum
D. viridiflorum
D. Dillenii
D. rigidum
Amphicarpa monoica
A. Pitcheri
Agastache nepetoides
Gerardia grandiflora
Phryma Leptostachya
Solidago ulmifolia
S. serotina
S. Canadensis
Aster cordifolius
A. Drummondii
A. sagittifolius
Helianthus hirsutus
H. strumosus
Prenanthes altissimum
Hieracium scabrum

The primary grouping of the plants of the sylva depends mainly upon the soil and the physiographic position. A secondary grouping can often be made out according to the season of the year, though obviously this is possible only in the case of herbs. In the limestone district four physiographic plant-groups are discernible. 1. The ravine group, consisting of a slender thread of riparian plants along the stream in the center of the ravine, and where there are out-croppings of rock, certain rupestrine species commonly occur. In general the flora of ravines consists of such plants as demand rich soil and considerable moisture. 2. The hillside-group, consisting of plants requiring a rich soil but less water than the foregoing; it is tolerant of more light, but here, too, there are out-croppings of rock and rupestrine forms. 3. The hill-summit group, consisting of plants habituated to a dry, often stony, semi-barren soil, and forming a transition to the xerophytic flora. 4. The plain-group, consisting of strictly mesophytic plants growing under conditions of soil, moisture and light that may be considered normal for the sylva. Riparian and rupestrine elements are seldom noticeable. The forest-plain is now very poorly preserved, most of it having been cleared into farms or transformed into permanent pastures.

The sylva thus shows an alternation of plant elements. Ravine plants, slope plants, hill plants, plain plants often occur in close juxtaposition. Often a slight depression has but a single ravine species, or a low ledge but one or two rupestrine forms. There is, then, a subtle change of floral elements occasioned by delicate changes in soil, elevation, and light, which makes exact analysis impossible.

i. **Sylvales quercoides carpininae.** The blue beech subassociation of sylvan ravine plants occupies the deeper portions of the ravines. There is usually a watercourse, at ordinary times, however, dry. If the ravine has steep rocky banks with a stream fed by an unfailing spring, the flora is that of the fontinal rupestrine type. The blue beech subassociation is a reduced form of the riparian persisting amid mesophytic vegetation. The ligneous element is as follows:

Juglans cinerea	Platanus occidentalis
Carya amara	Physocarpus intermedius
Carpinus Caroliniana	Cercis Canadensis
Ostrya Virginica	Rhus Toxicodendron
Quercus alba	Euonymus atropurpureus
Q. macrocarpa	Celastrus scandens
Q. acuminata	Acer dasycarpum
Q. rubra	A. nigrum
Ulmus fulva	Aesculus glabra
U. Americana	A. lutea
Celtis occidentalis	Vitis riparia
Morus rubra	Quinaria quinquefolia
Asimina triloba	Tilia Americana

Next to the watercourse such herbs as *Collinsia verna*, *Impatiens* spp., *Circaea Lutetiana*, *Eupatorium ageratoides*, and *Asplenium pycnocarpon* occur, while on lower slopes *Hydro-*

phyllum Virginicum and *H. appendiculatum,* or *Galium Aparine,* form an almost unmixed community. The wild ginger (*Asarum ambiguum*) also forms dense patches on rich lower slopes. Especially noteworthy is the liliaceous element. A line of tall Solomon's seals, true and false (*Polygonatum* spp., and *Smilacina* spp.), nods over the stream at the verge of the bank. *Uvularia grandiflora* is also frequent. Certain grasses, notably *Uniola latifolia, Brachyelytrum aristatum, Bromus purgans,* and the various species of *Elymus,* have a similar nodding habit.

a. Praevernales.

The prevernal ravine plants commonly possess bulbs, bulb-like corms, thickened rootstocks, or tubers. *Sanguinaria Canadensis, Claytonia Virginica, Erythronium albidum, Isopyrum biternatum, Dicentra Cucullaria, Dentaria laciniata, Erigenia bulbosa, Viola papilionacea, Collinsia verna,* and *Phlox divaricata* are common.

b. Vernales.

The vernal ravine herbs consist mainly of plants that mature their fruit in late summer or autumn. Typical species are:

Arisaema atrorubens	Cypripedium parviflorum (very rare)
Uvularia grandiflora	Asarum ambiguum
Smilacina stellata (rare)	Thalictrum purpurascens
S. racemosa	Leontice thalictroides
Polygonatum biflorum	
P. commutatum	

c. Praeaestivales.

The preaestival flora consists mainly of *Galium Aparine, Hydrophyllum Virginicum, H. appendiculatum,* and *Ellisia Nyctelea.*

d. Aestivales.

The aestival flora is not well marked. *Agrimonia striata* and *A. mollis, Zizia aurea, Cryptotaenia Canadensis,* and *Sani-*

cula Canadensis, are the commonest herbs with the exception of the brome and lyme grasses (species of *Bromus, Elymus,* and *Asprella*).

e. Autumnales.

The autumnal and late summer vegetation consists of such plants as *Gerardia Besseyana, Campanula Americana, Lobelia syphilitica, Rudbeckia triloba, Eupatorium ageratoides,* and *Solidago flexicaulis.*

ii. **Sylvales quercoides juglandinae.** The walnut sub-association of rich slopes consists of *Juglans nigra* and the various hickories (*Carya* spp.), *Quercus alba* and *Q. acuminata,* in control, but often thickets of *Ostrya Virginica* cover the lower slopes and form a transition to the preceding. Frequently the hillsides are covered with patches of shrubs, notably *Rhus glabra* and *Corylus Americana.* The herbs in general are those common to the sylva. *Thalictrum anemonioides, Trillium sessile, Corydalis montana* and *Dicentra Cucullaria* are frequent early spring species. Later *Camassia Fraseri, Delphinium tricorne, Verbena Aubletia,* and *Erigeron pulchellus* occur in large patches. *Oxalis violacea* and many violets (*Viola* spp.), are common, as are also *Phlox divaricata* and *Polemonium reptans.* In summer species of *Galium, Agrimonia,* and *Desmodium* are characteristic. The usual sylvan ferns also abound. The most striking herb of the richer slopes is, however, *Veratrum Woodii.* The autumnal herbs consist mainly of *Compositae,* among which species of *Helianthus, Eupatorium, Solidago* and *Aster* are preeminent.

iii. **Sylvales quercoides fraxininae.** The blue ash sub-association of hill summits consists of a scraggly growth of *Fraxinus quadrangulata, Quercus tinctoria, Q. alba, Q. imbricaria,* and *Diospyros Virginiana.* Shrubs and undershrubs are frequent; *Mespilus coccinea, Hypericum prolificum, Rhus aromatica,* and *Rhamnus lanceolata* are characteristic. The herbs are of semi-xerophytic species; such plants as *Antennaria plantaginifolia, Parthenium integrifolium, Comandra umbellata, Astragalus Mexicanus,* and *Viola palmata* being representatives of a flora, the more xerophytic aspects of which will be considered later.

The flora of the forest plain, in general, is that typical of the sylva.

There are, however, north of Columbia two forms of the oak sylva that require brief mention. In the normal oak sylva of the plain the white oak, *Quercus alba,* is dominant, but as the sylva approaches the prairie or encroaches upon it, the forest first formed is developed naturally from the trees fringing the streams. Later, or partly synchronizing with it, the flora of the normal oak forest makes its way in. Thus it happens that some of the highest land in the region is forested in large part with lowland and riparian trees. The other type of oak forest occurs south and southwestward of the Pinnacles upon soil lighter than any in the immediate vicinity of Columbia, and there the black oaks are dominant.

iv. **Sylvales quercoides ulminae.** The elm subassociation of the oak sylva occupies the region of the coal measures north of Columbia. Besides the elm (*Ulmus Americana*), the bur oak (*Quercus macrocarpa*), the swamp white oak (*Q. platanoides*), the swamp black oak (*Q. palustris*), and the red oak (*Q. rubra*) are common. The white oak (*Q. alba*) is relatively scarce. The black cherry (*Prunus serotina*) is frequent, and the juniper (*Juniperus Virginiana*) is common on the hill slopes. The strictly riparian trees such as the sycamore (*Platanus occidentalis*) and the cottonwood (*Populus monilifera*) are found even on the high ridges. On hills about the Pinnacles the river birch (*Betula nigra*), elsewhere not found except at the margins of streams, is not infrequent. The forest floor is usually very weedy and grassy and rarely well-marked.

v. **Sylvales quercoides sassafrasinae.** The sassafras subassociation of the oak sylva occupies certain comparatively light soils in the vicinity of the Pinnacles, and perhaps elsewhere. Along with the sassafras grow the black and red oaks (*Quercus tinctoria, Q. imbricaria, Q. rubra, and Q. Schneckii*). The white oaks occur in relatively less abundance. The herbs are such as prefer light dry soils. Thus *Phlox pilosa* replaces *P. divaricata,* so abundant in the sylva about Columbia. The forest floor is well marked, showing that the black oak forest, unlike the preceding, is not derived, but original.

C. Arbustales. Plants of the mesophytic thicket zone.

The thicket in the vicinity of Columbia is the oak forest reduced to brush conditions. It is seen in all stages from the second growth forest to half-cleared fields, and is found along fences and other odds and ends of the farm. The peculiarity of the thicket formation is the contrariety of its elements. Two opposite forces are at work. The brush seeks to grow into forest, and if left alone, would do so. But disintegrating forces are steadily at work. These are partly due to human agency, to fires, pasturings, underbrushing and the like, and partly to the eroding of hill-slopes, and to the destruction of the leaf-mould so essential to the forest floor.

The first effect of the underbrushing of a wooded tract is to expose the sylvan species to unwonted light. Violent changes of temperature and weather are mitigated to a certain extent by the forest trees and shrubs. Shade and shelter, then, are taken away. On slopes, the soil, no longer protected by the

4

timber, and not yet swarded over by pasture grasses, rapidly washes away, leaving extensive patches of naked rock. On the other hand there is a pronounced invasion of light-loving plants, especially composites, whose pappus-surmounted achenes are borne easily by the wind. The first season after underbrushing the herbage is mainly that of the forest floor, in a moribund condition, but with the addition of certain annuals from nearby fields. The fire-weed (*Erechthites hieracifolia*) is most characteristic of the vegetation of such newly deforested tracts. The second season marks the developing of two tendencies: First, the forest strives to spring up again, the oaks especially sprouting freely from the stumps of young trees; second, there is an increasing invasion of light-loving plants, consisting of wild prairie plants and of weeds from adjacent fields. The prickly lettuces (*Lactuca Scariola* and *L. virosa*) together with the native species of *Lactuca*, are especially abundant. If the tract is heavily pastured, or suffers severely from fires, the disintegrating forces predominate over the recuperative powers of the native sylvan growth. If the tract is suffered to grow up again into forest unhindered, the increasing shade of the rapidly rising second growth forest gradually and inevitably repels the invaders.

A brush lot, which is not cleared at once and brought into cultivation, has before it three possibilities: First, it may reforest itself; second, it may eventually become swarded over, and become a semi-wild pasture, with scattered patches of shrubs, and a few timber trees; third, it may develop into a relatively stable fruticetum.

The thickets in the vicinity of Columbia are of five main classes: First, recently underbrushed tracts with a sylvan flora in a moribund condition; second, somewhat older brush lots suffering invasion, and in which the final outcome of the struggle between sylvan and open species is still uncertain; third, brush-lots with the young trees in control, thus denoting the final victory of the sylvan elements; fourth, brush-lots apparently of a stable thicket formation, with shrubby species in control; fifth, brush-lots which have become swarded over with grass, the brush growing thinner every year, and the open elements in control. The park-like half-wild pastures stand for the final victory of the open vegetation.

The flora of brush-lots cannot be separated into definite plant-societies, till some degree of stability in the vegetation has been reached. The unpastured young brush-lot has an exceedingly dense plant-growth consisting of an inextricable mixture of sylvan, prairie and ruderal plants. All that it is possible to do is to determine the nature and extent of the invasion, and to endeavor to discover the ultimately dominant element. Moreover portions of the tract may be in various stages of development. Thus side by side there may be going on a process of reforesting, and a process of disintegration into a wild pasture.

A brush-lot is measurably stable only when it is dominated by shrubby species. It is probable, however, that in a region natural to forests a fruticetum leads ultimately to a sylva.

1. **Arbustales rhuoides.** The sumac association is extremely heterogeneous. The fruticose element, consisting of shrubs, lianas, arborescent plants, and the young growth of timber trees, has little unity. The true shrubs tend to grow in dense patches. Thus on one hillside the sumacs (*Rhus glabra, R. copallina, R. aromatica*) may form a compact growth, on another *Rhamnus lanceolata, Euonymus atropurpureus* or *Cornus asperifolia, C. Drummondii,* and *C. candidissima* may form

similar clumps. Again rich slopes may support a dense growth of hazel (*Corylus Americana*). The herbs also are of heterogeneous types. Along the rocky beds of ravines occur patches of *Viola Rafinesquii, Draba cuneifolia, Plantago Virginica,* and *Cerastium nutans. Allium Canadense* and *Nothoscordum striatum* are also common along such beds. Later in the season *Rudbeckia triloba* is the commonest herb. On the hill-slopes *Hybanthus concolor, Verbena Aubletia, Taenidia integerrima, Camassia Fraseri, Astragalus Mexicanus,* and *Corydalis flavula* are conspicuous in spring and early summer, to be followed later by *Asclepias verticillata, Ruellia ciliosa, R. strepens, Koellia Virginica, Monarda fistulosa, Heliopsis scabra, Rudbeckia* spp., *Silphium integrifolium,* and *Helianthus hirsutus.* Hill summits are swarded over with various panic-grasses (*Panicum* spp.), and *Danthonia spicata. Viola pedata, Comandra umbellata, Parthenium integrifolium, Zizia cordata,* and the bush-clovers, *Lespedeza* spp., are characteristic herbs. *Andropogon furcatus, A. avenaceus,* and *Triodia cuprea* are common late grasses.

D. Spinosae. The flora of the hawthorn glades.

a. **Spinosae mespileoides. The haw association.** On the coal measures to the north of Columbia occur extensive tracts of thorny thickets interspersed with timber trees of a lowland type. These tracts appear to stand for former prairies, since on the limestone in the sylva proper such chaparral growths do not occur, though small patches of haw (*Mespilus*) are frequent, especially along the roads and on the summits of cliffs. Together with the species of haw (*Mespilus*) grow the similar wild crab-apples (*Pyrus Iowensis* and *P. angustifolia*), the wild plums (*Prunus hortulana* and *P. Americana*), the black haws (*Viburnum prunifolium* and *V. rufotomentosum*). Lianas are very frequent, consisting especially of *Smilax hispida* and *S. rotundifolia, Vitis riparia, Menispermum Canadense, Rhus Toxicodendron,* and *Quinaria quinquefolia.* The herbs are not at all characteristic, being of the usual lowland types. The following list comprises the species of haws which occur in these glades:

Mespilus Crus-galli	M. macracantha
M. punctata	M. mollis
M. cordata	M. Biltmoreana
M. Eggerti	M. campestris
M. viridis	M. tomentosa
M. nitida	M. Chapmanii
M. coccinea	M. dispessa
M. rotundifolia	

E. SENTAE. THE FLORA OF BRAMBLE AND BRIER THICKETS.

a. **Sentae ruboides.** The bramble association of mostly prickly undershrubs, often with recurved branches, or even climbing or trailing, is found usually in patches in wild fields or in open thickets. It is composed mainly of armed rosaceous shrubs, but similar patches consisting wholly of the buckbush (*Symphoricarpos vulgaris*) or with some admixture of brambles and gooseberries (*Ribes* spp.), are very common. There are no characteristic herbs. The following are the chief species:

Ribes gracile	Rosa setigera
R. Missouriense	R. Woodsii
Rubus occidentalis	R. humilis
R. nigrobaccus	Hypericum prolificum
R. procumbens	Symphoricarpos vulgaris

F. AGRESTES. PLANTS OF WILD, OR SEMI-WILD, FIELDS.

There are two types of wild fields: First, park-like tracts with frequent trees left standing for shade or for their nuts, fruit, or timber; second, wild open permanent pastures. Both forms have an herbaceous flora that is essentially prairie, but with many ruderal plants. The study of the invasion of these prairie plants is interesting. While in the immediate vicinity of Columbia there are now no prairies proper, it seems probable that at no very distant time the region of the coal-measures was prairie. It has been seen that the sylva there has been derived from the timber accompanying the streams, and that such trees as *Quercus macrocarpa, Q. platanoides,* and *Q. palustris,* are dominant. It has also been seen that the hawthorn glades stand probably for former prairies. Moreover at the summits of the cliffs there is commonly a narrow zone of typical prairie species, and similar patches occur on the summits of certain hills. In open thickets and in old roads in woods little remnants of prairie vegetation still persist. It is easy then to understand the source of the steady invasion of prairie species.

a. **Agrestes caryoides.** The hickory association of trees in park-like fields is due primarily to human selection. When the forest was felled, certain trees, notably the various hickories (*Carya* spp.), the walnut (*Juglans nigra*), the persimmon (*Diospyros Virginiana*), the honey locust (*Gleditschia triacanthos*), the Kentucky coffee tree (*Gymnocladus dioica*), and various oaks and ashes (spp. of *Quercus* and *Fraxinus*), were left standing for various economic reasons. The herbs are essentially the same as that usual to the open wild fields, the sward consisting of *Poa pratensis,* or often of cultural species, such as the meadow grasses and clovers. The spring beauty (*Claytonia Virginica*) is very common in spring.

b. **Agrestes vernonioides.** The ironweed association of wild and half-wild fields consists of certain prairie plants together with the usual pasture grasses and weeds. Such fields are pseudo-prairies. The vegetation is much alike in all, consisting of the fleabanes (*Erigeron annuus, E. ramosus,* and *E. Canadensis*), *Rudbeckia hirta, Teucrium Canadense, Verbena stricta, Koellia Virginica, Eupatorium serotinum, Vernonia Baldwinii, V. maxima, V. interior,* and the common pasture weeds *Cirsium lanceolatum, Verbascum Thapsus, Gnaphalium obtusifolium,* etc. *Triodia cuprea* and *Eragrostis pectinacea* are characteristic grasses in autumn.

III. XEROPHYTES.

The xerophytic vegetation of the region falls into two primary zones, the zone of cliffs, and the zone of barrens. To these is to be added a third zone, that of the cliff and bluff prairies. These zones are poorly differentiated, all three mingling occasionally at the summits of cliffs. Much of the vegetation is mesophytic, but therein is comprised nearly all our genuinely xerophytic species. On hills and knolls in woods and thickets occur also a few xerophytic plants, and as we have seen, the shore sands support a xerophytic growth.

A. Rupestres. Plants of the cliff zone.

The rupestrine flora gives to the region its stamp of individuality. Many of the plants are endemic to the limestone cliffs of Missouri and the neighboring states. The flora has not come from other regions, it has developed here, and no other species successfully invades its peculiar habitat, if there be excepted a few weeds, such as the mullein (*Verbascum Thapsus*). Because of its endemic character it is a vanishing flora. Many of its most characteristic species are verging upon extinction, and in many places the ledges are becoming more barren year by year. Naturally the vegetation is inaccessible to ordinary processes of destruction; it suffers also little from competition, hence is a zone of slight tension, as is shown by the fact that here on the verges of the cliffs the prairie plants have found a final asylum from the encroaching sylva. The destruction of the flora comes about from two causes. The processes of quarrying and blasting destroy it outright, and the clearing of the forests at the summits and at the bases of the cliffs causes a gradual drying of the whole cliff affected, and allows the soil to be eroded from the summits and slopes. The cliff vegetation suffers easily from drouth. While little moisture is needed, that little must always be at hand. Thus from the great drouth of 1901 no other shrub suffered as severely as the red-bud (*Cercis Canadensis*), it being almost everywhere killed to the root, yet the red-bud is common at the summits of cliffs, where at all times there is excessive drainage. The drying up of springs and streams as the result of deforesting is especially fatal to the cliff vegetation, to which an always humid air is necessary for its best development.

A cliff may be divided into four subzones. 1. The subzone of wet and dripping rocks. 2. The subzone of comparatively deep soil, usually at the foot of the cliff, or at the top of flat ledges. 3. The subzone of naked, often perpendicular rock. 4. The subzone of cliff summits. The first subzone is properly hydrophytic, the second is mesophytic, the others xerophytic in the main. These subzones tend to fuse and certain plants, such as *Cystopteris fragilis* and *Houstonia angustifolia,* are found on the cliffs from top to bottom. In no other portion of the region do cryptogams play so important a role as here. Liverworts, mosses, ferns and lichens constitute often the greater portion of the vegetation.

1. **Rupestres fontinales.** The fontinal cliff vegetation occupies moist rocky banks, damp ledges, and dripping rocks. It is the most delicate of all plant formations in the region. Three strands of fontinal vegetation are discernible. a. The strand of gregarious liverworts, mosses, and walking ferns, covering slabs of rock in the streams, and the dripping ledges of the cliffs. b. The strand of fontinal ferns and cresses on wet rocky banks. Where it adjoins the preceding it lies above it. c. The strand of moist cliff plants, such as *Senecio aureus, Eupatorium ageratoides,* and the lyme grasses, *Elymus* spp., which occupies the upper portions of the fontinal subzone. Certain riparian trees and shrubs occur, but only *Physocarpus* is characteristic.

a. **Fontinales scolopendrioides.** The walking fern association of liverworts, mosses, and ferns, occupies the lowest portion of the fontinal subzone. The walking fern (*Scolopendrium rhizophyllum*) is remarkable for its propagation by means of little plants borne at the apices of its fronds, thus enabling the plant to climb up the sheer faces of rocks. The principal liverworts are *Marchantia polymorpha, Conocephalus conicus, Grimaldia rupestris,* and *Dumortiera hirsuta.* A few phanerogams, such as *Pilea pumila, Erigeron Philadelphicus,* and *Solidago flexicaulis,* are frequent also.

b. **Fontinales cystopteridoides.** The bulbet-fern association of ferns and cresses occupies the central portion of the fontinal subzone. It consists of a layer of ferns, mingled with rock-cresses and other moist-rock plants. *Cystopteris bulbifera* is especially common, its narrow fronds being often prolonged to a length of a metre or more. *C. fragilis, Woodsia* *obtusa, Asplenium platyneuron,* and *Polystichum achrostichoides* are abundant also. *Arabis laevigata, A. dentata,* and *A. Cañadensis* are common, as is also *Erigeron Philadelphicus.* These furnish good examples of rosettes.

c. **Fontinales senecionoides.** The groundsel association occupies the upper portion of the fontinal subzone, or often the whole sides of low moist cliffs. Such plants as *Senecio aureus, Eupatorium ageratoides, Campanula Americana* and *Asprella Hystrix* are typical. A brief list of plants follow:

Woodsia obtusa	E. Canadensis
Cystopteris fragilis	E. glaucifolius
Melica mutica	Asprella Hystrix
Festuca nutans	Senecio tomentosus
Bromus purgans	S. aureus
Elymus striatus	S. obovatus
E. Virginicus	

2. **Rupestres clivosae.** The clivose vegetation occupies those portions of cliffs which are covered with earth. It lies above the fontinal when that subzone is present. It consists of trees, shrubs and a rich variety of herbs. Not only are the characteristic rupestrine plants present, but practically the whole flora of rich deep ravines. The covered cliffs have a mesophytic mixed vegetation, which is hard to separate into definite societies and is best treated as a unit.

a. **Clivosae ostryoides.** The ironwood association of clivose trees, shrubs and herbs covers the lower slopes of the cliffs, or in the case of low slanting cliffs, to their summits. *Ostrya Virginica, Quercus acuminata, Ulmus fulva, Acer nigrum, Carya amara,* and *Staphylea trifolia* are characteristic trees and shrubs. The water-leaves (*Hydrophyllum* spp.) and bedstraws (*Galium* spp.) abound, as do also species of *Trade-*

scantia. The tall riparian grasses are frequent. *Veratrum Woodii,* and, locally, *Carex Albursina* and *Allium tricoccum,* are conspicuous for their broad leaves. *Uniola latifolia* is a characteristic grass. *Aquilegia Canadensis* and *Cystopteris fragilis* are common also.

3. **Rupestres rimosae.** The crevice and cranny vegetation of the naked rocks occupies commonly the upper portions of the cliffs, but occurs wherever nude rocks and ledges are present. The crevices with a deep soil bear a vegetation of a mesophytic type, which is often identical with that of the clivose subzone. *Aquilegia Canadensis,* and *Solidago Drummondii* are especially characteristic. The shallow crannies and narrow cracks are occupied by certain xerophytic ferns and a few flowering plants. The rimose vegetation attains its best development upon the cliffs of the Missouri river. A striking feature of these naked cliffs are the lianas that cover their surfaces. Practically all the rimose plants can be gathered into two associations:

a. **Rimosae quinarioides.** The Virginia creeper association of cliff lianas commonly mantles the sheer faces of cliffs in the manner of the ivy. These root in cracks and faults of the rock, and cling with their disc-bearing tendrils or aerial rootlets to the steep walls. *Quinaria quinquefolia* and *Rhus Toxicodendron* are by far the commonest cliff lianas, though others such as *Campsis radicans, Celastrus scandens,* and very rarely *Lonicera grata,* occur also, twining in trees and trailing over the rocks.

b. **Rimosae pellaeoides.** The cliff-brake association consists of a few rock ferns and cliff phanerogams. *Aquilegia Canadensis, Heuchera hispida, Solidago Drummondii, Woodsia obtusa,* and *Cystopteris fragilis* are common in the deeper crevices. *Houstonia angustifolia,* and the cliff-brakes, *Pellaea atropurpurea, P. dealbata* (very rare), and the lip-fern, *Cheilanthes lanuginosa,* grow in shallow crannies, but only *Pellaea atropurpurea* is at all common. The rocks themselves are more or less crusted with various lichens.

4. **Rupestres summae.** The cliff-summit vegetation occupies a narrow band at the verge of the cliffs. It consists of a row of shrubs and dwarfed trees interspersed with the cliff golden-rods, asters and other herbs. Back of this line and somewhat confluent with it is a thin ribbon of prairie vegetation, or if the soil be very dry and sterile, a barrens' flora. If the soil of the summits is very thin, there occur patches of slight rosulate plants, such as *Androsace, Draba* and *Alsine.*

a. **Summae juniperoides.** The red cedar association of summit trees, shrubs, and herbs is found at the verge of cliffs. There is a surprising variety of trees and shrubs. All the oaks except the palustrous species are present, but most characteristic are *Quercus acuminata, Q. obtusiloba,* and *Q. Marylandica.* Other trees are *Acer saccharinum, Fraxinus quadrangulata, Carya alba, C. amara,* and *Diospyros Virginiana.* Typical shrubs, or small trees, are *Juniperus Virginiana, Amelanchier Canadensis, Celtis occidentalis, Ostrya Virginica, Cornus asperifolia, C. Drummondii, Viburnum rufotomentosum,* and *Morus rubra. Vaccinium vacillans* occurs also on a high cliff-summit south of Grindstone creek. *Solidago Drummondii, S. radula, S. speciosa, Aster anomalus, A. turbinellus, A. oblongifolius* are characteristic herbs. Along the cliffs of the Missouri *Mentzelia oligosperma* is abundant.

b. **Summae androsacoides.** The rock-primrose association consists of diminutive rosettes, which occupy flat summits with an exceedingly shallow soil. *Androsace occidentalis,* *Draba cuneifolia,* and *Alsine Texana* are the chief species, with the exception of *Cladonia,* which is often abundant in such soils. *Scutellaria campestris, S. parvula,* and *Astragalus distortus* occur also. To these on the Pinnacles are to be added *Mirabilis hirsuta* and *Carex setifolia.*

B. CAMPANALES. PLANTS OF THE PRAIRIE ZONE.

In the vicinity of Columbia the true prairies are represented only by a thin ribbon about the summits of cliffs, or upon the summits of hills and bluffs. Hence the prairie flora is found growing mainly under xerophytic conditions. Such habitats, so unlike those usual to the species, are plainly the result of constriction by the sylva of former prairies. Here in a soil of such slight depth that trees and shrubs can find no foothold, a score or two of species of prairie plants lead a precarious existence. Besides there are a few prairie remnants in open thickets, wandering about as conditions make necessary, or a few hardy ones settling down in dense patches and battling stoutly against an untoward fate. The most successful of these is the sensitive brier (*Schranckia uncinata*). The prairie vegetation consists of two associations, the one growing on the cliffs and mixed with rupestrine forms, the other growing on hill-summits, or, as has been seen, in open thickets.

a. **Campanales psoraleoides.** The psoralea association of cliff prairie plants consists largely of *Leguminosae, Gramineae,* and *Compositae.* It is mixed more or less with rupestrine species, and in certain places coalesces with the flora of the red clay barrens. The aestival plants consist mainly of *Leguminosae—Psoralea, Amorpha, Kuhnistera, Tephrosia,* and *Baptisia*; the autumnal of *Gramineae—Andropogon, Bouteloua,* etc. Vernal species are scarce, consisting mainly of *Astragalus Mex-*

icanus and *Verbena Aubletia.* The following are the principal species:

Andropogon furcatus
A. avenaceus
Panicum virgatum (rare)
Bouteloua racemosa
Agropyron spicatum (rare)
Baptisia leucophaea (rare)
Trifolium stoloniferum (rare)
Psoralea tenuiflora
Amorpha canescens
A. nana
Kuhnistera purpurea
Tephrosia Virginiana
Astragalus Mexicanus
A. distortus
Euphorbia corollata
Steironema lanceolatum
Verbena Aubletia
Liatris scariosa
L. squarrosa
Silphium integrifolium
S. terebinthinaceum
Parthenium integrifolium
Rudbeckia purpurea
Coreopsis palmata

b. **Campanales schranckioides.** The sensitive brier association of hill prairie plants is much stressed by sylvan and thicket elements, and hence verges into the thicket vegetation of the uplands. With these may be associated certain isolated patches, as for instance one in the thicket east of the water-works dam, consisting of *Desmanthus Illinoensis, Schranckia uncinata, Rosa humilis, R. setigera,* and *Eriophorum lineatum,* the only station of this plant on high ground. The following are characteristic species:

Asplenium platyneuron
Panicum Enslini
Eriophorum lineatum
Luzula campestris
Gillenia stipulacea
Rosa humilis
R. setigera
Schranckia uncinata
Desmanthus Illinoensis
Astragalus Mexicanus

Ceanothus pubescens
Hypericum pseudomaculatum
Taenidia integerrima
Koellia Virginica
Gerardia grandiflora
Heliopsis scabra
Rudbeckia purpurea
R. pinnata
Helianthus hirsutus
Krigia amplexicaulis

C. Steriles. Plants of barrens.

Barrens in the vicinity of Columbia are in the main restricted to a few red clay hills, which lie near the cliffs. Upon them grow a typical xerophytic vegetation. A like flora is found also on certain hilltops with a rocky soil. Besides the red clay barrens there are a few sterile tracts along roads and railroads, especially where the surface soil has been removed.

a. **Steriles lecheoides.** The pinweed association of plants upon sterile red clay hills lies mainly next the cliffs. The two best examples are found, the one immediately south of the Hinkson ford on the Black's Mill road, the other near the Hinkson bridge on the Ashland road. Portions of Pansy Hill have a similar flora. The turf of these barrens is composed mainly of *Lechea tenuifolia* and *Cladonia* (spp.), but there are also thin swards of *Danthonia spicata, Aristida oligantha* and *A. basiramea.* The bird's-foot violet (*Viola pedata*), the violet wood sorrel (*Oxalis violacea*), and the hoary puccoon (*Lithospermum canescens*), are the commonest vernal plants. In summer *Stylosanthes biflora, Polygala verticillata, Ruellia ciliosa, Liatris intermedia, Cassia Chamaecrista,* and *Phaseolus helvolus* are abundant. The autumnal plants comprise the bush-clovers (*Lespedeza* spp.), *Gerardia asperula, G. Besseyana,* and *Solidago longipetiolata.* There is often a marked mixture of prairie elements. *Bouteloua racemosa* has become established in a few places and is gaining upon the *Lechea*. Several andropogons are present. The characteristic trees are *Quercus obtusiloba* and *Q. Marylandica*. The following plants are characteristic:

Andropogon scoparius	L. Virginica
A. furcatus	Phaseolus helvolus
Panicum filiforme	P. umbellatus
P. depauperatum	Oxalis violacea
P. implicatum	Polygala verticillata
P. lanuginosum	P. sanguinea
P. commutatum	Lechea major
Aristida basiramea	L. tenuifolia
A. oligantha	Viola pedata
Danthonia spicata	Lithospermum canescens
Eragrostis trichodes	Gerardia asperula
Hypoxis erecta	G. Besseyana
Quercus Marylandica	G. flava
Q. obtusiloba	Ruellia ciliosa
Q. tinctoria	Liatris intermedia
Cassia Chamaecrista	Solidago nemoralis
Stylosanthes biflora	S. longipetiolata
Lespedeza repens	Aster dumosus
L. procumbens	Erigeron divaricatus
L. frutescens	

b. **Steriles aristidoides.** The poverty grass association of poor soils occurs along roads and other barren spots. It consists usually of xerophytic grasses and plantains. These are characteristic:

Aristida oligantha	Plantago aristata
Sporobolus vaginaeflorus	P. spinulosa
Hordeum nodosum	Diodia teres (rare)
Verbena stricta	Ambrosia bidentata
Ruellia ciliosa	Dysodia chrysanthemoides

D. Collinae. Plants of dry hills.

The dry hill flora has slight importance in the region. It occurs on dry knolls and hillocks in the woods, and on sterile hill-slopes. There are two slight associations, one the ordinary sylvan, or thicket, xerophytic association, the other a solitary, but interesting, one on a hillside just beyond Hinkson creek on the Ashland road.

a. **Collinae antennarioides.** The cat's-foot association of plants on dry knolls and hillocks consists of patches of *Antennaria campestris, A. neglecta, A. plantaginifolia, Comandra umbellata, Carex Leavenworthii, C. cephalophora, C. cephaloidea, C. Muhlenbergii Xalapensis, Panicum depauperatum, P. Enslini, P. implicatum, Danthonia spicata, Festuca Shortii,* and *F. octoflora.*

b. **Collinae opuntioides.** The prickly pear association of plants on dry hillsides occurs only on a hill on the Ashland road between Hinkson and Grindstone creeks. It consists of the prickly pear (*Opuntia Rafinesquii*), *Verbena Aubletia, Blephilia ciliata, Teucrium Canadense, Croton capitatus,* and *C. monanthogynus.* Besides these there is the flora usual to dry open thickets.

IV. PARASITES ET SAPROPHYTES. PARASITIC AND SAPROPHYTIC PLANTS.

Besides the parasitic and saprophytic fungi, there are also a few parasites and saprophytes among the flowering plants. The most important of these parasites, ecologically, are the dodders (*Cuscuta Gronovii, C. tenuiflora,* and *C. Polygonorum*). These are common in all low grounds. *Orobanche uniflora* is rare in thickets, and *Monotropa uniflora,* saprophytic on leaf-mould, is scarce in rich woods. Certain other plants of ordinary habit are root-parasites, notably *Comandra umbellata* and the Gerardias.

V. ANTHROPOPHYTES.

The anthropophytic vegetation, inasmuch as it is either directly under human control, or consists of species which grow under a great variety of conditions and in a wide range of soils, does not fall readily into distinct societies. Moreover certain weeds are usual with certain crops. Thus the common chess (*Bromus secalinus*), and the cockle (*Agrostemma Githago*) occur wherever winter wheat is grown. In cultivated grounds weeds adapt themselves to such conditions as are imposed upon them by man. Obviously weeds in a meadow or a grainfield suffer less interruption than weeds growing in a cornfield or a garden.

The anthropophytic vegetation consists of five sorts of plants: First, pasture and meadow plants; second, field and garden crops: Third, orchard and vineyard plants; Fourth, ornamental plants; Fifth, weeds and escapes. The field and garden crops, as well as the orchard, vineyard, and ornamental plants, possess little ecological interest, since they grow under conditions that render any spontaneity impossible. In general the same is true of escapes, which either persist in a few patches, or lead a brief and fugitive life. The flora of pastures and meadows, however, is more important.

1. **Pascuales. Pasture plants.** Since the sward of pastures is invariably the blue grass (*Poa pratensis*), there is but one association of pasture plants.

a. **Pascuales pooides.** The blue grass association of pasture plants occurs not only in pastures, but in all tame or half-wild open places, such as orchards, roadsides, yards, and lawns. It is sometimes found in almost pure communities, but oftener certain clovers, especially the sheep clover (*Trifolium repens*), and such ruderal grasses as *Paspalum setaceum* and *Panicum sanguinale*, are mingled with it. Timothy and orchard grass are common also. As the pastures become worn out, weeds become more abundant, and commonly thistles (*Cirsium* spp.), mulleins (*Verbascum* spp.), milkweeds (*Asclepias* spp.), etc. are scattered freely over such pastures. In lawns the English blue grass (*Poa compressa*) is frequent, and the dandelion (*Taraxacum officinale*), and the plantains (*Plantago* spp.) are the chief weeds.

2. **Pratenses. Meadow plants.** We may distinguish three kinds of cultivated meadows: a, the grass meadow, consisting of such grasses as *Phleum pratense, Agrostis vulgaris*, and *Poa pratensis*; b, the clover meadow, consisting of *Trifolium pratense, T. medium*, and *T. hybridum*. Often the grass and clover meadows are combined; c, the alfalfa meadow, consisting of *Medicago sativa*.

a. **Pratenses phleoides.** The timothy association of meadow grasses reaches its perfection in rich lowlands. Besides the grasses mentioned above, several others are sown, such as *Festuca elatior pratensis, Bromus inermis, Arrhenatherum avenaceum, Alopecurus pratensis*, and *Dactylis glomerata*. Clovers are also frequent, as are the usual meadow weeds, such as *Erigeron annuus, E. ramosus*, and *Onagra biennis*.

b. **Pratenses trifolioides.** The clover association occurs usually with some admixture of the preceding. The same weeds are present, and certain others, especially *Rudbeckia hirta* and *Achillaea Millefolium*, are abundant.

c. **Pratenses medicaginoides.** The alfalfa association is much less common than the others, the soil in general being too acid for the alfalfa. Besides *Medicago sativa,* certain weeds that are altogether unique in the region, occur only in alfalfa fields, notably *Crepis setosa, Centaurea solstitialis, Cichorium Intybus, Lolium Italicum,* and *Malva moschata.*

3. **Ruderales. Weeds of cultivated and waste grounds.** Weeds are susceptible of division into associations from many points of view. Thus they may be divided into lowland, midland, and upland weeds. The lowland weeds consist mainly of native plants such as *Bidens frondosa, Coreopsis involucrata, Helianthus tuberosus subcanescens, Ambrosia* spp., *Polygonum* spp., and *Xanthium* spp. The midland weeds, for the most part exotic, are mainly *Chenopodiaceae* and *Amarantaceae,* with many *Gramineae* and *Compositae.* The uplands and sands have the weedy grasses such as *Panicum sanguinale, Eragrostis* spp., *Setaria* spp., and *Cenchrus tribuloides* (rare). Weeds may be classified also according to the cultural conditions in which they grow. It has been seen that certain weeds accompany certain crops. The weeds of cornfields are not those of pastures and meadows. Those about houses and those about barns differ. Those along streets of the city are not those along country roads. A superficial, yet useful division is into weeds of pastures, meadows and lawns. These are suited to biennials and perennials, since their habitats remain unbroken for a few years at least. Weeds of grain and stubble fields. Such weeds are usually winter annuals, for only plants that can grow and mature with the grain can insure their seeds being sown with the grain in autumn. Weeds of gardens, and hoed and cultivated crops. Such are mainly annuals, as the crops in which they grow exist but for the season. Weeds along roads, streets, and railroads. Weeds about houses and barns. Weeds in waste unswarded fields, etc. But whatever principle be adopted, there are many species com-

mon to all ruderal associations. In the treatment that follows certain natural assemblages of weeds are described as associations, though these can have little permanence as such, since a plowing under, or a rotation of crops, may bring about a quite different assemblage of weeds on the same ground the following season.

a. **Ruderales cirsioides.** The thistle association of pastures and old fields consists of tall herbs with foliage distasteful to cattle, whether through spiny foliage as in the thistle (*Cirsium* spp.), the woolly covering of the leaves as in the mullein (*Verbascum Thapsus*), and the cudweeds (*Gnaphalium* spp.), the vile smell as in the hound's-tongue (*Cynoglossum officinale*), or some poisonous or bitter principle as in the scoke (*Phytolacca decandra*) and the Jimson weeds (*Datura* spp.). Plants of acrid milky juice are common, such as species of *Asclepias, Apocynum, Euphorbia,* and *Lactuca.* Ruderal grasses are frequent also, and these, too, are kinds that cattle avoid, while better herbage is obtainable.

b. **Ruderales erigerontoides.** The fleabane association of meadows consists largely of *Erigeron annuus, E. ramosus, Rudbeckia hirta, Onagra biennis, Achillaea Millefolium,* certain chesses (*Bromus* spp.), and docks and sorrel (*Rumex* spp.). The pasture weeds are frequent also, as are species of *Vernonia, Verbena,* and *Teucrium.*

c. **Ruderales bromoides.** The chess association of grainfields occurs also along roadsides, where it reaches its best development in the region. Little wheat is grown, but where such fields are found, *Bromus secalinus* and *Agrostemma Githago* are the characteristic weeds. With them occur certain speedwells (*Veronica* spp.), the shepherd's-purse (*Capsella Bursa-pastoris*), the red-root or gromwell (*Lithospermum ar-*

vense), and the rye (*Secale cereale*). In fields of rye the barley (*Hordeum sativum hexastichon*) is a common weed. The chesses about low places and along roads consist of *Bromus secalinus, B. mollis, B. racemosus,* and *B. tectorum.* The characteristic weed of stubblefields is *Erigeron Canadensis.*

d. **Ruderales helianthoides.** The sunflower association of weeds of low grounds reaches its full development in late summer and autumn. It is found in low waste grounds. In neglected cornfields, especially where the corn has been drowned by floods, this association is seen most clearly. It consists of smartweeds (*Polygonum* spp.), and a host of autumnal composites, such as species of *Helianthus, Ambrosia, Coreopsis, Bidens,* and *Xanthium.* Certain grasses, such as *Panicum proliferum, P. capillare,* and *P. Crus-galli,* and the nut-grasses (*Cyperus* spp.) are common.

e. **Ruderales pharbitidoides.** The morning glory association in cornfields consists of herbaceous lianas, such as *Pharbitis hispida, P. Nil, Polygonum scandens,* and *P. Convolvulus.* The tall maize plants furnish fit hosts for these twiners. Certain cucurbits, especially *Sicyos angulata,* occur also.

f. **Ruderales amarantoides.** The pigweed association is universal in gardens, corn and potato fields, and in unswarded waste grounds. It consists of the numerous species of *Amarantus; Chenopodium, Setaria, Eragrostis, Panicum,* and *Eleusine.* With these occur almost every weed of the region as well as many escapes from garden and field. This association flourishes best in rich well manured soil, but it is common even in the poorest grounds.

g. **Ruderales portulacoides.** The purslane association, like the preceding, prefers gardens and cornfields. It consists of prostrate, mostly succulent, plants, such as *Portulaca oleracea, P. neglecta, Euphorbia maculata, E. nutans,* and *Mollugo verticillata.*

h. **Ruderales setarioides.** The foxtail association consists of the weedy grasses. Its species occur in all other ruderal societies but often the grasses form a weedy sward consisting of *Panicum sanguinale, Paspalum setaceum, Eleusine Indica,* and the various species of *Setaria* and *Eragrostis.* Gardens and waste grounds support the pigweed association the first year, but by the second season these grasses often become established.

i. **Ruderales arctioides.** The burdock association occupies waste places, unkept yards, and waysides. It consists of large, coarse plants, such as *Arctium minus, Lactuca virosa, L. Scariola, L. Canadensis, L. Ludoviciana, Rumex crispus, R. obtusifolius, Abutilon Avicennae, Solanum nigrum, S. Carolinense,* and many minor weeds and escapes.

j. **Ruderales atriplicioides.** The orache association is found along streets and roadsides. Such weeds as *Atriplex hastatum, Chenopodium urbicum, C. anthelminticum, C. ambrosioides, Melilotus officinalis, M. alba, Polygonum* spp., *Marrubium vulgare, Leonurus Cardiaca, Lamium amplexicaule,* and *Sonchus asper, S. oleraceus,* and *S. arvensis,* are representative. Many of these seem not to occur in country districts. Some, such as *Polygonum littorale* and *Chenopodium ambrosioides,* prefer coal ashes and are frequent about cinder walks and railroad tracks.

k. **Ruderales plantaginoides.** The plantain association of low weeds occurs about houses, along paths, and in yards. Such plants as *Plantago Rugelii, P. major, Polygonum* *aviculare, P. erectum, P. littorale, Anthemis Cotula, Nepeta Cataria, Sida spinosa,* and various weedy grasses, are characteristic. Escapes are common, such as *Ornithogalum umbellatum, Asparagus officinale,* and *Linaria Linaria.*

l. **Ruderales malvoides.** The mallow association occurs principally in barnyards and old lanes. *Malva rotundifolia* grows in dense patches, but smartweeds (*Polygonum* spp.), sticktights (*Bidens* spp.), and *Panicum Crus-galli* are common also.

4. **Fugitivae. Escapes.** There is but one association of escapes that calls for notice. Usually these plants are scattered about in the various societies, but whatever their persistence, they appear always as strangers.

a. **Fugitivae glechomoides.** The ground gill association of creeping herbs is found in the neglected parts of old cemeteries, in old yards, and about houses in damp shady places. Such plants are *Glechoma hederacea, Lysimachia Nummularia,* and *Vinca minor.* The cypress spurge (*Euphorbia Cyparissias*) is frequent also in such places.

9. LITERATURE.

Blankinship, J. W. The plant formations of eastern Massachusetts. Rhodora **5**, 124-137, 1903.

Bray, W. L. The ecological relations of the vegetation of western Texas. Bot. Gaz. **32**, 99-123, 195-217, 262-291, 1901.

Clements, F. E. The development and structure of vegetation. Univ. of Neb., Bot. Surv. of Neb. **7**, 1904.

Coulter, S. M. An ecological comparison of some typical swamp areas. Mo. Bot. Gard., Report, **15**, 39-71, 1904.

Coville, F. V. Botany of the Death Valley expedition. U. S. Nat. Herb. Contr. **4**, 1893.

Cowles, H. C. The ecological relation of the vegetation in the sand dunes of Lake Michigan. Bot. Gaz. **27**, 94-117, 167-202, 281-308, 361-391, 1899.

Cowles, H. C. The physiographic ecology of Chicago and vicinity; a study of the origin, development and classification of plant societies. Bot. Gaz. **31**, 73-108, 145-182, 1901.

Daniels, F. P. Preliminary œcological study of the native and introduced plants of the vicinity of Columbia, Boone County, Missouri. Mo. Agr. Ex. Sta. Report, **1898**, 124-156, 1898.

Daniels, F. P. Ecology of the flora of Sturgis, Michigan, and vicinity. Mich. Acad. of Sci., Report **4**, 145-159, 1904.

Daniels, F. P. The flora of the vicinity of Manistee, Michigan. Mich. Acad. of Sci., Report **4**, 125-144, 1904.

Drude, Oskar. Die Florenreiche der Erde. Pet. Mitt., Ergänzungsheft **15**, No. 149, 1881-82.

