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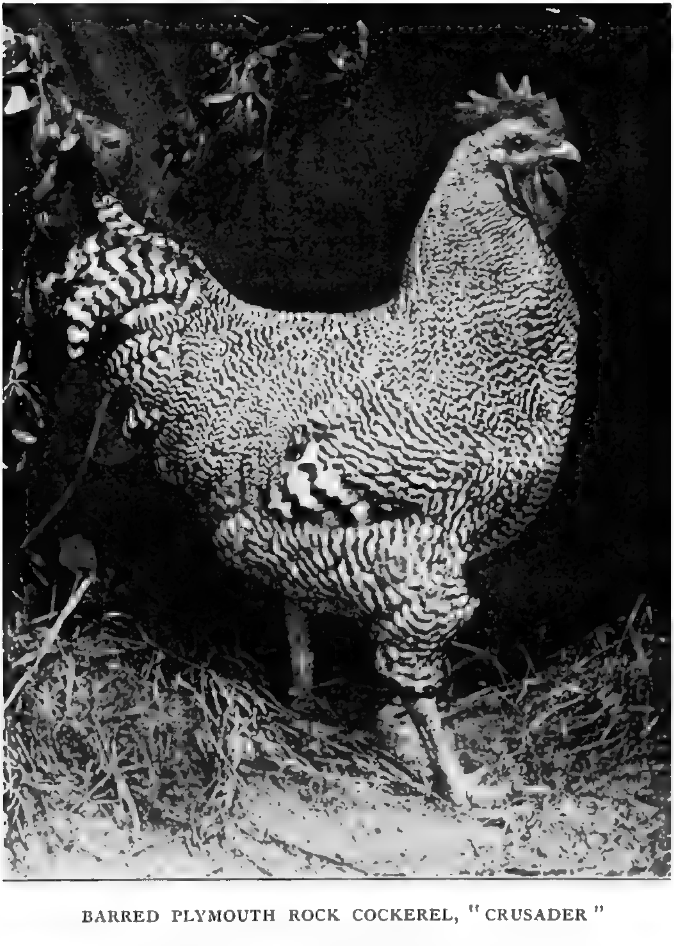

BARRED PLYMOUTH ROCK COCKEREL, "CRUSADER"

Owned by Grove Hill Poultry Yards, Waltham, Massachusetts
(Photograph by Schilling)

PRINCIPLES AND PRACTICE OF POULTRY CULTURE

BY

JOHN H. ROBINSON

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PREFACE

The method of treatment adopted in this book is the simple, scientific method, — that of presenting essential facts in logical order. The following of this method has led to some departures from the conventional way of presenting poultry topics. The unity of the poultry group is here conceived as essential and arising from the nature of the birds, rather than as artificial and relating to the purposes for which they are used; and I have tried to give practical effect to my very strong conviction that permanent poultry culture must be a feature in permanent agriculture, and that each of the common kinds of poultry has its peculiar place in agriculture. Hence the methods of managing the different kinds of poultry are not stated separately, as has been usual, but topics are discussed in their own appropriate order with reference to all the kinds. This arrangement emphasizes the things which apply alike to all kinds of poultry, and makes it easy to show that good practice is simple and that the same treatment will usually answer, in whole or in part, for several different kinds, thus lightening the work of the poultry keeper. It is believed also that by this arrangement of matter the student or reader is given, with instruction in the details of methods, a more comprehensive view of the subject as a whole than by the usual mode of presenting it.

To the best of my ability the book gives the consensus of authoritative opinion of a many-sided subject. In appraising this consensus I have had regard alike to practical authority, expressed in the views and practice of good poultrymen, and to scientific authority, found in the bulletins and other papers of those instructors and investigators who have been foremost in reducing to order the confused mass of common knowledge of poultry culture. To the practical poultrymen and fanciers I am most indebted for facts; to the instructors and investigators, for interpretations of facts and for ideas and suggestions as to the presentation of the subject in such a way as to meet the requirements of formal instruction.

To give credit, in the proper connection, to each of the many whose experiences and opinions have contributed something to a work which represents a life interest in poultry and more than a score of years of intimate business and professional acquaintance with poultry culture would be impossible. So it has seemed best to make few direct references in the text, but to give in the appendix a classified list of the literature of the subject.

The illustrations not credited to others are by the author. Although many of the photographs and drawings were made for this book, the elaborate scheme of illustration adopted was practicable only because I already had a large private collection of photographs from which to select, and because I had access to the files of photographs which had been used in *Farm-Poultry*. Those from the latter source the publishers have kindly allowed me to use, with this general acknowledgment.

JOHN H. ROBINSON

READING, MASSACHUSETTS

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INTRODUCTION

Need of instruction. The practice of poultry culture is an art or a craft or a combination of art and craft according to the purpose for which it is pursued and the taste and skill of those engaged in it. A workman may attain great proficiency in many operations merely through skill in imitation. Such a workman, however, must work always after a model or under the direction of one familiar with all phases of his art or craft and thoroughly understanding its principles. In any enterprise engaging large numbers of people, only a small proportion of these need be qualified to oversee and direct the work; but as the number of persons engaged diminishes, the proportion understanding the processes involved and their relations must increase, until, in such occupations as farming and housekeeping, each husbandman and housewife must be able to do and to direct the doing of a variety of operations, adapting and adjusting all to the general result sought.

The relation of this fact to agricultural and technical education has not been sufficiently emphasized. Considering it here only in its application to poultry culture, it is plain that a general knowledge of the subject is as necessary and as useful to one whose plans contemplate perhaps the maintenance of a flock of a few hundred fowls on the farm as to one who intends to undertake operations on a large scale. Both require the same preparation, as far as preparation can be given by book and class instruction.

Scope of instruction. The subject includes a great variety of topics. An accurate general knowledge of the subject requires such familiarity with all these topics that the relations of the various phenomena of poultry culture will be promptly recognized and effects estimated with approximate correctness whenever there is occasion to consider them. It is from inability to do this that poultry keepers who have become proficient in a special line carried on under particular conditions so often make serious mistakes when conditions change or when they make departures from methods with which they are familiar. As it is not possible for a student during the period of a course of instruction, or even in some years of practice, to acquire such acquaintance with all phases of the subject empirically, a textbook must so present the subject that historical fact and description and discussion of materials and methods will, as far as possible, compensate for lack of experience. Thus a textbook must especially emphasize many things that do not strongly appeal to the novice most interested in what he can immediately put into practice.

The limits of instruction. The quantity of theory of this subject which one may assimilate and the rate at which principles may be mastered vary with the nature of the matter as well as with the preparation and capacity of the student.

Thus a thorough knowledge of the principles of poultry-house construction may be acquired from books alone in a comparatively short time, and with knowledge so acquired a person with a little skill in carpentry may design and build a house in every respect as good as any experienced poultryman would make, provided always that the principles are understood and correctly applied. But in feeding, a working knowledge of principles is rarely, if ever, acquired without practice. Practice in feeding sufficient to assist to a good understanding of principles can be had in a few months or even in a few weeks. In such matters as breeding, real practice cannot be given in connection with courses of instruction. Long-course students who are familiar with the general principles of breeding and their application to domestic animals should have no difficulty in understanding their applications to poultry. The short-course student who lacks this preparation, and who has had no experience in breeding, gets at best but a limited appreciation of principles from the condensed statement of them appropriate in a general treatise on poultry. The student at home is even more heavily handicapped. As a rule such an understanding of the principles of breeding as every breeder should have is only acquired after thorough study and long practice.

The three cases mentioned are representative of classes of topics in which book instruction alone, even when insufficient, may be of considerable value without practice. The practice of poultry culture includes also many operations (as killing and dressing poultry, caponizing, etc.) difficult to describe in words even when descriptions are supplemented with illustrations. Actual skill in these is not, however, essential to a general knowledge of the subject.

Conditions of student practice. In an agricultural college or school, students are given practice under the supervision of an instructor. As a rule the amount of actual practice by each student is no more (often less) than he would have at home with a small flock; but each student may observe the practice of other students and benefit by the instructor's suggestions to all. Students at these institutions have the further advantage of observation of the work at the permanent plant of the department, conducted usually by a skillful manager assisted by advanced students. As it is not generally feasible to make practice correspond chronologically with the work in the classroom, much of it is at first done by direction, just as it would be on a poultry plant where formal instruction was not given.