Ganong, W. F. The vegetation of the Bay of Fundy salt and diked marshes; an ecological study. Bot. Gaz. **36**, 161-186, 280-302, 349-367, 429-455, 1903.

Harshberger, J. W. An ecologic study of the flora of mountainous North Carolina. Bot. Gaz. **36**, 241-258, 368-383, 1903.

Harshberger, J. W. An ecological study of the New Jersey strand flora. Proc. Acad. Nat. Sci. Phil., **1900**, 623-671, 1900.

Harshberger, J. W. A phyto-geographic sketch of extreme southeastern Pennsylvania. Bull. Torr. Bot. Club, **31**, 125-129, 1904.

Hill, E. J. Flora of the White Lake region, Michigan, and its ecological relations. Bot. Gaz. **29**, 419-436, 1900.

Humboldt, A. von et **Bonpland, A.** Essai sur la geographie des plantes, 1805.

Kearney, T. H. The plant covering of Ocracoke Island: a study in the ecology of the North Carolina strand vegetation. U. S. Nat. Herb. Contr., **5**, 261-320, 1900.

Kearney, T. H. Report on a botanical survey of the Dismal swamp region. U. S. Nat. Herb. Contr. **5**, 320-550, 1901.

Lewis, F. J. Geographical distribution of vegetation of the basins of the rivers Eden, Tees, Wear, and Tyne. Geogr. Jour. **23**, 313-331, 1904.

Livingston, B. E. The distribution of the upland plant societies of Kent county, Michigan. Bot. Gaz. **35**, 36-55, 1903.

Lloyd, F. E., and **Tracy, S. M.** The insular flora of Mississippi and Louisiana. Torrey Bot. Club, Bull. **28**, 61-101, 1901.

Macbride, T. H. The Alamogordo Desert. Science, N. S. **21**, 90-97, 1905.

MacMillan, Conway. The Metaspermae of the Minnesota valley. Minn. Geol. and Nat. Hist. Surv., Bot. Ser. **1**, 1892.

MacMillan, Conway. Observations on the distribution of plants along shore at Lake of the Woods. Minn. Bot. Studies **1**, 949-1023, 1897.

Merriam, C. H. Life zones and crop zones of the United States. Bull. U. S. Dept. Agr., Biol. Surv. **10**, 1898.

Merriam, C. H., and others. The Death Valley expedition. N. Am. Fauna, **7**, 1893.

Pammel, L. H. Preliminary notes on the flora of western Iowa, especially from the physiographical ecological standpoint. Ia. Acad. of Sci., Proc. **9**, 152-180, 1902.

Pammel, L. H. Some ecological notes on the vegetation of the Uintah Mts. Ia. Acad. of Sci. Proc. **10**, 57-68, 1903.

Pound, Roscoe, and **Clements, F. E.** Phytogeography of Nebraska. Univ. of Neb. Bot. Surv. **1**, 1900.

Pound, Roscoe, and **Clements, F. E.** The vegetation regions of the prairie province. Bot. Gaz. **25**, 381-394, 1898.

Reed, H. S. A survey of the Huron River Valley. I. The ecology of a glacial lake. Bot. Gaz. **34**, 125-139, 1902.

Schimper, A. F. W. Pflanzen-Geographie auf physiologischer Grundlage. 1898.

Shriner, F. A., and **Copeland, E. B.** Deforestation and creek flow about Monroe, Wisconsin. Bot. Gaz. **37**, 139-143, 1904.

Smith, W. G., and **Moss, C. E.** Geographical distribution of vegetation in Yorkshire. Geog. Journ. **21**, 375-401, 1903.

Smith, W. G., and **Rankin, W. M.** Geographical distribution of vegetation in Yorkshire. Geog. Journ. **22**, 149-178, 1903.

Snow, Laetitia M. Some notes on the ecology of the Delaware coast. Bot. Gaz. **34**, 284-306, 1902.

Warming, J. E. B. Lehrbuch der ökologischer Pflanzengeographie. 1896.

Weld, L. H. Botanical survey of the Huron River Valley, II. A peat bog and morainal lake. Bot. Gaz. **37**, 36-52, 1904.

Whitford, H. N. The genetic development of the forests of northern Michigan: a study in physiographic ecology. Bot. Gaz. **31**, 289-325, 1901.

PART II.

FLORA.

The aim of the following flora is to include every native, naturalized or adventive higher plant, which is known certainly to grow in Boone county. Practically the flora is complete only for the immediate vicinity of Columbia. Over nine-tenths of the whole number of plants listed occur within a radius of five miles of Columbia. The flora of the cliffs, bottoms and shores of the Missouri river is but imperfectly known, and no work whatever has been done in the more remote northern, eastern and southeastern portions of the county.

Nevertheless the list contains 1058 species belonging to 435 genera and 101 families. There can be no doubt but that when the whole county shall have been adequately explored, the number of species will considerably exceed that found in Jackson county, from which 1141 species are known. There are appended also 85 species reported by Tracy in the Flora of Missouri, but which have not been verified for this list, though many of them doubtless are to be found in Boone county.

No plant that has not passed through the author's hands has, with perhaps two exceptions, been admitted to the list. Of most of them specimens are to be found in the Boone County

Herbarium, and of the others, except in the case of very rare plants, the gathering of which would mean their extinction, and of some common weeds and escapes whose preservation has been hitherto neglected, dried, but unmounted material exists. All but five or six species have been gathered by the author and have been carefully studied in the field. Three or four sheets, inherited from a former generation, preserve species that have not been recently found.

The flora has been made to conform as closely as possible, both in nomenclature and in the sequence of orders, families and genera, to Engler and Prantl's Natürliche Pflanzenfamilien. Synonyms, however, have been freely given, and an attempt has been made to include all names used in Britton and Brown's Illustrated Flora of the Northern States and Canada; Britton's Manual of the Flora of the Northern States and Canada; Small's Flora of the Southeastern United States; Gray's Manual of the Botany of the Northern United States (6th ed.); Gray's Synoptical Flora of North America; Beal's Grasses of North America; and Underwood's Our Native Ferns and their Allies. In the present distracted state of botanical nomenclature it has been thought best to follow Engler and Prantl, at least as to genera, but in the numerous cases of species not given there, the nomenclature of Britton's Manual has been employed where possible. Only in a few instances has this method led to the use of names unfamiliar to American botanists. The most distressing example is, perhaps, that of *Mespilus* for *Crataegus*. Here two closely related genera have been compressed into one, the haws being united to the medlars. Similarly *Camptosorus* has been merged into *Scolopendrium*, and *Notholaena* into *Pellaea*. This procedure is the more noticeable in that certain American botanists exhibit a tendency to elevate every sub-genus, or section, to generic rank. Obviously it transcends the bounds of a local flora to settle vexed questions of nomenclature; it is believed, however, that since the synonyms are given, no serious inconvenience will follow from the method used, and on the whole the result is a terminology that mediates between the old and the new.

The most striking feature of the flora is the large number of grasses, legumes and composites and on the other hand the almost complete absence of *Coniferae, Orchidaceae, Ericaceae,* and *Gentianaceae*. The beech, too, is lacking, and the scarlet oak, *Quercus coccinea* Wang. There are 95 species of trees and arborescent plants, and 55 species of shrubs, undershrubs, and vines, thus making a total of 150 species of ligneous plants. There are 113 species of true grasses, and 156 species of composites. There are also 71 species of *Cyperaceae*, and 63 species of *Leguminosae*. The large number of species of these families indicates a large prairie element in the flora—an element larger than the facies of the vegetation seemingly warrants.

The economic importance of the native flora has not been considered. This flora numbers among its members many timber trees of the first importance, many plants valuable for their edible fruits and nuts, or for their medicinal properties, and many choice ornamental and flowering plants. Many species already verge upon extinction, and immediate steps should be taken for their preservation.

Subkingdom I. PTERIDOPHYTA. Fernlike plants.

Order 1. FILICALES. Ferns.

Family 1. POLYPODIACEAE R. Br. Polypody family.

1. WOODSIA R. Br.

1. **W. obtusa** (Spreng.) Torr.
On limestone rocks; frequent.
NOVA SCOTIA to BRITISH COLUMBIA; GEORGIA to ARIZONA.

2. CYSTOPTERIS Bernh. [*FILIX* Adans.].

2. **C. fragilis** (L.) Bernh. [*F. fragilis* (L.) Underw.]. FRAGILE FERN.
Very common in rocky oak forests, and on ledges and cliffs.
NEWFOUNDLAND to ALASKA; GEORGIA to CALIFORNIA: almost cosmopolitan.

3. **C. bulbifera** (L.) Bernh. [*F. bulbifera* (L.) Underw.]. BULBET FERN.
On moist banks and wet rocks; common.
QUEBEC to WISCONSIN; ALABAMA to ARKANSAS.

3. ONOCLEA L.

4. **O. sensibilis** L. SENSITIVE FERN.
Rare and local in swampy places.
NEWFOUNDLAND to WYOMING and the GULF OF MEXICO.

4. NEPHRODIUM Rich. [*DRYOPTERIS* Adans.: *ASPIDIUM* Swartz]. SHIELD FERN.

5. **N. marginale** (L.) Michx. [*D. marginalis* (L.) Gray: *A. marginale* (L.) Swartz].
Moist banks of a stream at the Pinnacles.
PRINCE EDWARD ISLAND to MINNESOTA; ALABAMA and ARKANSAS.

5. POLYSTICHUM Rich. [*DRYOPTERIS* Adans.: *ASPIDIUM* Swartz].

6. **P. acrostichoides** (Michx.) Kuntze [*D. acrostichoides* (Michx.) Kuntze: *A. acrostichoides* (Michx.) Swartz]. CHRISTMAS FERN.

In oak forests and thickets; common. Some remarkable fronds, gathered in the forest south of Grindstone creek, July, 1903, have all the pinnae fertile.

NOVA SCOTIA to KANSAS and FLORIDA.

6. SCOLOPENDRIUM Smith [*CAMPTOSORUS* Link]. HARTSTONGUE.

7. **S. rhizophyllum** (L.) Hook. [*C. rhizophyllus* (L.) Link]. WALKING FERN.

Moist limestone rocks and cliffs; densely gregarious.

QUEBEC and MICHIGAN to KANSAS and GEORGIA.

7. ASPLENIUM L. SPLEENWORT.

8. **A. platyneuron** (L.) Oakes [*A. ebeneum* (L.) Ait.]. EBONY FERN.

Common in wild places in rocky ground.

MAINE to COLORADO; FLORIDA to TEXAS.

9. **A. pycnocarpon** Spreng. [*A. angustifolium* Michx., not Jacq.] NARROW-LEAVED SPLEENWORT.

Rich ravines in shady or half-open places.

QUEBEC to WISCONSIN; GEORGIA to ALABAMA; MISSOURI.

8. PELLAEA Link [*NOTHOLAENA* R. Br.]. CLIFF-BRAKE.

10. **P. atropurpurea** (L.) Link. COMMON CLIFF-BRAKE.

Dry cliffs and rocks; common.

ONTARIO to BRITISH COLUMBIA; GEORGIA to ARIZONA.

11. **P. dealbata** (Pursh) Daniels [*N. dealbata* (Pursh) Kuntze: *N. nivea dealbata* (Pursh) Dav.]. SNOWY CLIFF-BRAKE.

Cliffs of the Missouri near Rocheport; exceedingly rare.

MISSOURI and NEBRASKA to TEXAS and ARIZONA.

9. CHEILANTHES Swartz. LIP-FERN.

12. **C. lanuginosa** Nutt. [*C. gracilis* (Fée) Mett.; *C. Féei* Moore]. WOOLLY LIP-FERN.

Dry cliffs of Hinkson creek and the Missouri; also at the Pinnacles; local.

MINNESOTA to BRITISH COLUMBIA; WEST VIRGINIA to ARIZONA.

10. ADIANTUM L. MAIDEN-HAIR FERN.

13. **A. pedatum** L. COMMON MAIDEN-HAIR.

Oak forests; frequent.

NOVA SCOTIA to ALASKA; GEORGIA to CALIFORNIA: EASTERN ASIA.

Order 2. OPHIOGLOSSALES.

Family 2. OPHIOGLOSSACEAE Presl. Adder's tongue family.

11. OPHIOGLOSSUM L. ADDER'S TONGUE.

14. **O. vulgatum** L. COMMON ADDER'S TONGUE.

Very rare in thickets south of the University golf-links. The only specimen in the herbarium has the frond mucronate at the apex as in *O. Engelmannii* Prantl, but the areolae and veinlets resemble closely those of plants gathered at Manistee, Michigan, which belong unquestionably to *O. vulgatum* L.

NORTH AMERICA: EUROPE and ASIA.

12. BOTRYCHIUM Swartz. MOONWORT.

15. **B. Virginianum** (L.) Swartz. VIRGINIA GRAPE-FERN.

Rich oak woods; frequent.

NOVA SCOTIA to BRITISH COLUMBIA; FLORIDA to CALIFORNIA: EUROPE and ASIA.

Order 3. EQUISETALES.

Family 3. EQUISETACEAE Michx. Horsetail family.

13. EQUISETUM L. Horsetail.

16. **E. arvense** L. Common horsetail.
Sandy banks; common.
North America: Europe and Asia.

17. **E. pratense** Ehrh. Thicket horsetail.
Swales and low thickets.
Nova Scotia to Alaska; New Jersey to Colorado: Europe and Asia.

18. **E. hiemale** L. Scouring rush.
Low sandy or clay banks; common.
Northern Hemisphere.

19. **E. variegatum** Schleich. Small scouring rush.
Limose flats of the Missouri near Rocheport. No fruiting culms seen.
Greenland and Labrador to the Northwest Territory; New York to Missouri and Nevada: Europe and Asia.

Subkingdom II. SPERMATOPHYTA. Seed plants.

Class 1. GYMNOSPERMAE.

Order 4. CONIFERALES. Conifers.

Family 4. PINACEAE Lindl. Pine family.

14. JUNIPERUS L. [*SABINA* Haller]. Juniper.

20. **J. Virginiana** L. [*S. Virginiana* (L.) Antoine]. Red cedar.
Common on the summits of cliffs, but also frequent along streams and on hillsides.
Southern British America and throughout the United States; Mexico and the West Indies.

Class 2. ANGIOSPERMAE.

Subclass I. MONOCOTYLEDONEAE.

Order 5. PANDANALES.

Family 5. TYPHACEAE J. St. Hil. Cat-tail family.

15. TYPHA L. Cat-tail.

21. **T. latifolia L.** Common cat-tail.
Swamps, swales, and edges of ponds and lakes; common.
North America: Europe and Asia.

Order 6. HELOBIALES.

Family 6. POTAMOGETONACEAE Aschers. Pondweed family.

16. POTAMOGETON L. Pondweed.

22. **P. fluitans** Roth. [*P. Lonchites* Tuckerm.].
Ponds; local.
New Brunswick to Florida and west to the Pacific.

23. **P. hybridus** Michx. [*P. diversifolius* Raf.].
Ponds; frequent.
Maine to Nebraska; Florida to Texas.

24. **P. pusillus** L.
Ponds; scarce.
New Brunswick and North Carolina across the continent.

25. **P. Hillii** Morong.
Ponds; common.
New York to Michigan; Missouri.

Family 7. NAIADACEAE Lindl. Water nymph family.

17. NAIAS L. Water nymph.

26. **N. flexilis** Rostk. & Schmidt.
More's lake.
North America: Europe.

Family 8. ALISMACEAE DC. Water plantain family.

18. ALISMA L. Water plantain.

27. **A. Plantago** L. [*A. Plantago-aquatica* Auct.: *A. subcordatum* Raf.].
About ponds and streams, and in swales and swamps.
North America: Europe and Asia.

19. LOPHOTOCARPUS Durand [*LOPHIOCARPUS* Miq.: *SAGITTARIA* L.].

28. **L. calycinus** (Engelm.) J. G. Smith [*Lophiocarpus calycinus* (Engelm.) Micheli: *S. calycinus* Engelm.].
Muddy margins of ponds, often in dense masses.
Almost transcontinental.

20. SAGITTARIA L. Arrowhead.

29. **S. variabilis** Engelm. [*S. latifolia* Willd.]. Common arrowhead.
Muddy margins of ponds and streams; very variable in foliage, some forms connecting closely with the preceding.
Transcontinental.

30. **S. platyphylla** (Engelm.) J. G. Smith.
Stagnant waters near the covered bridge over Roche Perche creek.
Alabama to Missouri and Texas.

Family 9. HYDROCHARITACEAE Aschers. Frog's-bit family.

21. ELODEA Michx. [*PHILOTRIA* Raf.: *UDORA* Nutt.]. Water thyme.

31. **E. minor** Engelm. [*P. minor* (Engelm.) Small: *U. Canadensis minor* Engelm.]. Waterweed.
In ponds; local.
Minnesota and Missouri to Tennessee and Arkansas.

Order 7. GLUMIFLORALES.

Family 10. GRAMINEAE Juss. Grass family.

22. ZEA L. MAIZE.

32. **Z. Mays** L. INDIAN CORN.

The staple farm crop of the vicinity; the plants often persistent in fields and waste places.

Scarcely known in the wild state, but of neotropic origin; now cultivated in all warm lands.

23. TRIPSACUM L. GAMA GRASS.

33. **T. dactyloides** L.

A single patch by the Wabash R. R. just north of Columbia.

RHODE ISLAND to KANSAS; FLORIDA to TEXAS, MEXICO and SOUTH AMERICA.

24. ANDROPOGON L. [*SCHIZACHYRIUM* Nees.: *SORGHUM* Pers.: *SORGHASTRUM* Nash: *CHRYSOPOGON* Trin.]. BEARD GRASS.

34. **A. scoparius** Michx. [*Schizachyrium scoparium* (Michx.) Nash]. BROOM GRASS.

Sterile red clay hills and dry roadsides; infrequent.

NEW BRUNSWICK to ALBERTA; FLORIDA to TEXAS.

35. **A. furcatus** Muhl. TURKEY FOOT.

Cliffs, dry banks, open thickets, and all wild open lands.

MAINE to MANITOBA; FLORIDA to TEXAS.

36. **A. Hallii** Hack. HALL'S BEARD GRASS.

Roadsides; scarce.

MISSOURI and MONTANA to MEXICO.

37. **A. Halepensis** (L.) Brot. [*Sorghum Halepense* (L.) Pers.]. JOHNSON GRASS.

Persisting in meadows; common along the railroad at Rocheport.

SOUTHERN EUROPE and ASIA, thence introduced into all warm lands.

38. **A. Sorghum vulgaris** (Pers.) Hack. [*A. Halepensis sativus* Hack.: *Sorghum vulgare* Pers.]. SORGHUM.
Persisting in fields after cultivation.
AFRICA and ASIA; cultivated in all warm lands.

39. **A. avenaceus** Michx. [*Sorghastrum avenaceum* (Michx.) Nash: *Sorghastrum nutans* (L.) Nash: *C. avenaceus* (Michx.) Benth.: *C. nutans* (L.) Benth.]. INDIAN GRASS.
Dry fields and open thickets; frequent.
ONTARIO to MANITOBA; FLORIDA to ARIZONA.

25. PASPALUM L.

40. **P. setaceum** Michx.
Fields, yards and roadsides; common.
NEW HAMPSHIRE, MICHIGAN and FLORIDA to MISSOURI and TEXAS.

26. PANICUM L. [*SYNTHERISMA* Walt.: *ECHINOCHLOA* Beauv.]. PANIC GRASS.

41. **P. filiforme** L. [*S. filiformis* (L.) Nash]. WIRE GRASS.
Red clay hill south across Hinkson creek.
NEW HAMPSHIRE to SOUTH CAROLINA and the INDIAN TERRITORY.

42. **P. sanguinale** L. [*S. sanguinalis* (L.) Nash]. CRAB GRASS.
Cultivated fields, gardens and waste places.
EUROPE, thence throughout the world.

43. **P. Crus-galli** L. [*E. Crus-galli* (L.) Beauv.]. BARNYARD GRASS.
Yards, fields, waste places, and about ditches and puddles; very variable in the length of the awns and the color of the panicle, as well as in the hairiness of the sheaths.
EUROPE, thence throughout the world.

44. **P. capillare** L. OLD WITCH GRASS.
A common autumnal weed in fields and waste lands.
NOVA SCOTIA to BRITISH COLUMBIA; FLORIDA to CALIFORNIA.

45. **P. Gattingeri** Nash [*P. capillare campestre* Gatt.: *P. capillare Gattingeri* Nash]. GATTINGER'S WITCH GRASS.

Old fields and open thickets, usually in poor soil; occasional in moist places and swamps.

CONNECTICUT to NORTH CAROLINA, west to MISSOURI.

46. **P. flexile** (Gatt.) Scribn. [*P. capillare flexile* Gatt.]. SMALL WITCH GRASS.

Knolls in thickets, waysides and waste places.

PENNSYLVANIA to MICHIGAN and MISSOURI.

47. **P. virgatum** L. SWITCH GRASS.

Summit of Hinkson cliffs south.

MAINE to ONTARIO and MINNESOTA; FLORIDA to TEXAS.

48. **P. proliferum** Lam.

Along streams and in wet places; also as a weed in all situations. It has two chief forms, the one upright with an ample terminal panicle, the other [*P. proliferum geniculatum* (Muhl.) Vasey] decumbent, rooting at the nodes, the lateral panicles numerous and short—the more frequent form in waste places.

MAINE to FLORIDA and west to MICHIGAN and TEXAS.

49. **P. perlongum** Nash.

Red clay barrens, where it is common and characteristic.

ILLINOIS to SOUTH DAKOTA; MISSOURI to the INDIAN TERRITORY.

50. **P. Enslini** Trin. [*P. linearifolium* Scribn.].

Hilltops and knolls, sometimes forming the chief part of the sward.

NEW YORK to the INDIAN TERRITORY.

51. **P. depauperatum** Muhl.

Dry places in open thickets and on knolls.

MAINE to MINNESOTA; FLORIDA to TEXAS.

52. **P. Columbianum** Scribn.

Open woods, thickets, and semi-wild fields.

MASSACHUSETTS to MICHIGAN and MISSOURI.

53. **P. implicatum** Scribn.

Dry thickets and hills; common: well marked by its papillose-hirsute sheaths and leaves, but varying into the various species of this difficult group.

MAINE to MISSOURI.

54. **P. dichotomum** L.

Woodlands, thickets, wild fields and pastures, chiefly in dry soil: exceedingly variable.

CONNECTICUT to TEXAS.

54 a. **P. dichotomum fasciculatum** Wats.

The common form in pastures and fields, the fasciculate autumn condition of which is well known.

Range of the type.

54 b. **P. dichotomum commune** Wats.

The form usual in open thickets, and when growing in fields with rich soil.

Range of the type.

54 c. **P. dichotomum gracile** Wats.

The strictly sylvan form with slender culms and long pedunculate panicles.

Range of the type.

54 d. **P. dichotomum villosum** Vasey.

Dry hills: often quite distinct, but sometimes verging into the other pubescent species of the group.

Range of the type.

55. **P. nitidum** Lam.

Dry thickets: a pilose form.

MASSACHUSETTS to MICHIGAN; GEORGIA to MISSOURI.

56. **P. lanuginosum** Ell.

Dry thickets and the bluffs of streams.

NEW JERSEY and FLORIDA to MISSOURI.

57. **P. commutatum** Schultes.

Wild dry hills, especially in thickets: a form on Pansy Hill and on red clay barrens is very short, with narrower leaves and smaller panicles, appearing often quite distinct, and connecting the species closely with *P. Columbianum* Scribn.

NEW YORK to FLORIDA and TEXAS.

58. **P. Porterianum** Nash [*P. latifolium* Walt.: *P. Walteri* Poir.].

Moist thickets and margins of ponds, where shaded: some specimens connect closely with the next species.

MAINE and MICHIGAN to FLORIDA and TEXAS.

59. **P. pubifolium** Nash.

Oak woods along Grindstone creek.

NEW YORK to MISSISSIPPI and MISSOURI.

60. **P. clandestinum** L.

Common in low thickets and on stream banks: some plants with almost glabrous sheaths, only the upper being sparingly papillose-hispid, might perhaps be referred to *P. macrocarpum* Le Conte, and still other forms connect with *P. Porterianum* Nash.

QUEBEC to GEORGIA and TEXAS.

27. **SETARIA** Beauv. [*CHAETOCHLOA* Scribn.: *IXOPHORUS* Schlecht.: *CHAMAERAPHIS* R. Br.]. FOXTAIL.

61. **S. glauca** (L.) Beauv. [*Chaetochloa glauca* (L.) Scribn.: *Ixophorus glaucus* (L.) Nash: *Chamaeraphis glauca* (L.) Kuntze]. YELLOW FOXTAIL.

Very common in cultivated and waste grounds.

EUROPE, thence to all but arctic lands.

62. **S. viridis** (L.) Beauv. [*Chaetochloa viridis* (L.) Scribn.: *I. viridis* (L.) Nash: *Chamaeraphis viridis* (L.) Porter]. GREEN FOXTAIL.

Common in cultivated and waste lands.

EUROPE, thence to all but arctic lands.

63. **S. Italica** (L.) Beauv. [*Chaetochloa Italica* (L.) Scribn.: *I. Italicus* (L.) Nash: *Chamaeraphis Italica* (L.) Kuntze]. ITALIAN MILLET.

Escaped into waste places from cultivation.

EAST INDIES, thence to most other lands.

64. **S. verticillata** (L.) Beauv. [*Chaetochloa verticillata* (L.) Scribn.: *I. verticillatus* (L.) Nash: *Chamaeraphis verticillata* (L.) Porter]. ROUGH FOXTAIL.

Rare in waste places.

EUROPE, thence cosmopolitan.

28. CENCHRUS L. BUR GRASS.

65. **C. tribuloides** L. SAND BUR.

Rare along the Wabash R. R.; also in the sandy flats of Grindstone creek.

NEW ENGLAND to CALIFORNIA: also in many tropical lands.

29. LEERSIA Swartz [*HOMALOCENCHRUS* Mieg.].

66. **L. Virginica** Willd. [*H. Virginicus* (Willd.) Britton]. WHITE GRASS.

Alluvial woods and wet places; common.

MAINE to NORTH DAKOTA; FLORIDA to TEXAS.

67. **L. oryzoides** (L.) Swartz [*H. oryzoides* (L.) Mieg.]. RICE CUT-GRASS.

In streams and wet swales.

NOVA SCOTIA to WASHINGTON; FLORIDA to CALIFORNIA; SOUTH AMERICA: EUROPE and ASIA.

30. ARISTIDA L. TRIPLE-AWNED GRASS.

68. **A. basiramea** Engelm.

Red clay hill south of Columbia; scarce.

MANITOBA to ILLINOIS; VIRGINIA to the INDIAN TERRITORY.

69. **A. oligantha** Michx. POVERTY GRASS.

Open sterile places and dry roadsides; common.

NEW JERSEY and MISSISSIPPI to NEBRASKA and TEXAS.

31. MUHLENBERGIA (MUEHLENBERGIA) Schreb. DROPSEED GRASS.

70. **M. sobolifera** (Muhl.) Trin. COMMON DROPSEED.

Rocky woods and waysides; common.

NEW ENGLAND and MINNESOTA to VIRGINIA and TEXAS.

71. **M. Mexicana** (L.) Trin. MEXICAN DROPSEED.

Borders of swales and in moist ravines.

NEW ENGLAND and NORTH CAROLINA to SOUTH DAKOTA, INDIAN TERRITORY and MEXICO.

72. **M. racemosa** (Michx.) B. S. P. [*M. glomerata* (Willd.) Trin.]. WILD TIMOTHY.
Low grounds and wet meadows.
NEWFOUNDLAND and NEW JERSEY to BRITISH COLUMBIA and NEVADA.

73. **M. sylvatica** Torr. WOOD DROPSEED.
Rich woods; frequent.
NEW BRUNSWICK and NORTH CAROLINA to the ROCKY MOUNTAINS.

74. **M. tenuiflora** (Willd.) B. S. P. [*M. Willdenovii* Trin.]. SLENDER DROPSEED.
Rare in rich woods.
MASSACHUSETTS to ONTARIO and MINNESOTA; ALABAMA to TEXAS.

75. **M. diffusa** Schreb. [*M. Schreberi* Gmel.]. NIMBLE WILL.
Common in waste places; also in woods.
MAINE and FLORIDA to MINNESOTA and NEW MEXICO.

32. BRACHYELYTRUM Beauv.

76. **B. aristatum** (Pers.) Beauv. [*B. erectum* (Schreb.) Beauv.].
Rich woods, where it is the most characteristic grass.
NEWFOUNDLAND and MINNESOTA to ALABAMA and KANSAS.

33. PHLEUM L. HERD GRASS.

77. **P. pratense** L. TIMOTHY.
Meadows, pastures and fields.
EUROPE and ASIA, thence to NORTH AMERICA.

34. ALOPECURUS L. FOXTAIL.

78. **A. pratensis** L. MEADOW FOXTAIL.
Meadows, and occasionally in waste places.
EUROPE, AFRICA and ASIA, thence to NORTH AMERICA.

79. **A. geniculatus** L. MARSH FOXTAIL.
A weed in the University Horticultural grounds.
OLD WORLD, thence to NORTH AMERICA.

79 a. **A. geniculatus fulvus** (J. E. Smith) Scribn. [*A. geniculatus aristulatus* (Michx.) Torr.].

Muddy shores and ditches; the typical limose grass.

NEWFOUNDLAND to BRITISH COLUMBIA; FLORIDA to CALIFORNIA.

35. SPOROBOLUS R. Br. RUSH GRASS.

80. **S. vaginaeflorus** (Torr.) Wood [*S. minor* Vasey].

Common along paths and roadsides.

MASSACHUSETTS to TEXAS.

81. **S. cuspidatus** (Torr.) Wood [*S. brevifolius* (Nutt.) Scribn.].

Open thickets south of the waterworks dam.

NORTHWEST TERRITORY and MANITOBA to MISSOURI and KANSAS.

36. CINNA L. WOOD REED GRASS.

82. **C. arundinacea** L.

Rare in wooded deep ravines.

NEWFOUNDLAND and the NORTHWEST TERRITORY to NORTH CAROLINA and TEXAS.

37. AGROSTIS L. BENT GRASS.

83. **A. alba** L. WHITE BENT GRASS.

Low flat meadows and along streams.

EUROPE, thence throughout NORTH AMERICA.

84. **A. vulgaris** With. [*A. alba vulgaris* (With.) Thurber]. RED TOP.

Meadows and upland pastures, but also in low flats: too near the preceding, with which it is now more usually united.

EUROPE, thence throughout all temperate regions.

85. **A. perennans** (Walt.) Tuckerm. THIN GRASS.

Oak woods in rich soil.

QUEBEC to WISCONSIN; NORTH CAROLINA to KANSAS and TEXAS.

86. **A. hyemalis** (Walt.) B. S. P. [*A. scabra* Willd.]. HAIR GRASS.

Dry woods and thickets, but occasional in low grounds.

NORTH AMERICA and SIBERIA.

38. AVENA L. OAT.

87. **A. sativa** L. COMMON OATS.

A commonly cultivated grain, escaping occasionally into waste places.

OLD WORLD, thence to the NEW.

39. ARRHENATHERUM Beauv. OAT GRASS.

88. **A. avenaceum** Beauv. [*A. elatius* (L.) Beauv.].

Meadows and along streets.

EUROPE, thence to NORTH AMERICA.

40. DANTHONIA DC. WILD OAT GRASS.

89. **D. spicata (L.)** Beauv.

Sterile hills, where it is often the prevailing grass.

NEWFOUNDLAND to NORTH DAKOTA; NORTH CAROLINA to TEXAS.

41. SPARTINA Schreb. MARSH GRASS.

90. **S. cynosuroides** (L.) Willd. FRESHWATER CORD GRASS.

Rare along Hinkson creek.

NOVA SCOTIA to ASSINIBOIA; NEW JERSEY to TEXAS, OREGON and CALIFORNIA.

42. SCHEDONNARDUS Steud.

91. **S. Texanus** Steud. [*S. paniculatus* (Nutt.) Trelease].

Along the railroad at Rocheport.

ILLINOIS to ASSINIBOIA; MISSOURI to TEXAS and NEW MEXICO.

43. BOUTELOUA Lag. [*ATHEROPOGON* Muhl.]. MESQUITE GRASS.

92. **B. racemosa** Lag. [*B. curtipendula* (Michx.) Torr.: *A. curtipendulus* (Michx.) Fourn.]. TALL MESQUITE.

Dry open hills and summits of cliffs.

ONTARIO to MANITOBA; GEORGIA to ARIZONA; MEXICO: SOUTH AMERICA.

44. **ELEUSINE** Gaertn. CRAB GRASS.

93. **E. Indica** (L.) Gaertn. WIRE GRASS.
Yards and waste places, bordering usually all paths.
Tropics of the OLD WORLD, thence as a weed to all warm lands.

45. **TRIODIA** R. Br. [*SIEGLINGIA* Bernh.: *TRICUSPIS* Beauv.: *TRIDENS* R. & S.].

94. **T. cuprea** Jacq. [*Triodia seslerioides* (Michx.) Benth.: *S. seslerioides* (Michx.) Scribn.: *Tricuspis seslerioides* (Michx.) Torr.: *Tridens seslerioides* (Michx.) Nash]. TALL RED TOP.
Fields and hilltops; abundant.
MASSACHUSETTS and FLORIDA to KANSAS and TEXAS.

46. **ERAGROSTIS** Host [*NEERAGROSTIS* Bush].

95. **E. capillaris** (L.) Nees.
Dry places; uncommon.
NEW HAMPSHIRE to TEXAS.

96. **E. Frankii** Steud.
Abundant along roadsides and in fields.
CONNECTICUT to MINNESOTA and south to LOUISIANA.

97. **E. pilosa** (L.) Beauv.
Yards and roadsides; frequent.
EUROPE to AUSTRALIA, thence to NORTH AMERICA.

98. **E. Purshii** Schrad.
Common in yards, fields, roadsides and waste places.
ONTARIO and throughout the UNITED STATES.

99. **E. major** Host. SKUNK GRASS.
Abundant in cultivated and waste grounds: smaller forms are referable perhaps to *E. minor* Host.
EUROPE, thence throughout NORTH AMERICA.

100. **E. pectinacea** (Michx.) Nees.
A very common autumnal weed in fields.
MASSACHUSETTS to TEXAS.

100a. **E. pectinacea spectabilis** Gray.

The larger and more glabrous form.

Range of the type.

101. **E. trichodes** (Nutt.) Nash [*E. tenuis* Gray].

Dry light soil; frequent.

OHIO to NEW MEXICO (NEW ENGLAND according to Dr. Beal).

102. **E. hypnoides** (Lam.) B. S. P. [*E. reptans* (Michx.) Nees: *N. hypnoides* (Lam.) Bush].

Rare along the muddy shores of the waterworks dam; common along the Missouri.

VERMONT to OREGON south into the tropics.

47. EATONIA Raf.

103. **E. obtusata** (Michx.) Gray.

Dry soil; infrequent.

MASSACHUSETTS to ASSINIBOIA and OREGON; FLORIDA to ARIZONA.

104. **E. Pennsylvanica** (DC.) Gray.

Common along streams: there occurs in woods a slender form closely simulating *E. nitida* (Spreng.) Nash.

NEW BRUNSWICK to BRITISH COLUMBIA; GEORGIA to TEXAS.

104 a. **E. Pennsylvanica major** Torr.

Rich grounds.

Range of the type.

48. KOELERIA Pers.

105. **K. cristata** (L.) Pers.

One plant on the summit of a rocky ledge at the northwest corner of the waterworks dam, June 1903.

ONTARIO to BRITISH COLUMBIA; PENNSYLVANIA to CALIFORNIA: EUROPE and ASIA.

49. MELICA L. MELIC GRASS.

106. **M. mutica** Walt.

Moist rocky ledges in shade; uncommon.

PENNSYLVANIA to WISCONSIN; FLORIDA to TEXAS and COLORADO.

50. DIARRHENA Raf. [*KORYCARPUS* Zea].

107. **D. Americana** Beauv. [*K. diandrus* (Michx.) Kuntze].
Rich shady banks and alluvial woods; frequent.
OHIO and MICHIGAN to KANSAS; GEORGIA to the INDIAN TERRITORY.

51. UNIOLA L. SPIKE GRASS.

108. **U. latifolia** Michx.
Common on rich shady banks and hillsides.
PENNSYLVANIA to KANSAS; FLORIDA to NEW MEXICO.

52. DACTYLIS L. ORCHARD GRASS.

109. **D. glomerata** L.
Meadows and fields; common.
OLD WORLD, thence to the NEW.

53. POA L. MEADOW GRASS.

110. **P. annua** L. LOW SPEAR GRASS.
Lawns and streets; becoming common.
EUROPE and ASIA, thence throughout NORTH AMERICA.

111. **P. pratensis** L. KENTUCKY BLUE GRASS. JUNE GRASS.
Fields and all open not wholly wild situations, forming the usual sward of permanent meadows and pastures; only occasional in woods.
Temperate zones of both hemispheres.

112. **P. Wolfii** Scribn.
Rich wooded hillsides; rare.
ILLINOIS to TENNESSEE and KANSAS.

113. **P. alsodes** Gray. GROVE MEADOW GRASS.
Creek beds in shady glens; rare.
NOVA SCOTIA to MINNESOTA; NORTH CAROLINA to MISSOURI.

114. **P. sylvestris** Gray. SYLVAN SPEAR GRASS.
Rich rocky woods; infrequent.
NEW YORK to WISCONSIN and NEBRASKA; NORTH CAROLINA to LOUISIANA and KANSAS.

115. **P. compressa** L. ENGLISH BLUE GRASS.
Lawns and roadsides; becoming frequent,
EUROPE and ASIA, thence to NORTH AMERICA.

116. **P. Chapmaniana** Scribn. [*P. cristata* Chapm.].
Roadsides.
KENTUCKY and TENNESSEE to MISSOURI; GEORGIA and FLORIDA to MISSISSIPPI.

54. GLYCERIA R. Br. [*PANICULARIA* Fabr.]. MANNA GRASS.

117. **G. fluitans** (L.) R. Br. [*P. fluitans* (L.) Kuntze].
Shallow water in ponds and ditches; uncommon.
NEWFOUNDLAND to BRITISH COLUMBIA; NORTH CAROLINA to CALIFORNIA: EUROPE, ASIA, AFRICA and AUSTRALIA.

118. **G. nervata** (Willd.) Trin. [*P. nervata* (Willd.) Kuntze]. FOWL MEADOW GRASS.
Borders of streams and in wet meadows; common: a form with very small spikelets is frequent.
NEWFOUNDLAND to BRITISH COLUMBIA, south to FLORIDA and MEXICO.

55. FESTUCA L. FESCUE GRASS

119. **F. ovina duriuscula** (L.) Hack. SHEEP'S FESCUE.
Meadows and fields of the University farm.
EUROPE, thence to NORTH AMERICA.

120. **F. octoflora** Walt. [*F. tenella* Willd.]. SMALL FESCUE.
Dry bluffs north of Grindstone creek; rare.
QUEBEC to BRITISH COLUMBIA; FLORIDA to CALIFORNIA.

121. **F. elatior** L. TALL FESCUE.
Low roadsides and half-wild meadows; common.
EUROPE, thence to NORTH AMERICA.

121 a. **F. elatior pratensis** (Huds.) Gray. MEADOW FESCUE.
Meadows and roadsides: a cultivated and more mesophytic form.
Range of the type.

122. **F. nutans** Willd. NODDING FESCUE.
Wooded rocky hillsides; frequent.
NOVA SCOTIA to NEBRASKA; FLORIDA to TEXAS.

123. **F. Shortii** Kunth. [*F. nutans Shortii* (Kunth.) Beal: *F. obtusa* Spreng.].
Rocky banks and hillsides; scarce.
PENNSYLVANIA and GEORGIA to MINNESOTA and TEXAS.

56. BROMUS L. BROME GRASS.

124. **B. inermis** Leyss. HUNGARIAN BROME GRASS.
Along a creek in the University farm, escaped from cultivation.
EUROPE, thence to EASTERN NORTH AMERICA.

125. **B. tectorum** L. DOWNY CHEAT.
Roadsides and lanes; scarce.
EUROPE, thence to NORTH AMERICA.

126. **B. ciliatus** L. WOOD CHESS.
Woods and shaded banks.
NEWFOUNDLAND to BRITISH COLUMBIA; FLORIDA to CALIFORNIA.

127. **B. purgans** L. [*B. ciliatus purgans* (L.) Gray].
Rocky banks of streams and wooded cliffs and ledges.
Throughout SOUTHERN CANADA and the UNITED STATES.

128. **B. secalinus** L. CHESS. CHEAT.
Grainfields and waste places.
EUROPE, thence wherever winter wheat is grown.

129. **B. mollis** L. [*B. hordeaceus* L.]. SOFT CHESS.
Roadsides and waste places; very common.
EUROPE, thence to the UNITED STATES.

130. **B. racemosus** L. UPRIGHT CHESS.
Frequent in low waste grounds.
EUROPE and ASIA, thence to NORTH AMERICA.

57. LOLIUM L. DARNEL.

131. **L. perenne** L. DARNEL.
Meadows and streets; uncommon.
EUROPE and ASIA, thence to NORTH AMERICA.

132. **L. Italicum** A. Br. ITALIAN RYE GRASS.
Alfalfa fields.
EUROPE, thence to the UNITED STATES.

58. AGROPYRON Gaertn. WHEAT GRASS.

133. **A. repens** (L.) Beauv. COUCH, QUITCH, QUICK, or QUACK GRASS.
Waste places and fields; still uncommon.
EUROPE and ASIA, thence to NORTH AMERICA.

134. **A. spicatum** (Pursh) Scribn. & Sm. PRAIRIE WHEAT GRASS.
Summit of a ledge at the northwest corner of the waterworks dam, the only known station.
MICHIGAN and MANITOBA to OREGON; MISSOURI to TEXAS.

59. SECALE L. RYE.

135. **S. cereale** L. COMMON RYE.
Frequent in waste places.
OLD WORLD, thence to the NEW.

60. TRITICUM L. WHEAT.

136. **T. sativum vulgare** (Vill.) Hack. [*T. vulgare* Vill.]. WINTER WHEAT.
Occasionally adventitious.
OLD WORLD, thence to the NEW.

61. HORDEUM L. BARLEY.

137. **H. sativum hexastichon** (L.) Hack. SIX-ROWED BARLEY.
Rarely adventitious, but common as a weed in oatfields.
OLD WORLD, thence to the NEW.

138. **H. nodosum** L. [*H. pratense* Huds.].
Roadsides, especially in hard clay; common.
MICHIGAN to BRITISH COLUMBIA and ALASKA; TEXAS to CALIFORNIA: EUROPE and ASIA.

139. **H. jubatum** L. SQUIRREL-TAIL GRASS.
Rare in waste places.
LABRADOR to ALASKA; NEW JERSEY to CALIFORNIA.

62. ELYMUS L. Lyme grass.

140. **E. striatus** Willd. Small wild rye.

Common on banks of streams and on ledges: a frequent form is glabrous throughout.

Maine and Ontario to Tennessee and Kansas.

140a. **E. striatus villosus** Gray.

Dry and exposed banks.

Range of the type.

141. **E. Virginicus** L. Terrell grass.

Fence-rows and stream-banks; common: an infrequent form is remarkably long-awned.

Nova Scotia to Manitoba and Wyoming; Florida to Texas.

142. **E. Canadensis** L. Common wild rye.

Banks of streams; common.

Nova Scotia to Alberta; Georgia to New Mexico; Oregon and California.

143. **E. glaucifolius** Muhl. [*E. Canadensis glaucifolius* (Muhl.) Torr.]. Blue wild rye.

Moist banks; especially frequent at Rock Bridge.

Range of the preceding.

63. ASPRELLA Willd. [*ASPERELLA* Humb.: *HYSTRIX* Moench].

144. **A. Hystrix** (L.) Willd. [*Asperella Hystrix* (L.) Humb.: *H. Hystrix* (L.) Millsp.]. Bottle-brush grass.

Woodlands and banks; common.

New Brunswick to Minnesota; Georgia to Texas.

Family 11. CYPERACEAE J. St. Hil. Sedge family.

64. DULICHIUM L. C. Rich.

145. **D. spathaceum** (L.) Pers. [*D. arundinaceum* (L.) Britton].

Swamp at Brushwood lake.

Nova Scotia to Nebraska; Florida to Texas.

65. CYPERUS L. Galingale.

146. **C. flavescens** L.
Marshy grounds; rare.
Maine to Michigan; Florida to Mexico: Europe and Africa.

147. **C. diandrus** Torr.
Muddy shores; frequent.
New Brunswick to Minnesota; South Carolina to Kansas.

148. **C. inflexus** Muhl. [*C. aristatus* Rottb.].
Hillside near Rollins' spring.
Vermont to the Northwest Territory and Oregon; Florida to California and Mexico.

149. **C. acuminatus** Torr. & Hook.
Swales and muddy shores; scarce.
Illinois and Louisiana to Oregon and California.

150. **C. filiculmis** Vahl.
Along the railroad near Rocheport.
New Hampshire and Ontario to Minnesota and Nebraska; Florida to Texas and Mexico.

151. **C. pseudovegetus** Steud. [*C. calcaratus* Nees].
Marsh meadows; rare.
Delaware to Kansas; Florida to Texas.

152. **C. Hallii** Britton.
Rich meadows; rare.
Missouri and Kansas to Texas.

153. **C. esculentus** L. Yellow nut-grass.
Abundant in low grounds and waste places and fields.
Cosmopolitan.

154. **C. erythrorhizos** Muhl.
Low flats of the Missouri at Providence.
Massachusetts to Nebraska; Florida to California.

155. **C. speciosus parvus** (Boeckl.) Britton.
Swales; rare.
Missouri to New Mexico.

156. **C. strigosus** L.
Low meadows and swales; very common and variable.
MAINE to NEBRASKA; FLORIDA to TEXAS.

156a. **C. strigosus capitatus** Boeckl.
Dry banks; rare.
Range of the type.

156b. **C. strigosus compositus** Britton.
Frequent in rich alluvial meadows.
NEW YORK to ALABAMA; MISSOURI and IOWA.

156c. **C. strigosus robustior** Kunth.
Rich lowlands; frequent.
Range of the type.

156d. **C. strigosus elongatus** (Torr.) Britton.
Damp places; frequent.
NORTH CAROLINA to MISSOURI and TEXAS.

66. KYLLINGA Rottb.

157. **K. pumila** Michx.
Local in alluvial flats and low pastures.
VIRGINIA and MICHIGAN to MISSOURI; FLORIDA to TEXAS.

67. ERIOPHORUM L. [*SCIRPUS* L.]. COTTON GRASS.

158. **E. lineatum** (Michx.) Benth. & Hook. [*S. lineatus* Michx.].
Common along streams and in swales and swamps: a form with remarkably long spikelets occurs in Hinkson creek in shallow water.
ONTARIO to OREGON; GEORGIA to TEXAS.

68. SCIRPUS L. BULRUSH.

159. **S. Americanus** Pers. [*S. pungens* Vahl.]. THREE SQUARE.
Common in shallow waters and on muddy shores.
NORTH AMERICA: CHILE: EUROPE.

160. **S. lacustris** L. GREAT BULRUSH.

More's lake in water of considerable depth, also in the waterworks dam and a few ponds.

Throughout NORTH AMERICA and the OLD WORLD.

161. **S. fluviatilis** (Torr.) Gray. CLUB-RUSH.

Rare in Bear creek.

QUEBEC to MINNESOTA; NEW JERSEY to KANSAS.