Those who use this book in connection with home practice will find it a good plan to read it in order and then give special attention to topics related to the work of the season. The amount of practice will depend, of course, on the extent of their operations. It is well to remember that if work is projected on a scale out of proportion to knowledge and skill, the cost of practice (through losses) may be far beyond its value. Also, while there is a certain benefit to be derived from unsuccessful effort and unprofitable experience, it is of an indefinite and rather negative quality.

The student at work for a successful poultry keeper has the best of opportunities for practice and observation. This is true, though his employer or superintendent has a narrow view of conditions and methods beyond his own experience, and though the methods used are at points defective. It may be accepted as a certainty that wherever success with poultry is continuous, most of the essentials of good practice are observed.

The student who learns, or has good cause to suppose, that a poultry plant on which he is engaged is maintained from other sources than the annual income from poultry will, as a rule, find it to his advantage to leave it; for he is not likely to learn there to do a profitable day's work in a day, and he is likely to acquire habits of work and an attitude toward his work which permanently impair his efficiency.

Collateral reading. Only carefully selected standard books and papers should be used. Indiscriminate reading of poultry literature is a hindrance oftener than a help. The fictions of poultry culture are mostly plausible and generally more alluring than the facts, and the usual result of much reading in advance of a thorough grounding in principles is an accumulation of obsolete and impracticable ideas. The danger of this is greatest to the independent student, who lacks the opportunity of the college student to refer to instructors for opinions on matters which attract his attention as he reads. In the present state of knowledge of the subject it cannot be expected that even those who may be classed as good authorities will agree at all points, but the seeming disagreements of authorities are often due to partial statements, and disappear when a full statement is made. On the whole there is little of direct importance to a novice in poultry culture about which authorities are not substantially agreed.

Technical terms and definitions. These have hitherto been given scant attention by writers on poultry. Most of the terms have been taken from common usage and are generally very loosely used. Many terms constantly used in a technical sense have been neither defined nor applied with precision by writers on the subject. In this book such terms as require definition will be defined either in the text or in the footnotes, when first used, and each term used thereafter only in accordance with the definition.

PART I. THE POULTRY INDUSTRY

CHAPTER I

NATURE AND USES OF POULTRY

Classes of domestic birds.[1] Birds in domestication are divided according to their relations to men into three general classes: *Poultry*, *Pigeons*, and *Cage Birds*. This book is concerned with pigeons and cage birds only in so far as discussion of the contrasting characters of poultry and the other two classes serves to illustrate the nature and emphasize the usefulness of poultry.

Kinds of poultry. The word "poultry"[2] is the name of a group of domestic birds so different in some respects that from a naturalist's standpoint their inclusion in one group seems arbitrary and artificial, warranted perhaps by convenience but not justified on any scientific principle. Besides the more familiar kinds, as to the position of which in this group there is no disagreement, a few others not so well known are included in it by authorities on poultry culture. The group as thus made up includes fowls,[1] turkeys, guineas, peafowls, pheasants, ostriches, ducks, geese, and swans.

Common characters of poultry. Birds of the poultry group are alike in the several characteristics which determine adaptability to, and a high degree of usefulness in, domestication.

1. *They are terrestrial in habit*, — some naturally, others as a result of modifications of structure under domestication. Fowls, turkeys, guineas, peafowls, and pheasants are land birds with no power of sustained flight. The aquatic habit of ducks and geese of

[1] *Bird* is the generic term applying to all feathered creatures. *Fowl*, which once had as wide significance, is now applied to the most common kind of domestic bird, — to cocks and hens, and in dead poultry especially to hens.

[2] The term applies to living birds and also to their flesh as food for man. It is properly collective in meaning, for though used to refer to a single kind of birds, when so used it does not identify that kind, but merely indicates that it is one of the several kinds comprised in the poultry group.

the species that have been domesticated, though conspicuous, is not their principal habit. They are essentially land birds. Ducks and geese in their natural state are also aërial in habit, though the power of sustained flight seems to be used only for purpose of migration. In domestication ducks and geese within a few generations lose the power of flight to such an extent that they are the most easily restrained of all domestic creatures.

2. *They are omnivorous feeders*, like man, and hence may be fed largely on food wasted by man (in manufacture as well as in consumption) and on foods wasted by or not available for the larger domestic animals. The different kinds of poultry vary in the proportions of different kinds of food which they normally take. This is of further advantage to man, as will be shown in Chapter XI.

3. *They are docile in disposition* and readily adapt themselves to the conditions of life which domestication imposes. Of the many kinds of birds valuable for food purposes it is significant that only five are commonly found in a state of domestication: four kinds of poultry (fowls, turkeys, ducks, geese), and pigeons. These do not appear to have been deliberately selected for domestication as more valuable than others. It is probable that from the time savage man began to snare and trap birds, or was moved occasionally to try to remedy a less than mortal injury inflicted by his weapon, nearly every kind of bird has been kept in captivity. Many wild birds are as highly prized for food as any of those that have been domesticated. It was, evidently, not so much the taste of men, or the something in the bird which appealed to that taste, which had most effect in determining which kinds should be domesticated. It was adaptability to the conditions of domestic life; and this adaptability depended upon docility,— capacity to develop confidence in man and to live in some degree of harmony with other domestic creatures.

4. *They are of sufficient size to be individually of economic importance.* This applies to ordinary specimens of the smaller kinds and all specimens of the larger kinds of poultry. Bantam fowls (except the larger types, Cochin and Brahma) are of no importance except for "fancy."

5. *They tend to improve in domestication* in qualities most valuable to man. This is most noticeable in a comparison of poultry and pigeons. Improvement in pigeons is possible, and much

has been done in that line, but no such marked general improvement has taken place in pigeons as in the common kinds of poultry.

6. *They are completely under the control of man in domestication.* In this respect the pigeon affords a most striking contrast. All kinds of poultry can be restrained by fences or kept in yards; pigeons can be controlled only in cages.

7. *They are dependent upon man for existence in civilization.* Aërial birds may maintain themselves in settled districts independently of man.[1] Birds of the poultry group, once domesticated, become dependent on man and can exist in contact with civilization only as the property of individuals who protect them.

The elementary poultry character. The characteristic of terrestrial birds which is of prime economic importance is the condition of the young when hatched. The young of terrestrial birds emerge from the shell full-formed, well covered with down, capable of locomotion, and able to feed themselves as soon as they require nourishment. Thus from the start they are, in a remarkable degree, independent of the parent, while the young of aërial birds, hatched naked, blind, and helpless, are wholly dependent upon the parents until quite full-grown. A high degree of independence in the young of birds which live and nest upon the ground is a necessary condition of that mode of life in a state of nature. In domestication this same characteristic greatly augments their usefulness, permitting important modifications in their habits and making it possible to produce them economically in much greater numbers and under a greater variety of conditions than any other kind of domestic creatures. The importance of this characteristic is seen very plainly when we contrast those habits of aërial and terrestrial birds which are associated with the condition of the young, and compare the things which may profitably be done with birds in domestication.

Young aërial birds require so much attention from their parents that birds of this class are necessarily monogamous in mating habits

[1] It is a fact worth noting in this connection that while the wild pigeon in North America has almost disappeared, flocks of free pigeons maintain themselves in large cities, where they often make themselves a nuisance, escaping destruction more easily than in the open country because conditions in the city prohibit the use of the weapons most effective in exterminating them. So the little English sparrow, individually insignificant, finds its greatest safety in the cities, where it multiplies amazingly, and efforts to dislodge or exterminate it are futile.

and of relatively low fecundity, rearing usually only from two to four or five young at a time and breeding only once or twice in a season. Even pigeons in domestication, while breeding perhaps once in two months the year round, produce annually but ten or twelve young to the pair. Thus it is necessary to retain, for breeding purposes, as many males as females, and even then the rate of increase is slow as compared with that of land birds. In general, birds of this class will perish if deprived of the care of their own parents, while, because the amount of attention they require is out of all proportion to their individual value, man cannot afford to attend to their wants.