162. **S. atrovirens** Muhl.

Margins of streams and ponds, and in swales: forms bearing new plants among the spikelets are common, and plants with remarkably amply decompound umbels occur.

NOVA SCOTIA to MANITOBA; GEORGIA to LOUISIANA.

69. HELEOCHARIS (ELEOCHARIS) R. Br.
SPIKE RUSH.

163. **H. (E.) acuminata** (Muhl.) Nees [*H. (E.) compressa* Sull.].

Swale near More's lake.

ANTICOSTI to MANITOBA; GEORGIA to LOUISIANA and NEBRASKA.

164. **H. (E.) tenuis** (Willd.) Schultes.

Wet meadows; infrequent.

CAPE BRETON ISLAND to MANITOBA; FLORIDA to TEXAS.

165. **H. (E.) intermedia** (Muhl.) Schultes.

Marsh meadows and swales.

ONTARIO to MINNESOTA; NEW JERSEY to MISSOURI.

166. **H. (E.) glaucescens** (Willd.) Schultes. [*H. (E.) palustris glaucescens* (Willd.) Gray].

Common in dry stream-beds, swales and limose places.

ONTARIO to MINNESOTA; FLORIDA to TEXAS.

167. **H. (E.) palustris** (L.) R. & S.

Swamps and pond borders, often in shallow water; very common.

LABRADOR to BRITISH COLUMBIA; FLORIDA to CALIFORNIA: EUROPE and ASIA.

168. **H. (E.) Engelmanni** Steud.
Swales; infrequent.
MASSACHUSETTS and VIRGINIA to TEXAS and CALIFORNIA.

169. **H. (E.) ovata** (Roth.) R. & S. [*H. (E.) obtusa* Schultes].
All low and limose places, often in water: variable.
NEW BRUNSWICK to BRITISH COLUMBIA; FLORIDA to TEXAS and OREGON.

70. CAREX L. SEDGE.

170. **C. Leavenworthii** Dewey [*C. cephalophora angustifolia* Boott].
Wild meadows and sterile open places.
IOWA to MISSISSIPPI and TEXAS.

171. **C. cephalophora** Muhl.
Sterile hills; common.
MAINE to MINNESOTA; FLORIDA to TEXAS.

172. **C. cephaloidea** Dewey.
Dry hills and banks; frequent.
MASSACHUSETTS to WYOMING.

173. **C. Muhlenbergii Xalapensis** (Kunth) Britton.
Upland thickets and open barrens.
NEW YORK to MISSOURI, TEXAS and MEXICO.

174. **C. retroflexa** Muhl. [*C. roseæ retroflexa* (Muhl.) Torr.].
Oak forests; common.
MASSACHUSETTS to MICHIGAN; FLORIDA to TEXAS.

175. **C. Texensis** (Torr.) Bailey [*C. rosea Texensis* Torr.].
Oak forests and thickets; scarce.
ILLINOIS to ALABAMA and TEXAS.

176. **C. rosea** Schkuhr.
Rich oak forests; common and variable.
NEWFOUNDLAND to MANITOBA; NORTH CAROLINA to MISSOURI and NEBRASKA.

177. **C. Sartwellii** Dewey.
Swales and ditches; frequent.
ONTARIO to BRITISH COLUMBIA; NEW YORK to ARKANSAS and UTAH.

178. **C. vulpinoidea** Michx.
All low grounds; abundant and variable.
NEW BRUNSWICK to MANITOBA; FLORIDA to TEXAS.

179. **C. gravida** Bailey.
Rich oak woods; scarce.
ILLINOIS to SOUTH DAKOTA; MISSOURI to the INDIAN TERRITORY.

179a. **C. gravida laxifolia** Bailey.
Common in the woods south of Grindstone creek.
Range of the type.

180. **C. conjuncta** Boott.
Common in swales and along ditches and streams.
NEW JERSEY to MICHIGAN and MINNESOTA; FLORIDA to TEXAS.

181. **C. stipata** Muhl.
Swamp south of Hinkson creek.
NEWFOUNDLAND to BRITISH COLUMBIA; FLORIDA to CALIFORNIA.

182. **C. Crus-corvi** Shuttlw.
Swamp at Brushwood lake; rare.
DISTRICT OF COLUMBIA to MICHIGAN and MINNESOTA; FLORIDA to TEXAS.

183. **C. interior** Bailey.
Low meadows; frequent.
MAINE to MINNESOTA; FLORIDA to KANSAS.

184. **C. tribuloides** Wahl.
Marsh meadows; frequent and variable.
NEW BRUNSWICK to MANITOBA; FLORIDA to ARIZONA.

184a. **C. tribuloides Bebbii** Bailey.
Marsh meadows.
Range of the type.

184b. **C. tribuloides moniliformis** (Tuckerm.) Britton [*C. tribuloides reducta* Bailey].
Alluvial meadows; common.
NEW BRUNSWICK to NORTH DAKOTA; NEW YORK to MISSOURI.

185. **C. cristatella** Britton [*C. tribuloides cristata* Bailey].
Very common in low grounds.
New Brunswick to Manitoba; Pennsylvania to Missouri and Nebraska.

186. **C. scoparia** Schkuhr.
Grassy swales; rather infrequent.
Nova Scotia to Manitoba; Florida to Colorado.

187. **C. straminea** Willd.
Fields and copses; frequent and very variable.
New Brunswick to Manitoba; North Carolina to the Indian Territory.

188. **C. mirabilis** Dewey [*C. straminea mirabilis* (Dewey) Tuckerm.].
Thickets and open uplands.
New Brunswick to Manitoba; Georgia to the Indian Territory.

189. **C. tenera** Dewey [*C. straminea aperta* Boott].
Swales; frequent.
Maine to Ontario; Virginia to Louisiana; Iowa and Missouri.

190. **C. Jamesii** Schwein.
Oak woods and thickets; common.
New York and Michigan to Iowa; District of Columbia to the Indian Territory.

191. **C. crinita** Lam.
Wet swamps; rare and local.
Nova Scotia to Ontario; Florida to Texas.

192. **C. pubescens** Muhl.
Rich woods and thickets; locally abundant.
Nova Scotia to North Dakota; New Jersey to Missouri.

193. **C. umbellata vicina** Dewey.
High pasture on a bluff of Hinkson creek, east.
Nova Scotia to the Northwest Territory; New Jersey to Missouri.

194. **C. Pennsylvanica** Lam.
The commonest sedge, forming the usual sward in forests.
NEW BRUNSWICK to the NORTHWEST TERRITORY; NORTH CAROLINA to KANSAS.

195. **C. setifolia** (Dewey) Britton [*C. eburnea* Boott].
About the Pinnacles, where it is common and characteristic.
NEW BRUNSWICK to the NORTHWEST TERRITORY; PENNSYLVANIA to MISSOURI and NEBRASKA.

196. **C. Albursina** Sheldon [*C. laxiflora latifolia* Boott].
Rich wooded hillsides; rare and local.
QUEBEC to MINNESOTA; VIRGINIA to MISSOURI.

197. **C. laxiflora** Lam.
Grassy meadows and woods; very common and variable.
MAINE to MINNESOTA; FLORIDA to the INDIAN TERRITORY.

197a. **C. laxiflora varians** Bailey.
Copses and half-wild fields; common.
Range of the type.

198. **C. blanda** Dewey [*C. laxiflora striatula* Carey].
Common in all grassy places.
MAINE to MINNESOTA; FLORIDA to the INDIAN TERRITORY.

199. **C. Hitchcockiana** Dewey.
Rich oak forests; occasional.
VERMONT to MICHIGAN and ONTARIO; NEW JERSEY to MISSOURI.

200. **C. oligocarpa** Schkuhr.
Dry oak forests and thickets; very common.
VERMONT to MICHIGAN and ONTARIO; NORTH CAROLINA to the INDIAN TERRITORY.

201. **C. conoidea** Schkuhr.
Wild meadows; scarce.
NOVA SCOTIA to ONTARIO; NEW JERSEY to NORTH CAROLINA and MISSOURI.

202. **C. granularis** Muhl.
Moist open places; common.
NEW BRUNSWICK to MANITOBA; FLORIDA to LOUISIANA.

203. **C. glaucodea** Tuckerm.
Ravines and stream-beds; scarce.
MASSACHUSETTS and VIRGINIA to MISSOURI and ARKANSAS.

204. **C. amphibola** Steud. [*C. grisea angustifolia* Boott: *C. grisea* (?) *rigida* Bailey].
Thickets east of Providence bridge; rare and local.
NEW JERSEY to IOWA; FLORIDA to TEXAS.

205. **C. grisea** Wahl.
Moist grassy places in woods; common.
MAINE to MINNESOTA; NORTH CAROLINA to KANSAS.

206. **C. Davisii** Schwein. & Torr.
Low meadows and fence-rows; common. Very variable both in the length of the spikes and in the degree of inflation of the perigynium.
MASSACHUSETTS to MINNESOTA; GEORGIA to the INDIAN TERRITORY.

207. **C. Caroliniana** Schwein. [*C. triceps Smithii* (Porter) Bailey].
Dry open places; rare.
NEW JERSEY and MICHIGAN to MISSOURI; NORTH CAROLINA to ARKANSAS.

208. **C. triceps** Michx. [*C. triceps hirsuta* (Willd.) Bailey].
Very common in grassy copses and in wild meadows.
MASSACHUSETTS to MICHIGAN; FLORIDA to TEXAS.

209. **C. lupulina** Muhl.
Swamps; local.
HUDSON BAY to FLORIDA and TEXAS.

209a. **C. lupulina pedunculata** Dewey.
Swamp at Brushwood lake.
Range of the type.

210. **C. utriculata** Boott.
Swampy creek-borders at the Pinnacles.
ANTICOSTI to BRITISH COLUMBIA; DELAWARE to CALIFORNIA.

211. **C. Frankii** Kunth. [*C. stenolepis* Torr.].
Common along streams and in wet places.
PENNSYLVANIA to MISSOURI; GEORGIA to TEXAS.

212. **C. squarrosa** L.
Wet swamps and swales; local.
CONNECTICUT to NEBRASKA; GEORGIA to LOUISIANA.

213 **C. typhinoides** Schwein.
Wooded swamp at Brushwood lake.
QUEBEC to IOWA; VIRGINIA to LOUISIANA.

214. **C. aristata** R. Br. [*C. trichocarpa aristata* (R. Br.) Bailey].
Swamp south of Hinkson creek.
NEW ENGLAND and ONTARIO to the NORTHWEST TERRITORY; NEW YORK and MISSOURI to UTAH and OREGON.

215. **C. Shortiana** Dewey.
Along streams and in swales; common.
PENNSYLVANIA and VIRGINIA to IOWA and the INDIAN TERRITORY.

Order 8. SPATHIFLORALES.

Family 12. ARACEAE Neck. Arum family.

71. ACORUS L.

216. **A. Calamus** L. SWEET FLAG.
Margins of ponds and streams north and west; local.
NOVA SCOTIA to MINNESOTA; FLORIDA to TEXAS: EUROPE and ASIA.

72. ARISAEMA Mart. [*MURICANDA* Small]. INDIAN TURNIP.

217. **A. atrorubens** Blume [*A. tryphyllum* (L.) Torr.]. JACK-IN-THE-PULPIT.
Alluvial woods and rich hillsides; frequent.
NOVA SCOTIA to MINNESOTA; FLORIDA to LOUISIANA and KANSAS.

218. **A. Dracontium** (L.) Schott. [*M. Dracontium* (L.) Small]. GREEN DRAGON.
Rich hillsides; infrequent.
MAINE to MINNESOTA; FLORIDA to LOUISIANA.

Family 13. LEMNACEAE Dumort. Duckweed family.

73. SPIRODELA Schleid. DUCKWEED.

219. **S. polyrrhiza** (L.) Schleid.
Floating on ponds, or occasionally rooting on muddy shores or the bottoms of dried-up puddles.
All temperate and tropical lands.

74. LEMNA L. DUCKWEED.

220. **L. Valdiviana** Philippi [*L. cyclostasa* (Ell.) Chev.].
Floating on ponds; occasionally fruiting in autumn.
MASSACHUSETTS and FLORIDA to CALIFORNIA and MEXICO: SOUTH AMERICA.

221. **L. minor** L. LITTLE DUCKWEED.
Floating on ponds; common.
Cosmopolitan.

75. WOLFFIA Horkel.

222. **W. papulifera** Thompson.
Ponds; the typical station.
Kennett and Columbia, MISSOURI.

Order 9. FARINOSALES.

Family 14. COMMELINACEAE Reichenb. Spiderwort family.

76. COMMELINA L. DAY-FLOWER.

223. **C. nudiflora** L.
Alluvial banks of Brushwood lake.
NEW JERSEY to MISSOURI; FLORIDA and TEXAS to PARAGUAY.

224. **C. Virginica** L.
Yards and streets; frequent.
NEW YORK to NEBRASKA; FLORIDA to TEXAS.

77. TRADESCANTIA L. SPIDERWORT.

225. **T. brevicaulis** Raf. [*T. Virginica villosa* Watson]. HAIRY SPIDERWORT.
Dry thickets and barren fields.
ILLINOIS and TENNESSEE to MISSOURI.

226. **T. Virginica** L. [*T. Virginiana* L.]. COMMON SPIDERWORT.
Common in oak woods, thickets, half-wild fields, and roadsides.
NEW YORK to SOUTH DAKOTA; VIRGINIA to ARKANSAS.

227. **T. reflexa** Raf.
Rich hillsides.
MICHIGAN and MINNESOTA to FLORIDA and TEXAS.

228. **T. pilosa** Lehm. [*T. Virginica flexuosa* (Raf.) Watson].
Rich hillsides about limestone cliffs and ledges.
PENNSYLVANIA and MISSOURI to FLORIDA.

Family 15. PONTEDERIACEAE Dumort. Pickerel-weed family.

78. HETERANTHERA Ruiz. & Pav. MUD PLANTAIN.

229. **H. reniformis** Ruiz. & Pav.
Margins of ponds; local.
CONNECTICUT to KANSAS; LOUISIANA and TEXAS to SOUTH AMERICA.

Order 10. LILIIFLORALES.

Family 16. JUNCACEAE Vent. Rush family.

79. JUNCUS L. RUSH.

230. **J. marginatus** Rostk.
Marsh meadows; common.
MAINE and ONTARIO to NEBRASKA and FLORIDA.

231. **J. aristulatus** Michx. [*J. marginatus aristulatus* (Michx.) Coville: *J. marginatus biflorus* Wood].

Marsh meadows; especially frequent in the region of the waterworks dam: intermediate forms connect it with the preceding.

NEW YORK to MICHIGAN; FLORIDA to TEXAS and MEXICO.

232. **J. tenuis** Willd.

Very common along paths, where it is apt to be depauperate, and in swales, where it is tall with an ample panicle.

NORTH AMERICA, becoming cosmopolitan.

232a. **J. tenuis anthelatus** Wiegand.

Swamps and swales; rare and local.

MAINE to MISSOURI; SOUTH CAROLINA to TEXAS.

233. **J. dichotomus** Ell.

Low springy, but sterile places; frequent.

MAINE and FLORIDA to MISSOURI and TEXAS.

234. **J. effusus** L. SOFT RUSH.

Swale near Wabash railroad north of Columbia; rare.

NORTH AMERICA: EUROPE and ASIA.

235. **J. acuminatus** Michx.

Swales and borders of ponds and lakes; common and variable.

MAINE to MINNESOTA; GEORGIA and TEXAS to MEXICO and our northwestern coasts.

235a. **J. acuminatus legitimus** Engelm.

Swales and flats.

Range of the type.

236. **J. scirpoides** Lam.

Margin of More's lake and the waterworks dam.

NEW YORK to MICHIGAN; FLORIDA to TEXAS.

237. **J. nodosus** L. KNOTTED RUSH.

Limose banks of the Missouri at Rocheport.

NOVA SCOTIA to BRITISH COLUMBIA; VIRGINIA and MISSOURI to NEBRASKA and NEVADA.

80. LUZULA DC. [*JUNCOIDES* Adans.]. Wood rush.

238. **L. campestris** (L.) DC. [*J. campestris* (L.) Kuntze].
Pansy Hill; very rare.
North America: Europe and Asia.

Family 17. LILIACEAE Adans. Lily family.

81. VERATRUM Tourn. False hellebore.

239. **V. Woodii** Robbins. Indian poke.
On rich wooded hillsides in the vicinity of limestone ledges, blossoming only occasionally; common.
Indiana to Missouri and Arkansas.

82. UVULARIA L. Bellwort.

240. **U. grandiflora** Smith.
Rich oak woods; common.
Quebec to Minnesota; Georgia to Missouri.

83. HEMEROCALLIS L. Day lily.

241. **H. fulva** L. Common day lily.
Escaped from cultivation; along roads and railroads, and persistent in old yards.
Europe and Asia, thence to North America.

84. ALLIUM L. [*VALIDALLIUM* Small]. Onion.

242. **A. Canadense** L. Wild garlic.
Along streams and in springy places; common.
Maine to Minnesota; Florida to Arkansas.

243. **A. tricoccum** Ait. [*V. tricoccum* (Ait.) Small]. Wild leek.
Abundant on rich hillsides south of Hinkson creek, southwest of Columbia.
New Brunswick to Minnesota; Georgia to Missouri.

8

244. **A. Cepa** L. ONION.
Occasional in waste places.
Not known in a wild state but of Old World origin, now universal in cultivation.

85. NOTHOSCORDUM Kunth. FALSE GARLIC.

245. **N. striatum** (Jacq.) Kunth. [*N. bivalve* (L.) Britton].
Summits of cliffs in light soil; frequent along Hinkson creek.
VIRGINIA to NEBRASKA; FLORIDA to TEXAS and MEXICO.

86. LILIUM L. LILY.

246. **L. superbum** L. TURK'S-CAP LILY.
Low meadows; rather frequent in 1897, very scarce in late years.
MAINE to MINNESOTA; NORTH CAROLINA to TENNESSEE and MISSOURI.

87. ERYTHRONIUM L. ADDER'S TONGUE.

247. **E. Americanum** Ker. YELLOW ADDER'S TONGUE.
Boone county, G. C. Swallow; specimen not dated, and no station now known.
NOVA SCOTIA to MINNESOTA; FLORIDA to ARKANSAS.

248. **E. mesachoreum** Knerr. PRAIRIE ADDER'S TONGUE.
Open woods and thickets: early blooming; frequent.
IOWA to NEBRASKA; MISSOURI to the INDIAN TERRITORY.

249. **E. albidum** Nutt. WHITE DOG'S-TOOTH VIOLET.
Rich hillsides and alluvial flats; common.
ONTARIO to MINNESOTA; GEORGIA to TEXAS.

88. CAMASSIA Lindl. [*QUAMASSIA* Raf.]. QUAMASH.

250. **C. Fraseri** (Gray) Torr. [*Q. hyacinthina* (Raf.) Britton]. WILD HYACINTH.
Oak forests, especially on the middle portions of hillsides; common.
PENNSYLVANIA to MICHIGAN and MINNESOTA; GEORGIA to TEXAS.

89. ORNITHOGALUM L.

251. **O. umbellatum** L. STAR OF BETHLEHEM.
Yards and meadows in the city of Columbia.
EUROPE, thence to the UNITED STATES.

90. ASPARAGUS L.

252. **A. officinalis** L. ASPARAGUS.
Waste places and roadsides; frequent.
EUROPE, thence to NORTH AMERICA.

91. SMILACINA Desf. [*VAGNERA* Adans.]. FALSE SOLOMON'S SEAL.

253. **S. stellata** (L.) Desf. [*V. stellata* (L.) Morong].
Rich hillsides; rare and local.
NEWFOUNDLAND to BRITISH COLUMBIA; VIRGINIA to CALIFORNIA.

254. **S. racemosa** (L.) Desf. [*V. racemosa* (L.) Morong]. WILD SPIKENARD.
Oak woods, especially on rich hillsides; common.
NOVA SCOTIA to BRITISH COLUMBIA; GEORGIA to ARIZONA.

92. POLYGONATUM Tourn. [*SALOMONIA* Heist.]. SOLOMON'S SEAL.

255. **P. biflorum** (Walt.) Ell. [*S. biflora* (Walt.) Britton]. TWO-FLOWERED SOLOMON'S SEAL.
Oak woods and copses; frequent.
NEW BRUNSWICK to MICHIGAN; FLORIDA to WEST VIRGINIA and MISSOURI.

256. **P. commutatum** (R. & S.) Dietr. [*P. giganteum* Dietr.: *S. commutata* (R. & S.) Britton]. GIANT SOLOMON'S SEAL.
Oak woods on banks and rich hillsides; common.
QUEBEC to MANITOBA; GEORGIA to NEW MEXICO and UTAH.

93. TRILLIUM L. WAKE ROBIN.

257. **T. erectum L.** BIRTHROOT.
Ravine south of Hinkson creek southwest of Columbia; station apparently destroyed recently.
NOVA SCOTIA to MANITOBA; NORTH CAROLINA to MISSOURI.

258. **T. sessile L.** BLACK SUSAN.
Very common in woods and thickets.
PENNSYLVANIA to MICHIGAN and MINNESOTA; FLORIDA to ARKANSAS.

94. SMILAX Tourn. [*NEMEXIA* Raf.] GREENBRIER.

259. **S. herbacea** L. [*N. herbacea* (L.) Small]. CARRION FLOWER.
Thickets on rich hillsides.
NEW BRUNSWICK to MANITOBA; FLORIDA to LOUISIANA.

260. **S. pulverulenta** Michx. [*S. herbacea pulverulenta* (Michx.) Gray: *N. pulverulenta* (Michx.) Small].
Frequent in open copses and bottom lands.
ONTARIO to WISCONSIN; NORTH CAROLINA to MISSOURI.

261. **S. ecirrhata** (Engelm.) Watson. UPRIGHT SMILAX.
Deep woods along Grindstone creek; rare.
MICHIGAN to MINNESOTA; VIRGINIA to MISSOURI.

262. **S. rotundifolia** L. CATBRIER.
Copses and hawthorn glades; frequent.
ONTARIO to MINNESOTA; FLORIDA to TEXAS.

263. **S. hispida** Muhl. GREENBRIER.
Thickets and bottoms; common.
ONTARIO to MINNESOTA and SOUTH DAKOTA; FLORIDA to TEXAS.

Family 18. AMARYLLIDACEAE Lindl. Amaryllis family.

95. HYPOXIS L. STAR GRASS.

264. **H. erecta** L. [*H. hirsuta* (L.) Coville].

Tops of cliffs, sterile hills and red clay barrens.
MAINE to ASSINIBOIA; FLORIDA to TEXAS.

Family 19. DIOSCOREACEAE Lindl. Yam family.

96. DIOSCOREA L. YAM.

265. **D. villosa** L. WILD YAM-ROOT.
In thickets, twining about bushes and fences.
RHODE ISLAND to MINNESOTA; FLORIDA to TEXAS.

Family 20. IRIDACEAE Lindl. Iris family.

97. IRIS L. FLEUR-DE-LIS.

266. **I. pumila** L. DWARF IRIS.
Fields west of Columbia, where it appears to be thoroughly established.
SOUTHERN EUROPE: widely cultivated.

267. **I. Virginica** L. [*I. versicolor* L.]. BLUE FLAG.
Swamps and swales; scarce and local.
NEWFOUNDLAND to MANITOBA; FLORIDA to ARKANSAS.

268. **I. foliosa** Mack. & Bush. LEAFY BLUE FLAG.
Frequent in the swamp south of Hinkson creek.
ILLINOIS and KENTUCKY to MISSOURI and KANSAS.

268a. **I. foliosa Boonensis** Daniels. Nov. var. LEAFY WHITE FLAG.
Flowers varying in color from pure white to delicate cream, otherwise as in the type; common in the southern portion of the swamp mentioned above.
Boone County, MISSOURI.

98. BELAMCANDA Adans. [*GEMMINGIA* Fabr.].

269. **B. Chinensis** (L.) DC. [*G. Chinensis* (L.) Kuntze]. BLACKBERRY LILY.
On hills and along roadsides; locally common.
ASIA, thence to the eastern UNITED STATES.

99. SISYRINCHIUM L. BLUE-EYED GRASS.

270. **S. campestre** Bicknell.
Thickets and open wild places.
WISCONSIN to NORTH DAKOTA; LOUISIANA to NEW MEXICO.

271. **S. graminoides** Bicknell [*S. anceps* Watson].
Low grassy places; frequent.
NEWFOUNDLAND to MINNESOTA; FLORIDA to TEXAS.

Order 11. MICROSPERMALES.

Family 21. ORCHIDACEAE Lindl. **Orchis family.**

100. CYPRIPEDIUM (CYPRIPEDILUM) L. LADY'S SLIPPER.

272. **C. pubescens** Willd. [*C. hirsutum* Mill.]. LARGE YELLOW LADY'S SLIPPER.
Rich bank of Grindstone creek; only one plant discovered.
NOVA SCOTIA to MINNESOTA and SOUTH DAKOTA; GEORGIA to MISSOURI and NEBRASKA.

273. **C. parviflorum** Salisb. SMALL YELLOW LADY'S SLIPPER.
One plant in a deep ravine south of Hinkson creek; a plant was also collected by Charles Thom, five miles south of Columbia.
NEWFOUNDLAND to BRITISH COLUMBIA; GEORGIA to MISSOURI and WASHINGTON.

101. SPIRANTHES L. C. Rich. [*GYROSTACHYS* Pers.]. LADIES' TRESSES.

274. **S. cernua** (L.) L. C. Rich. [*G. cernua* (L.) Kuntze].
Thickets and wild pastures; scarce.
NOVA SCOTIA to MINNESOTA; FLORIDA to TEXAS.

275. **S. gracilis** Bigel. [*G. gracilis* (Bigel.) Kuntze]. SLENDER LADIES' TRESSES.
Dry thickets and hill summits; very rare; one plant gath-

ered on a hill along the Providence road south of Hinkson creek, Sept., 1896: several plants were detected on a thicketed slope due east of Columbia, Sept., 1905.

NOVA SCOTIA to MINNESOTA; FLORIDA to LOUISIANA and KANSAS.

102. APLECTRUM Nutt. PUTTY ROOT.

276. **A. hiemale** (Willd.) Nutt. [*A. spicatum* (Walt.) B. S. P.]. ADAM AND EVE.

Four or five plants in rich woods south of Hinkson creek southwest; one plant in the woods south of Grindstone creek.

ONTARIO and the NORTHWEST TERRITORY to OREGON; GEORGIA and MISSOURI to CALIFORNIA.

Subclass 2. DICOTYLEDONEAE.

Series 1. CHORIPETALAE.

Order 12. JUGLANDALES.

Family 22. JUGLANDACEAE Lindl. Walnut family.

103. JUGLANS L. WALNUT.

277. **J. nigra** L. BLACK WALNUT.

Common on rich hillsides and in half-wild parks and pastures.

MASSACHUSETTS to MINNESOTA and SOUTH DAKOTA; FLORIDA to TEXAS.

278. **J. cinerea** L. BUTTERNUT.

Rich rocky hillsides along streams; frequent.

NEW BRUNSWICK to NORTH DAKOTA; GEORGIA to ARKANSAS.

104. CARYA Nutt. [*HICORIA* Raf.]. HICKORY.

279. **C. alba** Nutt. [*H. ovata* (Mill.) Britton]. SHAG-BARK HICKORY.

Oak woods and wild fields; common and very variable in size of leaflets and nuts, and in the pubescence, some forms connecting closely with the next two.

QUEBEC to MINNESOTA; FLORIDA to TEXAS.

280. **C. sulcata** (Willd.) Nutt. [*H. sulcata* (Willd.) Britton: *H. laciniosa* (Michx. f.) Sarg.]. BIG SHELL-BARK HICKORY.

Rich ravines; scarce.

NEW YORK to MICHIGAN and IOWA; PENNSYLVANIA to TENNESSEE, TEXAS and INDIAN TERRITORY.

281. **C. tomentosa** (Lam.) Nutt. [*H. alba* (L.) Britton]. MOCKER-NUT.

Common on hillsides; variable, a frequent form having five to seven leaflets and villous twigs.

MASSACHUSETTS to MICHIGAN, NEBRASKA and MISSOURI.

282. **C. porcina** Nutt. [*H. glabra* (Mill.) Britton]. PIG-NUT HICKORY.

Rich hillsides; infrequent.

MAINE to MINNESOTA; FLORIDA to TEXAS.

283. **C. amara** Nutt. [*H. minima* (Marsh.) Britton]. BITTERNUT.

Along streams and in low grounds; occasional on rich hillsides, or even dry ledges.

QUEBEC to MINNESOTA; FLORIDA to TEXAS.

284. **C. olivaeformis** Nutt. [*H. Pecan* (Marsh.) Britton]. PECAN.

There is a grove of these trees near Rocheport, the origin of which is not definitely known.

KENTUCKY and INDIANA to IOWA and TEXAS.

Order 13. SALICALES.

Family 23. SALICACEAE Lindl. **Willow family.**

105. POPULUS L. POPLAR.

285. **P. alba** L. ABELE.

Frequently spontaneous in yards and roadsides.

EUROPE and ASIA, thence to NORTH AMERICA.

286. **P. monilifera** Ait. [*P. deltoides* Marsh.]. COTTONWOOD.

Common along streams.

QUEBEC to the NORTHWEST TERRITORY; FLORIDA to NEW MEXICO.

106. SALIX L. WILLOW.

287. **S. nigra** Marsh. BLACK WILLOW.

A common tree along streams: intermediate forms connect this species with both *S. longipes* Anders. and *S. amygdaloides* Anders.

NEW BRUNSWICK to MICHIGAN, WESTERN ONTARIO and SOUTH DAKOTA; FLORIDA to CALIFORNIA.

287 a. **S. nigra falcata** (Pursh) Torr.

With the type; frequent.

MASSACHUSETTS to MICHIGAN; FLORIDA to MISSOURI.

288. **S. longipes** Anders. [*S. nigra Wardii* Bebb: *S. Wardii* Bebb].

Common along streams.

MARYLAND to MISSOURI; FLORIDA to TEXAS.

289. **S. amygdaloides** Anders. PEACH-LEAVED WILLOW.

Abundant along streams.

QUEBEC to BRITISH COLUMBIA; NEW YORK to MISSOURI, TEXAS and OREGON.

290. **S. alba** L. WHITE WILLOW. SALLOW.

Commonly planted for ornament, and escaped along streams especially in the city of Columbia.

EUROPE, thence to NORTH AMERICA.

291. **S. longifolia** Muhl. [*S. fluviatilis* Nutt.: *S. interior* Rowl.]. SAND BAR WILLOW.

Sandy flats along streams and the margins of lakes; blossoming often in late summer.

QUEBEC and MAINE to VIRGINIA; westward across the continent.

292. **S. humilis** Marsh. PRAIRIE WILLOW.

Two shrubs, one pistillate, the other staminate, along the

Hinton road, some 6½ miles north of Columbia.

NOVA SCOTIA to MICHIGAN, WESTERN ONTARIO and SOUTH DAKOTA; NORTH CAROLINA to TENNESSEE and NEBRASKA.

293. **S. cordata** Muhl.

A shrub along streams and in swales: the plants seldom typical, the leaves being more or less pale and glaucous underneath.

NEW BRUNSWICK and NORTH CAROLINA across the continent.

293 a. **S. cordata angustata** (Pursh) Anders.

With the preceding.

Range of the type.

294. **S. Missouriensis** Bebb [*S. cordata vestita* Anders.]. MISSOURI WILLOW.

A small tree, occasionally, however, of considerable size, along streams and in rich bottoms.

MISSOURI to NEBRASKA and the INDIAN TERRITORY.

Order 14. FAGALES.

Family 24. BETULACEAE Agardh. **Birch family.**

107. **CARPINUS** L. HORNBEAM.

295. **C. Caroliniana** Walt. BLUE BEECH.

Common along Bear and Grindstone creeks; seldom along Hinkson creek.

NOVA SCOTIA to MINNESOTA and NEBRASKA; FLORIDA to TEXAS.

108. **OSTRYA** Scop. HOP-HORNBEAM.

296. **O. Virginica** Willd. [*O. Virginiana* (Mill.) Willd.]. IRONWOOD.

Common along streams and on lower hillsides, and in rich woods.

CAPE BRETON ISLAND to SOUTH DAKOTA; FLORIDA to TEXAS.

109. CORYLUS Tourn. Hazel. Filbert.

297. **C. Americana** Walt. Wild hazel-nut.
Thickets, especially on hillsides.
Maine to Manitoba; Florida to Kansas

110. BETULA Tourn. Birch.

298. **B. nigra** L. River birch.
Frequent along streams.
Massachusetts to Minnesota and Kansas; Florida to Texas.

111. ALNUS Tourn. Alder.

299. **A. serrulata** Willd. [*A. rugosa* (Du Roi) Koch]. Smooth alder.
Along a stream in the University Farm.
Maine to Minnesota; Florida to Texas.

Family 25. FAGACEAE Drude. Beech family.

112. QUERCUS L. Oak.

300. **Q. imbricaria** Michx. Shingle oak.
Common in the borders of woods and wild fields.
Pennsylvania to Michigan and Nebraska; Georgia to Arkansas.

300 a. **Q. imbricaria** Michx. X **Q. palustris** Du Roi.
One small tree three miles northwest of Columbia.
Missouri.

300 b. **Q. imbricaria** Michx X **Q. tinctoria** Willd. [X **Q. Leana** Nutt.]. Lean's oak.
One tree five miles northeast of Columbia.
District of Columbia, Michigan, Ohio and Missouri.

301. **Q. Marylandica** Muench. [*Q. nigra* Wang.]. Black jack.
Sterile red clay hills and summits of cliffs; scarce.
Long Island to Nebraska; Florida to Texas.

302. **Q. rubra** L. RED OAK.

Oak woods and thickets, especially in moist rich soil.

NOVA SCOTIA to MINNESOTA; FLORIDA to TEXAS.

303. **Q. Schneckii** Britton [*Q. Texana* Sarg.]. TEXAN OAK.

Oak forests and thickets, especially in open places.

MICHIGAN to IOWA and MISSOURI; FLORIDA to TEXAS.

304. **Q. palustris** Du Roi. PIN OAK. SWAMP BLACK OAK.

Low plains and swamps; common only north and west of Columbia on the coal measures.

MASSACHUSETTS to WISCONSIN; FLORIDA to the INDIAN TERRITORY.

305. **Q. tinctoria** Michx. [*Q. coccinea tinctoria* (Michx.) Gray: *Q. velutina* Lam.]. BLACK OAK. QUERCITRON.

Rocky uplands and hillsides; common.

MAINE and ONTARIO to MINNESOTA and NEBRASKA; FLORIDA to TEXAS.

305 a. **Q. tinctoria** Michx. X **Q. palustris** Du Roi.

One tree north of More's Lake.

MISSOURI.

306. **Q. alba** L. WHITE OAK.

Oak forests and thickets in all soils; very common and variable in leaf-contour.

MAINE to MINNESOTA and NEBRASKA.

307. **Q. obtusiloba** Michx. [*Q. minor* (Marsh.) Sarg.: *Q. stellata* Wang.]. POST OAK.

Fringing the tops of cliffs in sterile soil; also on hills near Rocheport.

MASSACHUSETTS to MICHIGAN and KANSAS; FLORIDA to TEXAS.

308. **Q. macrocarpa** Michx. BUR OAK.

Frequent in heavy clay soil: very variable both in the size of the acorns and in the lobing of the leaves.

NOVA SCOTIA to MANITOBA and WYOMING; GEORGIA to TEXAS.

309. **Q. platanoides** (Lam.) Sudw. [*Q. bicolor* Willd.]. SWAMP OAK.

Low swampy grounds and flats; more abundant east of Columbia.

QUEBEC and MAINE to MICHIGAN and IOWA; GEORGIA to ARKANSAS.

310. **Q. acuminata** (Michx.) Sarg. [*Q. Muhlenbergii* Engelm.]. CHESTNUT OAK.

In rocky woods and along cliffs; common and variable: a shrubby form, bearing acorns when only a few feet high, simulates *Q. prinoides* Willd., but neither fruit nor foliage afford characters sufficiently distinct to warrant a definite separation; Gray[1] remarks that *Q. prinoides* Willd. runs into *Q. Muhlenbergii* Engelm. in the far west.

VERMONT to MINNESOTA; FLORIDA to TEXAS.

Order 15. URTICALES.

Family 26. ULMACEAE Mirbel. Elm family.

113. ULMUS L. ELM.

311. **U. fulva** Michx. SLIPPERY ELM.

Hillsides along streams and borders of woods.

QUEBEC to NORTH DAKOTA; FLORIDA to TEXAS.

312. **U. racemosa** Thomas. ROCK ELM.

Rare along the banks of Roche Perche creek, and of a small stream south.

QUEBEC to MICHIGAN and NEBRASKA; NEW JERSEY to TENNESSEE and MISSOURI.

313. **U. Americana** L. WATER ELM. AMERICAN ELM.

Along streams and in alluvial bottoms and swamps, but well distributed also in drier situations.

NEWFOUNDLAND to SASKATCHEWAN; FLORIDA to TEXAS.

114. CELTIS L. HACKBERRY.

314. **C. occidentalis** L. AMERICAN NETTLE-TREE.

Common both in uplands and along streams.

QUEBEC to MANITOBA; NORTH CAROLINA to LOUISIANA and KANSAS.

[1] Manual, 6th ed., p. 476.

315. **C. Georgiana** Small. GEORGIA HACKBERRY.
Rare along streams.
MARYLAND to MISSOURI; FLORIDA to ALABAMA.

Family 27. MORACEAE Lindl. Mulberry family.

115. MORUS L. MULBERRY.

316. **M. rubra** L. RED MULBERRY.
Frequent along cliffs and streams.
VERMONT to ONTARIO and SOUTH DAKOTA; FLORIDA to TEXAS.

317. **M. nigra** L. BLACK MULBERRY.
Occasionally escaped from cultivation.
OLD WORLD, thence to the NEW.

116. MACLURA Nutt. [*TOXYLON* Raf.].

318. **M. aurantiaca** Nutt. [*T. pomiferum* Raf.]. OSAGE ORANGE.
A frequent escape from hedges.
VIRGINIA to MISSOURI; GEORGIA to TEXAS; naturalized eastward and northward.

117. HUMULUS L. HOP.

319. **H. Lupulus** L. COMMON HOP.
Grassy thickets and banks of streams.
NOVA SCOTIA to MANITOBA; FLORIDA to ARIZONA: EUROPE and ASIA.

118. CANNABIS Tourn. HEMP.

320. **C. sativa** L. COMMON HEMP.
Roadsides and waste places.
ASIA and EUROPE, thence to the greater part of NORTH AMERICA.

Family 28. URTICACEAE Reichenb. Nettle family.

119. URTICA L. NETTLE.

321. **U. dioica** L. Stinging nettle.

Weed in waste grounds.

Europe, Asia and North Africa, thence to North America.

322. **U. gracilis** Ait. Slender nettle.

Common in alluvial bottoms and waste places in low rich grounds.

Nova Scotia to British Columbia; North Carolina to Louisiana and Kansas.

120. LAPORTEA Gaud. [*URTICASTRUM* Fabr.]. Wood nettle.

323. **L. Canadensis** Gaud. [*U. divaricatum* (L.) Kuntze].

Common in alluvial bottoms in shade.

Nova Scotia to Minnesota and South Dakota; Florida to Kansas.

121. PILEA Lindl. [*ADICEA* Raf.]. Clearweed.

324. **P. pumila** (L.) Gray [*A. pumila* (L.) Raf.]. Richweed.

Common in alluvial bottoms and wooded swamps in shade.

New Brunswick to Minnesota and South Dakota; Florida to Louisiana and Kansas.

122. BOEHMERIA Jacq. False nettle.

325. **B. cylindrica** (L.) Willd.

Alluvial bottoms and wooded swamps in shade; common.

Quebec to Minnesota and Nebraska; Florida to Kansas.

123. PARIETARIA Tourn. Pellitory.

326. **P. Pennsylvanica** Muhl.

In hedges, crevices of damp rocks, and damp waste or wild half-open or deeply shaded places; common.

Ontario to British Columbia; Florida to Colorado and Mexico.

Order 16. SANTALES.

Family 29. SANTALACEAE R. Br. Sandal-wood family.

124. COMANDRA Nutt. Bastard toad-flax.

327. **C. umbellata** (L.) Nutt.

Dry open thickets and sterile hills; common. Parasitic on the roots of trees.

Cape Breton Island to British Columbia; Georgia to California.

Order 17. ARISTOLOCHIALES.

Family 30. ARISTOLOCHIACEAE Blume. Birthwort family.

125. ASARUM L. Asarabacca.

328. **A. ambiguum** (Bicknell) Daniels [*A. reflexum ambiguum* Bicknell]. Wild ginger.

Dense patches on the sides of rich ravines; common. Typical *A. reflexum* Bicknell does not appear to occur, all plants examined having long-attenuate calyx-tips. Plants gathered at Ionia and Alto, Mich., agree with these in every detail, having the wide rectangular sinus in the leaf blades and the triangular calyx-segments abruptly long-attenuately tipped.

Michigan to Illinois and Missouri.

126. ARISTOLOCHIA L. Birthwort.

329. **A. Serpentaria** L. Virginia snakeroot.

Rich deep woods; detected in a few places along Grindstone creek and on a wooded hillside southwest.

Connecticut to Michigan; Florida to Missouri.

Order 18. POLYGONALES.

Family 31. POLYGONACEAE Lindl. Knotweed family.

127. **RUMEX** L. DOCK.

330. **R. salicifolius** Weinm. WHITE DOCK.
Swales; scarce.
LABRADOR to BRITISH COLUMBIA; FLORIDA to LOWER CALIFORNIA.

331. **R. verticillatus** L. SWAMP DOCK.
Swamps, especially along Roche Perche creek.
QUEBEC to MICHIGAN and IOWA; FLORIDA to TEXAS.

332. **R. altissimus** Wood. TALL DOCK.
Occasional along creeks.
MASSACHUSETTS to MICHIGAN and SOUTH DAKOTA; MARYLAND to TEXAS.

333. **R. crispus** L. CURLED DOCK.
Common in fields and waste places, and in low grounds.
EUROPE and ASIA, now cosmopolitan.

334. **R. obtusifolius** L. BITTER DOCK.
Very common in cultivated and waste grounds.
EUROPE and ASIA, now almost cosmopolitan.

335. **R. persicarioides** L. [*R. maritimus* Auct.]. GOLDEN DOCK.
Shores of the Missouri River.
NEW BRUNSWICK to BRITISH COLUMBIA; NORTH CAROLINA to KANSAS and CALIFORNIA.

336. **R. Acetosella** L. SHEEP SORREL.
Meadows and waysides; still uncommon, but increasing its area year by year.
EUROPE and ASIA, thence to all but torrid lands.

128. **POLYGONUM** L. [*TOVARA* Adans.]: *PERSICARIA* Adans.: *TRACAULON* Raf.: *TINIARIA* Reichenb.]. KNOTWEED. SMARTWEED.

337. **P. littorale** Link. SHORE KNOTWEED.
Waste places, especially along cinder-walks and railroad tracks on coal ashes, where little else grows.
EUROPE and NORTH AMERICA.

338. **P. erectum** L. TALL KNOTWEED.

Yards and roadsides; common.

ONTARIO to the NORTHWEST TERRITORY; GEORGIA to TEXAS and COLORADO.

339. **P. aviculare** L. DOORWEED.

Very common about houses and along paths and roads.

EUROPE, ASIA and NORTH AMERICA.

340. **P. acre** H. B. K. [*P. punctatum* Ell.: *Persicaria punctata* (Ell.) Small]. WATER SMARTWEED.

Very common in low grounds and sandy flats, also in damp yards.

Almost throughout AMERICA.

341. **P. Hydropiper** L. [*Persicaria Hydropiper* (L.) Opiz.]. COMMON SMARTWEED. WATER PEPPER.

Common in waste places and low grounds.

EUROPE and NORTH AMERICA.

342. **P. hydropiperoides** Michx. [*Persicaria hydropiperoides* (Michx.) Small]. MILD WATER PEPPER.

Swales and low grounds.

NEW BRUNSWICK to MINNESOTA and CALIFORNIA; FLORIDA to MEXICO.

343. **P. emersum** (Michx.) Britton [*P. Muhlenbergii* Wats.].

Swamp across Hinkson creek south of Columbia.

MAINE and ONTARIO to the NORTHWEST TERRITORY and BRITISH COLUMBIA; VIRGINIA to LOUISIANA and MEXICO.

344. **P. Persicaria** L. [*Persicaria Persicaria* (L.) Small]. LADY'S THUMB.

Yards and fields; very common.

EUROPE, thence to all AMERICA.

345. **P. Pennsylvanicum** L. [*Persicaria Pennsylvanica* (L.) Small].

Along streams and in wet grounds; common.

NOVA SCOTIA to MINNESOTA and SOUTH DAKOTA; FLORIDA and NEBRASKA to MEXICO.

346. **P. incarnatum** Ell. [*P. lapathifolium incarnatum* (Ell.) Wats.: *Persicaria incarnata* (Ell.) Small].

Wet flats along streams; frequent.

VERMONT to MINNESOTA; FLORIDA to TEXAS.

347. **P. lapathifolium** L. [*Persicaria lapathifolia* (L.) S. F. Gray].

Waste and low places; common.

NORTH AMERICA, EUROPE and ASIA.

348. **P. nodosum** Pers. [*P. lapathifolium nodosum* (Pers.) Small].

Wet grounds, where it grows to a great size.

Almost cosmopolitan.

349. **P. orientale** L. [*Persicaria orientalis* (L.) Vilm.]. PRINCE'S FEATHER.

Adventitious in yards and waste places.

INDIA, thence to AUSTRALIA, SOUTH AFRICA and NORTH AMERICA.

350. **P. Virginianum** L. [*Tovara Virginiana* (L.) Adans.]. VIRGINIA KNOTWEED.

Alluvial bottoms and wooded swamps; common in shade.

NOVA SCOTIA to MINNESOTA and NEBRASKA; FLORIDA to TEXAS.

351. **P. sagittatum** L. [*Tracaulon sagittatum* (L.) Small]. TEAR-THUMB.

Along ditches and small streams and in swamps and swales; local, but abundant where found.

NEWFOUNDLAND to SASKATCHEWAN; FLORIDA to TEXAS: ASIA.

352. **P. Convolvulus** L. [*Tiniaria Convolvulus* (L.) Webb. & Moq.]. BLACK BINDWEED. WILD BUCKWHEAT.

Cornfields and waste places; infrequent except at Rocheport.

EUROPE and ASIA, thence to NORTH AMERICA.

353. **P. scandens** L. [*P dumetorum scandens* (L.) Gray: *Tiniaria scandens* (L.) Small]. CLIMBING FALSE BUCKWHEAT.

Woods and thickets and about cliffs and houses; common and variable in the character of the calyx wings, some forms verging toward *P. dumetorum* L., others towards *P. cristatum* Engelm. & Gray.

Nova Scotia to the Rocky Mountains; Florida to Louisiana.

129. FAGOPYRUM Gaertn. Buckwheat.

354. **F. esculentum** Moench [*F. Fagopyrum* (L.) Karst.].
Occasional in waste places.
Europe and Asia, thence to North America.

Order 19. CENTROSPERMALES.

Family 32. CHENOPODIACEAE Dumort. Goosefoot family.

130. CHENOPODIUM L. Goosefoot.

355. **C. hybridum** L. Maple-leaved goosefoot.
Common in waste places, especially in shade.
Quebec to the Northwest Territory; New York to New Mexico and Utah: Europe.