Among terrestrial birds, pairing seems to have been the original mating habit. The disposition to pair often crops out even in fowls, which are conspicuously polygamous and indiscriminate in this relation. Young geese usually mate in pairs, and these and the males of geese and some others of the rarer kinds of poultry generally mate with only a small number of females. But when one parent, naturally the female, can hatch and care for a large number of young, the male, relieved of direct responsibility for the care of his offspring, increases the number of his mates and seeks to destroy the rivals for their affections. However beautiful monogamy among the lower creatures may appear when considered ethically, economically it is a fault which severely restricts the possibilities of reproduction and reduces the profits of production. The general serviceableness and popularity of the various kinds of poultry are very nearly in proportion to the amount of deviation from the habit of pairing which it has been possible to secure.

Not being dependent on the care of adults of their own kind, the young of land birds may be reared by other land birds or by the use of artificial methods. So it is possible to relieve the females also of the care of the young to any extent desirable, and to take full advantage of their fecundity.

Values of poultry. Poultry contribute to the welfare of men in more ways than any other class of creatures. They supply him with flesh and eggs for food, and feathers for comfort or ornament, utilize many wastes of the house and farm, are of service in agriculture, and minister to man's pleasure. Their *likeness* simplifies the work of caring for different kinds under one management, their differences of habit often enable the poultryman to handle flocks of several kinds much more profitably than he could keep an equal number of any one kind, and their difference in products gives a greater variety of articles for use or sale.

The use of poultry flesh as food is governed by its convenience, quality, and cheapness.

Convenience. While, compared among themselves, the common birds of the poultry group show considerable diversity in size, compared with other domestic creatures generally used for food they are all small. Their size is such that at any season and in any climate an ordinary family can use a carcass while fresh. Their conformation is such that the killing and dressing of poultry are comparatively easy and cleanly processes, often performed by women, and even by quite young children.

Quality. The flesh of poultry, compared with that of mammals grown for food purposes in domestication, is finer grained and, when in proper condition, more tender. It is at the same time easily digested and highly nutritious. The flesh of the more common kinds of strictly land birds (fowls and turkeys) is regarded as a necessity for invalids and persons of weak digestion, and is the most popular luxury in the meat line. The flesh of ducks and geese, being more oily and of stronger flavor, is not so freely used except by those races which do not eat pork, but all kinds of poultry meat are commonly rated as greater delicacies than meat of other domestic creatures.

Cheapness. The cost of poultry is estimated differently by the producer consuming a home product and the consumer buying what he uses. For the grower, as a rule, poultry is actually cheap meat. The agricultural service of the birds and their feeding largely on stuffs that would otherwise go to waste make the cost of production on farms small. Even where they are grown at greater expense, the cost is usually low enough to make it as economical for the grower to use poultry freely as to buy other meat of like quality. It is this *cheapness* and *convenience*, as already noted, that determine the use in America of enormous quantities of poultry by producers and bring about the almost universal desire to grow poultry wherever there is opportunity to do so.

For the buyer, poultry is generally cheap as compared with other meats which may be used to supplement the beef, mutton, and pork which are staple meat foods for most healthy people, or as substitutes for them in the diet of invalids. Thus it is *cheapness* and *quality* that determine the use of poultry by those who, buying all meat as they use it, are not brought to an appreciation of the convenience enjoyed by those who produce their own poultry. This difference in estimates of the properties making poultry desirable as food accounts for the too common failure of poultry growers to understand the demand for poultry of superior table quality. The grower using poultry as a staple meat and selling his surplus is not as particular as to the quality of the meat as the nonproducing consumer to whom it is a delicacy.

Properties of eggs. The egg — the most unique of food products — is the only article of animal food which we have in a natural package. The term "hen fruit," though facetiously used, recognizes a resemblance between the egg and the large class of fruits whose edible portion is protected by a covering which, as long as it remains intact, is a highly effective guard against many external causes of deterioration. Eggs may be kept reasonably fresh and sweet in conditions and at temperatures in which meat could be kept for only a short time. Easily digested, highly nutritious, considered as a separate article of diet they have, in even greater degree than the creatures which supply them, the properties of palatability and convenience.