356. **C. urbicum** L. City goosefoot.
Common about houses and along streets; not seen outside the city limits.
Europe, thence to Canada and the United States.

357. **C. Berlandieri** Moq.
Dry waste grounds; scarce.
Florida; Missouri to Texas.

358. **C. album** L. Lamb's-quarters. Pigweed.
Everywhere in waste and cultivated grounds.
Europe and Asia, now a cosmopolitan weed.

359. **C. ambrosioides** L. Mexican tea.
Waste places; locally frequent.
Tropical America, thence to all mild and warm lands.

360. **C. anthelminticum** L. [*C. ambrosioides anthelminticum* (L.) Gray]. Wormseed.

Sparingly along streets.
EUROPE, thence to AMERICA.

131. SPINACIA L. SPINACH.

361. **S. oleracea** L.
Occasionally adventitious in gardens.
Not known in a wild state, but probably from the ORIENT.

132. ATRIPLEX L. ORACHE.

362. **A. hastatum** (**hastata**) L. [*A. patulum hastatum* (L.) Gray].
Common in waste places and along streets.
NEW BRUNSWICK to BRITISH COLUMBIA; SOUTH CAROLINA to MISSOURI, NEBRASKA and UTAH: EUROPE.

Family 33. AMARANTACEAE J. St. Hil. Amaranth family.

133. AMARANTUS (AMARANTHUS) L. AMARANTH.

363. **A. paniculatus** L. [*A. hybridus paniculatus* (L.) U. & B.]. RED AMARANTH.
Along roads and in waste places; scarce.
TROPICAL AMERICA, becoming cosmopolitan.

364. **A. chlorostachys** Willd. GREEN AMARANTH.
Waste grounds.
TROPICAL AMERICA, now cosmopolitan.

365. **A. hybridus** L. [*A. chlorostachys hybridus* (L.) Wats.]. SLENDER PIGWEED.
Alluvial waste lands at Providence.
TROPICAL AMERICA, now cosmopolitan.

366. **A. retroflexus** L. COMMON PIGWEED.
Abundant in cultivated and waste lands.
TROPICAL AMERICA, now cosmopolitan.

367. **A. spinosus** L. THORNY PIGWEED.
Very common in gardens and waste lands.
TROPICAL AMERICA, thence to NORTH AMERICA.

368. **A. albus** L. [*A. graecizans* Britt. & Br.]. TUMBLEWEED.
Common in cultivated and waste lands.
TROPICAL AMERICA, thence to NORTH AMERICA.

369. **A. blitoides** Wats. CREEPING PIGWEED.
Roadsides and fields; common.
COLORADO and UTAH to MEXICO, thence to all but ARCTIC NORTH AMERICA.

Family 34. PHYTOLACCACEAE Lindl. Pokeweed family.

134. PHYTOLACCA L. SCOKE.

370. **P. decandra** L. POKEWEED.
Common in waste and newly cleared ground.
MAINE to MINNESOTA; FLORIDA to TEXAS, thence to EUROPE.

Family 35. NYCTAGINACEAE Lindl. Four-o'clock family.

135. MIRABILIS L. [*ALLIONIA* Loefl.: *OXYBAPHUS* Vahl.]. FOUR-O'CLOCK.

371. **M. hirsuta** (Pursh) Daniels [*A. hirsuta* Pursh: *O. hirsuta* (Pursh) Choisy]. UMBRELLA-WORT.
Limestone ledges; rare about Columbia, but common at the Pinnacles.
MINNESOTA to the NORTHWEST TERRITORY; MICHIGAN and MISSOURI to TEXAS and COLORADO.

372. **M. decumbens** (Nutt.) Daniels [*A. decumbens* (Nutt.) Rydb.].
Rocky ledges along Hinkson creek south; rare.
MISSISSIPPI to MISSOURI and NEW MEXICO.

Family 36. AIZOACEAE A. Br. Carpet-weed family.

136. MOLLUGO L. CARPET-WEED.

373. **M. verticillata** L.
Waste places and fields, especially in sandy soil.
TROPICAL AMERICA, thence to NORTH AMERICA.

Family 37. PORTULACACEAE Reichenb. Purslane family.

137. CLAYTONIA L. Spring beauty.

374. **C. Virginica** L. [*C. Virginiana* L.].
Very common in oak woods and thickets and in wild meadows.
Nova Scotia to Saskatchewan; Georgia to Texas and Colorado.

138. PORTULACA L. Purslane.

375. **P. oleracea** L. Pussley.
Gardens and cultivated grounds.
Tropical America, now cosmopolitan.

376. **P. neglecta** Mack. & Bush. Large purslane.
Common in waste grounds and fields.
Minnesota and Arkansas to Kansas.

377. **P. grandiflora** Hook. Portulaca.
Occasionally escaped to roadsides.
South America, common in ornamental cultivation.

Family 38. CARYOPHYLLACEAE Reichenb. Pink family.

139. AGROSTEMMA L. [*LYCHNIS* L.] Cockle.

378. **A. Githago** L. [*L. Githago* (L.) Lam.]. Corn cockle.
Wheatfields and waste places.
Europe and Asia, now cosmopolitan.

140. SILENE L. Catchfly. Campion.

379. **S. antirrhina** L. Sleepy catchfly.
Waste places and wild low grounds; common.
Maine to British Columbia; Florida to Texas and Mexico.

380. **S. nivea** Muhl. [*S. alba* Muhl.]. White campion.
Very rare on the flats of Hinkson creek, but common along Grindstone creek.

MAINE; PENNSYLVANIA to MINNESOTA; MARYLAND to TENNESSEE and MISSOURI.

381. **S. stellata** (L.) Ait. f. STARRY CAMPION.
Common in rich shady hillsides and ravines.
MASSACHUSETTS to MINNESOTA and SOUTH DAKOTA; GEORGIA to TEXAS.

141. SAPONARIA L. SOAPWORT.

382. **S. officinalis** L. BOUNCING BET.
Roadsides and old yards, rarely in wild places.
EUROPE and ASIA, thence to NORTH AMERICA.

142. STELLARIA L. [*ALSINE* L.]. STARWORT.

383. **S. media** (L.) Cyrill. [*A. media* L.]. CHICKWEED.
In waste places and about buildings; scarce.
GREENLAND: EUROPE and ASIA, now cosmopolitan.

143. CERASTIUM L. MOUSE-EAR CHICKWEED.

384. **C. semidecandrum** L. SMALL MOUSE-EAR CHICKWEED.
Lawns; uncommon.
EUROPE, thence to the eastern UNITED STATES.

385. **C. vulgatum** L. COMMON MOUSE-EAR CHICKWEED.
Very common in waste grounds; also in wild situations.
Cosmopolitan.

386. **C. brachypodum** (Engelm.) Robinson.
Low grounds; scarce.
ILLINOIS to SOUTH DAKOTA and COLORADO; GEORGIA to ARIZONA and MEXICO.

387. **C. nutans** Raf. [*C. longipedunculatum* Muhl.] NODDING CHICKWEED.
Common along streams and in ravines.
HUDSON BAY to LITTLE SLAVE LAKE; NOVA SCOTIA and NORTH CAROLINA to BRITISH COLUMBIA, NEVADA and MEXICO.

144. ALSINE Wahlenb. [*ARENARIA* L.: *ALSINOPSIS* Small]. SANDWORT.

388. **A. Texana** (Robinson) Daniels [*Arenaria Texana* (Robinson) Britton: *Arenaria stricta Texana* Robinson: *Alsinopsis Texana* (Robinson) Small]. TEXAN SANDWORT.

Summits of limestone cliffs; rare south along Hinkson creek, frequent at the Pinnacles.

MISSOURI and KANSAS to the INDIAN TERRITORY and TEXAS.

145. ANYCHIA Rich. FORKED CHICKWEED.

389. **A. dichotoma** Michx.

Dry thickets and rocky woods.

MAINE to MINNESOTA; FLORIDA to ARKANSAS.

390. **A. Canadensis** (L.) B. S. P. [*A. capillacea* (Nutt.) DC.].

Oak woods and shaded cliffs; frequent.

MASSACHUSETTS to MINNESOTA; GEORGIA to ARKANSAS.

Order 20. RANALES.

Family 39. NYMPHAEACEAE DC. Water lily family.

146. NELUMBO Adans. SACRED BEAN.

391. **N. lutea** (Willd.) Pers. WATER CHINQUAPIN.

Pond near Rocheport.

MASSACHUSETTS and ONTARIO to MINNESOTA; FLORIDA to TEXAS.

147. NYMPHAEA Tourn. [*CASTALIA* Salisb.]. WATER LILY.

392. **N. odorata** Ait. [*C. odorata* (Ait.) Woodv. & Wood.]. FRAGRANT POND LILY.

In a pond on University Farm, 1897; station since destroyed.

NEWFOUNDLAND to MANITOBA; FLORIDA to TEXAS; CUBA.

Family 40. CERATOPHYLLACEAE Gray. Hornwort family.

148. CERATOPHYLLUM L. HORNWORT.

393. **C. demersum** L.
Ponds; local.
NORTH AMERICA: EUROPE and ASIA.

Family 41. ANONACEAE DC. Custard-apple family.

149. ASIMINA Adans. PAPAW.

394. **A. triloba** (L.) Dunal. COMMON PAPAW.
Common in shaded bottoms and ravines.
NEW JERSEY, NEW YORK and ONTARIO to MICHIGAN and IOWA; FLORIDA to TEXAS.

Family 42. RANUNCULACEAE Juss. Crowfoot family.

150. HYDRASTIS Ellis. ORANGE ROOT.

395. **H. Canadensis** L. GOLDEN SEAL.
Rare in rich oak woods.
NEW YORK to ONTARIO and MINNESOTA; GEORGIA and TENNESSEE to MISSOURI.

151. ISOPYRUM L. FALSE RUE-ANEMONE.

396. **I. biternatum** (Raf.) T. & G.
Common in woods and thickets along streams, and in deep ravines.
ONTARIO and MICHIGAN to MINNESOTA; FLORIDA to TEXAS.

152. ACTAEA L. BANEBERRY.

397. **A. alba** (L.) Mill. WHITE BANEBERRY.
Woods about Rocheport cave.
NOVA SCOTIA and ANTICOSTI to BRITISH COLUMBIA; GEORGIA to LOUISIANA and MISSOURI.

153. AQUILEGIA L. COLUMBINE.

398. **A. Canadensis** L. WILD COLUMBINE.
Common on cliffs and ledges, and on the banks of streams and the sides of ravines.

NOVA SCOTIA to the NORTHWEST TERRITORY; GEORGIA to TEXAS.

154. DELPHINIUM L. LARKSPUR.

399. **D. tricorne** Michx. DWARF LARKSPUR.
In thickets, mainly on moist hillsides; common.
PENNSYLVANIA to MINNESOTA; GEORGIA to ARKANSAS.

400. **D. Ajacis** L. GARDEN LARKSPUR.
Thoroughly wild on the bluffs of the Missouri River at Providence.
EUROPE, thence to CANADA and the UNITED STATES.

155. ANEMONE L. [*HEPATICA* Scop.]. WIND-FLOWER.

401. **A. Virginiana** L. TALL ANEMONE.
Common upon the cliffs, occurring also in open thickets and on rocky hills.
NOVA SCOTIA to MANITOBA and the CANADIAN ROCKY MOUNTAINS; GEORGIA to KANSAS.

402. **A. acutiloba** (DC.) Lawson [*H. acutiloba* DC.: *H. acuta* (Pursh) Britton]. ACUTE-LEAVED LIVERLEAF. HEPATICA.
Rich woods near the Pinnacles.
QUEBEC to MINNESOTA; GEORGIA to MISSOURI.

156. CLEMATIS L. [*VIORNA* Reichenb.]. VIRGIN'S BOWER.

403. **C. Pitcheri** T. & G. [*C. Simsii* Britton: *V. Simsii* (Britton) Small]. WILD CLEMATIS.
Low grounds; scarce.
INDIANA to NEBRASKA and TEXAS.

404. **C. Virginiana** L. COMMON VIRGIN'S BOWER.
Moist thickets and swamps; scarce and local.
NOVA SCOTIA to MANITOBA; GEORGIA to KANSAS.

157. RANUNCULUS L. CROWFOOT. BUTTERCUP.

405. **R. abortivus** L. Small-flowered crowfoot.

Woods, open grounds, and waste places; all soils, but in dry grounds is apt to pass into the next; common.

Labrador to Manitoba and British Columbia; Florida to Arkansas and Colorado.

406. **R. micranthus** Nutt. [*R. abortivus micranthus* (Nutt.) Gray]. Rock crowfoot.

Dry rocky woods and thickets; common.

Massachusetts to Saskatchewan; Georgia to Arkansas and Colorado.

407. **R. recurvatus** Poir.

Along rills in shade; very scarce in Hinkson creek valley, but more frequent in the region north of More's Lake.

Nova Scotia to Manitoba; Florida to Missouri.

408. **R. hispidus** Michx. Hairy buttercup.

In thickets and midland woods, but also in low grounds, where it tends to coalesce with the next.

Ontario to the Northwest Territory; Georgia to Arkansas.

409. **R. septentrionalis** Poir. Marsh buttercup.

Alluvial flats and swales, also moist ledges and ravines. Most of the plants are more or less hispid, approaching thus the foregoing, but the styles and achenes appear normal.

New Brunswick to Manitoba; Georgia to Missouri.

410. **R. fascicularis** Muhl. Early buttercup.

Very rare in the Hinkson creek region along the cliffs.

New England to Manitoba; Georgia to Texas.

158. THALICTRUM L. [*ANEMONELLA* Spach.: *SYNDESMON* Hoffmg.]. Meadow rue.

411. **T. anemonioides** Michx. [*A. thalictroides* (L.) Spach.: *S. thalictroides* (L.) Hoffmg.]. Rue anemone.

Common in open woods and thickets.

New England to Ontario and Minnesota; Florida to Kansas.

412. **T. purpurascens** L. PURPLISH MEADOW RUE.
Wooded flats along streams and in deep ravines; scarce.
NOVA SCOTIA and ANTICOSTI to SASKATCHEWAN; FLORIDA to ARIZONA.

Family 43. BERBERIDACEAE T. & G. Barberry family.

159. PODOPHYLLUM L. MAY APPLE.

413. **P. peltatum** L. WILD MANDRAKE.
Common in rich woods and thickets.
QUEBEC to MINNESOTA; FLORIDA to TEXAS.

160. LEONTICE L. [*CAULOPHYLLUM* Michx.].

414. **L. thalictroides** L. [*C. thalictroides* (L.) Michx.]. BLUE COHOSH.
Rich alluvial woods; infrequent.
NEW BRUNSWICK to MINNESOTA and SOUTH DAKOTA; SOUTH CAROLINA to TENNESSEE, MISSOURI and NEBRASKA.

Family 44. MENISPERMACEAE DC. Moonseed family.

161. MENISPERMUM Tourn. MOONSEED.

415. **M. Canadense** L.
Woods, thickets and fence-rows; common.
QUEBEC to MANITOBA; GEORGIA to the INDIAN TERRITORY.

Family 45. LAURACEAE Lindl. Laurel family.

162. SASSAFRAS Nees.

416. **S. officinale** Nees [*S. Sassafras* (L.) Karst.]. SASSAFRAS.
Oak openings; somewhat scarce; seldom more than a shrub, but trees of considerable size occur.
MAINE to ONTARIO, MICHIGAN and NEBRASKA; FLORIDA to TEXAS.

163. LINDERA Thunb. [*BENZOIN* Fabr.]. SPICE-BUSH.

417. **L. Benzoin** (L.) Blume [*B. Benzoin* (L.) Coulter]. BENJAMIN BUSH.

Wet woods; very scarce.

MASSACHUSETTS to MICHIGAN; GEORGIA to TENNESSEE and KANSAS.

Order 21. RHOEDALES.

Family 46. PAPAVERACEAE Juss. Poppy family.

164. SANGUINARIA L. BLOODROOT.

418. **S. Canadensis** L.

Rich hillsides and the banks of ravines; common.

NOVA SCOTIA to MANITOBA; FLORIDA to ARKANSAS.

165. DICENTRA Borkh., Bernh. [*BICUCULLA* Adans.]. BLEEDING HEART.

419. **D. Canadensis** (Goldie) Walp. [*B. Canadensis* (Goldie) Millsp.]. SQUIRREL CORN.

Rich hillsides along the south bank of Hinkson creek in two places southwest; the westernmost station appears now to be destroyed.

NOVA SCOTIA to MINNESOTA and NEBRASKA; VIRGINIA to KENTUCKY and MISSOURI.

420. **D. Cucullaria** (L.) Torr. [*B. Cucullaria* (L.) Millsp.]. DUTCHMAN'S BREECHES.

Abundant in woods and thickets in rich soil and on hillsides.

NOVA SCOTIA to MINNESOTA and WASHINGTON; NORTH CAROLINA to MISSOURI and NEBRASKA.

166. CORYDALIS Vent. [*CAPNOIDES* Adans.].

421. **C. flavula** Raf. [*Capnoides flavulum* (Raf.) Kuntze].

Open rocky places, especially along ravines.

ONTARIO to MINNESOTA; VIRGINIA to LOUISIANA and KANSAS.

422. **C. montana** Engelm. [*C. aurea occidentalis* Engelm.: *Capnoides montanum* (Engelm.) Britton].

Thickets along hillsides; common; the capsules of plants from the uplands are often minutely pruinose when fresh, approaching thus *C. crystallina* Engelm.; the capsules, however, of typical *C. crystallina* Engelm. from plants from southwestern Missouri are very densely pruinose.

SOUTH DAKOTA to MONTANA; TEXAS to UTAH and ARIZONA; MISSOURI.

Family 47. CRUCIFERAE Juss. Mustard family.

167. LEPIDIUM L. PEPPER GRASS.

423. **L. Virginicum** L.

Waste places; frequent.

QUEBEC to MINNESOTA and SOUTH DAKOTA; FLORIDA to TEXAS; WEST INDIES and MEXICO: naturalized in EUROPE.

424. **L. apetalum** Willd. [*L. intermedium* Gray].

Fields and waste places.

MAINE to NEW YORK and TEXAS across the continent: ASIA: adventitious in EUROPE.

168. SISYMBRIUM L. HEDGE MUSTARD.

425. **S. officinale** (L.) Scop.

Waste places, especially about dwellings; common.

EUROPE and ASIA, thence to NORTH AMERICA.

169. SINAPIS L. [*BRASSICA L.*]. MUSTARD.

426. **S. alba** L. [*B. alba* Boiss.]. WHITE MUSTARD.

Waysides; scarce.

EUROPE and ASIA, thence to NORTH AMERICA.

170. BRASSICA L. KALE.

427. **B. nigra** (L.) Koch. BLACK MUSTARD.

Frequent in fields and waste places.

EUROPE, thence to NORTH AMERICA.

428. **B. juncea** (L.) Cosson. INDIAN MUSTARD.
Yards; locally common.
EUROPE and ASIA, thence to eastern NORTH AMERICA, the WEST INDIES, and SOUTH AMERICA.

429. **B. Japonica** Siebold. JAPANESE MUSTARD.
Waste places; uncommon.
EASTERN ASIA, thence to NORTH AMERICA.

430. **B. Sinapistrum** Boiss. [*B. arvensis* (L.) B. S. P.]. CHARLOCK.
Fields and waste places.
EUROPE and SIBERIA, thence to NORTH AMERICA.

431. **B. campestris** L. RUTA-BAGA.
Waste places, and persisting in fields.
OLD WORLD, now universal in cultivation.

431a. **B. campestris rapifera** Metzg. TURNIP.
Adventive in waste places.
OLD WORLD, now universal in cultivation.

432. **B. napus** L. RAPE.
Occasionally adventitious in fields.
Adventitious from EUROPE.

171. RAPHANUS L. RADISH.

433. **R. sativus** L. GARDEN RADISH.
Persisting in gardens.
EUROPE, now universal in cultivation.

172. BARBAREA R. Br. WINTER CRESS.

434. **B. vulgaris** R. Br. [*B. Barbarea* (L.) MacM.]. YELLOW ROCKET.
Waste grounds, preferring moist soil.
EUROPE and ASIA, now almost cosmopolitan.

435. **B. stricta** Andrz. [*B. vulgaris stricta* (Andrz.) Gray]. WINTER CRESS.
Roadsides; frequent.
EUROPE and ASIA, thence to NORTH AMERICA.

173. IODANTHUS (JODANTHUS) Gray [*THELYPODIUM* Endl.]. PURPLE ROCKET.

436. **I. (J.) pinnatifidus** (Michx.) Steud. [*T. pinnatifidum* (Michx.) Watson].

Scarce in wet places.

PENNSYLVANIA to MINNESOTA; TENNESSEE to LOUISIANA and TEXAS.

174. NASTURTIUM R. Br. [*RORIPA* Scop.]. CRESS.

437. **N. Armoracia** Fries. [*R. Armoracia* (L.) Hitchc.]. HORSE RADISH.

Roadsides and yards; frequent.

EUROPE, thence to AMERICA.

438. **N. officinale** R. Br. [*R. Nasturtium* (L.) Rusby]. WATER CRESS.

Springs near Rocheport.

EUROPE and ASIA, thence to AMERICA.

439. **N. sylvestre** (L.) R. Br. [*R. sylvestris* (L.) Bess.]. CREEPING YELLOW WATER-CRESS.

Waste places; rare.

EUROPE, thence to eastern NORTH AMERICA.

440. **N. sinuatum** Nutt. [*R. sinuata* (Nutt.) Hitchc.] YELLOW CRESS.

Common on the muddy banks of the Missouri.

MINNESOTA to SASKATCHEWAN and OREGON; ARKANSAS to ARIZONA and NEVADA.

441. **N. palustre** (L.) DC. [*N. terrestre* R. Br.: *R. palustris* (L.) Bess.]. MARSH CRESS.

In swamps and about streams and ponds; common and variable.

GREENLAND and NORTH AMERICA: TROPICAL AMERICA: EUROPE and ASIA: AUSTRALIA and NEW ZEALAND.

442. **N. obtusum** Nutt. [*R. obtusa* (Nutt.) Britton].

Alluvial flats and stream-beds which are dry in summer.

MICHIGAN to BRITISH COLUMBIA; MISSOURI to TEXAS; CALIFORNIA.

443. **N. sessiliflorum** Nutt. [*R. sessiliflora* (Nutt.) Hitchc.].
Wet grounds and muddy banks, usually in shade.
VIRGINIA to IOWA and KANSAS; FLORIDA to TEXAS.

175. CARDAMINE L. BITTER-CRESS.

444. **C. parviflora** L. SMALL BITTER-CRESS.
Common on rocky banks; apparently intergrades with the next.
QUEBEC to OREGON; GEORGIA to MISSOURI: EUROPE and ASIA.

445. **C. Pennsylvanica** Muhl. PENNSYLVANIA CRESS.
Common along streams and in springy places.
NEWFOUNDLAND to ALASKA; FLORIDA to MISSOURI and CALIFORNIA.

446. **C. rhomboidea** DC. [*C. bulbosa* (Schreb.) B. S. P.]. SPRING CRESS.
In rills and springs; local.
NOVA SCOTIA to MINNESOTA and SOUTH DAKOTA; FLORIDA to TEXAS.

176. DENTARIA L. TOOTHWORT.

447. **D. laciniata** Muhl. PEPPER-ROOT.
Common in rich moist woods.
QUEBEC to MINNESOTA; FLORIDA to LOUISIANA.

177. CAPSELLA DC. [*BURSA* Weber]. SHEPHERD'S PURSE.

448. **C. Bursa-pastoris** (L.) Medic. [*B. Bursa-pastoris* (L.) Britton].
Very common in fields and waste places.
EUROPE, now cosmopolitan.

178. DRABA L. WHITLOW-GRASS.

449. **D. cuneifolia** Nutt.

Rocky ravines and hillsides, and on ledges and cliffs; common.

KENTUCKY and ILLINOIS to CALIFORNIA; ALABAMA to TEXAS.

179. DESCURAINIA Webb & Berth. [*SISYMBRIUM* L.: *SOPHIA* Adans.]. TANSY MUSTARD.

450. **D. canescens** (Nutt.) Prantl [*Sisymbrium canescens* Nutt.: *Sophia pinnata* (Walt.) Britton].

Common on rocky hillsides, and cliffs.

FLORIDA to CALIFORNIA, northward to the ARCTIC CIRCLE.

451. **D. intermedia** (Rydb.) Daniels [*Sophia intermedia* Rydb.: *Sophia incisa* Auct.: *Sisymbrium incisum* Auct.]. WESTERN TANSY MUSTARD.

Along the railroad near Rocheport.

MINNESOTA to BRITISH COLUMBIA; TENNESSEE to CALIFORNIA.

180. ARABIS L. ROCK CRESS.

452. **A. dentata** T. & G. TOOTHED ROCK CRESS.

Local on ledges and cliffs.

NEW YORK to MINNESOTA; VIRGINIA to TENNESSEE and MISSOURI.

453. **A. Canadensis** L. SICKLE-POD.

Common in rocky woods and thickets.

NEW ENGLAND and ONTARIO to MINNESOTA and SOUTH DAKOTA; GEORGIA to TEXAS.

454. **A. laevigata** (Muhl.) Poir. SMOOTH ROCK CRESS.

Common on moist ledges and cliffs.

QUEBEC to MINNESOTA; NORTH CAROLINA and GEORGIA to ARKANSAS.

Order 22. ROSALES.

Family 48. CRASSULACEAE DC. Orpine family.

181. SEDUM L. ORPINE.

455. **S. Telephium** L. Live-forever.
Old yards and roadsides.
Asia and Europe, thence to North America.

182. PENTHORUM L. Stonecrop.

456. **P. sedoides** L. Ditch stonecrop.
Common in swamps, swales, and wet meadows.
New Brunswick to Minnesota and South Dakota; Florida to Texas: China and Japan.

Family 49. SAXIFRAGACEAE Dumort. Saxifrage family.

183. HEUCHERA L. Alum root.

457. **H. hispida** Pursh. Hairy alum root.
Cliffs and ledges; also common in rocky and hilly thickets.
Ontario and Michigan to the Northwest Territory; Virginia to Kansas and Idaho.

184. RIBES L. Currant. Gooseberry.

458. **R. gracile** Michx. Smooth wild gooseberry.
Rocky thickets and half-wild fields.
Michigan to South Dakota and Kansas; Tennessee and Louisiana to Texas.

459. **R. Missouriense** Nutt. Missouri gooseberry.
Very common along streams and in old fields.
Pennsylvania to South Dakota; Illinois and Missouri to Kansas.

460. **R. Cynosbati** L. Prickly gooseberry.
Thickets at the Pinnacles.
New Brunswick to Manitoba; North Carolina to Missouri.

Family 50. PLATANACEAE Lindl. Planetree family.

185. PLATANUS L. Planetree.

461. **P. occidentalis** L. Sycamore. Buttonwood.

Common along streams and in bottom lands.
MAINE to MINNESOTA and NEBRASKA; FLORIDA to TEXAS.

Family 51. **ROSACEAE** Juss. **Rose family.**

186. **PHYSOCARPUS** Maxim. [*OPULASTER* Medic.: *SPIRAEA* L.: *NEILLIA* Don.]. NINE-BARK.

462. **P. intermedius** (Rydb.) Daniels [*O. intermedius* Rydb.].
Rocky banks of streams; scarce.
ILLINOIS to SOUTH DAKOTA; ALABAMA to COLORADO.

463. **P. Missouriensis** Daniels. Nov. spec. MISSOURI NINE-BARK.

Shrub 2 to 3 m. high with shreddy bark and recurved branches; leaves broadly ovate, with inequally serrate margins, often more or less three-lobed, stellate-pubescent when young, the pubescence persisting along the midribs and veins of the mature leaves, which are cuneate to subcordate at the base; flowers in umbel-like corymbs, white or pinkish green; the pedicels and calyces densely stellate-pubescent when young, but conspicuously so when mature. Along cliffs and rocky banks.

MISSOURI; St. Louis County (E. H. Favor), Boone County (Chas. Thom; F. P. Daniels), Jackson County (B. F. Bush).*

---

*The following may serve as a synopsis of the species of *Physocarpus* Maxim. [*Opulaster* Medic.] occurring in the eastern United States:

A. Pubescence stellate.
  1. Leaf-blades densely pubescent when mature.
     P. ferrugineus (Nutt.) Daniels [*O. stellatus* Rydb.: *S. opulifolia ferruginea* Nutt.].
  2. Leaf-blades sparsely pubescent when mature, or nearly glabrous.
     a. Follicles stellate-pubescent.
        P. Missouriensis Daniels.
     b. Follicles glabrous or nearly so.
        P. Michiganensis Daniels. Nov. spec.

Shrub 1-3.5 m. high with shreddy bark and recurved branches; leaves ovate, cuneate, or occasionally truncate at the base, mostly slightly three-lobed, the margins doubly, but inequally serrate, densely stellate-pubescent when young, sparingly so when mature, especially underneath along the veins; flowers in rounded umbel-like corymbs, usually white

187. GILLENIA Moench [*PORTERANTHUS* Britton]. BOWMAN'S-ROOT.

464. **G. stipulacea** Nutt. [*P. stipulatus* (Muhl.) Britton]. WILD IPECAC.

Common in thickets and open places in woods, especially on hilltops: some plants with monstrous pods on elongated stipes were found in an old road near Grindstone creek, 1903.

NEW YORK and MICHIGAN to MISSOURI and KANSAS; GEORGIA to LOUISIANA and the INDIAN TERRITORY.

188. PYRUS (PIRUS) Tourn. [*MALUS* Juss.]. PEAR. APPLE.

465. **P. communis** L. COMMON PEAR.

Occasionally adventitious along roadsides, etc.

ASIA and EUROPE, thence to all temperate lands.

466. **P. Malus** L. [*M. Malus* (L.) Britton]. COMMON APPLE.

Thickets and roadsides; not infrequent.

ASIA and EUROPE, thence to all temperate lands.

467. **P. angustifolia** Ait. [*M. angustifolia* (Ait.) Michx.]. WILD CRAB APPLE.

Copses and open places in woods; scarce.

NEW JERSEY to ILLINOIS and KANSAS; FLORIDA to LOUISIANA.

---

with a pinkish tinge, the calyx and pedicels densely stellate-pubescent; follicles usually 4, rarely 1, 3 or 5, glabrous and shining when mature. Stream-banks; common.

MICHIGAN; Kent County, near McCord's (F. P. Daniels); Ionia County, Easton Township (F. P. Daniels).

B. Pubescence simple, or none.

1. Follicles 2-4, pubescent.

   P. intermedius (Rydb.) Daniels [*O. intermedius* Rydb.].

2. Follicles mostly 5, glabrous.

   P. opulifolius (L.) Maxim. [*O. opulifolius* (L.) Kuntze: *S. opulifolius* L.: *N. opulifolia* (L.) Benth.].

It is with a feeling of protest that these stellate forms of *Physocarpus* are described as new species, but the limitation of *P. opulifolius* (L.) Maxim. by recent authorities to the more glabrate forms, seems to leave no other recourse.

468. **P. Ioensis** (Wood) Bailey [*M. Ioensis* (Wood) Britton]. WESTERN CRAB APPLE.

On the rocky banks of streams and rocky hillsides.

WISCONSIN to MINNESOTA; KENTUCKY to LOUISIANA and OKLAHOMA.

189. AMELANCHIER. Medic. SERVICE BERRY.

469. **A. Canadensis** (L.) Medic. SHAD-BUSH. JUNE BERRY.

Edges of cliffs and on rocky banks; frequent.

NEWFOUNDLAND to ONTARIO, MINNESOTA and SOUTH DAKOTA; FLORIDA to LOUISIANA.

190. MESPILUS L. [*CRATAEGUS* L.]. MEDLAR. HAWTHORN.

470. **M. Crus-galli** (L.) Willd. [*C. Crus-galli* L.]. COCKSPUR THORN.

In thickets and hawthorn glades; common and immensely variable, both in foliage and fruit.

QUEBEC to MANITOBA; FLORIDA to TEXAS.

471. **M. punctata** (Jacq.) Willd. [*C. punctata* Jacq.].

Scarce in hawthorn glades north of Columbia.

QUEBEC to WISCONSIN; GEORGIA to TENNESSEE and MISSOURI.

472. **M. cordata** (Mill.) Willd. [*C. cordata* (Mill.) Ait.]. WASHINGTON THORN.

A few clumps along streams and in the hawthorn glades north of Columbia.

NEW JERSEY to ILLINOIS and MISSOURI; GEORGIA to TENNESSEE.

473. **M. Eggerti** (Britton) Daniels [*C. Eggerti* Britton].

Rare in the hawthorn glades north of Columbia.

IOWA to MISSOURI and KANSAS.

475. **M. viridis** (L.) Sweet [*C. viridis* L.]. GREEN THORN.

Common along streams in the hawthorn glades north.

VIRGINIA to MISSOURI; FLORIDA to TEXAS.

475. **M. nitida** (Engelm.) Daniels [*C. nitida* Engelm.]. SHINING THORN.

Common in low flats along streams and in glades.

ILLINOIS to MISSOURI and ARKANSAS.

476. **M. coccinea** (L.) Willd. [*C. coccinea* L.]. SCARLET HAW.

Rocky thickets and hawthorn glades; common and extremely variable, numerous forms connecting closely with the next four species.

NEWFOUNDLAND to MANITOBA; FLORIDA to TEXAS.

477. **M. rotundifolia** (Ehrh.) Daniels [*C. rotundifolia* (Ehrh.) Borck.].

Ledges and hawthorn glades; infrequent.

CONNECTICUT to MICHIGAN; FLORIDA to ALABAMA and MISSOURI.

478. **M. macracantha** (Lodd.) Wenzig. [*C. macracantha* Lodd.: *C. coccinea macracantha* (Lodd.) Dudl.].

Rare in thickets and glades.

QUEBEC to DAKOTA; VIRGINIA to MISSOURI.

479. **M. mollis** (T. & G.) Daniels [*C. mollis* (T. & G.) Scheele: *C. coccinea mollis* T. & G.]. RED HAW.

Very common in thickets, glades, bottoms, and in old fields and along roadsides; very variable in foliage and fruit.

QUEBEC to MICHIGAN and SOUTH DAKOTA; PENNSYLVANIA and TENNESSEE to LOUISIANA and TEXAS.

480. **M. Biltmoreana** (Beadle) Daniels [*C. Biltmoreana* Beadle]. BILTMORE THORN.

Rare in glades.

PENNSYLVANIA to MISSOURI; SOUTH CAROLINA to ALABAMA and TENNESSEE.

481. **M. campestris** (Britton) Daniels [*C. campestris* Britton]. PRAIRIE THORN.

Abundant in the hawthorn glades north of Columbia. There are forms connecting with the following three species.

MISSOURI and KANSAS.

482. **M. tomentosa** (L.) Ait. [*C. tomentosa* L.]. GRAY THORN.

Common in thickets. This species intergrades with the next.

NEW JERSEY to ONTARIO and MICHIGAN; GEORGIA to MISSOURI.

483. **M. Chapmanii** (Beadle) Daniels [*C. Chapmanii* (Beadle) Ashe].
Glades north.
VIRGINIA and GEORGIA to MISSOURI.

484. **M. dispessa** (Ashe) Daniels [*C. pyriformis* Britton].
Frequent in the glades and old pastures north.
MISSOURI.

191. RUBUS L. BRAMBLE.

485. **R. occidentalis** L. BLACK RASPBERRY.
Thickets and roadsides; common.
QUEBEC to ONTARIO, MINNESOTA and SOUTH DAKOTA; GEORGIA to ALABAMA and TEXAS.

486. **R. nigrobaccus** Bailey [*R. villosus* Auct.]. BLACKBERRY.
Old fields, roadsides, and recently cleared woodlands; very common.
NEW ENGLAND to MINNESOTA; FLORIDA to ARKANSAS.

487. **R. procumbens** Muhl. [*R. Canadensis* Auct.]. DEWBERRY.
Very common in fields and thickets.
NEWFOUNDLAND to ONTARIO and MINNESOTA; NORTH CAROLINA to LOUISIANA and the INDIAN TERRITORY.

192. FRAGARIA L. STRAWBERRY.

488. **F. Virginiana** Duchesne. WILD STRAWBERRY.
Common in fields, thickets and open woods.
PRINCE EDWARD ISLAND to MINNESOTA and SOUTH DAKOTA; GEORGIA to the INDIAN TERRITORY.

489. **F. Grayana** Vilm. [*F. Virginiana Grayana* (Vilm.) Rydb.: *F. Virginiana Illinoensis* Gray].
Common in open places.
NEW YORK to MINNESOTA; OHIO to MISSOURI and KANSAS.

193. POTENTILLA L. Cinque-foil.

490. **P. Monspeliensis** L. [*P. Norvegica* Auct.]. Rough cinque-foil.

Common in meadows and waste grounds.

Labrador to Alaska; Georgia to Texas and Mexico: Europe and Asia.

491. **P. leucocarpa** Rydb. [*P. rivalis millegrana* (Engelm.) Watson].

Scarce about paths in low grounds.

Illinois to Minnesota and Washington; Missouri to New Mexico and California.

492. **P. paradoxa** Nutt. [*P. supina* Michx.].

Common on the limose shores of the Missouri.

New York and Ontario to Oregon; Tennessee to New Mexico; Mexico: East Asia.

493. **P. Canadensis** L. Five-finger.

Very common in upland woods, thickets and fields.

Maine and Quebec to Minnesota and South Dakota; Georgia to the Indian Territory.

493a. **P. Canadensis simplex** (Michx.) T. & G.

Woods along Grindstone creek.

Range of the type.

194. GEUM L. Avens.

494. **G. strictum** Ait. Yellow avens.

Very rare in low grounds southwest.

Newfoundland to British Columbia; New Jersey to Arizona: Asia.

495. **G. Canadense** Jacq. [*G. album* Gmel.]. White avens.

Low grounds in shade; common and variable.

Nova Scotia to Minnesota; Georgia to Missouri.

496. **G. vernum** (Raf.) T. & G. Spring avens.

Common along streams and in low grounds and thickets.

New York to Michigan and Ontario; New Jersey to Tennessee and Texas.

195. AGRIMONIA L. Agrimony.

497. **A. striata** Michx. [*A. Eupatoria* Auct. in part].
Very common in oak forests and thickets.
Connecticut to Minnesota; Virginia to Missouri and Kansas.

498. **A. mollis** (T. & G.) Britton [*A. Eupatoria* Auct. in part].
Frequent in thickets and along streams.
Connecticut to Michigan and Minnesota; Georgia to Kansas.

499. **A. parviflora** Soland. Small-flowered agrimony.
Deep ravines and swamps; local.
New York to Michigan and South Dakota; Georgia to Louisiana and Kansas.

196. ROSA Tourn. Rose. Brier.

500. **R. rubiginosa** L. Sweetbrier. Eglantine.
Along roadsides and in half-wild fields.
Europe, thence to North America.

501. **R. humilis** Marsh. Low rose. Wild brier.
Dry thickets and hillsides; common.
Maine to Ontario and Minnesota; Georgia to Louisiana.

501a. **R. humilis villosa** Best.
Dry thickets.
New Jersey and New York; Missouri.

502. **R. Woodsii** Lindl. Woods' rose.
University golf-links south of Columbia.
Michigan to the Northwest Territory; Missouri to New Mexico and Colorado.

503. **R. setigera** Michx. Prairie climbing rose.
Common in thickets and wild fields.
West Virginia and Ontario to Wisconsin; Florida to Texas.

197. PRUNUS L. [*AMYGDALUS* L. : *PADUS* Borckh.]. PLUM. CHERRY.

504. **P. Americana** Marsh. WILD PLUM.
Common in glades and thickets.
NEW YORK to MONTANA; FLORIDA to COLORADO.

505. **P. hortulana** Bailey. WILD GOOSE PLUM.
Fence rows and thickets.
ILLINOIS to KANSAS; TENNESSEE and ALABAMA to TEXAS.

506. **P. domestica** L. COMMON PLUM.
Occasionally spontaneous.
Unknown in a wild state, but of Old World origin.

507. **P. Persica** (L.) Sieb. & Zucc. [*A. Persica* L.]. PEACH.
Occasionally spontaneous in yards and roadsides.
ASIA, thence to all warm lands.

508. **P. Cerasus** L. SOUR CHERRY.
Wild rocky banks of Hinkson creek southwest; also in old yards and roadsides.
ASIA MINOR, thence to all temperate lands.

509. **P. serotina** Ehrh. [*Padus serotina* (Ehrh.) Agardh.]. WILD BLACK CHERRY.
Frequent in woods and thickets.
NOVA SCOTIA to NORTH DAKOTA; FLORIDA to TEXAS.

510. **P. Virginiana** L. [*Padus Virginiana* (L.) Roem.]. CHOKE CHERRY.
Rocky banks of Hinkson creek southwest.
NEWFOUNDLAND to MANITOBA and BRITISH COLUMBIA; GEORGIA to TEXAS and COLORADO.

Family 52. LEGUMINOSAE Juss. Pulse family.

198. SCHRANCKIA (SCHRANKIA) Willd. [*MORONGIA* Britton]. SENSITIVE BRIER.

511. **S. uncinata** Willd. [*M. uncinata* (Willd.) Britton].
Common on dry hills and in open thickets: a plant recently gathered has remarkably long pods (H. S. Reed).
VIRGINIA to SOUTH DAKOTA; FLORIDA to TEXAS.

199. DESMANTHUS Willd. [*ACUAN* Medic.].

512. **D. Illinoensis** (Michx.) Daniels [*A. Illinoensis* (Michx.) Kuntze: *D. brachylobus* Benth.]. PRAIRIE MIMOSA.

A single patch east of the water-works dam; frequent at Rocheport along the railroad.

INDIANA to MINNESOTA and SOUTH DAKOTA; FLORIDA to TEXAS and COLORADO.

200. CERCIS L. JUDAS TREE.

513. **C. Canadensis** L. RED BUD.

Frequent in rocky woods and on cliffs.

NEW JERSEY to ONTARIO and MINNESOTA; FLORIDA to TEXAS.

201. CASSIA L. [*CHAMAECRISTA* Moench]. SENNA.

514. **C. Marylandica** L. MARYLAND SENNA.

Infrequent in rich woods and thickets.

CONNECTICUT to MICHIGAN and NEBRASKA; FLORIDA to LOUISIANA and KANSAS.

515. **C. Chamaecrista** L. [*Chamaecrista fasciculata* Michx.]. SENSITIVE PARTRIDGE PEA.

Common in thickets and open woods.

MAINE to MINNESOTA and SOUTH DAKOTA; FLORIDA to TEXAS; MEXICO to BOLIVIA and URUGUAY.

202. GLEDITSCHIA (GLEDITSIA) L. SWEET LOCUST.

516. **G. triacanthos** L. HONEY LOCUST.

Common in woods and along roadsides. A frequent unarmed form is perhaps worthy of varietal rank.

NEW YORK, ONTARIO and MICHIGAN to SOUTH DAKOTA and KANSAS; GEORGIA to TEXAS.

203. **GYMNOCLADUS** Lam. COFFEE-TREE.

517. **G. dioica** (L.) Koch [*G. Canadensis* Lam.]. KENTUCKY COFFEE-TREE.
Rich woods and fields; scarce but well distributed.
PENNSYLVANIA and ONTARIO to MINNESOTA and SOUTH DAKOTA; WEST VIRGINIA and TENNESSEE to the INDIAN TERRITORY.

204. **BAPTISIA** Vent. WILD INDIGO.

518. **B. leucantha** T. & G. WHITE WILD INDIGO.
Rich open places; scarce.
ONTARIO to MINNESOTA; FLORIDA to TEXAS.

519. **B. leucophaea** Nutt. [*B. bracteata* Britton & Brown, not Muhl.]. HAIRY WHITE WILD INDIGO.
Summits of cliffs along Grindstone creek; rare.
MICHIGAN to MINNESOTA; LOUISIANA to TEXAS.

205. **MEDICAGO** L. LUCERNE. MEDIC.

520. **M. lupulina** L. HOP MEDIC.
Waste places and streets; scarce.
EUROPE and ASIA, becoming cosmopolitan.

521. **M. sativa** L. ALFALFA.
Fields and waste places.
EUROPE, thence to all temperate lands.

206. **MELILOTUS** Juss. SWEET CLOVER.

522. **M. officinalis** (L.) Lam. YELLOW MELILOT.
Streets and waste places; scarce.
EUROPE and ASIA, thence to NORTH AMERICA.

523. **M. alba** Desv. WHITE SWEET CLOVER.
Waste places and roadsides; common.
EUROPE and ASIA, thence to NORTH AMERICA.

207. TRIFOLIUM L. Clover. Trefoil.

524. **T. procumbens** L. Low hop-clover.
A small patch in the thickets south of the University golf links.
Europe, thence to North America.

525. **T. dubium** Sibth. [*T. procumbens minus* (Smith) Koch]. Least hop-clover.
Pastures and old fields; rare.
Europe, thence to North America.

526. **T. hybridum** L. Alsike clover.
Frequent in meadows and waste places.
Europe, thence widely distributed as a meadow plant.

527. **T. repens** L. White clover. Sheep clover.
Abundant in fields, lawns and waste places.
Europe: Siberia: Sub-arctic America, now in the greater part of North America.

528. **T. stoloniferum** Muhl. Running buffalo clover.
Rare in thickets back of Hinkson creek bluffs south.
Ohio and Michigan to South Dakota; Kentucky to Missouri.

529. **T. incarnatum** L. Crimson clover.
Rare in meadows.
Europe, thence to North America.

530. **T. pratense** L. Red clover.
Common in meadows and fields.
Europe and Asia, thence to North America.

531. **T. medium** L. Mammoth clover. Zigzag clover.
Frequent in meadows and fields.
Europe and Siberia, thence to North America.

208. PSORALEA L. Pomme blanche.

532. **P. tenuiflora** Pursh.
Summits of cliffs; local.
Illinois and Minnesota to Montana; Missouri and Texas to Colorado; Sonora.

209. AMORPHA L. FALSE INDIGO.

533. **A. fruticosa** L. BASTARD INDIGO.
Rocky banks of streams, often in shallow water.
OHIO to MINNESOTA and MANITOBA; FLORIDA to TEXAS; COLORADO to CHIHUAHUA.

534. **A. canescens** Pursh. LEAD PLANT.
Common on hills and cliffs.
INDIANA and MICHIGAN to MINNESOTA and MANITOBA; LOUISIANA to NEW MEXICO.

535. **A. nana** Nutt. [*A. microphylla* Pursh].
Only on the summits of the highest cliffs, and on sterile red clay hills.
MINNESOTA and the NORTHWEST TERRITORY to IOWA and MISSOURI.

210. DALEA L. [*PAROSELA* Cav.].

536. **D. alopecuroides** Willd. [*P. Dalea* (L.) Britton].
Roadsides near Providence.
ILLINOIS to MINNESOTA and SOUTH DAKOTA; ALABAMA to NEW MEXICO and MEXICO.

211. KUHNISTERA Lam. [*PETALOSTEMON* Michx.]. PRAIRIE CLOVER.

537. **K. candida** (Willd.) Kuntze [*P. candidus* (Willd.) Michx.]. WHITE PRAIRIE CLOVER.
Along the railroad at Rocheport.
INDIANA to MINNESOTA and the NORTHWEST TERRITORY; MISSISSIPPI to TEXAS and COLORADO.

538. **K. purpurea** (Vent.) MacM. [*P. violaceus* Michx.]. VIOLET PRAIRIE CLOVER.
Dry open places and summits of cliffs; frequent.
MICHIGAN to the NORTHWEST TERRITORY; MISSOURI to TEXAS and COLORADO.

212. TEPHROSIA Pers. [*CRACCA* L.]. GOAT'S-RUE.

539. **T. Virginiana** (L.) Pers. [*C. Virginiana* L.]. CATGUT. HOARY PEA.

Dry open places; local.

SOUTHERN NEW ENGLAND and ONTARIO to MANITOBA; FLORIDA to TEXAS and MEXICO.

213. ROBINIA L. LOCUST TREE.

540. **R. Pseudacacia** L. COMMON LOCUST.

Apparently native in a large flat southwest along Hinkson creek remote from all clearings; common along roadsides and in yards.

PENNSYLVANIA to IOWA; GEORGIA to the INDIAN TERRITORY: range now much extended through cultivation.

214. ASTRAGALUS L. [*GEOPRUMNON* Rydb.: *HOLCOPHACOS* Rydb.]. MILK VETCH.

541. **A. Mexicanus** A. DC. [*G. Mexicanum* (A. DC.) Rydb.]. GROUND PLUM.

Hillsides and open thickets; frequent.

ILLINOIS to SOUTH DAKOTA; ARKANSAS to TEXAS.

542. **A. Canadensis** L. [*A. Carolinianus* L.]. COMMON MILK VETCH.

Hillsides and bottom lands; frequent.

QUEBEC to the ROCKY MOUNTAINS; GEORGIA to LOUISIANA and COLORADO.

543. **A. distortus** T. & G. [*H. distortus* (T. & G.) Rydb.]. BENT MILK VETCH.

Summits of cliffs south of the waterworks dam and of Hinkson creek east of the Black's Mill road; local.

WEST VIRGINIA to IOWA; MISSISSIPPI to TEXAS.

215. STYLOSANTHES Sw. PENCIL FLOWER.

544. **S. biflora** (L.) B. S. P. [*S. elatior* Sw.].

Common on barren hills.

NEW YORK to KANSAS; FLORIDA to TEXAS.

544a. **S. biflora hispidissima** (Michx.) Pollard & Ball.
Barren hills; apparently more frequent than the type.
Range of the type.

216. DESMODIUM Desv. [*MEIBOMIA* Heister]. Tick-trefoil.

545. **D. nudiflorum** (L.) DC. [*M. nudiflora* (L.) Kuntze].
Common in oak forests and thickets.
Quebec to Minnesota; Florida to Louisiana and Kansas.

546. **D. grandiflorum** (Walt.) DC. [*D. acuminatum* (Michx.) DC.: *M. grandiflora* (Walt.) Kuntze].
Very common in upland oak forests.
Quebec to Minnesota and South Dakota; Florida to Texas.

547. **D. pauciflorum** (Nutt.) DC. [*M. pauciflora* (Nutt.) Kuntze].
Oak forests and thickets; infrequent.
New York and Ontario to Michigan and Missouri; Florida to Texas.

548. **D. Michauxii** (Vail) Daniels [*D. rotundifolium* (Michx.) DC.: *M. Michauxii* Vail].
Dry oak forests and thickets; scarce.
Maine to Ontario and Minnesota; Florida to Louisiana.

549. **D. sessilifolium** (Torr.) T. & G. [*M. sessilifolia* (Torr.) Kuntze].
Dry oak forests; uncommon.
Massachusetts to Michigan; Kentucky and Mississippi to Kansas and Texas.

550. **D. canescens** (L.) DC. [*M. canescens* (L.) Kuntze]. Hoary tick-trefoil.
Rich woods and banks of streams; common.
Massachusetts to Minnesota and Nebraska; Florida to Texas.

550a. **D. canescens hirsutum** Hook. [*M. canescens hirsuta* (Hook.) Vail].
Common in thickets.
Missouri.

551. **D. bracteosum** (Michx.) DC. [*D. cuspidatum* Hook.: *M. bracteosa* (Michx.) Kuntze].

Common in oak thickets and open woods.

ONTARIO to MICHIGAN and MINNESOTA; FLORIDA to TEXAS and MISSOURI.

552. **D. longifolium** (T. & G.) Daniels [*M. longifolia* (T. & G.) Vail].

Open wild meadows and along roadsides.

ILLINOIS to MISSOURI; ALABAMA to LOUISIANA.

553. **D. paniculatum** (L.) DC. [*M. paniculata* (L.) Kuntze].

Very common in oak openings.

MASSACHUSETTS and ONTARIO to MINNESOTA and NEBRASKA; FLORIDA to TEXAS.

554. **D. pubens** (T. & G.) Young [*M. paniculata pubens* (T. & G.) Vail].

Dry oak forests and thickets

VIRGINIA to MISSOURI and the INDIAN TERRITORY; FLORIDA to TEXAS.

555. **D. viridiflorum** (L.) Beck. [*M. viridiflora* (L.) Kuntze].

Oak woodlands; scarce.

NEW YORK to MICHIGAN; FLORIDA to TEXAS and MISSOURI.

556. **D. Dillenii** Darl. [*M. Dillenii* (Darl.) Kuntze].

Oak woods and thickets.

MAINE and ONTARIO to MINNESOTA; VIRGINIA to MISSOURI and TEXAS.

557. **D. Illinoense** Gray [*M. Illinoensis* (Gray) Kuntze].

Open grounds and wild meadows.

MICHIGAN to SOUTH DAKOTA and TEXAS.

558. **D. Canadense** (L.) DC. [*M. Canadensis* (L.) Kuntze]. SHOWY TICK-TREFOIL.

Frequent on banks and in open thickets.

NEW BRUNSWICK to SASKATCHEWAN; NORTH CAROLINA to the INDIAN TERRITORY.

559. **D. rigidum** (Ell.) DC. [*M. rigida* (Ell.) Kuntze].
Dry oak woods and thickets; frequent.
MASSACHUSETTS to MICHIGAN and NEBRASKA; FLORIDA to LOUISIANA.

217. LESPEDEZA Michx. BUSH CLOVER.

560. **L. repens** (L.) Bart. CREEPING BUSH CLOVER.
Hillsides and railroad banks.
LONG ISLAND to MINNESOTA; FLORIDA to TEXAS.

561. **L. procumbens** Michx. TRAILING BUSH CLOVER.
Dry wild open places.
MASSACHUSETTS and MICHIGAN to the INDIAN TERRITORY; FLORIDA to LOUISIANA.

562. **L. violacea** (L.) Pers. VIOLET BUSH CLOVER.
Open places and roadsides; common.
NEW ENGLAND to MINNESOTA and KANSAS; FLORIDA to LOUISIANA and MEXICO.

563. **L. Stuvei** Nutt. STUVE'S BUSH CLOVER.
Dry wild places.
LONG ISLAND to MICHIGAN; VIRGINIA to the INDIAN TERRITORY.

564. **L. frutescens** (L.) Britton [*L. Stuvei intermedia* Wats.].
Dry open places.
MASSACHUSETTS to ONTARIO and MICHIGAN; FLORIDA to TEXAS.

565. **L. Virginica** (L.) Britton [*L. reticulata* Pers.].
Very common in dry open places and thickets.
MASSACHUSETTS to MINNESOTA; FLORIDA to TEXAS.

218. VICIA L. VETCH.

566. **V. Cracca** L. COW VETCH.
Roadsides and fields; uncommon.
NEWFOUNDLAND to BRITISH COLUMBIA; NORTH CAROLINA to MISSOURI.

219. LATHYRUS L. Vetchling.

567. **L. myrtifolius** Muhl. [*L. palustris myrtifolius* (Muhl.) Gray]. Marsh pea.

Rare in marsh meadows.

New Brunswick to Manitoba; North Carolina to Tennessee and Missouri.

220. AMPHICARPA Ell. [*FALCATA* Gmel.: *AMPHICARPAEA* DC.]. Hog peanut.

568. **A. monoica** Ell. [*F. comosa* (L.) Kuntze: *Amphicarpaea monoica* (Ell.) Nutt.].

Low and rich woodlands; rare.

New Brunswick to Minnesota and South Dakota; Florida to Louisiana.

569. **A. Pitcheri** (T. & G.) Daniels [*F. Pitcheri* (T. & G.) Kuntze: *Amphicarpaea Pitcheri* T. & G.].

Common in thickets.

New York and Michigan to South Dakota; Tennessee and Missouri to Texas.

221. APIOS Moench. Ground nut.

570. **A. tuberosa** Moench. [*A. Apios* (L.) MacM.].

Swamp south of Hinkson creek.

New Brunswick to Minnesota and South Dakota; Florida to Texas.

222. PHASEOLUS L. [*STROPHOSTYLES* Ell.]. Bean.

571. **P. helvolus** L. [*S. helvola* (L.) Britton: *S. angulosa* (Ort.) Ell.]. Wild bean.

Clay barrens and roadsides; common.

Massachusetts and Quebec to Minnesota and South Dakota; Florida to Texas.

572. **P. umbellatus** (Muhl.) Britton [*S. umbellata* (Muhl.) Britton: *S. peduncularis* Ell.].

Red clay barrens; rare.

New York to Missouri; Florida to Louisiana.

573. **P. pauciflorus** Benth. [*S. pauciflora* (Benth.) Watson].

Along the Wabash railroad near Persinger.

INDIANA to MINNESOTA and SOUTH DAKOTA; MISSISSIPPI to TEXAS.

Order 23. GERANIALES.

Family 53. GERANIACEAE J. St. Hil. Geranium family.

223. GERANIUM L. CRANESBILL.

574. **G. maculatum** L. SPOTTED CRANESBILL.

Common in oak forests and thickets.

NEWFOUNDLAND to MANITOBA; FLORIDA and MISSISSIPPI to MISSOURI and NEBRASKA.

575. **G. Carolinianum** L. SMALL CRANESBILL.

Frequent in waste and open places.

NOVA SCOTIA to BRITISH COLUMBIA; FLORIDA to CALIFORNIA; MEXICO; WEST INDIES and the BERMUDA ISLANDS.

Family 54. OXALIDACEAE Lindl. Wood sorrel family.

224. OXALIS L. [*IONOXALIS* Small: *XANTHOXALIS* Small]. WOOD SORREL.

576. **O. violacea** L. [*I. violacea* (L.) Small]. VIOLET WOOD SORREL.

Open woods, clay barrens, and wild roadsides; common.

NEW ENGLAND to the ROCKY MOUNTAINS; FLORIDA to NEW MEXICO: BOLIVIA: adventitious in CEYLON and ITALY.

577. **O. Dillenii** Jacq. [*O. corniculata Dillenii* (Jacq.) Trelease].

Roadsides and waste places.

NEW JERSEY and the GREAT LAKES to VANCOUVER; FLORIDA to TEXAS.

578. **O. stricta** L. [*O. corniculata stricta* (L.) Sav.: *X. stricta* (L.) Small]. YELLOW WOOD SORREL.

Common in fields and thickets.

NOVA SCOTIA to SOUTH DAKOTA; FLORIDA to TEXAS.

579. **O. cymosa** Small [*X. cymosa* Small].
Very common in woods, fields and waste places.
ONTARIO to MICHIGAN and NEBRASKA; FLORIDA to TEXAS.

Family 55. LINACEAE Dumort. Flax family.

225. LINUM L. FLAX.

580. **L. usitatissimum** L. COMMON FLAX.
Waste places; rare.
Native of the CAUCASUS, thence to all temperate lands.

Family 56. RUTACEAE Juss. Rue family.

226. XANTHOXYLUM L. PRICKLY ASH.

581. **X. fraxineum** Willd. [*X. Americanum* Mill.].
Bottom lands and open thickets; frequent.
QUEBEC and ONTARIO to MINNESOTA and SOUTH DAKOTA; GEORGIA to the INDIAN TERRITORY.

227. PTELEA L. HOP-TREE.

582. **P. trifoliata** L.
Common on rocky banks.
CONNECTICUT to MINNESOTA; FLORIDA to TEXAS.

Family 57. SIMARUBACEAE DC. Quassia family.

228. AILANTHUS Desf. TREE OF HEAVEN

583. **A. glandulosa** Desf.
A frequent escape along roadsides.
EASTERN ASIA, thence to the UNITED STATES.

Family 58. POLYGALACEAE Reichenb. Milkwort family.

229. POLYGALA L. MILKWORT.

584. **P. verticillata** L. WHORLED MILKWORT.
Sterile hills and red clay barrens; scarce.
MAINE and QUEBEC to SASKATCHEWAN; FLORIDA to TEXAS and UTAH.

585. **P. sanguinea** L. [*P. viridescens* L.]. PURPLE MILKWORT.

Red clay barrens, but also in low wild meadows.

NOVA SCOTIA to MINNESOTA; NORTH CAROLINA to the INDIAN TERRITORY.

Family 59. EUPHORBIACEAE J. St. Hil. Spurge family.

230. PHYLLANTHUS L.

586. **P. Carolinensis** Walt.

Flats of Hinkson creek; very rare.

PENNSYLVANIA to ILLINOIS and MISSOURI; FLORIDA to TEXAS and CENTRAL AMERICA.

231. CROTON L. CROTON.

587. **C. capitatus** Michx.

Dry open places and roadsides; common.

NEW JERSEY to IOWA; GEORGIA to TEXAS.

588. **C. monanthogynus** Michx.

Common in dry open places, roadsides and yards.

NORTH CAROLINA to IOWA and KANSAS; FLORIDA to TEXAS and MEXICO.

232. ACALYPHA L. THREE-SEEDED MERCURY.

589. **A. Virginica** L.

Common in low woods and waste places.

ONTARIO and MICHIGAN to MINNESOTA; FLORIDA to TEXAS.

590. **A. gracilens** Gray [*A. Virginica gracilens* (Gray) Muell.].

Frequent on cliffs and in dry open thickets.

MASSACHUSETTS to MICHIGAN and KANSAS; FLORIDA to TEXAS.

233. RICINUS L. CASTOR BEAN.

591. **R. communis** L. PALMA CHRISTI.

A frequent escape in waste places.

AFRICA, thence to all hot and warm lands.

234. EUPHORBIA L. [*CHAMAESYCE* S. F. Gray: *DICHROPHYLLUM* Kl. & Garcke: *TITHYMALOPSIS* Kl. & Garcke: *TITHYMALUS* Adans.: *POINSETTIA* Graham]. SPURGE.

592. **E. nutans** Lag. [*E. Preslii* Guss.: *C. nutans* (Lag.) Small].

Fields and thickets, especially along streams; common.

All NORTH AMERICA east of the ROCKY MOUNTAINS except the far north: introduced into EUROPE and the MADEIRA ISLANDS.

593. **E. maculata** L. [*C. maculata* (L.) Small]. PURSLANE SPURGE.

Very common in fields and waste places.

NORTH AMERICA.

594. **E. humistrata** Engelm. [*C. humistrata* (Engelm.) Small]. SPREADING SPURGE.

Waste places; locally abundant.

QUEBEC to NEW YORK, MISSISSIPPI and KANSAS.

595. **E. marginata** Pursh [*D. marginatum* (Pursh) Kl. & Garcke].

Waste places; scarce about Columbia, but common at Providence.

MINNESOTA to COLORADO and TEXAS; introduced eastward.

596. **E. corollata** L. [*Tithymalopsis corollata* (L.) Small]. FLOWERING SPURGE.

Common in fields and thickets, especially in light soil.

MASSACHUSETTS to ONTARIO and MINNESOTA; FLORIDA to KANSAS and TEXAS.

597. **E. dentata** Michx. [*P. dentata* (Michx.) Small].

Along streams and in waste places.

PENNSYLVANIA to SOUTH DAKOTA; LOUISIANA to MEXICO.

598. **E. heterophylla** L. [*P. heterophylla* (L.) Small].

Frequent along streams in the crevices of rocks.

ILLINOIS and MINNESOTA to MONTANA; south to FLORIDA, CENTRAL AMERICA, PERU and BRAZIL.

599. **E. Missouriensis** (Norton) Small [*Tithymalus Missouriensis* (Norton) Small]. MISSOURI SPURGE.
Infrequent in meadows and flats.
MINNESOTA to WASHINGTON; MISSOURI to NEW MEXICO.

600. **E. Cyparissias** L. CYPRESS SPURGE.
Roadsides and cemeteries; frequent.
EUROPE, thence to the EASTERN UNITED STATES.

Family 60. CALLITRICHACEAE Lindl. Water starwort family.

235. CALLITRICHE L. WATER STARWORT.

601. **C. Austini** Engelm. [*C. deflexa Austini* (Engelm.) Hegelm.].
Muddy shores of the waterworks dam; very rare.
NEW YORK to ILLINOIS and MISSOURI; NEW JERSEY to LOUISIANA and MEXICO.

Order 24. SAPINDALES.

Family 61. ANACARDIACEAE Lindl. Cashew family.

236. RHUS L. [*SCHMALTZIA* Desv.]. SUMAC.

602. **R. glabra** L. [*S. glabra* (L.) Small]. SMOOTH SUMAC.
Thickets and open wooded hillsides; common.
NOVA SCOTIA to BRITISH COLUMBIA; FLORIDA to ARIZONA.

603. **R. copallina** L. [*S. copallina* (L.) Small]. DWARF SUMAC.
Dry thickets and summits of cliffs; scarce.
MAINE and ONTARIO to MINNESOTA and NEBRASKA; FLORIDA to TEXAS.

604. **R. aromatica** Ait. [*R. Canadensis* Marsh.: *S. aromatica* (Ait.) Desv.]. FRAGRANT SUMAC.
Rocky woods and cliffs; common.
NEW ENGLAND and ONTARIO to SASKATCHEWAN; FLORIDA to LOUISIANA.

605. **R. Toxicodendron** L. [*R. radicans* L.]. POISON IVY.

Common in all soils and situations; polymorphous, some forms being bushy, others trailing, others high-climbing on trees or cliffs.

NOVA SCOTIA to BRITISH COLUMBIA; FLORIDA to ARIZONA; BERMUDA ISLANDS; MEXICO: EASTERN ASIA.

Family 62. CELASTRACEAE Lindl. Staff-tree family.

237. EUONYMUS (EVONIMUS) L. BURNING BUSH.

606. **E. atropurpureus** Jacq. WAAHOO.

Common on rocky banks and in thickets.

NEW YORK and ONTARIO to MONTANA; FLORIDA to TEXAS.

238. CELASTRUS L. STAFF-TREE.

607. **C. scandens** L. CLIMBING BITTER-SWEET.

Frequent in thickets and hawthorn glades.

QUEBEC to MANITOBA; GEORGIA to NEW MEXICO.

Family 63. STAPHYLEACEAE DC. Bladder-nut family.

239. STAPHYLEA L. BLADDER-NUT.

608. **S. trifolia** L. [*S. trifoliata* Schmidt].

Rich wooded hillsides; frequent.

QUEBEC to ONTARIO and MINNESOTA; GEORGIA to TENNESSEE and MISSOURI.

Family 64. ACERACEAE J. St. Hil. Maple family.

240. ACER L. [*NEGUNDO* Moench: *RULAC* Adans.]. MAPLE.

609. **A. rubrum** L. SCARLET MAPLE.

Very rare along Hinkson creek.

NEW BRUNSWICK to MANITOBA; FLORIDA to TEXAS.

610. **A. dasycarpum** Ehrh. [*A. saccharinum* L.]. SILVER MAPLE.

Very common in low grounds and along streams: the form with deeply cleft leaves, and commonly planted as a shade tree, is the var. *laciniatum* Sargent.

NEW BRUNSWICK to ONTARIO and NORTH DAKOTA; FLORIDA to the INDIAN TERRITORY.

611. **A. Negundo** L. [*N. aceroides* Moench: *R. Negundo* (L.) A. S. Hitchc.]. BOX-ELDER.

Infrequent along streams; common as an ornamental tree.

VERMONT and ONTARIO to MANITOBA; FLORIDA to NEW MEXICO.

612. **A. saccharinum** Wang. [*A. saccharum* Marsh.]. SUGAR MAPLE. ROCK MAPLE.

Oak forests in rich soil; seldom in groves in rich soil.

NEWFOUNDLAND to MANITOBA and SOUTH DAKOTA; GEORGIA to TEXAS.

613. **A. barbatum** Michx. [*A. saccharum barbatum* (Michx.) Trelease].

Common in rocky soil.

MAINE and MICHIGAN to TENNESSEE and MISSOURI.

614. **A. nigrum** Michx. f. [*A. saccharinum nigrum* (Michx. f.) T. & G.: *A. saccharum nigrum* (Michx. f.) Britton]. BLACK MAPLE.

Common in rich rocky woods near streams.

ONTARIO to MINNESOTA; GEORGIA to LOUISIANA.

Family 65. HIPPOCASTANACEAE T. & G. Horse chestnut family.

241. AESCULUS L. HORSE CHESTNUT.

615. **A. glabra** Willd. OHIO BUCKEYE.

Common on hillsides and the banks of streams; usually a small tree.

PENNSYLVANIA and MICHIGAN to IOWA and KANSAS; GEORGIA to TEXAS.

616. **A. arguta** Buckl. [*A. glabra arguta* (Buckl.) Robinson]. Dwarf buckeye.

Common on roadsides and in upland thickets; usually a shrub.

Iowa to Nebraska; Missouri to Texas.

617. **A. lutea** Wang. [*A. octandra* Marsh.: *A. flava* Ait.] Sweet buckeye.

Rich woods in deep ravines; rare.

Pennsylvania to Iowa; Georgia to Texas.

Family 66. **BALSAMINACEAE** Lindl. **Jewell-weed family.**

242. **IMPATIENS** L. Jewell-weed.

618. **I. aurea** Muhl. [*I. pallida* Nutt.]. Pale touch-me-not.

Common in damp shaded places and about springs and streams.

Quebec to Saskatchewan and Oregon; Florida to Missouri and Kansas.

619. **I. biflora** Walt. [*I. fulva* Nutt.]. Spotted touch-me-not.

About streams and springs and in deep ravines; much less frequent than the preceding.

Newfoundland to Washington and Oregon; Florida to Mississippi and Kansas.

Order 25. RHAMNALES.

Family 67. **RHAMNACEAE** Dumort. **Buckthorn family.**

243. **RHAMNUS** L. Buckthorn.

620. **R. lanceolata** Pursh. Indian cherry.

Common on rocky banks and roadsides.

Pennsylvania to Iowa and Colorado; Alabama to Texas.

621. **R. cathartica** L. Buckthorn.

Roadsides near the Providence bridge.

Europe, Asia and Northern Africa, thence naturalized in many parts of the United States.

244. CEANOTHUS L. Red-root.

622. **C. Americanus** L. New Jersey tea.
Open thickets and dry woods; infrequent.
Ontario and Michigan to Manitoba; Florida to Texas.

623. **C. pubescens** (T. & G,) Rydb. [*C. ovatus pubescens* T. & G.]. Hairy red-root.
Pansy Hill and other barren knolls; frequent.
Michigan to Iowa and Nebraska; Arkansas to Texas.

Family 68. VITACEAE Lindl. Grape family.

245. VITIS Tourn. Grape.

624. **V. aestivalis** Michx. Summer grape.
Thickets and fence-rows; frequent.
New York to Michigan and Missouri; Florida to Mississippi.

625. **V. cinerea** Engelm. Downy grape.
Rocky banks along streams; uncommon.
Illinois to Kansas; Missouri to Texas; Florida.

625a. **V. cinerea canescens** (Engelm.) Bailey. Hoary grape.
Low thickets; frequent.
Illinois and Missouri to Texas.

626. **V. cordifolia** Michx. Frost grape.
Frequent in woods and thickets along streams.
New York to Kansas; Florida to Texas.

627. **V. riparia** Michx. [*V. vulpina* L.]. Riverside grape.
Common along streams: the fruit ripe in the fall.
New Brunswick to Montana; Florida to Texas and Colorado.

627a. **V. riparia praecox** Engelm. [*V. vulpina praecox* (Engelm.) Bailey]. June grape.
Along streams: the fruit ripe in July.
Missouri.

628. **V. rubra** Michx. [*V. palmata* Vahl.] RED GRAPE.
Scarce on rocky hillsides.
ILLINOIS and MISSOURI to LOUISIANA and TEXAS.

246. QUINARIA Raf. [*AMPELOPSIS* Michx.: *PARTHENOCISSUS* Planch.]. FALSE GRAPE.

629. **Q. quinquefolia** (L.) Koehne [*A. quinquefolia* (L.) Michx.: *P. quinquefolia* (L.) Planch.]. VIRGINIA CREEPER.
Common in woods, thickets and fence-rows; frequently covering the sheer sides of cliffs and of buildings.
QUEBEC to MANITOBA and the ROCKY MOUNTAINS; FLORIDA to NEW MEXICO; CUBA.

247. AMPELOPSIS Michx. [*CISSUS* L.].

630. **A. cordata** Michx. [*C. Ampelopsis* Pers.]. IVY GRAPE.
Frequent along streams.
VIRGINIA to ILLINOIS and MISSOURI; FLORIDA to TEXAS and MEXICO.

Order 26. MALVALES.

Family 69. TILIACEAE Juss. Linden family.

248. TILIA L. LINDEN.

631. **T. Americana** L. BASSWOOD.
Frequent in alluvial woods.
NEW BRUNSWICK to MANITOBA and NORTH DAKOTA; GEORGIA to TEXAS.

Family 70. MALVACEAE Neck. Mallow family.

249. ABUTILON Gaertn. INDIAN MALLOW.

632. **A. Avicennae** Gaertn. [*A. Abutilon* (L.) Rusby: *A. Theophrasti* Medic.]. VELVET LEAF.
Common in waste places.
EUROPE and ASIA, thence to NORTH AMERICA.

250. ALTHAEA L. Marsh mallow.

633. **A. rosea** (L.) Cav. Hollyhock.
Persisting in old yards and waysides.
Turkey, Greece and Crete, thence widely cultivated.

251. MALVA L. [*CALLIRRHOE* Nutt.]. Mallow.

634. **M. rotundifolia** L. Cheeses. Common mallow.
Common in barnyards and about houses.
Europe and Asia, thence to North America.

635. **M. moschata** L. Musk mallow.
Fields and roadsides; infrequent.
Europe, thence to North America.

636. **M. digitata** (Nutt.) T. & G. [*C. digitata* Nutt.]. Poppy mallow.
Dry open grounds; very rare.
Missouri to Kansas; Arkansas to Texas.

252. SIDA L.

637. **S. spinosa** L. Prickly sida.
Common in fields and waste places.
New York to Michigan and Iowa; Florida to Texas: most tropic lands.

253. HIBISCUS L. Rose mallow.

638. **H. Trionum** L. Bladder ketmia.
Infrequent in waste places.
Europe, thence to Eastern North America.

Order 27. PARIETALES.

Family 71. GUTTIFERAE Juss. Balsam-tree family.

254. HYPERICUM L. [*SAROTHRA* L.]. St. John's-wort.

639. **H. corymbosum** Muhl. [*H. maculatum* Walt.]. Spotted St. John's-wort.
Low grounds; very common and variable.
Ontario to Minnesota; Florida to Texas and Kansas.

640. **H. subpetiolatum** Bicknell.
Common in oak woods and thickets.
MAINE to NEW YORK; GEORGIA to TENNESSEE and MISSOURI.

641. **H. pseudomaculatum** Bush.
Pansy Hill and other clay barrens.
ILLINOIS to MISSOURI and ARKANSAS.

642. **H. perforatum** L. COMMON ST. JOHN'S-WORT.
Roadsides and waste places; uncommon.
CANARY ISLANDS, EUROPE and SIBERIA, thence to NORTH AMERICA.

643. **H. prolificum** L. SHRUBBY ST. JOHN'S-WORT.
Common in thickets in both low and rocky ground.
NEW JERSEY to MICHIGAN and MINNESOTA; GEORGIA to ARKANSAS.

644. **H. nudiflorum** Michx.
Dry thickets; scarce.
NORTH CAROLINA and FLORIDA to TEXAS; MISSOURI (Shannon County; Boone County).

645. **H. sphaerocarpum** Michx. [*H. cistifolium* Lam.].
Common on rocky hillsides and cliffs.
ONTARIO to ILLINOIS and MISSOURI; ALABAMA to ARKANSAS.

646. **H. mutilum** L.
Low swampy grounds and stream-banks; common.
NOVA SCOTIA to MANITOBA; FLORIDA to TEXAS.

647. **H. Drummondii** (Grev. & Hook.) T. & G. [*S. Drummondii* Grev. & Hook.].
Dry open places; rare except near the Pinnacles.
VIRGINIA to ILLINOIS and MISSOURI; FLORIDA to MISSOURI.

Family 72. CISTACEAE Lindl. Rockrose family.

255. HELIANTHEMUM Tourn. FROST-WEED.

648. **H. majus** (L.) B. S. P. HOARY FROST-WEED.
Scarce on high bluffs.
MAINE to MINNESOTA and SOUTH DAKOTA; GEORGIA to TEXAS.

256. LECHEA L. Pinweed.

649. **L. major** Michx. [*L. villosa* Ell.]. Large pinweed.
Sterile hills and clay barrens; frequent.
Massachusetts to Michigan and Nebraska; Florida to Texas.

650. **L. tenuifolia** Michx. Thin pinweed.
Abundant in all barren places.
Massachusetts to Wisconsin; Florida to Texas; Cuba.

Family 73. VIOLACEAE DC. Violet family.

257. HYBANTHUS Jacq. [*SOLEA* Spreng.: *CUBELIUM* Raf.].

651. **H. concolor** (Forst.) Spreng. [*S. concolor* (Forst.) Ging.: *C. concolor* (Forst.) Raf.]. Green violet.
Abundant on rich hillsides.
New York and Ontario to Michigan; North Carolina to Kansas.

258. VIOLA L. Violet.

652. **V. pedata** L. [*V. pedata bicolor* Pursh]. Pansy violet.
Pansy Hill and red clay barrens; scarce.
New England to Maryland and District of Columbia; Missouri.

652a. **V. pedata lineariloba** DC. [*V. pedata* Auct.]. Bird's-foot violet.
With the type but much commoner: biologically this is the species, while the type is the variety.
Maine and Ontario to Minnesota and South Dakota; Florida to Missouri.

653. **V. palmata** L. Palmate-leaved violet.
Dry oak thickets and forests; scarce.
Maine and Ontario to Minnesota; Georgia to Arkansas.

653a. **V. palmata dilatata** Ell.

With the type, but much more abundant.

Range of the type.

654. **V. sororia** Willd. [*V. palmata sororia* (Willd.) Pollard: *V. palmata asarifolia* (Pursh) House]. WOOLLY BLUE VIOLET.

Rare in dry oak thickets.

NEW YORK to MICHIGAN and NEBRASKA; VIRGINIA to MISSOURI.

655. **V. papilionacea** Pursh [*V. obliqua* Britton & Brown: *V. palmata cucullata* Auct. and *V. cucullata* Auct. mainly]. COMMON BLUE VIOLET.

Abundant in rich soil: very variable in leaf-contour, pubescence, size and the color of the flowers.

NOVA SCOTIA to MINNESOTA and SOUTH DAKOTA; GEORGIA to MISSOURI and KANSAS.

656. **V. domestica** Bicknell. [*V. papilionacea domestica* (Bicknell) Pollard]. YARD VIOLET.

About houses and along streets: something very like it with large broadly reniform leaves and of stout habit is common along streams.

NEW YORK to VIRGINIA and MISSOURI.

657. **V. cuspidata** Greene.

Here are referred hirsute plants with dark blue flowers, but forms connecting with *V. papilionacea* Pursh are plentiful: mainly in the drier soils.

MICHIGAN to BRITISH COLUMBIA; INDIANA to MISSOURI.

658. **V. Missouriensis** Greene. MISSOURI VIOLET.

Oak woods; scarce: the flowers vary from pale purple to almost white; the plants are somewhat pubescent.

MISSOURI.

659. **V. cucullata** Ait. MARSH BLUE VIOLET.

Along streams: the flowers are similar to the preceding, but the plants are glabrous or hairy only upon the new leaves.

MAINE to ONTARIO; GEORGIA to MISSOURI.

660. **V. Rafinesquii** Greene. [*V. tenella* Muhl.: *V. tricolor arvensis* Hook.]. FIELD PANSY.

Very common in wild open places, especially about rivulets with low rocky shores.

MAINE to MICHIGAN; GEORGIA to TEXAS.

661. **V. striata** Ait. PALE VIOLET.

Moist thickets about streams; becoming very scarce.

NEW ENGLAND and ONTARIO to MINNESOTA; GEORGIA to MISSOURI.

662. **V. pubescens** Ait. HAIRY YELLOW VIOLET.

Oak woods; scarce and seldom typical.

QUEBEC to SOUTH DAKOTA; SOUTH CAROLINA to TENNESSEE and MISSOURI.

663. **V. scabriuscula** (T. & G.) Schwein. [*V. pubescens scabriuscula* T. & G.]. SMOOTH YELLOW VIOLET.

Common along streams and in low woods: forms connecting this with the preceding are not rare on the higher grounds.

NOVA SCOTIA to MANITOBA; SOUTH CAROLINA to TENNESSEE and MISSOURI.

Family 74. LOASACEAE Reichenb. Loasa family.

259. MENTZELIA L.

664. **M. oligosperma** Nutt.

Common on the bluffs and banks of the Missouri.

ILLINOIS to SOUTH DAKOTA and COLORADO; LOUISIANA to TEXAS and MEXICO.

Order 28. OPUNTIALES.

Family 75. CACTACEAE Lindl. Cactus family.

260. OPUNTIA Mill. PRICKLY PEAR.

665. **O. Rafinesquii** Engelm. [*O. humifusa* Raf.]. WESTERN PRICKLY PEAR.

Barren hillside between Hinkson and Grindstone creeks.

MICHIGAN to SOUTH DAKOTA; MISSOURI to KANSAS and TEXAS.

Order 29. MYRTIFLORALES.

Family 76. LYTHRACEAE Lindl. Loosestrife family.

261. ROTALA L.

666. **R. ramosior** (L.) Koehne.
Muddy margins of ponds and streams.
Massachusetts to Michigan* and Nebraska; Florida to Texas; Mexico and California; West Indies and South America: Philippine Islands.

262. AMMANNIA L.

667. **A. coccinea** Rottb.
Common in limose places.
Indiana and Iowa to South Dakota; Florida to Texas and Mexico: Brazil: Pacific Islands.

263. LYTHRUM L. Loosestrife.

668. **L. alatum** Pursh. Winged loosestrife.
Rare in low grounds.
Massachusetts and Ontario to Michigan and South Dakota; Kentucky to Arkansas.

264. CUPHEA P. Br. [*PARSONSIA* P. Br.]. Wax-weed.

669. **C. viscosissima** Jacq. [*P. petiolata* (L.) Rusby]. Clammy cuphea.
Infrequent in creek-bottoms.
Rhode Island to Ontario, Illinois and Kansas; Georgia to Louisiana.

---

*This plant, not mentioned by Beal in his recent Flora of Michigan, grows plentifully about a lake just west of Alto, Michigan.

Family 77. ONAGRACEAE Dumort. Evening-primrose family.

265. JUSSIEUA (JUSSIAEA) L. PRIMROSE WILLOW.

670. **J. diffusa** Foiskl. [*J. repens* Auct.]. CREEPING PRIMROSE WILLOW.

In and about ponds; local.

KENTUCKY and ILLINOIS to KANSAS; FLORIDA to TEXAS: TROPICAL ASIA and AMERICA.

266. LUDWIGIA L. [*ISNARDIA* L.]. FALSE LOOSESTRIFE.

671. **L. alternifolia** L. SEED-BOX. RATTLE-BOX.

Frequent in swales and marsh-meadows.

NEW HAMPSHIRE to ONTARIO and MICHIGAN; FLORIDA to TEXAS and KANSAS.

672. **L. palustris** (L.) Ell. [*I. palustris* L.]. WATER PURSLANE.

Common in limose places.

NOVA SCOTIA to MANITOBA and OREGON; FLORIDA to CALIFORNIA and MEXICO: EUROPE.

267. EPILOBIUM L. WILLOW-HERB.

673. **E. adenocaulon** Haussk.

Wet places and swamps; local.

NEW BRUNSWICK to BRITISH COLUMBIA; PENNSYLVANIA and MISSOURI to UTAH and CALIFORNIA.

268. ONAGRA Tourn. [*OENOTHERA* L.]. EVENING PRIMROSE.

674. **O. biennis** (L.) Scop. [*Oenothera biennis* L.]. COMMON EVENING PRIMROSE.

Common in all open and waste places; often a bad weed.

LABRADOR and FLORIDA to the MISSISSIPPI VALLEY and SOUTH DAKOTA.

674a. **O. biennis grandiflora** (Ait.) Lindl.

With the type, of which it is a stout and large-flowered form.

Range of the type.

675. **O. strigosa** Rydb. [*Oenothera biennis strigosa* (Rydb.) Mack. & Bush]. HAIRY EVENING PRIMROSE.

Fields in dry soil.

SOUTH DAKOTA to MONTANA; MISSOURI to NEBRASKA.

269. OENOTHERA L. [*RAIMANNIA* Rose].

676. **O. sinuata** L. [*O. laciniata* Hill: *R. laciniata* (Hill) Rose].

Meadows and waste places; infrequent.

VERMONT to MICHIGAN and SOUTH DAKOTA; FLORIDA to TEXAS, MEXICO and SOUTH AMERICA.

270. XYLOPLEURUM Spach [*HARTMANNIA* Spach : *OENOTHERA* L.].

677. **X. speciosum** (Nutt.). Raim. [*H. speciosa* (Nutt.) Small: *O. speciosa* Nutt.]. SHOWY PRIMROSE.

Along the Missouri, especially about railroads.

SOUTH CAROLINA to MICHIGAN and KANSAS; GEORGIA to ARIZONA and MEXICO: naturalized in the eastern part of its range.

271. MERIOLIX Raf. [*OENOTHERA* L.].

678. **M. serrulata** (Nutt.) Walp. [*O. serrulata* Nutt.].

Along the railroad near Rocheport.

WISCONSIN and MINNESOTA to MANITOBA; MISSOURI to TEXAS and NEW MEXICO.

272. GAURA L.

679. **G. biennis** L.

Roadsides between Hallsville and the Pinnacles; also along Hinkson creek south.

QUEBEC to MINNESOTA and NEBRASKA; GEORGIA to ARKANSAS.

273. CIRCAEA L. ENCHANTER'S NIGHTSHADE.

680. **C. Lutetiana** L.
Common in alluvial woods and deep ravines.
NOVA SCOTIA to ONTARIO and SOUTH DAKOTA; GEORGIA to KANSAS.

Order 30. UMBELLIFLORALES.

Family 78. ARALIACEAE Vent. Ginseng family.

274. ARALIA L. WILD SARSAPARILLA.

681. **A. racemosa** L. SPIKENARD.
Rare in rich woods, but somewhat frequent at the Pinnacles.
NEW BRUNSWICK to MINNESOTA and SOUTH DAKOTA; GEORGIA to MISSOURI.

275. PANAX L. [*ARALIA* L.]. GINSENG.

682. **P. quinquefolium** L. [*A. quinquefolia* (L.) D. & P.]. WILD GINSENG.
Rare in rich woods and deep ravines.
QUEBEC to MINNESOTA and NEBRASKA; FLORIDA to ALABAMA and MISSOURI.

Family 79. UMBELLIFERAE Juss. Parsley family.

276. SANICULA L. SANICLE.

683. **S. gregaria** Bicknell. BLACK SNAKEROOT.
Oak woods; much less frequent than the next.
NEW HAMPSHIRE to MINNESOTA and NEBRASKA; NORTH CAROLINA to ARKANSAS and KANSAS.

684. **S. Canadensis** L. [*S. Marylandica Canadensis* (L.) Torr.]. AMERICAN SANICLE.
Abundant in oak woods.
MASSACHUSETTS and VERMONT to MICHIGAN and SOUTH DAKOTA; FLORIDA to TEXAS.

277. CHAEROPHYLLUM L. CHERVIL.

685. **C. procumbens** (L.) Crantz. SPREADING CHERVIL.
Common in alluvial flats.
NEW YORK and ONTARIO to MICHIGAN and IOWA; NORTH CAROLINA to KANSAS.

686. **C. Texanum** Coult. & Rose.
Hedges; scarce.
MISSOURI to TEXAS.

687. **C. Floridanum** (Coult. & Rose) Bush [*C. Teinturieri Floridanum* Coult. & Rose].
Frequent in fence-rows.
SOUTH CAROLINA to FLORIDA; MISSOURI.

278. OSMORRHIZA Raf. [*WASHINGTONIA* Raf.]. SWEET CICELY.

688. **O. brevistylis** DC. [*W. Claytonii* (Michx.) Britton]. WOOLLY SWEET CICELY.
Common in rich woods.
NOVA SCOTIA to MINNESOTA and SOUTH DAKOTA; NORTH CAROLINA to MISSOURI and NEBRASKA: ASIA.

689. **O. longistylis** (Torr.) DC. [*W. longistylis* (Torr.) Britton]. SMOOTH SWEET CICELY.
Common in rich alluvial woods.
NOVA SCOTIA to MONTANA and the NORTHWEST TERRITORY; NORTH CAROLINA to KANSAS and COLORADO.

279. CORIANDRUM L. CORIANDER.

690. **C. sativum** L.
Yards; scarce.
Native of the MEDITERRANEAN region, thence to the UNITED STATES.

280. ERIGENIA Nutt. HARBINGER OF SPRING.

691. **E. bulbosa** Nutt.
Frequent in rich damp woods.
ONTARIO to MINNESOTA; DISTRICT OF COLUMBIA to ALABAMA and KANSAS.

281. **ZIZIA** Koch. ALEXANDERS.

692. **Z. aurea** (L.) Koch. GOLDEN ALEXANDERS.

Frequent in wet woods and thickets.

NEW BRUNSWICK and ONTARIO to MONTANA; FLORIDA to TEXAS.

693. **Z. cordata** (Walt.) DC. HEART-LEAVED ALEXANDERS.

Dry hills and upland woods.

CONNECTICUT to the NORTHWEST TERRITORY; GEORGIA to MISSOURI and OREGON.

282. **CICUTA** L. WATER-HEMLOCK.

694. **C. maculata** L. SPOTTED COWBANE. MUSQUASH ROOT.

Common along streams and ditches, and the margins of ponds, and in swamps.

NEW BRUNSWICK to MANITOBA; FLORIDA to TEXAS.

283. **CRYPTOTAENIA** DC. [*DERINGA* Adans.]. HONEWORT.

695. **C. Canadensis** (L.) DC. [*D. Canadensis* (L.) Kuntze].

Common in rich woods.

NEW BRUNSWICK to SOUTH DAKOTA; GEORGIA to TEXAS.

284. **CARUM** L. CARVIES.

696. **C. Carvi** L. CARAWAY.

Occasional in yards and streets.

EUROPE and the MEDITERRANEAN region to THIBET and SIBERIA, thence to NORTH AMERICA.

285. **TAENIDIA** Drude [*PIMPINELLA* L.]. PIMPERNEL.

697. **T. integerrima** (L.) Drude [*P. integerrima* (L.) Gray]. YELLOW PIMPERNEL.

Abundant on rocky hillsides.

QUEBEC to MINNESOTA; GEORGIA to MISSISSIPPI and MISSOURI.

286. SIUM L. Water parsnip.

698. **S. cicutaefolium** Gmel.
Swamp at Brushwood lake.
Newfoundland to British Columbia; Florida to California.

287. FOENICULUM L. Fennel.

699. **F. vulgare** Gaertn. [*F. Foeniculum* (L.) Karst.].
Yards; rare.
Europe, thence to the United States.

288. THASPIUM Nutt. Meadow parsnip.

700. **T. aureum** Nutt. [*T. trifoliatum aureum* (Nutt.) Britton]. Golden meadow parsnip.
Woods and thickets; common.
New England to Wyoming and Oregon; Georgia to Arkansas.

701. **T. cordatum** T. & G. [*T. aureum cordatum* (T. & G.) B. S. P., not (Walt.) B. S. P., Walter's plant being *Zizia cordata* (Walt.) DC.: *T. aureum trifoliatum* Coult. & Rose].* Heart-leaved meadow parsnip.
Frequent on dry hills: the plants have simple cordate basal leaves, or in some plants, all the leaves are simple; scarcely to be distinguished in flower from *Zizia cordata* (Walt.) DC.
Ohio to Oregon.

702. **T. barbinode** (Michx.) Nutt.
Common on the banks of streams.
New York and Ontario to Minnesota; Florida to Arkansas.

---

*If the name *cordatum* be thought untenable on account of the former confusion of *Zizia* with *Thaspium*, the name *Thaspium Ziziopsis* is suggested as suitable for this plant, which stands in the same relation to *T. aureum* Nutt. as *Z. cordata* (Walt.) DC. does to *Z. aurea* (L.) Koch. But as Nuttall's *T. aureum* is allowed to stand in spite of a like confusion, so the term *T. cordatum* may be allowed, going back only to T. & G. and excluding the reference to Walter.

289. PASTINACA L. Parsnip.

703. **P. sativa** L. Common parsnip.
Roadsides and waste places; common.
Europe, thence to North America.

290. DAUCUS L. Carrot.

704. **D. Carota** L. Common carrot.
Fields and roadsides; common.
Europe and Asia, thence to North America.

Family 80. CORNACEAE Link. Dogwood family.

291. CORNUS L. [*SVIDA* Opiz: *CYNOXYLON* Raf.]. Cornel. Dogwood.

705. **C. sericea** L. [*C. Amomum* Mill.: *S. Amomum* (Mill.) Small]. Silky dogwood. Kinnikinnik.
Along streams and in swamps. Some forms are very close to *C. Baileyi* Coult. & Evans, to which they might be referred but for the blue drupe. There are also apparent hybrids with the next.
New Brunswick to Ontario and South Dakota; Florida to Texas.

706. **C. asperifolia** Michx. [*S. asperifolia* (Michx.) Small]. Rough dogwood.
Common on cliffs and rocky banks.
Ontario and Michigan to South Dakota and Kansas; Florida to Texas.

707. **C. Drummondii** Meyer [*C. asperifolia Drummondii* (Meyer) Coult. & Evans]. Drummond's dogwood.
Cliffs and dry grounds; common.
Missouri to Texas.

708. **C. candidissima** Marsh. [*C. paniculata* L'Her.: *S. candidissima* (Marsh.) Small]. Panicled cornel.
Upland thickets; scarce.
Maine and Ontario to Minnesota; Georgia to Missouri and Nebraska.

709. **C. florida** L. [*Cynoxylon floridum* (L.) Raf.]. FLOWERING DOGWOOD.

Very rare in oak woods and on rocky banks.

MASSACHUSETTS to ONTARIO and MINNESOTA; FLORIDA to TEXAS and MEXICO.

Series 2. SYMPETALAE.

Order 31. ERICALES.

Family 81. PIROLACEAE Agardh. Shin-leaf family.

292. MONOTROPA L. CORPSE-PLANT.

710. **M. uniflora** L. INDIAN PIPE.

Rare in rich oak woods: saprophytic on leaf mould.

ANTICOSTI to BRITISH COLUMBIA; FLORIDA to CALIFORNIA and MEXICO: EASTERN ASIA.

Family 82. ERICACEAE DC. Heath family.

293. VACCINIUM L. BLUEBERRY.

711. **V. vacillans** Kalm. LOW BLUEBERRY.

High cliffs of Grindstone creek; a restricted patch south of the stream, also a few scattered bushes on the bluff on the opposite side.

MAINE to ONTARIO and MICHIGAN; GEORGIA to MISSOURI.

Order 32. PRIMULALES.

Family 83. PRIMULACEAE Vent. Primrose family.

294. ANDROSACE L.

712. **A. occidentalis** Pursh. ROCK PRIMROSE.

Summits of cliffs; local.

MICHIGAN to the NORTHWEST TERRITORY; ARKANSAS to UTAH and NEW MEXICO.

295. SAMOLUS L. WATER PIMPERNEL.

713. **S. floribundus** H. B. K. [*S. Valerandi Americanus* Gray].
Rare about Brushwood lake.
NEWFOUNDLAND to BRITISH COLUMBIA; FLORIDA to CALIFORNIA and MEXICO.

296. LYSIMACHIA L. LOOSESTRIFE.

714. **L. Nummularia** L. MONEYWORT.
Damp yards.
EUROPE, thence to NORTH AMERICA.

297. STEIRONEMA Raf. LOOSESTRIFE.

715. **S. ciliatum** (L.) Raf. FRINGED LOOSESTRIFE.
Rare in moist thickets.
NOVA SCOTIA to BRITISH COLUMBIA; FLORIDA to ARIZONA: naturalized in EUROPE.

716. **S. lanceolatum** (Walt.) Gray.
Old road-bed south of Grindstone creek.
MAINE to MINNESOTA; FLORIDA to ARIZONA.

717. **S. heterophyllum** (Michx.) Raf. [*S. lanceolatum angustifolium* (Lam.) Gray]. SWAMP LOOSESTRIFE.
In swamps; local.
VIRGINIA to MISSOURI; FLORIDA to MISSISSIPPI.

298. CENTUNCULUS L. CHAFFWEED.

718. **C. minimus** L.
Beds of dried-up puddles; rare.
ILLINOIS and MINNESOTA to BRITISH COLUMBIA; MISSOURI to TEXAS and MEXICO: SOUTH AMERICA: EUROPE.

299. DODECATHEON L. SHOOTING STAR.

719. **D. Meadia** L. AMERICAN COWSLIP.
Damp ledges near the Pinnacles; scarce.
PENNSYLVANIA to MANITOBA; GEORGIA to TEXAS.

Order 33. EBENALES.

Family 84. EBENACEAE Vent. **Ebony family.**

300. DIOSPYROS L. DATE PLUM.

720. **D. Virginiana** L. PERSIMMON.

Fields and rocky woods; well distributed, but seldom in abundance; a large grove, however, occurs near Rocheport cave.

RHODE ISLAND to IOWA and KANSAS; FLORIDA to TEXAS.

Order 34. CONTORTALES.

Family 85. OLEACEAE Lindl. **Olive family.**

301. FRAXINUS L. ASH.

721. **F. Americana** L. WHITE ASH.

Common in rich woods and old fields.

NOVA SCOTIA to MINNESOTA; FLORIDA to TEXAS.

722. **F. lanceolata** Borck. [*F. viridis* Michx. f.]. GREEN ASH.

Along streams, and common as an ornamental tree: the typical form with leaves green beneath is rare; a form with leaves whitened beneath, thus approaching *F. Pennsylvanica* Marsh., but glabrous, is common.

QUEBEC to the NORTHWEST TERRITORY; FLORIDA to LOUISIANA and the INDIAN TERRITORY.

723. **F. quadrangulata** Michx. BLUE ASH.

Common on cliffs and rocky hillsides.

ONTARIO and MICHIGAN to MINNESOTA; ALABAMA to ARKANSAS.

724. **F. nigra** Marsh. [*F. sambucifolia* Lam.]. BLACK ASH.

Common in low grounds.

NEWFOUNDLAND to MANITOBA; VIRGINIA to ARKANSAS.

302. SYRINGA L. Lilac.

725. **S. vulgaris** L. Common lilac.
Tending to spread in old gardens and yards.
Eastern Europe and the Orient, now common in cultivation.

Family 86. GENTIANACEAE Dumort. Gentian family.

303. SABBATIA Adans. Rose-pink.

726. **S. campestris** Nutt. Prairie rose-pink.
Open thickets southwest.
Missouri to Kansas; Arkansas to Texas.

304. GENTIANA Tourn. [*DASYSPHANA* Adans.]. Gentian.

727. **G. Andrewsii** Griseb. [*D. Andrewsii* (Griseb.) Small]. Closed gentian.
Very rare in low grounds and the borders of swamps.
Quebec to the Northwest Territory; Georgia to Missouri.

Family 87. APOCYNACEAE Lindl. Dogbane family.

305. VINCA L. Periwinkle.

728. **V. minor** L. Blue periwinkle.
Cemeteries and old gardens.
Europe and Western Asia, common in cultivation.

306. APOCYNUM L. Dogbane.

729. **A. androsaemifolium** L. Common dogbane.
Scarce in fields and waste places.
Anticosti to British Columbia; Georgia to Arizona.

730. **A. urceolifer** Miller. Downy dogbane.
Roadsides and old fields: some forms resemble closely *A. hypericifolium* Ait., but are densely pubescent, and are perhaps referable to *A. pubescens* R. Br.
New York and Maryland to Missouri.

731. **A. hypericifolium** Ait.
Fields and roadsides; scarce.
ONTARIO to BRITISH COLUMBIA; OHIO to NEW MEXICO.

732. **A. cannabinum** L. INDIAN HEMP.
Common in fields; thickets and waste places.
ANTICOSTI to BRITISH COLUMBIA; FLORIDA to LOWER CALIFORNIA.

733. **A. album** Greene [*A. cannabinum glaberrimum* DC.]. RIVER INDIAN HEMP.
Along streams and in low grounds.
MAINE and ONTARIO to WISCONSIN; VIRGINIA to MISSOURI.

Family 88. ASCLEPIADACEAE Lindl. Milkweed family.

307. GOMPHOCARPUS L. [*ACERATES* Ell.]. GREEN MILKWEED.

734. **G. longifolius** (Ell.) K. Sch. [*A. longifolia* Ell.: *A. Floridana* (Lam.) Hitchc.].
Wild fields and along railroads; local, but becoming yearly more frequent.
OHIO and ONTARIO to MINNESOTA; FLORIDA to TEXAS.

308. ASCLEPIAS L. MILKWEED.

735. **A. tuberosa** L. BUTTERFLY WEED.
Dry fields and roadsides; less common than the next.
MAINE to ONTARIO and MINNESOTA and COLORADO; FLORIDA to ARIZONA.

736. **A. decumbens** L. [*A. tuberosa decumbens* (L.) Pursh]. PLEURISY ROOT.
Common with the above, into which it merges in numerous forms.
NEW YORK to ILLINOIS; NORTH CAROLINA and FLORIDA to MISSOURI.

737. **A. purpurascens** L. PURPLE MILKWEED.
Fields and open thickets; infrequent.
MASSACHUSETTS to MINNESOTA; NORTH CAROLINA to TENNESSEE and KANSAS.

738. **A. incarnata** L. SWAMP MILKWEED.
Frequent along streams and in low grounds.
NEW BRUNSWICK to the NORTHWEST TERRITORY; TENNESSEE to LOUISIANA and KANSAS.

739. **A. Cornuti** Decne. [*A. Syriaca* L.]. COMMON MILKWEED. SILKWEED.
Very common in fields and waste places.
NEW BRUNSWICK to SASKATCHEWAN; GEORGIA to KANSAS.

740. **A. quadrifolia** L. FOUR-LEAVED MILKWEED.
Common in woods and thickets.
MAINE and ONTARIO to MINNESOTA; NORTH CAROLINA to ARKANSAS.

741. **A. verticillata** L. WHORLED MILKWEED.
Common in dry fields and thickets.
MAINE and ONTARIO to the NORTHWEST TERRITORY; FLORIDA to NEW MEXICO and MEXICO.

309. ENSLENIA Nutt. [*AMPELANUS* Raf.: *GONOLOBUS* Michx.]. CLIMBING MILKWEED.

742. **E. albida** Nutt. [*A. albidus* (Nutt.) Britton: *G. laevis* Michx.]. SAND VINE.
Thickets, old pastures and roadsides.
PENNSYLVANIA to ILLINOIS and KANSAS; FLORIDA to TEXAS.

Order 35. TUBIFLORALES.

Family 89. CONVOLVULACEAE Vent. Bindweed family.

310. IPOMOEA L. MORNING-GLORY.

743. **I. pandurata** L. MAN-OF-THE-EARTH.
Dry thickets and hillsides; common.
CONNECTICUT and ONTARIO to MICHIGAN; FLORIDA to TEXAS and KANSAS.

744. **I. lacunosa** L. SMALL WILD MORNING-GLORY.
Fence-rows and low grounds; rare.
PENNSYLVANIA to ILLINOIS and KANSAS; SOUTH CAROLINA to TEXAS.

311. PHARBITIS Choisy [*IPOMOEA* L.]. MORNING-GLORY.

745. **P. hispida** Choisy [*P. purpurea* (L.) Voight: *I. purpurea* (L.) Roth]. COMMON MORNING-GLORY.
Cornfields, yards and waste places; common.
TROPICAL AMERICA, thence to NORTH AMERICA.

746. **P. Nil** (L.) Choisy [*P. hederacea* (L.) Choisy: *I. hederacea* Jacq.]. IVY-LEAVED MORNING-GLORY.
Cornfields and waste places; common.
TROPICAL AMERICA, thence to the UNITED STATES.

312. CALYSTEGIA R. Br. [*CONVOLVULUS* L.]. BINDWEED.

747. **C. Americana** (Sims) Daniels [*Convolvulus sepium Americanus* Sims: *Convolvulus Americanus* (Sims) Greene]. AMERICAN HEDGE BINDWEED.
Fields, waste places and swamps; infrequent.
NOVA SCOTIA to MONTANA; NORTH CAROLINA to UTAH.

313. CUSCUTA L. DODDER.

748. **C. Polygonorum** Engelm. [*C. chlorocarpa* Engelm.] SMARTWEED DODDER.
Low grounds, principally on *Polygonum* and *Bidens*; the commonest local dodder.
PENNSYLVANIA to MINNESOTA; DELAWARE to ARKANSAS.

749. **C. tenuiflora** Engelm. [*C. Cephalanthi* Engelm.]. BUTTON BUSH DODDER.
Swales; on tall herbs and shrubs.
PENNSYLVANIA to MICHIGAN and the NORTHWEST TERRITORY; TEXAS to ARIZONA.

750. **C. Gronovii** Willd. LOVE-VINE.
Low grounds and swales; common on *Mentha* and other herbs.
NOVA SCOTIA to MANITOBA; FLORIDA to TEXAS.

Family 90. POLEMONIACEAE DC. Polemonium family.

314. PHLOX L. Phlox.

751. **P. pilosa** L. Downy phlox.
Dry woods and thickets; much scarcer, except near the Pinnacles, than the next.
New Jersey and Ontario to Manitoba; Florida to Texas.

752. **P. divaricata** L. Common wild phlox.
Rich woods and thickets; common and variable.
Pennsylvania and Ontario to Michigan and Minnesota; Florida to Alabama.

315. POLEMONIUM L. Greek valerian.

753. **P. reptans** L.
Common in rich woods and thickets.
New York to Minnesota; Georgia to Missouri.

Family 91. HYDROPHYLLACEAE Lindl. Waterleaf family.

316. HYDROPHYLLUM L. Waterleaf.

754. **H. appendiculatum** Michx.
Rich banks and deep ravines; common.
Ontario to Minnesota; North Carolina to Kansas.

755. **H. Virginicum** L.
With the preceding, but less common.
Quebec to Alaska; South Carolina to Kansas and Washington.

317. ELLISIA L. [*MACROCALYX* Trew].

756. **E. Nyctelea** L. [*M. Nyctelea* (L.) Kuntze].
Common in waste places, hedges, and shady rocky places.
New Jersey to Minnesota; North Carolina to Kansas.

318. PHACELIA Juss.

757. **P. Purshii** Buckl.
Common in low shady grounds and about damp cliffs and ledges.
Pennsylvania to Minnesota and South Dakota; North Carolina to Alabama and Missouri.

Family 92. BORRAGINACEAE Lindl. Borage family.

319. CYNOGLOSSUM L. Comfrey.

758. **C. officinale** L. Hound's tongue.
Common in fields and waste places.
Europe and Asia, thence to North America.

759. **C. Virginicum** L. Wild comfrey.
Frequent in oak woods and thickets.
New Brunswick to Ontario and Michigan; Florida to Louisiana and Kansas.

320. LAPPULA Moench. [*ECHINOSPERMUM* Sw.]. Stickseed.

760. **L. Virginiana** (L.) Greene [*E. Virginicum* Lehm.] Virginia stickseed.
Common in woods and thickets.
New Brunswick to Minnesota and South Dakota; Georgia to Louisiana.

321. MYOSOTIS L. Forget-me-not.

761. **M. Virginica** (L.) B. S. P. [*M. verna* Nutt.]. Scorpion-grass.
Thickets; rare.
Maine to Ontario and Minnesota; Florida to Texas.

322. MERTENSIA Roth. Lungwort.

762. **M. Virginica** (L.) DC. Blue-bells.
Alluvial banks of streams; rare and local.
New Jersey to Ontario and Minnesota; Georgia to Tennessee and Kansas.

323. LITHOSPERMUM L. Gromwell.

763. **L. arvense** L. Corn gromwell.
Waste places and grainfields; frequent.
Europe and Asia, thence to North America.

764. **L. officinale** L. Common gromwell.
About the railroad at Rocheport.
Europe and Asia, thence to North America.

765. **L. canescens** (Michx.) Lehm. Hoary puccoon.
On barren hills and cliffs, and in dry woods.
New Jersey to Ontario and the Northwest Territory; Georgia to Arizona.

324. ONOSMODIUM Michx. False gromwell.

766. **O. molle** Michx. Soft false gromwell.
Dry cliffs and sterile hills; infrequent.
Michigan and Manitoba to Saskatchewan; Missouri to Texas and Arizona.

Family 93. VERBENACEAE J. St. Hil. Vervain family.

325. VERBENA L. Vervain.

767. **V. angustifolia** Michx. Narrow-leaved vervain.
Dry fields and pastures; scarce.
Massachusetts to Minnesota; Florida to Mississippi and Arkansas.

768. **V. urticifolia** L. White vervain.
Frequent in waste places.
New Brunswick to Minnesota and South Dakota; Florida to Texas.

769. **V. hastata** L. Blue vervain.
Rare along streams and railroads.
Nova Scotia to British Columbia; Florida to New Mexico.

770. **V. stricta** Vent. Hoary vervain.
Very common along roadsides and in dry fields.
Pennsylvania and Michigan to South Dakota and Wyoming; Tennessee and Texas to New Mexico.

771. **V. bracteosa** Michx. CREEPING VERVAIN.
Infrequent in waste places and fields.
MICHIGAN and MINNESOTA to BRITISH COLUMBIA; FLORIDA to CALIFORNIA.

772. **V. Aubletia** L. [*V. Canadensis* (L.) Britton]. WILD VERBENA.
Common in thickets and rocky woodlands.
ILLINOIS to KANSAS; FLORIDA to NEW MEXICO and MEXICO.

326. LIPPIA L. [*PHYLA* Lour.]. FOG-FRUIT.

773. **L. lanceolata** Michx. [*P. lanceolata* (Michx.) Greene].
Common along streams and in wet meadows.
NEW JERSEY to MICHIGAN and SOUTH DAKOTA; FLORIDA to TEXAS, MEXICO and CALIFORNIA.

Family 94. LABIATAE Juss. Mint family.

327. TEUCRIUM L. GERMANDER.

774. **T. Canadense** L. WOOD SAGE.
Very common in fields and thickets.
NEW BRUNSWICK and ONTARIO to MINNESOTA and SOUTH DAKOTA; FLORIDA to TEXAS and MEXICO.

328. ISANTHUS Michx. FALSE PENNYROYAL.

775. **I. brachiatus** (L.) B. S. P. [*I. caeruleus* Michx.].
About streams; rare except in the region of Bear creek.
QUEBEC to MINNESOTA; GEORGIA to TEXAS.

329. SCUTELLARIA L. SKULLCAP.

776. **S. versicolor** Nutt. [*S. cordifolia* Muhl.].
Rich hillsides and alluvial woods; frequent.
PENNSYLVANIA to WISCONSIN and MISSOURI; FLORIDA to TEXAS.

777. **S. galericulata** L. HOODED WILLOW-HERB.
Along a stream north of More's lake; scarce.
NEWFOUNDLAND to ALASKA; NORTH CAROLINA to ARIZONA and WASHINGTON: EUROPE and ASIA.

778. **S. campestris** Britton. [*S. parvula mollis* Gray]. PRAIRIE SKULLCAP.
Cliffs; scarce.
NORTH CAROLINA to IOWA and the INDIAN TERRITORY.

779. **S. parvula** Michx. SMALL SKULLCAP.
Common on cliffs.
QUEBEC to MINNESOTA and SOUTH DAKOTA; FLORIDA to TEXAS.

780. **S. nervosa** Pursh. VEINED SKULLCAP.
Thickets about the waterworks dam; infrequent.
NEW YORK to ILLINOIS; NORTH CAROLINA to MISSOURI.

781. **S. lateriflora** L. MAD-DOG SKULLCAP.
About streams and in swamps.
NEWFOUNDLAND to BRITISH COLUMBIA; FLORIDA to NEW MEXICO and WASHINGTON.

330. MARRUBIUM L. HOARHOUND. HOREHOUND.

782. **M. vulgare** L. WHITE HOARHOUND.
Streets of Columbia.
EUROPE and ASIA, thence to NORTH AMERICA.

331. AGASTACHE Clayt. [*LOPHANTHUS* Benth.]. GIANT HYSSOP.

783. **A. nepetoides** (L.) Kuntze [*L. nepetoides* (L.) Benth.]. CATNIP GIANT HYSSOP.
Rich woods and thickets; frequent.
VERMONT and ONTARIO to WISCONSIN and SOUTH DAKOTA; GEORGIA to MISSOURI.

332. NEPETA L. CATNIP.

784. **N. Cataria** L. COMMON CATNIP
Common in yards and waste places; also in weedy woods.
NEW BRUNSWICK and QUEBEC to MINNESOTA; GEORGIA to KANSAS.

333. GLECOMA (GLECHOMA) L. [*NEPETA* L.]. GROUND IVY.

785. **G. hederacea** L. [*N. Glechoma* Benth.]. GILL-OVER-THE-GROUND.

Yards and cemeteries.

EUROPE and ASIA, thence to NORTH AMERICA.

334. BRUNELLA (PRUNELLA) L. SELF-HEAL.

786. **B. (P.) vulgaris** L. HEAL-ALL.

Common in fields, thickets and forests.

Cosmopolitan.

335. LAMIUM L. DEAD-NETTLE.

787. **L. amplexicaule** L. HENBIT.

Common in waste places.

EUROPE and ASIA, thence to NORTH AMERICA.

336. LEONURUS L. MOTHERWORT.

788. **L. Cardiaca** L.

Common in waste places.

EUROPE and ASIA, thence to NORTH AMERICA.

337. STACHYS L. HEDGE-NETTLE.

789. **S. tenuifolia** Willd. [*S. aspera glabra* (Ridd.) Gray] SMOOTH HEDGE-NETTLE.

Common along streams and in marsh meadows.

NEW YORK to MICHIGAN and KANSAS; NORTH CAROLINA to LOUISIANA.

338. MONARDA L. HORSE-MINT. BERGAMOT.

790. **M. fistulosa** L. WILD BERGAMOT.

Thickets and open oak woods; very variable and seldom typical; numerous forms connect the type with the two following.

MAINE to ONTARIO, MINNESOTA and SOUTH DAKOTA; FLORIDA to LOUISIANA.

791. **M. mollis** L. [*M. fistulosa mollis* (L.) Benth.]. SMOOTH BERGAMOT.

Very common in fields, thickets, and open woods: some forms are close to *M. scabra* Beck., but all the leaves examined are slender-petioled.

NEW ENGLAND to SOUTH DAKOTA; GEORGIA to TEXAS.

792. **M. media** Willd. PURPLE BERGAMOT.

Moist thickets; scarce.

MAINE to MICHIGAN; NORTH CAROLINA to TENNESSEE and MISSOURI.

793. **M. Bradburiana** Beck.

Dry thickets; scarce.

ILLINOIS and ALABAMA to MISSOURI and KANSAS.

794. **M. citriodora** Cerv. LEMON HORSE-MINT.

Along the railroad near Rocheport.

MISSOURI to NEBRASKA and COLORADO; TENNESSEE to TEXAS and ARIZONA.

339. BLEPHILIA Raf.

795. **B. ciliata** (L.) Raf.

Very common in fields and thickets.

MASSACHUSETTS to WISCONSIN; GEORGIA to MISSOURI.

796. **B. hirsuta** (Pursh) Torr.

Common in shaded alluvial flats.

VERMONT to WISCONSIN; GEORGIA to TEXAS.

340. HEDEOMA Pers. MOCK PENNYROYAL.

797. **H. pulegioides** (L.) Pers. AMERICAN PENNYROYAL.

Common in waste fields and open thickets.

CAPE BRETON ISLAND to ONTARIO and MINNESOTA; FLORIDA to MISSOURI and NEBRASKA.

341. KOELLIA Moench. [*PYCNANTHEMUM* Michx.]. MOUNTAIN MINT.

798. **K. Virginica** (L.) Baill. [*K. flexuosa* (Walt.) MacM.: *P. linifolium* Pursh]. NARROW-LEAVED MOUNTAIN MINT.

Dry hills and thickets; common.

MASSACHUSETTS to ONTARIO and MINNESOTA; FLORIDA to TEXAS.

799. **K. pilosa** (Nutt.) Britton [*P. muticum pilosum* (Nutt.) Gray]. HAIRY MOUNTAIN MINT.
Frequent in wild open places and dry thickets.
OHIO to IOWA and KANSAS; GEORGIA to ARKANSAS.

342. LYCOPUS L. WATER HOREHOUND. WATER HOARHOUND.

800. **L. communis** Bickn. [*L. Virginicus* Auct. mainly]. BUGLE WEED.
Frequent along streams.
NEWFOUNDLAND to BRITISH COLUMBIA; NORTH CAROLINA to MISSOURI and OREGON.

801. **L. rubellus** Moench. REDDISH WATER HOREHOUND.
Rare along streams.
NEW YORK and MICHIGAN to SOUTH DAKOTA; FLORIDA to LOUISIANA.

802. **L. lucidus** Turcz. WESTERN WATER HOREHOUND.
Scarce along streams and about ponds.
MINNESOTA to BRITISH COLUMBIA; MISSOURI to ARIZONA and CALIFORNIA.

803. **L. sinuatus** Ell. [*L. Americanus* Muhl.]. CUT-LEAVED WATER HOREHOUND.
Common in wet places.
NEWFOUNDLAND to BRITISH COLUMBIA; FLORIDA to CALIFORNIA.

343. MENTHA L. MINT.

804. **M. borealis** Michx. [*M. Canadensis glabrata* Benth.]. SMOOTH WILD MINT.
Local along streams.
NEW BRUNSWICK to the NORTHWEST TERRITORY; NORTH CAROLINA to NEW MEXICO.

805. **M. viridis** L. [*M. spicata* L.]. SPEARMINT.
Frequent in creeks and waste places.
EUROPE and ASIA, thence to NORTH AMERICA.

806. **M. piperita** L. PEPPERMINT.
Scarce in wet waste places.
EUROPE, thence to NORTH AMERICA.

Family 95. SOLANACEAE Pers. Nightshade family.

344. LYCIUM L. MATRIMONY VINE.

807. **L. vulgare** (Ait. f.) Dunal.
Along streets and roadsides.
EUROPE, AFRICA and ASIA, thence to NORTH AMERICA.

345. PHYSALIS L. GROUND CHERRY.

808. **P. pubescens** L. HAIRY GROUND CHERRY.
Common in fields and waste places.
PENNSYLVANIA, MICHIGAN and MISSOURI to CALIFORNIA; FLORIDA to CENTRAL AMERICA.

809. **P. pruinosa** L.
Fields in rich soil; infrequent.
MASSACHUSETTS to IOWA; FLORIDA to MISSOURI.

810. **P. Missouriensis** Mack. & Bush [*P. Lagascae* Britton & Brown, not R. & S.]. MISSOURI GROUND CHERRY.
Common on cliffs and in dry thickets.
MISSOURI to KANSAS; ARKANSAS to the INDIAN TERRITORY.

811. **P. lanceolata** Michx. PRAIRIE GROUND CHERRY.
Frequent in dry fields and open wild places.
NORTH CAROLINA and MICHIGAN to WYOMING; SOUTH CAROLINA to NEW MEXICO.

812. **P. Virginiana** Mill. VIRGINIA GROUND CHERRY.
Common in fields and thickets.
NEW YORK to MANITOBA; FLORIDA to LOUISIANA and COLORADO.

813. **P. heterophylla** Nees. CLAMMY GROUND CHERRY.
Very common in fields and waste grounds.
NEW BRUNSWICK to SASKATCHEWAN; FLORIDA to TEXAS and COLORADO.

814. **P. nyctaginea** Dunal.
Weedy woods.
RHODE ISLAND to IOWA and MISSOURI; GEORGIA to LOUISIANA.

348. SOLANUM L. [*LYCOPERSICON (LYCOPERSICUM)* Mill.]. NIGHTSHADE.

815. **S. tuberosum** L. POTATO.
Occasionally adventitious in waste places.
SOUTH AMERICA, thence universal in cultivation.

816. **S. Dulcamara** L. BITTERSWEET.
Scarce in waste places and low grounds.
EUROPE and ASIA, thence to NORTH AMERICA.

817. **S. nigrum** L. BLACK NIGHTSHADE.
Common in waste places, wild fields and moist thickets.
Cosmopolitan.

818. **S. Carolinense** L. HORSE-NETTLE.
Abundant in waste places.
MASSACHUSETTS and ONTARIO to MICHIGAN and NEBRASKA; FLORIDA to TEXAS.

819. **S. rostratum** Dunal. BUR NIGHTSHADE.
Occasional in waste places.
MICHIGAN to SOUTH DAKOTA; MISSISSIPPI to MEXICO: advancing eastward.

820. **S. Lycopersicum** L. [*L. Lycopersicon* (L.) Karst.]. TOMATO.
Occasionally adventitious in waste places.
SOUTH AMERICA, thence common in cultivation.

349. DATURA L. THORN-APPLE.

821. **D. Stramonium** L. JIMSON WEED. JAMESTOWN WEED
Common in waste grounds.
ASIA, thence cosmopolitan.

822. **D. Tatula** L. PURPLE THORN-APPLE.
Waste places; infrequent.
SOUTH AMERICA, thence cosmopolitan.

823. **D. Metel** L.
Waste places; scarce.
TROPICAL AMERICA, thence to the EASTERN UNITED STATES.

348. PETUNIA Juss. PETUNIA.

824. **P. violacea** Lindl. VIOLET PETUNIA.
Persistent in old gardens and escaped into waste places.
SOUTH AMERICA, thence common in cultivation.

825. **P. axillaris** (Lam.) B. S. P. WHITE PETUNIA.
Persistent in old gardens and escaped into waste places.
BRAZIL, thence common in cultivation.

Family 96. SCROPHULARIACEAE Lindl. Figwort family.

349. VERBASCUM L. MULLEIN. MULLEN.

826. **V. Thapsus** L. COMMON MULLEIN.
Common in fields and waste places.
EUROPE and ASIA, thence to NORTH AMERICA.

827. **V. Blattaria** L. MOTH MULLEIN.
Infrequent in fields and waste places.
EUROPE and ASIA, thence to NORTH AMERICA.

350. LINARIA Juss. TOAD-FLAX.

828. **L. Linaria** (L.) Karst. [*L. vulgaris* Mill.]. BUTTER-AND-EGGS.
Yards and roadsides.
EUROPE and ASIA, thence to all temperate lands.

351. COLLINSIA Nutt. INNOCENCE.

829. **C. verna** Nutt. BLUE-EYED MARY.
Common in rich deep ravines and alluvial woods.
NEW YORK and MICHIGAN to MINNESOTA; PENNSYLVANIA and KENTUCKY to the INDIAN TERRITORY.

352. SCROPHULARIA L. FIGWORT.

830. **S. Marylandica** L. [*S. nodosa Marilandica* (L.) Gray]. MARYLAND FIGWORT.
Common in woods and waste places.
NEW YORK to MICHIGAN and SOUTH DAKOTA; GEORGIA to TENNESSEE and MISSOURI.

353. CHELONE L. TURTLE-HEAD.

831. **C. glabra** L. SNAKE-HEAD.
Swale at Brushwood lake.
NEWFOUNDLAND to MANITOBA; FLORIDA to KANSAS.

354. PENTSTEMON (PENTASTEMON) Soland. BEARD-TONGUE.

832. **P. hirsutus** (L.) Willd. [*P. pubescens* Soland.]. HAIRY BEARD-TONGUE.
Thickets and open woods; common in dry soil: our plant is often near *P. canescens* Britton.
MAINE to MANITOBA; FLORIDA to TEXAS.

833. **P. Pentstemon** (L.) Britton [*P. laevigatus* Soland.]. SMOOTH BEARD-TONGUE.
Thickets and woods; infrequent and seldom typical, some forms connecting with the next.
PENNSYLVANIA to KENTUCKY and MISSOURI; FLORIDA to LOUISIANA.

834. **P. Digitalis** (Sweet) Nutt. [*P. laevigatus Digitalis* (Sweet) Gray]. FOXGLOVE BEARD-TONGUE.
Common in fields and moist thickets.
MAINE and NEW YORK to MICHIGAN and MISSOURI; GEORGIA to ARKANSAS.

355. MIMULUS L. MONKEY-FLOWER.

835. **M. ringens** L.
Rare in swales and along streams.
NOVA SCOTIA to MANITOBA; GEORGIA to TEXAS.

836. **M. alatus** Soland.
Common in swales and along streams and ponds.
CONNECTICUT to MICHIGAN; FLORIDA to TEXAS.

356. GRATIOLA L. HEDGE-HYSSOP.

837. **G. Virginiana** L. CLAMMY HEDGE-HYSSOP.
Common in limose places.
QUEBEC to BRITISH COLUMBIA; FLORIDA to CALIFORNIA.

357. CONOBEA Aubl.

838. **C. multifida** (Michx.) Benth.

Common along the Missouri; sparingly on a rich hillside south of Columbia.

PENNSYLVANIA to IOWA; TENNESSEE to TEXAS.

358. BACOPA Aubl. [*MONNIERA* P. Br.: *HERPESTIS* Gaertn.]. HEDGE-HYSSOP.

839. **B. rotundifolia** (Michx.) Wettst. [*M. rotundifolia* Michx.: *H. rotundifolia* (Michx.) Pursh]. ROUND-LEAVED HEDGE-HYSSOP.

Pond near Rocheport.

ILLINOIS to SOUTH DAKOTA; TENNESSEE and LOUISIANA to TEXAS.

359. ILYSANTHES Raf. FALSE PIMPERNEL.

840. **I. gratioloides** (L.) Benth. [*I. dubia* (L.) Barnh.: *I. riparia* Raf.].

Common in limose places.

NEW ENGLAND to MINNESOTA and SOUTH DAKOTA; FLORIDA to TEXAS; CALIFORNIA: ASIA: SOUTH AMERICA: adventitious in EUROPE.

360. VERONICA L. [*LEPTANDRA* Nutt.]. SPEEDWELL.

841. **V. Virginica** L. [*L. Virginica* (L.) Nutt.]. CULVER'S-ROOT.

Common in oak woods and thickets.

NOVA SCOTIA to NORTH DAKOTA; ALABAMA to MISSISSIPPI and KANSAS.

842. **V. serpyllifolia** L. THYME-LEAVED SPEEDWELL.

Common in fields.

EUROPE and ASIA: SOUTH AMERICA: LABRADOR to ALASKA; GEORGIA to CALIFORNIA.

843. **V. arvensis** L. CORN SPEEDWELL.
Common in fields and waste places.
EUROPE and ASIA, thence to NORTH AMERICA.

844. **V. peregrina** L. PURSLANE SPEEDWELL.
Very common in waste places and fields.
SOUTH AMERICA, now almost cosmopolitan.

845. **V. Americana** Schwein. BROOKLIME.
Rare along streams.
ANTICOSTI to ALASKA; PENNSYLVANIA to NEW MEXICO and CALIFORNIA.

361. SEYMERIA Pursh [*AFZELIA* Gmel.: *BRACHYGYNE* Small]. MULLEIN FOXGLOVE.

846. **S. macrophylla** Nutt. [*A. macrophylla* (Nutt.) Kuntze: *B. macrophylla* (Nutt.) Small].
Rich thickets along streams; common.
OHIO to NEBRASKA; KENTUCKY to TEXAS.

362. GERARDIA L. [*DASYSTOMA* Raf.]. FALSE FOXGLOVE.

847. **G. asperula** (Gray) Small [*G. tenuifolia asperula* Gray].
Sterile hills and red clay barrens.
MICHIGAN to MINNESOTA; INDIANA to MISSOURI and ARKANSAS.

848. **G. Besseyana** Britton [*G. tenuifolia macrophylla* Benth.]. PURPLE FALSE FOXGLOVE.
Dry thickets and barren hilltops; common.
IOWA and SOUTH DAKOTA to COLORADO; OHIO to LOUISIANA.

849. **G. grandiflora** Benth. [*D. grandiflora* (Benth.) Wood]. WESTERN FALSE FOXGLOVE.
Common in dry thickets and woodlands.
WISCONSIN to MINNESOTA; TENNESSEE to TEXAS.

850. **G. flava** L. [*D. flava* (L.) Wood]. DOWNY FALSE FOXGLOVE.

Local in oak thickets and red clay barrens.

MASSACHUSETTS and ONTARIO to WISCONSIN; FLORIDA to MISSISSIPPI and MISSOURI.

363. CASTILLEJA (CASTILLEIA) Mutis. PAINTED-CUP.

851. **C. coccinea** (L.) Spreng. SCARLET PAINTED-CUP.

There is an old, but undated, specimen from Boone county in the University Herbarium, but no station for it in the region is now known.

MAINE to MANITOBA; GEORGIA to TEXAS.

364. PEDICULARIS L. LOUSEWORT.

852. **P. Canadensis** L. COMMON LOUSEWORT.

Frequent in oak woods and thickets.

NOVA SCOTIA to MANITOBA; FLORIDA to TEXAS and MEXICO.

Family 97. OROBANCHACEAE Lindl. Broom-rape family.

365. OROBANCHE Tourn. [*APHYLLON* Mitchell: *THALESIA* Raf.]. BROOM-RAPE.

853. **O. uniflora** L. [*A. uniflorum* (L.) Gray: *T. uniflora* (L.) Britton]. ONE-FLOWERED CANCER-ROOT.

Rich oak forests, parasitic on the roots of herbs; rare.

NEWFOUNDLAND to BRITISH COLUMBIA; GEORGIA to TEXAS and CALIFORNIA.

Family 98. BIGNONIACEAE Pers. Cross-vine family.

366. CAMPSIS Lour. [*TECOMA* Juss.]. TRUMPET FLOWER.

854. **C. radicans** (L.) Seem. [*T. radicans* (L.) DC.]. TRUMPET CREEPER.

Common in thickets and along roadsides.

NEW JERSEY and PENNSYLVANIA to ILLINOIS and MISSOURI FLORIDA to TEXAS.

367. CATALPA Scop. Indian bean.

855. **C. bignonioides** Walt. [*C. Catalpa* (L.) Karst.]. Common catalpa.

Streets; occasionally adventitious.

New York to Florida and Texas; common in cultivation.

856. **C. speciosa** Warder. Catawba tree.

Streets; occasionally adventitious: a large patch in a woodlot south of the University golf-links, whence it has spread along streams, etc.

Illinois and Missouri; Alabama to Texas.

Family 99. ACANTHACEAE J. St. Hil. Acanthus family.

368. RUELLIA L.

857. **R. ciliosa** Pursh. Hairy ruellia.

Common in dry open grounds and thickets.

New Jersey to Michigan and Nebraska; Florida to Texas.

858. **R. strepens** L. Smooth ruellia.

Common in dry open woods and thickets.

Pennsylvania to Wisconsin; Florida to Texas.

858a. **R. strepens micrantha** (Engelm. & Gray) Britton [*R. strepens cleistantha* Gray].

At the foot of cliffs in shade.

Range of the type.

369. JUSTICIA L. [*DIANTHERA* L.]. Water-willow.

859. **J. Americana** (L.) Vahl. [*D. Americana* L.]. American water-willow.

Common in shallow streams.

Vermont and Ontario to Wisconsin; Georgia to Texas.

Family 100. PHRYMACEAE Schauer. Lopseed family.

370. PHRYMA L. Lopseed.

860. **P. Leptostachya** L.

Common in rich woods and alluvial bottoms.

Ontario to Minnesota and South Dakota; Florida to Kansas.

Order 36. PLANTAGINALES.

Family 101. PLANTAGINACEAE Lindl. Plantain family.

371. PLANTAGO L. Plantain.

861. **P. major** L. Common plantain.
Yards and streets; infrequent.
Cosmopolitan.

862. **P. Rugelii** Dec. Rugel's plantain.
Very common in yards and fields and along roads.
Maine and Ontario to North Dakota; Florida to Texas.

863. **P. cordata** Lam. Water plantain.
Local along Grindstone creek.
New York to Michigan and Missouri; Alabama to Louisiana.

864. **P. lanceolata** L. English plantain. Ribgrass.
Common in fields and yards.
Europe and Asia, now cosmopolitan.

865. **P. Virginica** L. Dwarf plantain.
Very common in wild pastures and dry open thickets.
Connecticut to Michigan and Missouri; Florida to Arizona.

866. **P. occidentalis** Decne. [*P. Virginica longifolia* Gray]. Western plantain.
Frequent in wild pastures.
Missouri to Texas.

867. **P. spinulosa** Decne. [*P. Patagonica spinulosa* (Decne.) Gray]. Spinulose plantain.
Roadsides; scarce and local.
South Dakota to Assiniboia and Montana; Missouri to Texas.

868. **P. aristata** Michx. [*P. Patagonica aristata* (Michx.) Gray]. Bracted plantain.
Very common along dry roadsides and paths.
Maine to British Columbia and Alaska; Florida to New Mexico.

Order 37. RUBIALES.

Family 102. RUBIACEAE B. Juss. Madder family.

372. HOUSTONIA L. Bluets.

869. **H. angustifolia** Michx. Cliff bluets.
Common on the cliffs of the Missouri.
Illinois to Kansas; Florida to Texas.

373. CEPHALANTHUS L. Button-bush.

870. **C. occidentalis** L.
In swamps and about ponds and streams.
New Brunswick and Ontario to Wisconsin and Nebraska; Florida to California; Cuba.

374. DIODIA Gronov. Button-weed.

871. **D. teres** Walt. Rough button-weed.
Roadsides and dry banks of the Waterworks dam.
Connecticut to Illinois and Kansas; Florida to New Mexico and Sonora.

375. GALIUM Tourn. Bedstraw.

872. **G. concinnum** T. & G. Shining bedstraw.
Very common in oak woods and thickets.
New Jersey to Minnesota; Virginia to Arkansas and Kansas.

873. **G. trifidum** L. Small bedstraw.
In swales; scarce.
Maine and Michigan to Missouri, Colorado and northward.

874. **G. tinctorium** L. [*G. trifidum latifolium* Torr.]. Wild madder.
Frequent in damp woods and swamps.
Canada to Michigan and South Dakota; North Carolina to Arizona.

875. **G. triflorum** Michx. SWEET-SCENTED BEDSTRAW.
Common in oak forests.
NOVA SCOTIA to ALASKA; FLORIDA to CALIFORNIA: EUROPE and EASTERN ASIA.

876. **G. circaezans** Michx. WILD LIQUORICE.
Common in oak woods and thickets.
QUEBEC to MINNESOTA; FLORIDA to TEXAS and KANSAS.

877. **G. pilosum** Ait. HAIRY BEDSTRAW.
Common on dry hills, and in thickets and open woods.
MASSACHUSETTS to MICHIGAN and KANSAS; FLORIDA to TEXAS.

878. **G. Aparine** L. CLEAVERS. GOOSEGRASS.
Hedges, cliffs and steep banks; common.
NEW BRUNSWICK to SOUTH DAKOTA and COLORADO; FLORIDA to TEXAS: EUROPE, ASIA and AFRICA: SOUTH AMERICA.

Family 103. CAPRIFOLIACEAE Vent. Honeysuckle family.

376. SAMBUCUS L. ELDER.

879. **S. Canadensis** L. BLACK ELDERBERRY.
Common in moist places and along roadsides.
NEW BRUNSWICK to MANITOBA; FLORIDA to ARIZONA.

377. VIBURNUM L. ARROW-WOOD.

880. **V. dentatum** L. ARROW-WOOD.
A few shrubs on the summit of the Pinnacles. The plants were seen only in flower and may quite possibly belong to *V. Demetrionis* Deane & Robinson, a species from Benton county, Missouri, not yet seen or described in flower. Till the fruits of these plants are seen, an indubitable determination is impossible.
NEW BRUNSWICK to MINNESOTA, and in the mountains to GEORGIA; MISSOURI, if indeed the forms found in many parts of the state belong to the species.

881. **V. Lentago** L. Nannyberry. Sheepberry.
Swamps and low grounds.
Ontario and Michigan to Manitoba; Georgia to Missouri.

882. **V. prunifolium** L. Black haw.
Common in thickets and hawthorn glades.
Connecticut to Michigan and Kansas; Florida to Texas.

883. **V. rufotomentosum** Small. Rust-leaved haw.
Common in rocky thickets and on banks.
Virginia to Missouri; Florida to Texas.

378. TRIOSTEUM L. Horse-gentian.

884. **T. perfoliatum** L. Feverwort.
Common in rich woods and thickets: some plants have the leaves narrowed to a sessile or slightly cuneate base as in *T. aurantiacum* Bicknell.
New York to Minnesota; Alabama to Kansas.

379. SYMPHORICARPOS Juss. Snowberry.

885. **S. vulgaris** Michx. [*S. Symphoricarpos* (L.) MacM.]. Indian currant. Buck-bush.
Very common in wild fields and thickets.
New York to South Dakota; Georgia to Texas.

380. LONICERA L. Honeysuckle.

886. **L. glauca** Hill [*L. dioica* L.]. Smooth honeysuckle.
One vine on a rocky bank of the Waterworks dam.
Quebec to Manitoba; Georgia to Missouri.

887. **L. grata** Ait. American woodbine.
Overhanging a rocky bank of Grindstone creek; also at the Pinnacles: almost too near the European *L. Caprifolium* L., to which it is referred by many authors.
New York to Michigan and Missouri; Georgia to Louisiana.

Family 104. VALERIANACEAE Batsch. Valerian family.

381. VALERIANELLA Moench. Corn salad.

888. **V. radiata** (L.) Dufr. Lamb-lettuce.
Common along streams, ditches and damp ravines.
New York to Michigan and Missouri; Florida to Texas.

Order 38. CAMPANULATALES.

Family 105. CUCURBITACEAE B. Juss. Gourd family.

382. CITRULLUS L. MELON.

889. **C. vulgaris** Schrad. [*C. Citrullus* (L.) Karst.]. WATERMELON.

Occasionally adventitious in waste places.

SOUTH AFRICA, thence universal in cultivation.

383. CUCUMIS L. CUCUMBER.

890. **C. Melo** L. MUSKMELON. CANTALOUPE.

Occasionally adventitious in waste places.

SOUTHERN ASIA and tropical AFRICA, thence universal in cultivation.

384. LAGENARIA Ser. GOURD.

891. **L. vulgaris** Ser. [*L. Lagenaria* (L.) Cockerell]. CALABASH GOURD.

Adventitious on the University Campus.

Tropics of the OLD WORLD, thence universal in cultivation.

385. CUCURBITA L. GOURD. SQUASH. PUMPKIN.

892. **C. Pepo pyxidaris** (DC.) Naudin. GOURD.

The gourd is occasionally adventitious in yards, etc.

SOUTH AMERICA, now common everywhere in cultivation.

893. **C. foetidissima** H.B.K. MISSOURI GOURD. FETID WILD PUMPKIN.

Along the railroad near Rocheport cave.

MISSOURI to NEBRASKA; TEXAS to CALIFORNIA; MEXICO.

386. ECHINOCYSTIS T. & G. [*MICRAMPELIS* Raf.]. BALSAM APPLE.

894. **E. lobata** (Michx.) T. & G. [*M. lobata* (Michx.) Greene]. WILD BALSAM APPLE.

Infrequent in waste places.

MAINE and ONTARIO to MONTANA; VIRGINIA and KENTUCKY to TEXAS and COLORADO.

387. SICYOS L. Bur-cucumber.

895. **S. angulatus** L. Star-cucumber.
Common on stream-banks and in waste places.
Quebec to South Dakota; Florida to Texas: naturalized in Eastern Europe.

Family 106. CAMPANULACEAE Juss. Bellflower family.

388. CAMPANULA L. [*CAMPANULASTRUM* Small]. Harebell. Bellflower.

896. **C. Americana** L. [*Campanulastrum Americanum* (L.) Small]. Tall bellflower.
Common in alluvial and moist woods and thickets.
New Brunswick to South Dakota; Georgia to Arkansas and Kansas.

389. SPECULARIA Heist. [*LEGOUZIA* Durand]. Venus' looking-glass.

897. **S. perfoliata** (L.) A. DC. [*L. perfoliata* (L.) Britton].
Common in fields and thickets.
Maine to British Columbia; Florida to Utah and Oregon; Mexico.

390. LOBELIA L. Lobelia.

898. **L. cardinalis** L. Cardinal flower.
Rare and local in swamps and swales.
New Brunswick to Saskatchewan; Florida to Texas.

899. **L. syphilitica** L. Great blue lobelia.
Common in wet grounds.
Maine and Ontario to South Dakota and Colorado; Georgia to Louisiana.

900. **L. spicata** Lam. Pale spiked lobelia.
Cliffs; scarce and seldom typical.
Nova Scotia to the Northwest Territory; Florida to Texas.

901. **L. leptostachys** A. DC.
Rare on the cliffs of Grindstone creek.
Virginia to Ohio and Illinois; Georgia to Kansas.

902. **L. inflata** L. INDIAN TOBACCO. COMMON LOBELIA.
Common in wild grounds and open thickets.
LABRADOR to the NORTHWEST TERRITORY; GEORGIA to ARKANSAS and NEBRASKA.

Family 107. COMPOSITAE Adans. Thistle family.

391. VERNONIA* Schreb. IRONWEED.

903. **V. crinita** Raf. [*V. Arkansana* DC.]. GREAT IRONWEED.
Roadsides and fields; local and rare.
MISSOURI and KANSAS to TEXAS.

904. **V. Baldwinii** Torr. BALDWIN'S IRONWEED.
Fields and roadsides; very common and variable.
MISSOURI and NEBRASKA to KANSAS and TEXAS.

905. **V. Duggariana** Daniels. Nov. spec.
Plant 1-1⅔ metres in height, finely tomentose; leaves numerous, lanceolate to linear, long acuminate at the apex, somewhat less so at the base; upper surfaces smooth, under surfaces tomentulose; veins prominent underneath; serrations rather distant, seldom deep, mostly lacking at the basal acuminations, and extremely slight at the apices; peduncles slightly thickened upward; corymbs pyramidal, less ample than in *V. Baldwinii* Torr.; heads globose-campanulate, somewhat smaller than in *V. Baldwinii* Torr.; ovate bracts purplish, the attenuate tips reflexed; pappus reddish purple.
Common in fields about Columbia; type specimen gathered in the wild lot north of Pansy Hill, July, 1904. It is the earliest flowering ironweed about Columbia, the achenes being for the most part matured before the other species begin to flower. Named after Dr. B. M. Duggar.

906. **V. flavipapposa** Daniels. Nov. spec.
Stems low, seldom exceeding one metre in height, tomentose with soft brownish tomentum; leaves ovate-lanceolate or elliptic, acuminate, serrations seldom deep and somewhat

*See Appendix A for a synopsis of the North American species of Vernonia occurring north of Mexico.

distant; under surfaces rugose and softly tomentose, upper surfaces slightly rough; cymes seldom broad, usually 1-3 dm., and somewhat compact, the branches short, the central heads sessile; peduncles only very slightly thickened upwards; heads small, hemispheric-campanulate, 4-5 mm. high; bracts greenish with dusky tips, ovate-lanceolate, squarrose, the tips strongly reflexed; pappus light yellow to light buff with no tinge of purple; achenes 2½-3 mm. long, minutely barbed on the ribs. The specific name refers to the color of the pappus.

Not infrequent in wild pastures east of Columbia. The plant resembles *V. Baldwinii* Torr. except in the color of the pappus and the somewhat smaller heads.

907. **V. parthenioides** Daniels. Nov. spec.

Plant 1 to 2 metres in height, the stem, especially the upper portion, canescent, with fine dense, but short, tomentum. Leaves broadly ovate, 4-5 cm. wide in the middle, thence tapering rather evenly to each end, the leaves being from 6-9 cm. long; the apices acute, but never acuminate. The cauline leaves are, with the exception of those subtending branches of the inflorescence, all distinctly petioled, the petioles from ½-1 cm. long. Leaves finely scabrous on the upper surfaces, on the under surfaces soft with fine whitish glandular tomentum, which is not flocculent or villous. The midrib and divaricate veins are white and very prominent underneath, but whitish and noticeable also above. The margins of the leaves are coarsely and doubly serrate with falcate teeth. The cymes range from small to ample, the heads being for the most part stout-peduncled, 20-30 flowered, involucres hemispheric, 7½-10 mm. broad, the bracts ovate, purplish with a green midrib, the margins ciliate, the attenuate tips recurved usually to one side; pappus purplish brown, the achenes hispidulous.

Half-wild and wild fields, Columbia, Mo. The plant appears very distinct from *V. Baldwinii* Torr., especially in the broadly ovate deeply and falcately serrate leaves, which resemble strikingly those of *Parthenium integrifolium* L., whence the specific name.

908. **V. peralta** Daniels. Nov. spec.

Stems very tall, 2-3 metres in height, rather sparingly tomentose except above; leaves very long, 2-3 dm. in length, oblong-lanceolate, long acuminate both at base and apex, coarsely and sharply serrate, rugose and tomentose underneath, roughish above; cymes paniculate, immense, often over 5 dm. in length, the primary branches leafy, the peduncles slender and seldom thickened upwards, central heads sessile or short peduncled; heads medium, hemispheric, 6-8 mm. high; bracts ovate, purplish, the acuminate tips spreading and moderately reflexed; pappus purplish, 8-12 mm. long; achenes 4-5 mm. long, nearly smooth, or slightly canescent, the furrows between ribs relatively deep.

Occasional in fields and blossoming late, the exceedingly long leaves and the paniculate cymes, several decimetres in length, make it a conspicuous plant when in bloom. At a distance it looks much like *V. altissima* Nutt., but close by all similarity vanishes, the plant belonging rather to the *V. Drummondii* group.

909. **V. pseudobaldwinii** Daniels. Nov. spec.

Stems low, 1 to 1½ metres in height, softly white tomentose; leaves ovate-lanceolate below, linear-elliptic above, acuminate, sharply and coarsely serrate, the upper subentire, the under surfaces softly tomentose, the upper only slightly scabrous; cymes small, 1-2½ dm. broad, all heads pedunculate, the central only shortly so, the peduncles not thickened upwards; heads small to medium, 4-5 mm. high; bracts ovate-lanceolate, the upper portions red-purple, the tips acute and obviously reflexed; pappus deep reddish-purple; achenes short, 3 mm. long, the ribs softly barbed.

Very common in fields and pastures, blossoming a little later than *V. Baldwinii* Torr. The plant is intermediate between *V. interior* Small and *V. Baldwinii* Torr. It, however, is much more abundant than typical *V. interior* Small. If *V. pseudobaldwinii* Daniels and the following species are hybrids, then both *V. interior* Small and *V. Drummondii* Shuttlw., at least in upland pastures, exist here only in a hybridizing condition, the number of typical forms appearing being no greater than the reversions called for under Mendel's law.

910. **V. pseudodrummondii** Daniels. Nov. spec.

Stems 1½ to 2 metres in height, densely tomentose with whitish tomentum; leaves large, elliptic-lanceolate or elliptic, acuminate at both base and apex, the margins sharply and deeply serrate, or those of the uppermost leaves subentire, under surfaces finely tomentose, the upper scabrous; cymes ample, subpaniculate, the larger branches leafy; peduncles rather slender, seldom noticeably thickened upwards, the central heads subsessile; heads large, 8-12 mm. high, oblong or cylindric; bracts reddish purple, floccosely ciliate at the margins, lanceolate and long acuminate, the tips spreading and more or less reflexed; pappus purplish, about twice the length of the hispidulous achene.

Very abundant in fields and pastures, where it blossoms about the first of August. The plant may be briefly described as intermediate between *V. Baldwinii* Torr., from which it differs in the larger oblong heads and the lanceolate bracts, and *V. Drummondii* Shuttlw., from which it differs in the broader leaves and the recurved bracts. But for its abundance it might perhaps be considered a hybrid between the two species mentioned above. It, however, is much more common than *V. Drummondii* Shuttlw., which is seldom typical here except in swamps.

JACKSON COUNTY, MISSOURI.

911. **V. interior** Small. INLAND IRONWEED.

Frequent in old fields.

MISSOURI and KANSAS to TEXAS.

912. **V. Drummondii** Shuttlw. [*V. altissima grandiflora* Gray]. DRUMMOND'S IRONWEED.

In the swamp south of Hinkson creek, and in old fields.

MICHIGAN to ILLINOIS and MISSOURI; KENTUCKY and ALABAMA to TEXAS.

912a. **V. Drummondii** Shuttlw. × **V. interior** Small.

Plants intermediate between the above two species are common in old fields, and may perhaps represent a new species, but no character, save the size of the heads, which are 8-10 mm. high, is constant, since some plants have the foliage and pubescence of *V. Drummondii* Shuttlw., and others that of *V. interior* Small.

913. **V. Reedii** Daniels. Nov. spec.

Plants tall, mostly over 2 metres in height, stem and peduncles densely covered with rufous or russet pubescence, which in some plants is almost villous; leaves oblong-lanceolate acuminate at the apex, the margins sharply serrate, surfaces harsh above, densely tomentose below, the midribs often rufous-hirsute, cymes pyramidal, the branches and peduncles stout and thickened upwards, some of the central heads of each fork nearly, or quite, sessile; heads very large, 12-15 mm. broad, bracts large, broadly ovate, obtusish but bluntly mucronate, loose and slightly spreading at maturity, but not reflexed; pappus unusually short, deep buff with a slight purplish tinge at base; achenes hispidulously barbed on the ribs.

Wild fields east of Columbia, where it is a striking plant, both on account of its great height and its reddish pubescence, which is unlike that of all other vernonias of the region; first gathered in company with H. S. Reed, after whom the species is named.

914. **V. altissima** Nutt. [*V. gigantea* (Walt.) Britton: *V. maxima* Small]. TALL IRONWEED.

Common in fields and along streams. It merges into *V. interior* Small in dry soil.

PENNSYLVANIA and MICHIGAN to MISSOURI; ALABAMA to LOUISIANA.

915. **V. chrysopappa** Daniels. Nov. spec.

Plants low, mostly less than a metre in height; stem puberulent, especially above, with short, close, brownish tomentum; leaves linear to lance-linear, long-acuminate both at base and apex, the lower sharply serrate, the upper entire with revolute margins; the upper surfaces minutely scabrous, the under minutely canescent; cymes pyramidal, 1-2½ dm. wide, the primary branches forking dichotomously at the apex; the central head of each fork nearly sessile, those lateral on peduncles 3-6 cm. long, which are slightly thickened upwards; heads small, 4 mm. broad, 6 mm. high; the pappus at maturity protruding about 5 mm. from the involucre; bracts of the involucre purplish brown, the margins scarious, and slightly flocculent, apices subacute or the upper mucronate, mostly appressed or slightly spreading at maturity, not reflexed; pappus buff to golden-brown, whence the specific name; achenes 4 mm. high, slightly hispidulous.

Frequent in wild pastures east of Columbia. The plant differs from *V. fasciculata* Michx. in the buff-colored pappus, the hispidulous achenes, the non-puncticulate leaves, and the more spreading bracts; and from small specimens of *V. maxima* Small in the color of the pappus, the pubescent stem and foliage, and in the shape of the leaves.

392. ELEPHANTOPUS L. ELEPHANT'S-FOOT.

916. **E. Carolinianus** Willd. CAROLINA ELEPHANT'S-FOOT.

Common along streams.

NEW JERSEY to KANSAS; FLORIDA to TEXAS.

393. EUPATORIUM L. [*CONOCLINUM* DC.]. THOROUGHWORT.

917. **E. purpureum** L. JOE-PYE WEED.

Common in low grounds.

NEW BRUNSWICK to MANITOBA; FLORIDA to TEXAS.

918. **E. maculatum** L. [*E. purpureum maculatum* (L.) Darl.]. SPOTTED JOE-PYE WEED.

Frequent in low grounds.

NEW YORK to BRITISH COLUMBIA; GEORGIA to NEW MEXICO.

919. **E. serotinum** Michx. AUTUMN THOROUGHWORT.

Common along streams.

MARYLAND to IOWA and KANSAS; FLORIDA to TEXAS.

920. **E. altissimum** L. TALL THOROUGHWORT.

Frequent in dry thickets and on wild hillsides.

PENNSYLVANIA to SOUTH DAKOTA; NORTH CAROLINA to TEXAS.

921. **E. sessilifolium** L. UPLAND BONESET.

Rare in thickets on the bluff between Hinkson and Grindstone creeks.

MASSACHUSETTS to MICHIGAN and MISSOURI; GEORGIA to ALABAMA.

922. **E. perfoliatum** L. COMMON BONESET.

Common in wet grounds.

NEW BRUNSWICK to NORTH DAKOTA; FLORIDA to TEXAS.

923. **E. ageratoides** L. f. WHITE SNAKEROOT.

Common in rich woods and deep ravines.

NEW BRUNSWICK to ONTARIO and SOUTH DAKOTA; GEORGIA to LOUISIANA and the INDIAN TERRITORY.

924. **E. aromaticum** L. AROMATIC BONESET.

Infrequent in dry thickets.

MASSACHUSETTS to MICHIGAN and MISSOURI.

925. **E. coelestinum** L. [*C. coelestinum* (L.) DC.]. MIST-FLOWER.

Rare in moist shady places.

NEW JERSEY and MICHIGAN to KANSAS; FLORIDA to TEXAS.

394. KUHNIA L. FALSE BONESET.

926. **K. eupatorioides** L.

Frequent in rocky open places.

NEW JERSEY to MICHIGAN and MONTANA; FLORIDA to TEXAS.

395. LIATRIS Schreb. [*LACINARIA* Hill]. BUTTON-SNAKEROOT.

927. **L. scariosa** (L.) Willd. [*Lacinaria scariosa* (L.) Hill]. LARGE BUTTON-SNAKEROOT.

Frequent in dry open wild places.

MAINE to MANITOBA; FLORIDA to TEXAS.

928. **L. squarrosa** (L.) Willd. [*Lacinaria squarrosa* (L.) Hill]. SCALY BLAZING-STAR.

Common on dry hills and cliffs.

ONTARIO to SOUTH DAKOTA; FLORIDA to TEXAS.

929. **L. intermedia** Lindl. [*L. squarrosa intermedia* (Lindl.) DC.: *Lacinaria intermedia* (Lindl.) Porter]. SLENDER BLAZING-STAR.

Frequent in red clay barrens and on sterile cliffs.

ONTARIO to SOUTH DAKOTA; FLORIDA to TEXAS.

396. SOLIDAGO L. [*OLIGONEURON* Small]. GOLDEN ROD.

930. **S. flexicaulis** L. [*S. latifolia* L.]. ZIGZAG GOLDEN ROD.

Shady banks and rich moist woods.

NEW BRUNSWICK to SOUTH DAKOTA; GEORGIA to KANSAS.

931. **S. speciosa** Nutt. SHOWY GOLDEN ROD.

Thickets along bluffs.

NOVA SCOTIA to MINNESOTA and NEBRASKA; NORTH CAROLINA to ARKANSAS.

932. **S. rigidiuscula** (T. & G.) Porter [*S. speciosa angustata* Gray].

Rare upon the summits of cliffs along Grindstone creek.

OHIO and MICHIGAN to MINNESOTA and NEBRASKA; ALABAMA to TEXAS and COLORADO.

933. **S. rugosa** Mill. ROUGH GOLDEN ROD.

Infrequent in moist or dry grounds.

NEWFOUNDLAND to ONTARIO and MICHIGAN; FLORIDA to TEXAS.

934. **S. ulmifolia** Muhl. ELM-LEAVED GOLDEN ROD.

Woods, thickets and wild fields; the commonest golden rod: immensely variable, passing into both the preceding and the following species.

MAINE to MINNESOTA and KANSAS; GEORGIA to TEXAS.

935. **S. juncea** Ait. EARLY GOLDEN ROD.

Infrequent in dry open places: occasionally obscurely triple-veined and very near *S. Missouriensis* Nutt. into which it passes westward.

NEW BRUNSWICK to MANITOBA; GEORGIA to MISSOURI.

936. **S. serotina** Ait. LATE GOLDEN ROD.
Common in moist thickets and open woodlands.
NEWFOUNDLAND to BRITISH COLUMBIA; FLORIDA to TEXAS and OREGON: naturalized in EUROPE.

936a. **S. serotina gigantea** (Ait.) Gray. GIANT GOLDEN ROD.
With the preceding, but less frequent.
Range of the type.

937. **S. Canadensis** L. COMMON GOLDEN ROD.
Thickets and roadsides; common and extremely variable, assuming especially scabrous and canescent forms.
NEW BRUNSWICK to SLAVE LAKE and BRITISH COLUMBIA; FLORIDA to ARIZONA: naturalized in EUROPE.

937a. **S. Canadensis procera** (Ait.) T. & G.
Frequent in open places.
Range of the type.

937b. **S. Canadensis scabriuscula** Porter [*S. Canadensis scabra* (Muhl.) T. & G.].
Common on dry sterile hills.
NEW YORK and MICHIGAN to MISSOURI; FLORIDA to TEXAS; MEXICO.

938. **S. nemoralis** Ait. GRAY GOLDEN ROD.
Barrens; local. The plant is near *S. mollis* Bartl., but it is taller and the panicle one-sided in full-grown plants.
QUEBEC to the NORTHWEST TERRITORY; FLORIDA to TEXAS and COLORADO.

939. **S. longipetiolata** Mack. & Bush. HOARY GOLDEN ROD.
Local on red clay barrens.
MICHIGAN to WYOMING; MISSOURI to TEXAS.

940. **S. radula** Nutt. HARSH GOLDEN ROD.
Local on cliffs and barrens.
ILLINOIS to MISSOURI; LOUISIANA to TEXAS.

941. **S. Drummondii** T. & G. CLIFF GOLDEN ROD.
Abundant on limestone cliffs.
ILLINOIS to MISSOURI and LOUISIANA.

942. **S. rigida** L. [*O. rigidum* (L.) Small]. STIFF GOLDEN ROD.

Rare on light dry soil.

ONTARIO and MICHIGAN to the NORTHWEST TERRITORY; GEORGIA to TEXAS and COLORADO.

397. ASTER L. STARWORT.

943. **A. oblongifolius** Nutt. AROMATIC ASTER.

Common on bluffs and wild hills.

PENNSYLVANIA to MINNESOTA and SOUTH DAKOTA; VIRGINIA to TEXAS.

944. **A. anomalus** Engelm. CLIFF ASTER.

Common on limestone cliffs.

ILLINOIS to MISSOURI and ARKANSAS.

945. **A. cordifolius** L. HEART-LEAVED ASTER.

Infrequent in thickets and open woods.

NEW BRUNSWICK to MINNESOTA; GEORGIA to MISSOURI.

946. **A. Drummondii** Lindl. DRUMMOND'S ASTER.

Dry soil in wild fields and thickets; abundant: extremely variable, numerous forms passing into the preceding and also into the following.

OHIO to MINNESOTA; ARKANSAS to TEXAS.

947. **A. sagittifolius** Willd. ARROW-LEAVED ASTER.

Common in thickets and open woods.

NEW BRUNSWICK to NORTH DAKOTA; NEW JERSEY to KENTUCKY and KANSAS.

948. **A. turbinellus** Lindl. PRAIRIE ASTER.

Common on cliffs and in thickets.

ILLINOIS to KANSAS; ARKANSAS to LOUISIANA.

949. **A. ericoides pilosus** (Willd.) Porter [*A. ericoides villosus* (Michx.) T. & G.]. HEATH ASTER.

Abundant in wild fields and along roads.

PENNSYLVANIA and ONTARIO to MINNESOTA; GEORGIA to MISSISSIPPI and MISSOURI.

950. **A. multiflorus** Ait. MANY-FLOWERED ASTER.
Dry grounds and roadsides.
MAINE to ONTARIO and SOUTH DAKOTA; GEORGIA to TEXAS and MEXICO.

951. **A. dumosus** L. BUSHY ASTER.
Barrens; seldom typical and verging toward *A. Tradescanti* L. in the common form.
MAINE to ONTARIO and SOUTH DAKOTA; FLORIDA to LOUISIANA and MISSOURI.

952. **A. lateriflorus** (L.) Britton [*A. diffusus* Ait.]. CALICO ASTER.
Common in both dry and moist places; extremely variable.
NOVA SCOTIA to ONTARIO, SOUTH DAKOTA and MISSOURI; NORTH CAROLINA to TEXAS.

953. **A. Tradescanti** L. MICHAELMAS DAISY.
Low grounds; common and polymorphous; a series of forms connecting with *A. dumosus* L., *A. lateriflorus* (L.) Britton, and *A. paniculatus* Lam.
ONTARIO to the NORTHWEST TERRITORY; FLORIDA to MISSOURI.

954. **A. paniculatus** Lam. PANICLED ASTER.
Low grounds; very variable and common.
NEW BRUNSWICK to MONTANA; VIRGINIA to LOUISIANA and KANSAS.

954a. **A. paniculatus bellidiflorus** (Willd.) Burgess.
Frequent in moist soil.
NEW BRUNSWICK to ONTARIO; NORTH CAROLINA to KANSAS.

955. **A. simplex** Willd. [*A. paniculatus simplex* (Willd.) Burgess]. TALL WHITE ASTER.
Common in moist places in shade.
MASSACHUSETTS to MICHIGAN; VIRGINIA to MISSOURI.

956. **A. salicifolius** Lam. WILLOW ASTER.
Common in moist places.
MAINE to ONTARIO and MONTANA; FLORIDA to TEXAS.

957. **A. prenanthoides** Muhl. SWAMP ASTER.
Infrequent in moist places.
MASSACHUSETTS to WISCONSIN; WEST VIRGINIA to MISSOURI.

398. ERIGERON L. [*LEPTILON* Raf.]. FLEABANE.

958. **E. pulchellus** Michx. [*E. bellidifolius* Muhl.]. ROBIN'S PLANTAIN. WILD DAISY.
Locally common in thickets and woods.
NOVA SCOTIA to MINNESOTA and SOUTH DAKOTA; FLORIDA to LOUISIANA.

959. **E. Philadelphicus** L. PHILADELPHIA FLEABANE.
Wet rocky banks of streams in shade; common.
Throughout NORTH AMERICA except the extreme north.

960. **E. annuus** (L.) Pers. SWEET SCABIOUS. COMMON FLEABANE.
Common in meadows and waste grounds.
NOVA SCOTIA to ALASKA; GEORGIA to MISSOURI: naturalized in EUROPE.

961. **E. ramosus** (Walt.) B. S. P. [*E. strigosus* Muhl.]. DAISY FLEABANE.
Common in meadows and fields.
NOVA SCOTIA to the NORTHWEST TERRITORY; FLORIDA to TEXAS.

962. **E. Canadensis** L. [*L. Canadense* (L.) Britton]. HORSEWEED.
Very common in stubble fields and waste places.
NORTH AMERICA, thence spreading throughout the world.

963. **E. divaricatus** Michx. [*L. divaricatum* (Michx.) Raf.]. LOW HORSEWEED.
Barrens; local.
MICHIGAN to MINNESOTA and SOUTH DAKOTA; ALABAMA to TEXAS.

399. ANTENNARIA Gaertn. EVERLASTING.

964. **A. neglecta** Greene. FIELD CAT'S-FOOT.
Pastures and open places in thickets.
MAINE to WISCONSIN; VIRGINIA to MISSOURI.

965. **A. campestris** Rydb. PRAIRIE CAT'S-FOOT.
Common in dry wild open places.
MICHIGAN to SASKATCHEWAN; MISSOURI to KANSAS.

966. **A. plantaginifolia** (L.) Richards. PLANTAIN-LEAF EVERLASTING.
Knolls in woods and thickets; common and variable.
LABRADOR to ONTARIO and NEBRASKA; FLORIDA to TEXAS.

967. **A. calophylla** Greene. BROAD-LEAVED EVERLASTING.
Dry rocky hills and barrens.
ILLINOIS to MISSOURI; GEORGIA to LOUISIANA.

400. GNAPHALIUM L. CUDWEED.

968. **G. obtusifolium** L. [*G. polycephalum* Michx.]. COMMON CUDWEED.
Common in pastures.
NOVA SCOTIA to MANITOBA; FLORIDA to TEXAS.

969. **G. uliginosum** L. LOW CUDWEED.
About puddles; very scarce.
NEWFOUNDLAND to MINNESOTA; VIRGINIA to MISSOURI; BRITISH COLUMBIA to OREGON: EUROPE.

970. **G. purpureum** L. PURPLE CUDWEED.
Meadows, pastures, and dry thickets.
MAINE to MICHIGAN and KANSAS; FLORIDA to TEXAS and MEXICO; WASHINGTON to CALIFORNIA and ARIZONA: SOUTH AMERICA.

401. INULA L. ELECAMPANE.

971. **I. Helenium** L. HORSEHEAL.
Infrequent along roadsides.
EUROPE, thence to NORTH AMERICA.

402. POLYMNIA L. Leaf-cup.

972. **P. Canadensis** L. Small-flowered leaf-cup.
Banks of Hinkson creek, southwest.
Ontario and Michigan to Minnesota; Georgia to Missouri.

973. **P. Uvedalia** L. Yellow leaf-cup.
Rich woods near Rocheport cave.
New York to Michigan and Missouri; Florida to Texas.

403. SILPHIUM L. Rosinweed.

974. **S. perfoliatum** L. Cup-plant.
Common on the banks of streams and in low grounds.
Ontario to Minnesota and South Dakota; Georgia to Louisiana: naturalized eastward.

975. **S. integrifolium** Michx. Rosinweed.
Common in thickets and on wooded hillsides.
Ohio and Michigan to Minnesota and Nebraska; Mississippi to Texas.

976. **S. terebinthinaceum** Jacq. Prairie dock.
Rare on barren bluffs of Grindstone creek.
Ontario and Michigan to Minnesota; Georgia to Louisiana.

977. **S. laciniatum** L. Compass plant.
Very rare along the Providence road.
Ohio and Michigan to South Dakota; Alabama to Texas.

404. PARTHENIUM L. Feverfew.

978. **P. integrifolium** L. American feverfew.
Common on bluffs and in dry thickets.
Maryland to Minnesota; Georgia to Texas.

405. AMBROSIA L. Ragweed.

979. **A. bidentata** L. Prairie ragweed.
Common along roadsides and in dry fields.
Illinois to Missouri; Louisiana to Texas and Mexico.

980. **A. trifida** L. GIANT RAGWEED.

Very common in alluvial flats and waste grounds.

QUEBEC to the NORTHWEST TERRITORY; FLORIDA to ARKANSAS and COLORADO.

981. **A. integrifolia** Muhl. [*A. trifida integrifolia* (Muhl.) T. & G.].

Occasional in poor soil.

NEW YORK to MICHIGAN and ILLINOIS; VIRGINIA to COLORADO.

982. **A. artemisiaefolia** L. COMMON RAGWEED.

Abundant in fields and waste grounds.

NOVA SCOTIA to BRITISH COLUMBIA; FLORIDA to MEXICO; WEST INDIES: SOUTH AMERICA: naturalized in EUROPE.

983. **A. psilostachya** DC. WESTERN RAGWEED.

Along the Wabash railroad north of Columbia, and along highways west.

MICHIGAN to the NORTHWEST TERRITORY; MISSOURI and TEXAS to CALIFORNIA and MEXICO.

406. XANTHIUM L. CLOTBUR.

984. **X. glabratum** (DC.) Britton [*X. strumarium* Auct.]. COMMON COCKLEBUR.

Waste places and low grounds.

NEW ENGLAND to NEBRASKA; FLORIDA to MEXICO.

985. **X. Pennsylvanicum** Wallr. PENNSYLVANIA COCKLEBUR.

Common in waste places and along streams.

ONTARIO to MINNESOTA; DISTRICT OF COLUMBIA to ARKANSAS.

986. **X. speciosum** Kearney. GREAT COCKLEBUR.

Waste places and along streams.

MISSOURI to NORTH DAKOTA; TENNESSEE to TEXAS.

987. **X. commune** Britton. COMMON CLOTBUR.

Common in waste places.

QUEBEC and NEW YORK to KANSAS; MISSOURI to ARIZONA.

407. HELIOPSIS Pers. Ox-eye.

988. **H. scabra** Dunal. Rough ox-eye.
Common in thickets and wooded uplands.
Maine to British Columbia; New Jersey to Arkansas.

408. ECLIPTA L.

989. **E. alba** (L.) Hassk.
Waste places and low grounds; common.
New York to Nebraska; Florida to Texas and Mexico: South America: naturalized extensively in the Old World.

409. RUDBECKIA L. [*ECHINACEA* Moench: *BRAUNERIA* Neck.: *LEPACHYS* Raf.: *RATIBIDA* Raf.]. Cone-flower.

990. **R. triloba** L. Small-flowered cone-flower.
Common along streams.
New Jersey to Michigan and Kansas; Georgia to Texas.

991. **R. subtomentosum** Pursh. Sweet cone-flower.
Swamp south of Hinkson creek.
Illinois to Kansas; Louisiana to Texas.

992. **R. hirta** L. Yellow daisy. Black-eyed Susan.
Very common in fields and thickets.
Quebec to South Dakota; Florida to Oklahoma and Colorado.

993. **R. grandiflora** Gmelin.
Along the railroad at Rocheport.
Missouri to the Indian Territory; Louisiana to Texas.

994. **R. laciniata** L. Tall cone-flower.
Frequent in moist thickets.
Quebec to Manitoba; Florida to New Mexico.

995. **R. purpurea** L. [*E. purpurea* (L.) Moench: *B. purpurea* (L.) Britton]. Purple cone-flower.
Common on rich hillsides.
Virginia to Michigan and Missouri; North Carolina to Louisiana.

996. **R. pallida** Nutt. [*B. pallida* (Nutt.) Britton]. PALE PURPLE CONE-FLOWER.

Rare on the bluffs of Grindstone creek.

MICHIGAN to SOUTH DAKOTA and MISSOURI; ALABAMA to TEXAS.

997. **R. pinnata** Vent. [*L. pinnata* (Vent.) T. & G.: *Ratibida pinnata* (Vent.) Barnh.]. GRAY-HEADED CONE-FLOWER.

Common in dry thickets and wild rocky fields.

NEW YORK and MICHIGAN to MINNESOTA and SOUTH DAKOTA; FLORIDA to TEXAS.

998. **R. Tagetes** James [*L. Tagetes* (James) Gray: *Ratibida Tagetes* (James) Barnh.]. SHORT-RAYED CONE-FLOWER.

Waste grounds near the Missouri, Kansas and Texas railroad.

MISSOURI to KANSAS; ARKANSAS to ARIZONA and NEW MEXICO.

410. HELIANTHUS L. SUNFLOWER.

999. **H. annuus** L. COMMON SUNFLOWER.

Common in yards and waste places.

MINNESOTA to SASKATCHEWAN; MISSOURI to TEXAS and MEXICO; adventitious eastward.

1000. **H. hirsutus** Raf. HARSH-LEAVED SUNFLOWER.

Very common in dry thickets and roadsides. Some forms approach closely *H. divaricatus* L., but the leaves are petiolate.

PENNSYLVANIA to MICHIGAN and WISCONSIN; GEORGIA to TEXAS.

1000a. **H. hirsutus trachyphyllus** T. & G.

Frequent in rich thickets.

ARKANSAS and MISSOURI to NEBRASKA.

1001. **H. strumosus** L. WOOD SUNFLOWER.

Oak woods and banks; variable.

MAINE to ONTARIO and MINNESOTA; GEORGIA to ARKANSAS.

1002. **H. macrophyllus** (Willd.) Daniels [*H. strumosus macrophyllus* (Willd.) Britton: *H. strumosus mollis* (Willd.) T. & G.]. HAIRY WOOD SUNFLOWER.

Common in open woods and thickets.

MASSACHUSETTS to MICHIGAN and IOWA; PENNSYLVANIA to MISSOURI.

1003. **H. tuberosus subcanescens** Gray. WILD JERUSALEM ARTICHOKE.

Abundant in low grounds and open wild places.

MINNESOTA to the NORTHWEST TERRITORY and MISSOURI.

411. ACTINOMERIS Nutt. [*VERBESINA* L.]. FALSE CROWN-BEARD.

1004. **A. squarrosa** Nutt. [*A. alternifolia* (L.) Britton: *V. alternifolia* (L.) Britton].

Rich bottoms and open wild places.

NEW YORK to MICHIGAN and IOWA; FLORIDA to LOUISIANA.

412. COREOPSIS L. [*BIDENS* L.]. TICKSEED.

1005. **C. tinctoria** Nutt. GARDEN TICKSEED.

Escaped from cultivation on the University Horticultural Grounds.

MICHIGAN to the NORTHWEST TERRITORY; LOUISIANA to ARIZONA; adventitious eastward.

1006. **C. palmata** Nutt. STIFF TICKSEED.

Rare on the summits of cliffs.

MICHIGAN to MANITOBA and NEBRASKA; LOUISIANA to TEXAS.

1007. **C. tripteris** L. TALL TICKSEED.

Infrequent in thickets and oak forests.

PENNSYLVANIA to MICHIGAN and WISCONSIN; FLORIDA to LOUISIANA and KANSAS.

1008. **C. involucrata** Nutt. [*B. involucrata* (Nutt.) Britton]. TICKSEED SUNFLOWER.

Abundant in low grounds and marsh meadows.

DELAWARE; ILLINOIS to KANSAS; ARKANSAS to TEXAS.

1008a. **C. involucrata** Nutt. × **Bidens comosa** (Gray) Wiegand.

Along the Wabash railroad, July, 1903.

1009. **C. discoidea** T. & G. [*B. discoidea* (T. & G.) Britton]. SMALL TICKSEED.

Low grounds.

MASSACHUSETTS to MICHIGAN and MISSOURI; NORTH CAROLINA to TEXAS.

413. BIDENS L. BEGGAR-TICKS.

1010. **B. frondosa** L. COMMON STICK-TIGHTS.

Common in waste places and low grounds.

NEW BRUNSWICK to SOUTH DAKOTA; FLORIDA to TEXAS.

1011. **B. connata** Muhl. SWAMP BEGGAR-TICKS.

Low grounds; common and varying into the next.

NEW HAMPSHIRE to MINNESOTA and SOUTH DAKOTA; NORTH CAROLINA to MISSOURI.

1012. **B. comosa** (Gray) Wiegand [*B. connata comosa* Gray]. LARGE SWAMP BEGGAR-TICKS.

Very common in low grounds.

MAINE to MINNESOTA and COLORADO; GEORGIA to LOUISIANA.

1013. **B. cernua** L. BUR-MARIGOLD.

Infrequent in low grounds.

NOVA SCOTIA to OREGON; NORTH CAROLINA to MISSOURI and COLORADO: EUROPE and ASIA.

1014. **B. bipinnata** L. SPANISH NEEDLES.

Common in low grounds and waste places.

RHODE ISLAND to NEBRASKA; FLORIDA to ARIZONA, MEXICO and TROPICAL AMERICA.

414. HELENIUM L. SNEEZEWEED.

1015. **H. tenuifolium** Nutt. FINE-LEAVED SNEEZEWEED.

Flats of Hinkson creek; very rare.

VIRGINIA to MICHIGAN and KANSAS; FLORIDA to TEXAS.

1016. **H. nudiflorum** Nutt. PURPLE SNEEZEWEED.
In low grounds near the Pinnacles.
VIRGINIA to MISSOURI; FLORIDA to TEXAS.

1017. **H. autumnale** L. SWAMP SNEEZEWEED.
Frequent in swamps.
QUEBEC to the NORTHWEST TERRITORY; FLORIDA to ARIZONA.

415. DYSODIA Cav. [*BOEBERA* Willd.]. FETID MARIGOLD.

1018. **D. chrysanthemoides** Lag. [*B. papposa* (Vent. Rydb.]. FALSE DOG-FENNEL.
Common along dry banks and roadsides.
OHIO to MINNESOTA and SOUTH DAKOTA; LOUISIANA to ARIZONA; naturalized eastward.

416. ANTHEMIS L. CAMOMILE.

1019. **A. Cotula** L. MAYWEED.
Common in yards and waste places.
EUROPE and ASIA, thence to both NORTH and SOUTH AMERICA.

417. ACHILLEA L. MILFOIL.

1020. **A. Millefolium** L. YARROW.
Common in fields and waste places.
EUROPE and ASIA, thence to NORTH AMERICA and AUSTRALIA: NORTHERN NORTH AMERICA.

1020a. **A. millefolium lanata** Koch.
A lanate form with smaller and more finely dissected leaves than the type, and with smaller rose-colored flowers, occurs rarely along roadsides.
LABRADOR to ALASKA; TEXAS to CALIFORNIA; indigenous north and west; adventitious in the EASTERN UNITED STATES.

418. CHRYSANTHEMUM L. [*TANACETUM* L.]. FEVERFEW.

1021. **C. Leucanthemum** L. OX-EYE DAISY. WHITEWEED.
Waste places and fields; uncommon.
EUROPE and ASIA, thence to NORTH AMERICA and NEW ZEALAND.

1022. **C. vulgare** (L.) Bernh. [*T. vulgare* L.]. Tansy.
Roadsides; uncommon.
Europe and Asia, thence to North America.

419. ARTEMISIA L. Wormwood.

1023. **A. annua** L. Annual wormwood. Common mugwort.
Roadsides; locally common.
Europe and Asia, thence to North America.

420. ERECHTHITES (ERECHTITES) Raf. Fireweed.

1024. **E. hieracifolia** (L.) Raf. Common fireweed.
Burnt places in woods and in low grounds.
Newfoundland to the Northwest Territory; Florida to Louisiana; Mexico.

421. CACALIA L. [*MESADENIA* Raf.]. Indian plantain.

1025. **C. reniformis** Muhl. [*M. reniformis* (Muhl.) Raf.]. Great Indian plantain.
Deep ravines; infrequent.
New Jersey to Minnesota; Georgia to Tennessee and Missouri.

1026. **C. atriplicifolia** L. [*M. atriplicifolia* (L.) Raf.]. Pale Indian plantain.
Common in thickets and open grounds.
Ontario and Michigan to Minnesota; Florida to Kansas.

1027. **C. tuberosa** Nutt. [*M. tuberosa* (Nutt.). Britton]. Tuberous Indian plantain.
Wild pasture five miles east of Columbia.
Ontario and Michigan to Minnesota; Alabama to Louisiana.

422. SENECIO L. Groundsel.

1028. **S. tomentosus** Michx. Woolly squaw-weed.
Scarce on moist banks and shady ledges.
New Jersey to Missouri; Florida to Texas.

1029. **S. aureus** L. Golden squaw-weed.
Common on moist banks and shaded cliffs.
Newfoundland to Ontario, Michigan and Missouri; Florida to Texas and Colorado.

1030. **S. obovatus** Muhl. Round-leaf squaw-weed.
Common on moist banks along Grindstone creek.
Nova Scotia to Ontario and Michigan; Florida to Missouri.

1031. **S. lobatus** Pers. Butterweed.
Moist flats of the Missouri near Rocheport.
North Carolina to Illinois and Missouri; Florida to Texas and Mexico.

423. ARCTIUM L. Burdock.

1032. **A. minus** Schk. Common burdock.
Common in waste places.
Europe and Asia, thence to North America.

424. CIRSIUM Scop. [*CARDUUS* L.: *CNICUS* L.]. Thistle.

1033. **C. lanceolatum** (L.) Scop. [*Carduus lanceolatus* L.: *Cnicus lanceolatus* (L.) Willd.]. Bull thistle.
Common in fields and waste places.
Europe, North Asia and North Africa: naturalized in North America and New Zealand.

1034. **C. altissimum** (L.) Spreng. [*Carduus altissimus* L.: *Cnicus altissimus* (L.) Willd.]. Tall thistle.
Common in fields and thickets.
Massachusetts to South Dakota; Florida to Texas.

1035. **C. discolor** (Muhl.) Spreng. [*Carduus discolor* (Muhl.) Nutt.: *Cnicus altissimus discolor* (Muhl.) Gray]. Field thistle.
Common in fields and thickets.
Quebec to South Dakota; Georgia to Missouri and Nebraska.

425. CENTAUREA L. Star-thistle.

1036. **C. Jacea** L. Brown knapweed.
Old meadows; infrequent.
Europe, thence to North America.

1037. **C. solstitialis** L. Star-thistle.
Weed in an alfalfa field in the flats of Grindstone creek.
Europe, thence to California and Missouri.

1038. **C. Cyanus** L. Blue-bottle. Cornflower.
Roadsides; infrequent.
Europe, thence to North America.

426. CICHORIUM L. Succory.

1039. **C. Intybus** L. Chicory.
Roadsides and fields; local.
Europe and Asia, thence to North America.

427. KRIGIA Schreber [*ADOPOGON* Neck.]. Dwarf dandelion.

1040. **K. amplexicaulis** Nutt. [*A. Virginicus* (L.) Kuntze]. Virginia goatsbeard.
Frequent in thickets and open oak woods.
Massachusetts to Ontario and Manitoba; Georgia to Kansas.

428. TRAGOPOGON L. Salsify. Goatsbeard.

1041. **T. porrifolius** L. Oyster plant.
Waste places; uncommon.
Europe, thence to North America and Australia.

429. TARAXACUM L. Dandelion.

1042. **T. officinale** Weber [*T. Taraxacum* (L.) Karst.]. Common dandelion.
Very common in yards and fields.
Europe and Asia, now cosmopolitan.

430. MULGEDIUM Cass. [*LACTUCA* L.]. Blue lettuce.

1043. **M. Floridanum** (L.) DC. [*L. Floridana* (L.) Gaertn.]. Florida lettuce.

Common on rich rocky hillsides.

New York to Michigan and Nebraska; Florida to Louisiana and Kansas.

1044. **M. leucophaeum** DC. [*L. leucophaea* (DC.) Gray: *L. spicata* (Lam.) Hitchc.]. Tall blue lettuce.

Common in low grounds.

Newfoundland to Manitoba; North Carolina to Tennessee, Missouri and Colorado.

431. SONCHUS L. Sow-thistle.

1045. **S. oleraceus** L. Common sow-thistle.

Common in waste places.

Old World, thence to the New.

1046. **S. asper** (L.) All. Spiny-leaved sow-thistle.

Frequent in waste places.

Old World, now cosmopolitan.

1047. **S. arvensis** L. Field sow-thistle.

Common in waste places.

Europe and Asia, thence to North America.

432. LACTUCA L. Lettuce.

1048. **L. virosa** L. Common prickly lettuce.

Abundant in waste grounds and unkept fields.

Europe, thence to North America.

1049. **L. Scariola** L. Prickly lettuce.

Waste places; less abundant than the preceding, with which it has connecting forms.

Europe, North Africa and Asia, thence to North America.

1050. **L. Canadensis** L. COMMON WILD LETTUCE.
Common in waste places and thickets.
NOVA SCOTIA to SASKATCHEWAN; FLORIDA to LOUISIANA and COLORADO.

1051. **L. sagittifolia** Ell. [*L. integrifolia* Bigel.]. ENTIRE-LEAVED WILD LETTUCE.
Common in waste places, wild fields and thickets.
NEW BRUNSWICK to ONTARIO and IDAHO; GEORGIA to MISSOURI and KANSAS.

1051a. **L. sagittifolia** Ell. × **L. Canadensis** L.
University Avenue, Columbia.

1052. **L. Ludoviciana** (Nutt.) DC. WESTERN LETTUCE.
Frequent along roadsides.
MINNESOTA to NORTH DAKOTA; ARKANSAS to TEXAS.

433. CREPIS L. HAWKSBEARD.

1053. **C. setosa** Hall. HAIRY HAWKSBEARD.
A common weed in an alfalfa field in a flat along Grindstone creek.
EUROPE, thence to MISSOURI. This seems to be the first occurrence of the plant in the UNITED STATES.

434. PRENANTHES L. [*NABALUS* Cass.]. RATTLESNAKE-ROOT.

1054. **P. crepidinea** Michx. [*N. crepidineus* (Michx.) DC.]. LARGE RATTLESNAKE-ROOT.
Rare in thickets about Brushwood lake.
PENNSYLVANIA to MINNESOTA; TENNESSEE to KANSAS.

1055. **P. altissima** L. [*N. altissimus* (L.) Hook.]. TALL RATTLESNAKE-ROOT.
Frequent in woods and thickets. The plants have bright brown pappus which seems to be peculiar to Missouri forms.
NEWFOUNDLAND to MANITOBA; GEORGIA to TENNESSEE and MISSOURI.

435. HIERACIUM L. HAWKWEED.

1056. **H. longipilum** Torr. LONG-HAIRED HAWKWEED.
Roadsides; local.
ONTARIO to MINNESOTA; ILLINOIS to KANSAS and TEXAS.

1057. **H. Gronovii** L. HAIRY HAWKWEED.
Common on barren hills.
MASSACHUSETTS to ONTARIO, MICHIGAN and MISSOURI; FLORIDA to LOUISIANA and the INDIAN TERRITORY.

1058. **H. scabrum** Michx. ROUGH HAWKWEED.
Rare in dry woods and thickets.
NOVA SCOTIA to MINNESOTA; GEORGIA to KANSAS.

SUPPLEMENTAL LIST.

The following species were reported from Boone county by S. M. Tracy in his Flora of Missouri, published in the Report of the Missouri State Horticultural Society for 1885. These plants have not been collected in the course of these studies, and no specimens of them from Boone county are extant in the herbarium of the University of Missouri. Some thirty of the eighty-five species included in the following list are out of range, and in the absence of authentic specimens their reported occurrence must be considered to be based on errors in determination. Of the remainder some may have become extinct since 1885, while others either have eluded our search thus far or occur only in the more remote parts of the county.

1. **Nephrodium hexagonopterum** (Michx.) Diels [*Phegopteris hexagonoptera* (Michx.) Fée]. BEECH FERN.

Boone county (Tracy).

QUEBEC to MINNESOTA; FLORIDA to LOUISIANA.

2. **Cryptogramma Stelleri** (Gmel.) Prantl [*Pellaea Stelleri* (Gmel.) Watt.: *Pellaea gracilis* (Michx.) Hook.]. SLENDER CLIFF-BRAKE.

Boone county (Galloway).

LABRADOR to BRITISH COLUMBIA; MASSACHUSETTS and PENNSYLVANIA to IOWA and COLORADO: ASIA.

3. **Polypodium vulgare** L. POLYPODY.

Boone county (Tracy).

NORTH AMERICA: EUROPE and ASIA.

4. **Potamogeton Spirillus** Tuckerm. SPIRAL PONDWEED.

Boone county (Tracy).

NOVA SCOTIA to MINNESOTA; VIRGINIA to MISSOURI and NEBRASKA.

5. **Panicum lineare** Krock. [*P. glabrum* (Schrad.) Gaud.: *Syntherisma linearis* (Krock.) Nash]. SMALL CRAB-GRASS.
Boone county (Galloway).
EUROPE, thence to NORTH AMERICA.

6. **P. cognatum** Schultes [*P. autumnale* Bosc.] TALL PANIC-GRASS.
Boone county (Galloway).
GEORGIA and ILLINOIS to MINNESOTA; FLORIDA to ARIZONA.

7. **Leersia lenticularis** Michx. [*Homalocenchrus lenticularis* (Michx.) Scribn.]. CATCH-FLY GRASS.
Boone county (Galloway).
VIRGINIA to ILLINOIS and MISSOURI; FLORIDA to TEXAS.

8. **Muhlenbergia capillaris** (Lam.) Trin. LONG-AWNED HAIR-GRASS.
Common in Boone county (Galloway).
MASSACHUSETTS to MISSOURI; FLORIDA to TEXAS.

9. **Sporobolus cryptandrus** (Torr.) Gray. SAND DROPSEED.
Boone county (Galloway).
NEW ENGLAND to DAKOTA; MISSOURI to TEXAS and MEXICO.

10. **Agrostis altissima** (Walt.) Tuckerm. [*A. elata* Trin.]. TALL BENT-GRASS.
Boone county (Galloway). Far out of range.
NEW JERSEY to FLORIDA and ALABAMA.

11. **Poa nemoralis** L. WOOD MEADOW-GRASS.
Boone county (Galloway). Far out of range.
ANTICOSTI to BRITISH COLUMBIA; MAINE and MASSACHUSETTS to SOUTH DAKOTA and COLORADO: EUROPE and ASIA.

12. **P. debilis** Torr. WEAK SPEAR-GRASS.
Boone county (Galloway). Also far out of range.
NOVA SCOTIA and ONTARIO to MINNESOTA; RHODE ISLAND to PENNSYLVANIA and WISCONSIN.

13. **P. brevifolia** Muhl. SHORT-LEAVED SPEAR-GRASS.
Boone county (Galloway). Probably an error for *P. Wolfii* Scribn., which was not described till 1894.
NEW JERSEY to ILLINOIS; NORTH CAROLINA to TENNESSEE.

14. **Glyceria Canadensis** (Michx.) Trin. [*Panicularia Canadensis* (Michx.) Kuntze]. RATTLESNAKE GRASS.
Boone county (Galloway).
NEWFOUNDLAND to ONTARIO and MINNESOTA; NEW JERSEY to KANSAS.

15. **G. arundinacea** Kunth.
Boone county (Galloway). Is *G. grandis* Wats. meant?
EUROPE.

16. **Festuca ovina** L. SHEEP'S FESCUE.
Boone county (Galloway). Probably *F. ovina duriuscula* (L.) Hack., which is known to occur here.
LABRADOR to BRITISH COLUMBIA; NEW JERSEY to CALIFORNIA; naturalized for the most part from EUROPE and ASIA.

17. **Bromus Kalmii** Gray. KALM'S CHESS.
Boone county (Galloway).
QUEBEC to MANITOBA; MASSACHUSETTS and PENNSYLVANIA to IOWA.

18. **B. sterilis** L. BARREN BROME-GRASS.
Boone county (Galloway).
EUROPE and ASIA, thence to the UNITED STATES.

19. **Agropyron caninum** (L.) R. & S. AWNED WHEAT-GRASS.
Boone county (Galloway). I met in forests a grass which I took to be this in 1897, but the material is lost, and I am not sure of the identity of the plant. Its occurrence is probable.
NEW BRUNSWICK to BRITISH COLUMBIA; NORTH CAROLINA to COLORADO: EUROPE and ASIA.

20. **Orontium aquaticum** L. GOLDEN CLUB.
Boone county (Tracy). Far out of range.
MASSACHUSETTS to PENNSYLVANIA; FLORIDA to LOUISIANA. Mainly near the coast.

21. **Tradescantia rosea** Vent. ROSEATE SPIDERWORT.
Boone county (Tracy).
MARYLAND to MISSOURI; FLORIDA to TEXAS.

22. **Veratrum viride** Ait. INDIAN POKE.

Boone county (Tracy). Probably *V. Woodii* Robbins, which is not listed from Boone county, and is said to be known only from Jefferson county, though gathered first from Pike county.

QUEBEC to ALASKA; MINNESOTA to TENNESSEE and on the PACIFIC COAST to BRITISH COLUMBIA.

23. **Smilax Pseudo-China** L. FALSE CHINESE SMILAX.

Boone county (Galloway).*

MARYLAND to NEBRASKA; FLORIDA to TEXAS.

24. **Orchis spectabilis** L. [*Galeorchis spectabilis* (L.) Rydb.]. SHOWY ORCHIS.

Boone county (Tracy).

NEW BRUNSWICK to MINNESOTA; GEORGIA to KENTUCKY and NEBRASKA.

25. **Populus grandidentata** Michx. LARGE-TOOTHED ASPEN.

Boone county (Tracy). Out of range.†

NOVA SCOTIA to MINNESOTA; NORTH CAROLINA to TENNESSEE.

26. **P. balsamifera** L. BALSAM POPLAR.

Boone county (Galloway). Out of range.

NEWFOUNDLAND and HUDSON BAY to ALASKA; NEW YORK to NEBRASKA and NEVADA.

27. **Rumex conglomeratus** Murr. SMALL GREEN DOCK.

Boone county (Galloway).

EUROPE, thence to the UNITED STATES.

---

*B. F. Bush in his Trees, Shrubs and Vines of Missouri, Mo. Hort. Soc. Report, 1894, p. 357, considers the Boone county locality to be very doubtful.

†B. F. Bush, loc. cit. p. 359, thinks the report of the occurrence of this species and the next in Boone county, to rest upon some mistake or upon specimens not native.

28. **Chenopodium capitatum** (L.) Aschers. [*Blitum capitatum* L.]. STRAWBERRY BLITE.

Boone county (Tracy).

NOVA SCOTIA to ALASKA; NEW JERSEY to NEVADA.

29. **Claytonia Caroliniana** Michx. CAROLINA SPRING BEAUTY.

Boone county (Tracy). Far out of range.

NEWFOUNDLAND to SASKATCHEWAN; NORTH CAROLINA to MICHIGAN and MINNESOTA; COLORADO and NEW MEXICO.

30. **Stellaria borealis** Bigel. [*Alsine borealis* (Bigel.) Britton]. NORTHERN CHICKWEED.

Boone county (Galloway). Far out of range.

RHODE ISLAND and NEW JERSEY to MICHIGAN and MINNESOTA, BRITISH COLUMBIA and COLORADO.

31. **Cerastium oblongifolium** Torr. [*C. arvense oblongifolium* (Torr.) Holl. & Britt.]. FIELD MOUSE-EAR CHICKWEED.

Boone county (Tracy). Out of range.

NEW YORK and VIRGINIA to ONTARIO and MINNESOTA; ROCKY MOUNTAINS and SIERRA NEVADA.

32. **Spergula arvensis** L. SPURREY.

Boone county (Tracy).

EUROPE, thence to NORTH AMERICA.

33. **Nuphar advena** (Soland.) R. Br. [*Nymphaea advena* Soland.]. YELLOW POND LILY.

Boone county (Tracy).

NEW BRUNSWICK to the ROCKY MOUNTAINS; FLORIDA to TEXAS and UTAH.

34. **Actaea rubra** (Ait.) Willd. [*A. spicata rubra* Ait.]. RED BANEBERRY.

Boone county (Galloway).

NOVA SCOTIA to SOUTH DAKOTA; NEW JERSEY and PENNSYLVANIA to NEBRASKA.

35. **Anemone quinquefolia** L. [*A. nemorosa* Michx., not L., which is European]. WIND-FLOWER.
Boone county (Tracy).
NOVA SCOTIA and GEORGIA to the ROCKY MOUNTAINS: CHINA.

36. **A. Pennsylvanica** L. [*A. Canadensis* L.]. PENNSYLVANIA ANEMONE.
Boone county (Tracy).
LABRADOR to the NORTHWEST TERRITORY; PENNSYLVANIA to COLORADO.

37. **Thalictrum polyganum** Muhl. [*T. Cornuti* T. & G., not L.]. TALL MEADOW RUE.
Boone county (Galloway). Far out of range.
LABRADOR and QUEBEC to MICHIGAN and FLORIDA.

38. **Argemone Mexicana** L. PRICKLY POPPY.
Boone county (Galloway).
TROPICAL AMERICA; adventitious in the UNITED STATES.

39. **Corydalis aurea** Willd. [*Capnoides aureum* (Willd.) Kuntze]. GOLDEN CORYDALIS.
Boone county (Galloway). Out of range.
NOVA SCOTIA to MINNESOTA; PENNSYLVANIA to WISCONSIN.

40. **Cardamine hirsuta** L. HAIRY BITTER-CRESS.
Boone county (Tracy). Out of range.
PENNSYLVANIA to MICHIGAN and NORTH CAROLINA: EUROPE and ASIA.

41. **Draba verna** L. WHITLOW GRASS.
Boone county (Galloway).
EUROPE and ASIA, thence to NORTH AMERICA.

42. **D. Carolinianum** Walt. CAROLINA WHITLOW GRASS.
Boone county (Tracy).
MASSACHUSETTS to ONTARIO and MINNESOTA; GEORGIA to ARKANSAS.

43. **Stenophragma Thalianum** (L.) Celak [*Sisymbrium Thalianum* (L.) Gay]. MOUSE-EAR CRESS.
Boone county (Tracy).
EUROPE and ASIA, thence to NORTH AMERICA.

44. **Arabis hirsuta** (L.) Scop. HAIRY ROCK-CRESS.
Boone county (Tracy).
NEW BRUNSWICK to BRITISH COLUMBIA; GEORGIA to CALIFORNIA: EUROPE and ASIA.

45. **Hesperis matronalis** L. DAME'S ROCKET.
Naturalized in Boone county (Tracy).
EUROPE and ASIA, thence to NORTH AMERICA.

46. **Spiraea salicifolia** L. MEADOW-SWEET.
Boone county (Tracy).
NEWFOUNDLAND to the ROCKY MOUNTAINS; GEORGIA to MISSOURI: EUROPE and ASIA.

47. **S. tomentosa** L. STEEPLE-BUSH.
Boone county (Tracy).
NOVA SCOTIA to MANITOBA; GEORGIA to KANSAS.

48. **Mespilus hyemalis** Walt. [*Crataegus flava* Ait.]. SUMMER HAW.
Boone county (Tracy). In 1897 I gathered specimens of a haw that I took to be this, but the material has been lost.
VIRGINIA to MISSOURI; FLORIDA to TEXAS.

49. **M. spathulata** (Michx.) Poir. [*C. spathulata* Michx.]. SMALL COCK-SPUR THORN.
Boone county (Tracy).
VIRGINIA to MISSOURI; FLORIDA to TEXAS.

50. **M. Oxyacantha** (L.) Crantz [*C. Oxyacantha* L.]. ENGLISH HAWTHORN.
Boone county (Tracy).
EUROPE and ASIA, thence to NORTH AMERICA.

51. **M. pirifolia** (Soland.) Desf. [*C. tomentosa pyrifolia* (Soland.) Gray]. PEAR-LEAVED THORN.
Boone county (Tracy).
NEW JERSEY to ONTARIO and MICHIGAN; GEORGIA to MISSOURI.

52. **Rosa Carolina** L. SWAMP ROSE.
Boone county (Tracy).
QUEBEC to MINNESOTA; FLORIDA to MISSISSIPPI and MISSOURI.

53. **Trifolium reflexum** L. BUFFALO CLOVER.

Boone county (Tracy).

PENNSYLVANIA and NEW YORK to ONTARIO and NEBRASKA; FLORIDA to TEXAS.

54. **Astragalus crassicarpus** Nutt. [*A. caryocarpus* Ker.: *Geoprumnon crassicarpum* (Nutt.) Rydb.]. GROUND PLUM.

Boone county (Tracy).

MINNESOTA to the NORTHWEST TERRITORY; MISSOURI and TEXAS to COLORADO.

55. **Vicia Caroliniana** Walt. CAROLINA VETCH.

Boone county (Galloway).

ONTARIO and MICHIGAN to MINNESOTA; GEORGIA to KANSAS.

56. **Lathyrus palustris** L. MARSH VETCHLING.

Boone county (Tracy). Far out of range.

LABRADOR to ALASKA; NEW YORK to BRITISH COLUMBIA: EUROPE and ASIA.

57. **Clitoria Mariana** L. BUTTERFLY PEA.

Boone county (Galloway).

NEW JERSEY to MISSOURI; FLORIDA to TEXAS.

58. **Polygala Senega** L. SENECA SNAKEROOT.

Boone county (Tracy).

NEW BRUNSWICK to the CANADIAN ROCKY MOUNTAINS; NORTH CAROLINA to MISSOURI.

59. **Ilex verticillata** (L.) Gray. WINTER-BERRY.

Boone county (Swallow).

NOVA SCOTIA to ONTARIO and WISCONSIN; FLORIDA to MISSOURI.

60. **Euonymus Americanus** L. STRAWBERRY BUSH.

Boone county (Tracy).

NEW YORK to ILLINOIS; FLORIDA to TEXAS.

61. **Viola cordata** Walt. [*V. cucullata cordata* (Walt.) Gray: *V. palmata villosa* (Walt.) Robins.; *V. villosa* Walt. in part]. SMOOTH WOOD VIOLET.

Boone county (Tracy). Out of range.

SOUTH ATLANTIC STATES.

62. **V. rotundifolia** Michx. ROUND-LEAVED VIOLET.
Boone county (Tracy). Far out of range.
LABRADOR to MINNESOTA, south in the ALLEGHANIES to NORTH CAROLINA and TENNESSEE.

63. **V. blanda** Willd. SWEET WHITE VIOLET.
Boone county (Tracy). Very far out of range.
NEWFOUNDLAND to BRITISH COLUMBIA, south in the ALLEGHANIES to NORTH CAROLINA, SOUTH CAROLINA and TENNESSEE.

64. **V. hastata** Michx. HALBERD-LEAVED YELLOW VIOLET.
Boone county (Galloway). Far out of range.
PENNSYLVANIA to OHIO; GEORGIA to ALABAMA.

65. **Aralia nudicaulis** L. WILD SARSAPARILLA.
Boone county (Tracy).
NEWFOUNDLAND to MANITOBA; NORTH CAROLINA to MISSOURI and COLORADO.

66. **Conioselinum Canadense** (Michx.) T. & G. [*C. Chinense* (L.) B. S. P.]. HEMLOCK-PARSLEY.
Boone county (Tracy). Out of range.
LABRADOR to MINNESOTA; NORTH CAROLINA to INDIANA.

67. **Steironema quadriflorum** (Sims) Hitchc. [*S. longifolium* (Pursh) Gray]. PRAIRIE MONEYWORT.
Boone county (Tracy).
NEW YORK and ONTARIO to MANITOBA; WEST VIRGINIA to KENTUCKY and IOWA.

68. **Asclepias rubra** L. RED MILKWEED.
Boone county (Galloway).
NEW JERSEY and PENNSYLVANIA to FLORIDA and TEXAS.

69. **A. variegata** L. WHITE MILKWEED.
Boone county (Galloway).
CONNECTICUT to ILLINOIS; FLORIDA to LOUISIANA and ARKANSAS.

70. **Cuscuta compacta** Juss. COMPACT DODDER.
Boone county (Tracy).
NEW YORK and ONTARIO to KANSAS; ALABAMA to TEXAS

71. **Phlox amoena** Sims [*P. procumbens* Gray, not Lehm.]. HAIRY PHLOX.
Boone county (Galloway). Out of range.
VIRGINIA and FLORIDA to TENNESSEE.

72. **P. reptans** Michx. CRAWLING PHLOX.
Boone county (Tracy). Out of range.
PENNSYLVANIA to KENTUCKY; GEORGIA to ALABAMA.

73. **Symphytum officinale** L. COMFREY.
Boone county (Galloway).
EUROPE and ASIA, thence to NORTH AMERICA.

74. **Nicandra physaloides** (L.) Gaertn. [*Physalodes Physalodes* (L.) Britton]. APPLE OF PERU.
Boone county (Galloway.)
PERU, thence to NORTH AMERICA.

75. **Plantago Patagonica** Jacq. PATAGONIAN PLANTAIN.
Boone county (Galloway). Out of range.
SOUTH AMERICA: MEXICO.

76. **P. heterophylla** Nutt. MANY-SEEDED PLANTAIN.
Boone county (Tracy). Out of range.
NEW JERSEY to FLORIDA, TEXAS and SOUTH CAROLINA.

77. **Galium latifolium** Michx. PURPLE BEDSTRAW.
Boone county (Tracy). Out of range.
In the mountains from PENNSYLVANIA to GEORGIA; MICHIGAN.

78. **Valerianella chenopodifolia** (Pursh) DC. GOOSE-FOOT CORN SALAD.
Boone county (Galloway). Out of range.
NEW YORK to WISCONSIN; VIRGINIA to KENTUCKY.

79. **Liatris elegans** (Walt.) Willd. [*Lacinaria elegans* (Walt.) Kuntze]. HANDSOME BLAZING-STAR.
Boone county (Galloway). Out of range.
VIRGINIA to FLORIDA and TEXAS in pine barrens.

80. **Solidago bicolor** L. WHITE GOLDEN ROD.

Boone county (Galloway).

NOVA SCOTIA to ONTARIO and MINNESOTA; GEORGIA to MISSOURI.*

81. **Aster undulatus** L. WAVY-LEAF ASTER.

Boone county (Galloway).

NEW BRUNSWICK to ONTARIO and MICHIGAN; FLORIDA to ALABAMA and ARKANSAS.

82. **Gnaphalium decurrens** Ives. CLAMMY CUDWEED.

Boone county (Galloway). Out of range.

NOVA SCOTIA to BRITISH COLUMBIA; PENNSYLVANIA to MICHIGAN; WASHINGTON to COLORADO, ARIZONA and TEXAS.

83. **Iva frutescens** L. HIGH-WATER SHRUB.

Boone county (Galloway). Out of range.

Sea-coasts and sea-marshes from MASSACHUSETTS to FLORIDA and TEXAS.

84. **Coreopsis trichosperma** Michx. [*Bidens trichosperma* (Michx.) Britton]. TICKSEED SUNFLOWER.

Boone county (Tracy). Out of range?

MASSACHUSETTS to MICHIGAN and ILLINOIS; GEORGIA to KENTUCKY.

85. **Senecio vulgaris** L. COMMON GROUNDSEL.

Boone county (Tracy).

EUROPE, thence to NORTH AMERICA.

---

*The range is thus given in Britton & Brown, An illustrated flora of the northern United States, Canada and the British possessions, V. 3, p. 333, but perhaps on Tracy's authority. I can find no trace of any collection of the species in Missouri, except Galloway's as above.

LITERATURE.

1. Columbia, Mo.

Daniels, F. P. Preliminary oecological study of the native and introduced plants of the vicinity of Columbia, Boone county, Missouri. Mo. Ag. Ex. Sta., Report, **1898,** 124-156, 1898.

2. Missouri.

Bush, B. F. Notes on a list of plants collected in southeastern Missouri in 1893. Mo. Bot. Gard., Report **5,** 139-153, 1894.

Bush, B. F. Notes on the mound flora of Atchison county, Missouri. Mo. Bot. Gard., Report **6,** 121-134, 1895.

Bush, B. F. The trees, shrubs and vines of Missouri. Mo. State Hort. Soc., Report **37,** 353-393, 1895.

Engelmann, George. Notes on the grapevines of Missouri. St. Louis Acad. of Sci., Trans. **1,** 660-662, 1856-60.

Mackenzie, K. K. and **Bush, B. F.** The Lespedezas of Missouri. St. Louis Acad. of Sci., Trans. **12,** 11-19, 1902.

Mackenzie, K. K. and **Bush, B. F.** New plants from Missouri. Mo. Bot. Gard., Report **16,** 1905.

Mackenzie, K. K. and **Bush, B. F.** New plants from Missouri. St. Louis Acad. of Sci., Trans. **12,** 79-89, 1902.

Mackenzie, K. K. and others. Manual of the flora of Jackson county, Missouri, 1902.

Prince, S. F. Some ferns of the cave region of Stone county, Missouri. The Fern Bull. **12,** 72-77, 1904.

Torrey, John. Catalogue of plants collected by Mr Charles Geyer, under the direction of Mr. I. N. Nicollet, during his exploration of the region between the Mississippi and Missouri rivers. In Nicollet, I. N., Report, 28th Cong. 2nd sess., House doc. no. **52,** 143-165, 1845.

Tracy, S. M. Flora of Missouri. Mo. State Hort. Soc., Report, **28,** apx. 1-106, 1896.

3. State and Local Floras.

Beal, W. J. Michigan flora. Mich. Acad. of Sci., Report, **5**, 1-147, 1905.

Beckwith, Florence and **Macauley, Mary E.** Plants of Monroe county, New York. Roch. Acad. of Sci., **3**, 1-150, 1896.

Bessey, C. E. and **Webber, H. J.** Catalogue of the flora of Nebraska. Neb. Board of Agr., Report **1889**, 1890.

Bogue, E. E. Ferns and flowering plants of Oklahoma. Okl. Ex. Sta., Bull. **45.** 1900.

Bolley, H. L. and **Waldron, L. R.** Preliminary list of seed-bearing plants of North Dakota. N. D. Ex. Sta. Bull. **46.** 1900.

Brainerd, Ezra, Jones, L. R. and **Eggleston, W. W.** Flora of Vermont. Contr. to the Bot. of Vermont **8,** 1900.

Britton, N. L. Catalogue of plants found in New Jersey. N. J. Geol. Surv. **2,** part 1, 1889.

Coulter, J. M. Botany of western Texas. U. S. Nat'l Herb., Contr. **2,** 1891-94

Cratty, R. I. Flora of Emmet county, Iowa. Ia. Acad. of Sci., Proc. **11,** 201-251, 1904.

Daniels, F. P. Ecology of the flora of Sturgis, Michigan, and vicinity. Mich. Acad. of Sci., Report **4,** 145-159, 1904.

Daniels, F. P. The flora of the vicinity of Manistee, Michigan. Mich. Acad. of Sci., Report **4,** 125-144, 1904.

Day, D. F. A catalogue of the native and naturalized plants of the city of Buffalo and vicinity. 1883.

Dudley, W. R. Cayuga flora, 1886.

Earle, F. S. The flora of the metamorphic region of Alabama. Ala. Agr. Ex. Sta., Bull. **119.** 1902.

Fitzpatrick, T. J. Notes on the flora of northeastern Iowa. Ia. Acad. of Sci., Proc. **5,** 107-173, 1898.

Fitzpatrick, T. J. and **Fitzpatrick, M. F. L.** The flora of southern Iowa. Ia. Acad. of Sci., Proc. **6,** 173-202 1899.

Jones, H. L. Catalogue of the phanerogams and ferns of Licking county, Ohio. Denison Univ. Sci. Lab. Bull. **7,** 1892.

Millspaugh, C. F. and **Nuttall, L. W.** Flora of West Virginia. Field Columbian Museum, Pub., Bot. ser. **1**, 69-276. 1896.

Mohr, Charles. Plant life of Alabama. U. S. Nat'l Herb., Contr. **7**, 1900.

Nelson, Aven. First report on the flora of Wyoming. Wy. Agr. Ex. Sta., Bull. **28**, 1896.

Pammel, L. H. Notes on the flora of western Iowa. Ia. Acad. of Sci., Proc. **3**, 106-135, 1896.

Pammel, L. H. Some weeds of Iowa. Ia. Agr. Ex. Sta., Bull. **70**, 1903.

Pammel, L. H. and **King, Charlotte M.** The vascular cryptogams of Iowa and the adjoining parts of southeastern Minnesota and western Wisconsin. Ia. Acad. of Sci., Proc. **9**, 134-151, 1902.

Selby, A. D. and **Duvel, J. W. T.** Sources of the Ohio flora. Journ. Columbus Hort. Soc., 35-58, 1899.

Shimek, B. The flora of the Sioux quartzite in Iowa. Ia. Acad. of Sci., Proc. **2**, 72-77, 1895; **5**, 28-31, 1898.

Torrey, John. Flora of the state of New York. Nat. Hist. of N. Y., part 2, **1-2**, 1843.

Watson, Sereno, and others. Botany of California. Cal. Geol. Surv, Bot. **1-2**, 1880.

APPENDIX A.

SPECIES OF VERNONIA OCCURRING NORTH OF MEXICO.

Genus **VERNONIA**

Subgenus **LEPIDAPLOA.** Pappus in two series; bracts of the involucre in several to many series.

A. **CAULINIFOLIAE.** Leaves mainly, or all, cauline.

I. *TRICHOSTACHYAE.* Bracts mainly with long filiform tips.

a. **Arkansanae.** Heads large, sometimes 2½ cm. high, 50-70 flowered.

1. **V. crinita** Raf. [*V. Arkansana* DC.]. ARKANSAS IRONWEED.

b. **Noveboracenses.** Heads medium, 15 to 40 flowered, 1¼ cm. high or less; leaves not scabrous.

2. Glabrous or pubescent; pappus reddish-purplish. **V. Noveboracensis** (L.) Willd. NEW YORK IRONWEED. MASSACHUSETTS to MINNESOTA; GEORGIA to MISSOURI.
3. Tomentulose; pappus straw-colored. **V. tomentosa** (Walt.) Ell. [*V. Noveboracensis tomentosa* (Walt.) Britton]. TOMENTOSE IRONWEED. NEW JERSEY and PENNSYLVANIA to NORTH CAROLINA.

c. **Scaberrimae.** Heads small to medium; leaves scabrous above.

4. Leaves sharply dentate; tips of bracts gradually tapering into erect awns. **V. Harperi** Gleason. HARPER'S IRONWEED. GEORGIA.
5. Leaves coarsely toothed; subulate tips of bracts soft. **V. pulchella** Small. SHOWY IRONWEED. GEORGIA.
6. Leaves entire or remotely toothed; subulate tips of bracts rigid. **V. scaberrima** Nutt. [*V. angustifolia scaberrima* (Nutt.) Gray]. HARSH IRONWEED. SOUTH CAROLINA to FLORIDA.
7. Leaves entire or remotely toothed; subulate tips of bracts recurved. **V. recurva** Gleason. RECURVE-BRACTED IRONWEED. GEORGIA.

II. *BRACHYSTACHYEAE.* Bracts mainly without filiform tips.

a. **Platyphyllae.** Leaves lanceolate to oval, not linear.

a. **Baldwiniae.** Bracts with attenuate-recurved tips.

8. Bracts ovate; pappus red-purple; inflorescence cymose; leaves ovate-lanceolate; heads medium. **V. Baldwinii** Torr. *V. interior Baldwini* (Torr.) Mack & Bush. BALDWIN'S IRONWEED.

9. Bracts ovate; pappus red-purple; inflorescence cymose; leaves lanceolate to linear; heads small. **V. Duggariana** Daniels. DUGGAR'S IRONWEED.
10. Bracts ovate; pappus red-purple; inflorescence cymose; leaves broadly ovate; heads medium. **V. partheni-oides** Daniels. PARTHENIUM-LIKE IRONWEED.
11. Bracts ovate; pappus red-purple; inflorescence cymose-paniculate; leaves long oblong-lanceolate; heads medium. **V. peralta** Daniels. PANICLED IRONWEED.
12. Bracts ovate; pappus light yellow; inflorescence cymose; leaves ovate-lanceolate; heads small. **V. flavipapposa** Daniels. FLAVIPAPPOSE IRONWEED.
13. Bracts oblong; pappus red-purple; inflorescence cymose; leaves ovate-lanceolate; heads small to medium. **V. pseudobaldwinii** Daniels. FALSE BALDWIN'S IRONWEED.
14. Bracts oblong; pappus red-purple; inflorescence cymose; leaves elliptic-lanceolate; heads large. **V. pseudodrummondii** Daniels. FALSE DRUMMOND'S IRONWEED.

b. **Drummondiae.** Bracts seldom, or but slightly reflexed: plants pubescent or tomentose.

15. Leaves pubescent or tomentose underneath; involucres 5-7½ mm. high, slightly spreading. **V. interior** Small. INLAND IRONWEED.
16. Leaves pubescent or tomentose underneath; involucres 6 mm. high, closely appressed. **V. Illinoensis** Gleason. ILLINOIS IRONWEED. ONTARIO and OHIO to IOWA.
17. Leaves densely tomentose beneath; heads 10-12½ mm. high; pappus tawny or purplish. **V. Drummondii** Shuttlw. [*V. altissima grandiflora* Gray. *V. Missurica* Raf.]. DRUMMOND'S IRONWEED.
18. Leaves densely tomentose beneath; heads 12-15 mm. high; pappus buff. **V. Reedii** Daniels. REED'S IRONWEED.

c. **Altissimae.** Bracts seldom, or but slightly, reflexed: plants glabrous, or nearly so.

19. Leaves glabrous, or nearly so, on both sides; pappus straw-colored; bracts acuminate, the inner occasionally aristate. **V. glauca** (L.) Britton [*V. Noveboracensis latifolia* Gray]. BROAD-LEAVED IRONWEED. MARYLAND and PENNSYLVANIA to OHIO and MICHIGAN; FLORIDA to LOUISIANA.
20. Leaves glabrous, or nearly so, on both sides; pappus straw-colored; bracts obtuse. **V. flaccidifolia** Small. FLACCID-LEAVED IRONWEED. GEORGIA to ALABAMA and TENNESSEE.

21. Leaves glabrous, or nearly so, on both sides; pappus purplish; heads large; bracts obtuse. **V. Michiganensis** Daniels. Nov. spec. MICHIGAN IRONWEED.

Plant 1½-2 metres in height; stems glabrate or slightly pubescent above; leaves elliptic-lanceolate, serrate, glabrate; cymes medium to ample; heads large, 8-10 mm. high; bracts oblong, obtuse to subacute, appressed; pappus red-purple. Common in the Grand river valley in CENTRAL MICHIGAN.

22. Leaves glabrous, or nearly so, on both sides; pappus purplish; heads under medium; bracts obtuse, loosely spreading at maturity. **V. gigantea** (Walt.) Trelease [*V. altissima* Nutt. in part]. GIANT IRONWEED. SOUTH CAROLINA to FLORIDA and ALABAMA.

22a. As above, but heads slightly larger; leaves tomentose beneath. **V. gigantea praealta** (Michx.) Daniels [*V. praealta* (L.?) Michx.]. MICHAUX'S IRONWEED. SOUTH CAROLINA to LOUISIANA.

23. Leaves glabrous, or nearly so, on both sides; pappus purplish; bracts obtuse, appressed at maturity; heads 6 to 7½ mm. high; corymbs ample. **V. altissima** Nutt. [*V. gigantea* (Walt.) Britton, in part: *V. maxima* Small]. TALL IRONWEED.

23a. As above, but the peduncles and under surfaces of the leaves pubescent. **V. altissima pubescens** (Morris) Daniels [*V. maxima pubescens* Morris]. HAIRY TALL IRONWEED. WEST VIRGINIA to ALABAMA.

24. Leaves glabrous, or nearly so, on both sides; pappus purplish; bracts obtuse, appressed at maturity; heads under 6 mm. high; corymbs few-branched. **V. oligantha** Greene. FEW-FLOWERED IRONWEED. FLORIDA.

25. Leaves glabrous, or nearly so, on both sides; pappus purplish; bracts acuminate. **V. ovalifolia** T. & G. OVAL-LEAVED IRONWEED. GEORGIA to FLORIDA.

β. **Stenophyllae.** Leaves linear, or even filiform.

a. **Fasciculatae.** Leaves smooth above, bracts obtuse, or merely acutish.

26. Leaves pubescent beneath; involucre campanulate, ciliate; pappus purplish. **V. Guadalupensis** Heller. GUADALUPE IRONWEED. TEXAS.

27. Leaves pubescent beneath; involucre hemispheric, densely arachnoid ciliate; pappus purple-tawny. **V. Reverchonii** Gleason. REVERCHON'S IRONWEED. TEXAS.

28. Leaves pubescent beneath; pappus buff. **V. chrysopappa** Daniels. BUFF-PAPPOSE IRONWEED.

29. Leaves glabrous beneath; pappus purple. **V. fasciculata** Michx. [*V. altissima* DC., not Michx.]. WESTERN IRONWEED. OHIO and MICHIGAN to SOUTH DAKOTA; KENTUCKY and MISSOURI to TEXAS.

29a. As above, but with relatively broad and short leaves. **V. fasciculata corymbosa** (Schweinitz) Daniels [*V. corymbosa* Schweinitz: *V. Schweinitzii* Steud.]. CORYMBED IRONWEED. Range of type.

b. **Jamesiae.** Leaves smooth above, bracts acuminate or acute.

30. Leaves not exceedingly numerous and crowded, serrate. **V. tenuifolia** Small. SLENDER-LEAVED IRONWEED. TEXAS.

31. Leaves not exceedingly numerous and crowded, entire. **V. marginata** (Torr.) Trelease [*V. altissima marginata* Torr.: *V. Jamesii* T. & G.]. JAMES'S IRONWEED. NEBRASKA to ARKANSAS and TEXAS.

32. Leaves exceedingly numerous and crowded. **V. Lettermannii** Engelm. LETTERMANN'S IRONWEED. ARKANSAS.

c. **Angustifoliae.** Leaves scabrous above.

33. Bracts with slender-spreading tips. **V. graminifolia** (Walt.) Trelease [*V. angustifolia* Michx.: *V. fasciculata* DC. not Michx.: *Liatris umbellata* Bertol.]. NARROW-LEAVED IRONWEED. NORTH CAROLINA and FLORIDA to ARKANSAS and TEXAS.

34. Bracts with acute erect or appressed tips; leaves remotely toothed. **V. Texana** (Gray) Small [*V. angustifolia Texana* Gray]. TEXAN IRONWEED. FLORIDA to ARKANSAS and TEXAS.

35. Bracts with acute erect or appressed tips; leaves entire. **V. Blodgettii** Small [*V. angustifolia pumila* Chapm.]. BLODGETT'S IRONWEED. FLORIDA.

d. **Lindheimerae.** Plants white woolly.

36. **V. Lindheimeri** Gray & Engelm. LINDHEIMER'S IRONWEED. TEXAS.

B. **RADICIFOLIAE.** Leaves mainly basal.

a. **Oligophyllae.** Stems naked, or with a few bract-like leaves.

37. **V. oligophylla** Michx. [*Serratula Caroliniensis* Dill.: *Chrysocoma acaulis* Walt.: *V. acaulis* (Walt.) Gleason]. FEW-LEAVED IRONWEED. NORTH CAROLINA to FLORIDA.

APPENDIX B.

LIST OF NEW SPECIES AND VARIETIES.

Iris foliosa Boonensis Daniels.
Physocarpus Missouriensis Daniels.
Physocarpus Michiganensis Daniels.
Thaspium ziziopsis * Daniels.
Vernonia Duggariana Daniels.
Vernonia flavipapposa Daniels.
Vernonia parthenioides Daniels.
Vernonia peralta Daniels.
Vernonia pseudobaldwinii Daniels.
Vernonia pseudodrummondii Daniels.
Vernonia Reedii Daniels.
Vernonia chrysopappa Daniels.
Vernonia Michiganensis Daniels.

*Novum nomen.

APPENDIX C.

List of New Hybrids.

Quercus imbricaria Michx. × Q. palustris Du Roi.
Quercus tinctoria Michx. × Q. palustris Du Roi.
Vernonia Drummondii Shuttlw. × V. interior Small.
Coreopsis involucrata Nutt. × Bidens comosa (Gray) Wiegand.
Lactuca sagittifolia Ell. × Canadensis L.

APPENDIX D.

List of New Combinations.

The combinations in the following list are new as far as somewhat limited library facilities have made it possible to determine:

Pellaea dealbata (Pursh) Daniels.
Asarum ambiguum * (Bicknell) Daniels.
Mirabilis hirsuta (Pursh) Daniels.
Mirabilis decumbens (Nutt.) Daniels.
Alsine Texana (Robinson) Daniels.
Descurainia intermedia (Rydb.) Daniels.
Physocarpus intermedius (Rydb.) Daniels.
Physocarpus ferrugineus * (Nutt.) Daniels.
Mespilus Eggerti (Britton) Daniels.
Mespilus nitida (Engelm.) Daniels.
Mespilus rotundifolia (Ehrh.) Daniels.
Mespilus mollis (T. & G.) Daniels.
Mespilus Biltmoreana (Beadle) Daniels.
Mespilus campestris (Britton) Daniels.
Mespilus Chapmani (Beadle) Daniels.
Mespilus dispessa (Ashe) Daniels.
Desmanthus Illinoensis (Michx.) Daniels.
Desmodium Michauxii (Vail) Daniels.
Desmodium longifolium (T. & G.) Daniels.
Amphicarpa Pitcheri (T. & G.) Daniels.
Calystegia Americana (Sims) Daniels.
Vernonia gigantea praealta † (Michx.) Daniels.
Vernonia altissima pubescens (Morris) Daniels.
Vernonia fasciculata corymbosa † (Schweinitz) Daniels.
Helianthus macrophyllus * (Willd.) Daniels.

---

*Varieties raised to specific rank.

†Species reduced to varietal rank.

SUMMARY

	Orders	Families	Native Genera	Native Species	Native Varieties	Introduced Genera	Introduced Species	Introduced Varieties	Total Genera	Total Species	Total Varieties
I. PTERIDOPHYTA	3	3	13	19					13	19	
1. FILICALES		1	10	13					10	13	
1. Polypodiaceae			10	13					10	13	
2. OPHIOGLOSSALES		1	2	2					2	2	
2. Ophioglossaceae			2	2					2	2	
3. EQUISETALES		1	1	4					1	4	
3. Equisetaceae			1	4					1	4	
II. SPERMATOPHYTA	35	104	351	861	43	71	178	3	422	1039	47
(i) *GYMNOSPERMAE*	1	1	1	1					1	1	
4. CONIFERALES		1	1	1					1	1	
4. Pinaceae			1	1					1	1	
(ii) *ANGIOSPERMAE*	34	103	350	860	43	71	178	3	421	1038	46
1. *Monocotyledoneae*	7	17	74	215	20	14	41	1	88	256	21

	Orders	Families	Native Genera	Native Species	Native Varieties	Introduced Genera	Introduced Species	Introduced Varieties	Total Genera	Total Species	Total Varieties
5. PANDANALES		1	1	1					1	1	
5. Typhaceae			1	1					1	1	
6. HELOBIALES		4	6	10					6	10	
6. Potamogetonaceae			1	4					1	4	
7. Naiadaceae			1	1					1	1	
8. Alismaceae			3	4					3	4	
9. Hydrocharitaceae			1	1					1	1	
7. GLUMIFLORALES		2	39	149	17	10	35	1	49	184	18
10. Gramineae			32	78	8	10	35	1	42	113	9
11. Cyperaceae			7	71	9				7	71	9
8. SPATHIFLORALES		2	5	7					5	7	
12. Araceae			2	3					2	3	
13. Lemnaceae			3	4					3	4	

9. FARINOSALES		2	3	7					3	7	
14. Commelinaceae			2	6					2	6	
15. Pontederiaceae			I	I					I	I	
10. LILIIFLORALES		5	17	36	3	4	6		21	42	3
16. Juncaceae			2	9	2				2	9	2
17. Liliaceae			11	21		3	4		13	25	
18. Amaryllidaceae			I	I					I	I	
19. Dioscoreaceae			I	I					I	I	
20. Iridaceae			2	4	I	I	2		3	6	I
11. MICROSPERMALES		I	3	5					3	5	
21. Orchidaceae			3	5					3	5	
2. *Dicotyledoneae*	27	86	276	645	23	57	137	2	333	782	25
(1) CHORIPETALAE	19	59	162	352	14	27	81	I	189	433	15
12. JUGLANDALES		I	2	8					2	8	
22. Juglandaceae			2	8					2	8	
13. SALICALES		I	2	8	2		2		2	10	2
23. Salicaceae			2	8	2		2		2	10	2

	Orders	Families	Native Genera	Native Species	Native Varieties	Introduced Genera	Introduced Species	Introduced Varieties	Total Genera	Total Species	Total Varieties
14. FAGALES		2	6	16	3				6	16	3
24. Betulaceae			5	5					5	5	
25. Fagaceae			1	11	3				1	11	3
15. URTICALES		3	10	13		1	3		11	16	
26. Ulmaceae			2	5					2	5	
27. Moraceae			3	3		1	2		4	5	
28. Urticaceae			5	5			1		5	6	
16. SANTALES		1	1	1					1	1	
29. Santalaceae			1	1					1	1	
17. ARISTOLOCHIALES		1	2	2					2	2	
30. Aristolochiaceae			2	2					2	2	
18. POLYGONALES		1	2	18		1	7		3	25	
31. Polygonaceae			2	18		1	7		3	25	

19. CENTROSPERMALES		7	11	17		5	19		16	36	
32. Chenopodiaceae			2	3		1	5		3	8	
33. Amarantaceae			1	1			6		1	7	
34. Phytolaccaceae			1	1					1	1	
35. Nyctaginaceae			1	2					1	2	
36. Aizoaceae						1	1		1	1	
37. Portulacaceae			2	2			2		2	4	
38. Caryophyllaceae			4	8		3	5		7	13	
20. RANALES		7	18	26			1		18	27	
39. Nymphaeaceae			2	2					2	2	
40. Ceratophyllaceae			1	1					1	1	
41. Anonaceae			1	1					1	1	
42. Ranunculaceae			9	17			1		9	18	
43. Berberidaceae			2	2					2	2	
44. Menispermaceae			1	1					1	1	
45. Lauraceae			2	2					2	2	
21. RHOEDALES		2	11	22		6	15	1	17	37	1

	Orders	Families	Native Genera	Native Species	Native Varieties	Introduced Genera	Introduced Species	Introduced Varieties	Total Genera	Total Species	Total Varieties
46. Papaveraceae			3	5					3	5	
47. Cruciferae			8	17		6	15	1	14	32	1
22. ROSALES		5	39	101	4	3	18		42	119	4
48. Crassulaceae			1	1		1	1		2	2	
49. Saxifragaceae			2	4					2	4	
50. Platanaceae			1	1					1	1	
51. Rosaceae			12	43	2		6		12	49	2
52. Leguminosae			23	52	2	2	11		25	63	2
23. GERANIALES		8	10	24		3	4		13	28	
53. Geraniaceae			1	2					1	2	
54. Oxalidaceae			1	4					1	4	
55. Linaceae						1	1		1	1	
56. Rutaceae			2	2					2	2	

57. Simarubaceae						1	1		1	1	
58. Polygalaceae			1	2					1	2	
59. Euphorbiaceae			4	13		1	2		5	15	
60. Callitrichaceae			1	1					1	1	
24. SAPINDALES		6	7	18					7	18	
61. Anacardiaceae			1	4					1	4	
62. Celastraceae			2	2					2	2	
63. Staphyleaceae			1	1					1	1	
64. Aceraceae			1	6					1	6	
65. Hippocastanaceae			1	3					1	3	
66 Balsaminaceae			1	2					1	2	
25. RHAMNALES		2	5	10	2		1		5	11	2
67. Rhamnaceae			2	3			1		2	4	
68. Vitaceae			3	7	2				3	7	2
26. MALVALES		2	3	3		3	5		6	8	
69. Tiliaceae			1	1					1	1	
70. Malvaceae			2	2		3	5		5	7	

	Orders	Families	Native Genera	Native Species	Native Varieties	Introduced Genera	Introduced Species	Introduced Varieties	Total Genera	Total Species	Total Varieties
27. PARIETALES		4	6	25	2		1		6	26	2
71. Guttiferae			1	8			1		1	9	
72. Cistaceae			2	3					2	3	
73. Violaceae			2	13	2				2	13	2
74. Loasaceae			1	1					1	1	
28. OPUNTIALES		1	1	1					1	1	
75. Cactaceae			1	1					1	1	
29. MYRTIFLORALES		2	13	15	1				13	15	1
76. Lythraceae			4	4					4	4	
77. Onagraceae			9	11	1				9	11	1
30. UMBELLIFLORALES		3	13	24		5	5		18	29	
78. Araliaceae			2	2					2	2	
79. Umbelliferae			10	17		5	5		15	22	

80. Cornaceae			1	5					1	5	
(2) Sympetalae	8	27	114	293	9	30	56	1	144	349	10
31. ERICALES		2	2	2					2	2	
81. Pirolaceae			1	1					1	1	
82. Ericaceae			1	1					1	1	
32. PRIMULALES		1	5	7		1	1		6	8	
83. Primulaceae			5	7		1	1		6	8	
33. EBENALES		1	1	1					1	1	
84. Ebenaceae			1	1					1	1	
34. CONTORTALES		4	7	20		2	2		9	22	
85. Oleaceae			1	4		1	1		2	5	
86. Gentianaceae			2	2					2	2	
87. Apocynaceae			1	5		1	1		2	6	
88. Asclepiadaceae			3	9					3	9	
35. TUBIFLORALES		12	49	90	1	12	28		61	118	1
89. Convolvulaceae			3	6		1	2		4	8	
90. Polemoniaceae			2	3					2	3	

	Orders	Families	Native Genera	Native Species	Native Varieties	Introduced Genera	Introduced Species	Introduced Varieties	Total Genera	Total Species	Total Varieties
91. Hydrophyllaceae			3	4					3	4	
92. Borraginaceae			6	6			3		6	9	
93. Verbenaceae			2	7					2	7	
94. Labiatae			12	26		5	7		17	33	
95. Solanaceae			2	10		3	9		5	19	
96. Scrophulariaceae			14	22		2	5		16	27	
97. Orobanchaceae			1	1					1	1	
98. Bignoniaceae			1	1		1	2		2	3	
99. Acanthaceae			2	3	1				2	3	1
100. Phrymaceae			1	1					1	1	
36. PLANTAGINALES		1	1	7			1		1	8	
101. Plantaginaceae			1	7			1		1	8	
37. RUBIALES		3	10	20					10	20	

102. Rubiaceae			4	10					4	10	
103. Caprifoliaceae . . .			5	9					5	9	
104. Valerianaceae . . .			1	1					1	1	
38. CAMPANULATALES . .		3	39	146	8	15	25	1	54	171	10
105. Cucurbitaceae			3	3		3	4		6	7	
106. Campanulaceae . . .			3	7					3	7	
107. Compositae			33	136	8	12	20	1	45	156	9
Total*	38	107	364	880	43	71	178	3	435	1058	47

*This summary does not include the 85 plants given in the supplemental list and resting on Tracy's authority.

INDEX

INDEX

References to the Flora are in brackets [ ]

References to the Flora are in brackets [ ]

References to the Flora are in brackets [ ]

References to the Flora are in brackets [ ]

References to the Flora are in brackets [ ]

References to the Flora are in brackets [ ]

References to the Flora are in brackets [ ]

References to the Flora are in brackets [ ]

References to the Flora are in brackets [ ]

References to the Flora are in brackets [ ]

References to the Flora are in brackets [ ]

References to the Flora are in brackets [ ]

References to the Flora are in brackets [ ]

References to the Flora are in brackets [ ]

References to the Flora are in brackets [ ]

References to the Flora are in brackets [ ]

References to the Flora are in brackets [ ]

References to the Flora are in brackets [ ]

References to the Flora are in brackets [ ]

References to the Flora are in brackets [ ]

References to the Flora are in brackets [ ]

References to the Flora are in brackets [ ]

References to the Flora are in brackets [ ]

References to the Flora are in brackets [ ]

References to the Flora are in brackets [ ]

References to the Flora are in brackets [ ]

References to the Flora are in brackets [ ]

References to the Flora are in brackets [ ]

References to the Flora are in brackets [ ]

References to the Flora are in brackets [ ]

References to the Flora are in brackets [ ]

References to the Flora are in brackets [ ]

References to the Flora are in brackets [ ]

References to the Flora are in brackets [ ]

References to the Flora are in brackets [ ]

References to the Flora are in brackets [ ]

References to the Flora are in brackets [ ]

References to the Flora are in brackets [ ]

References to the Flora are in brackets [ ]

References to the Flora are in brackets [ ]

References to the Flora are in brackets [ ]

UNIVERSITY OF MISSOURI STUDIES

VOLUME I

NUMBER 1

Contributions to a Psychological Theory of Music, by MAX MEYER, Ph. D., Professor of Experimental Psychology. pp. vi, 80. 1901. 75 cents. *Out of print.*

NUMBER 2

Origin of the Covenant Vivien, by RAYMOND WEEKS, Ph. D., Professor of Romance Languages. pp. viii, 64. 1902. 75 cents. *Out of print.*

NUMBER 3

The Evolution of the Northern Part of the Lowlands of Southeast Missouri, by C. F. MARBUT, A. M., Professor of Geology. pp. viii, 63. 1902. $1.25.

NUMBER 4

Eileithyia, by PAUL V. C. BAUR, Ph. D., Acting Professor of Classical Archaeology. pp. vi, 90. 1902. $1.00.

NUMBER 5

The Right of Sanctuary in England, by NORMAN MACLAREN TRENHOLME, Ph. D., Professor of History. pp. viii, 106. 1903. 75 cents.

UNIVERSITY OF MISSOURI STUDIES

VOLUME II

NUMBER 1

Ithaca or Leucas? by WILLIAM GWATHMEY MANLY, A. M., Professor of Greek Language and Literature. pp. vi, 52. 1903. $1.00.

NUMBER 2

Public Relief and Private Charity in England, by CHARLES A. ELLWOOD, Ph. D., Professor of Sociology. pp. viii, 96. 1903. 75 cents. *Out of print.*

NUMBER 3

The Process of Inductive Inference, by FRANK THILLY, Ph. D., Professor of Philosophy. pp. v, 40. 1904. 35 cents.

NUMBER 4

Regeneration of Crayfish Appendages, by MARY I. STEELE, M. A. pp. viii, 47. 1904. 75 cents.

NUMBER 5

The Spermatogenesis of Anax Junius, by CAROLINE MCGILL. pp. viii, 15. 1904. 75 cents. *Out of print.*

VOLUME I SCIENCE SERIES

NUMBER 1

Topography of the Thorax and Abdomen, by PETER POTTER, M. A., M. D., Associate Professor of Anatomy, St. Louis University. pp. vii, 142. 1905. $1.75.

NUMBER 2

The Flora of Columbia and Vicinity, by FRANCIS POTTER DANIELS, Ph. D. pp. x, 319. 1907. $1.25.

VOLUME I SOCIAL SCIENCE SERIES

The Clothing Industry in New York, by JESSE E. POPE, Ph. D., Professor of Economics and Finance. pp. xviii, 340. 1905. $1.25.