The most important use of eggs, however, is in combination with other ingredients in the endless variety of food concoctions that have been devised. While eggs for eating are often regarded as a luxury, to be indulged in according to the price of eggs as compared with other foods, eggs for cooking are generally regarded as a necessity. In a close analysis of the subject, the demand for eggs is seen to have a great deal of influence in determining the relative popularity of the different kinds of poultry, and also to increase their production, thus reducing the cost of table poultry to the consumer.

Feathers are a by-product in poultry culture, except in ostrich farming, which is limited to a few localities and not extensive anywhere. With this exception the production of feathers for commerce is never a direct object in poultry keeping. The feathers of the common kinds of poultry, when saved and sold, will, it is usually estimated, bring just about enough[1] to pay for dressing the birds and for the preparation of the feathers for market.

Services of poultry in agriculture. The possibilities of making poultry *work* are only beginning to be duly appreciated. For centuries poultry on farms have been kept about the dwelling and outbuildings, where a limited number might be tolerated, but with efforts to keep a large stock, or to keep several kinds together, they usually became a nuisance. Gradually farmers have been learning that, with a proper distribution of poultry on the farm, larger stocks can be kept at relatively less cost and with much better results. Some of the characteristics of poultry most objectionable when the stock is allowed to concentrate near the dwelling and is not kept under restraint are most useful when properly directed.

Of poultry in general it may be said that, more than any other kind of domestic live stock, they can be made of service to the husbandman, because of the extent to which they can be kept on land occupied by crops, not only without damaging the crops, but with benefit to them and improvement to the land.

Recreation in poultry culture. Poultry minister to the pleasure of man in various ways. Many flocks are kept "to look at" either because of their general attractiveness as living figures in the landscape, or because of their peculiar attractiveness to their owner. In these uses poultry satisfy a rather passive interest. Active interest in poultry kept for recreation is almost invariably closely associated with the desire of man to improve the products of nature. A bird which he regards as of exceptional merit is valued by the poultry fancier more as a product of his skill than as a thing in itself beautiful. The breeder of pit gamecocks is insensible to the brutality of the sport, because it is to him the necessary test of fighting quality and courage brought to their highest development by his skill in breeding and handling his birds.

[1] While this is the common opinion, and may still be right for most cases, at some places the cost of picking has increased of recent years faster than the price of feathers.

CHAPTER II

EVOLUTION OF THE POULTRY INDUSTRY

Antiquity of poultry culture. The beginnings of poultry keeping were a part of prehistoric human life. Our Aryan ancestors had poultry, but whether they domesticated it after having made some progress in civilization, or at an earlier period, or received it from an earlier or an alien race is not known. From the greater ease of taking and holding in captivity such birds as the fowl, duck, and goose it is quite reasonable to suppose that these may have been domesticated before any of the mammals, and by people in a most primitive state. The distribution of domestic fowls, ducks, and geese over the earth has followed in a general way the migrations of peoples of Aryan origin. An important exception appears to be the case of the Chinese poultry, which, according to their tradition, was received from the West about 1400 B.C.

Pre-modern poultry culture. Prior to the middle of the nineteenth century, poultry culture was essentially primitive and apparently conducted on the same general lines in all lands. Accounts of poultry keeping in this long period are rare and historically of little value. Unsatisfactory as these writings are as sources of complete information, they give an impression of the conditions that they reflect which is undoubtedly correct in its general features, and which suffices for the practical student, if not for the curious investigator. From the remaining records of this period and from the fact that in it nearly all prominent types of poultry were developed and brought to a high grade of excellence, it may reasonably be concluded:

First: That the common idea that poultry culture throughout this period was characterized by general ignorance of good methods of management and universal failure to appreciate the possibilities of profit from poultry is erroneous; and,

Second: That the industry was everywhere developed on a scale and along lines appropriate to circumstances affecting it; that keepers of poultry in general were as well versed in management as conditions and the scale of operations required; and that persons especially interested in poultry, though relatively less numerous, were, probably, quite as skillful as now.

We are coming to a better appreciation of these facts as, after many efforts to force the development of the industry in accordance with "factory" ideas, we return to the simpler methods of earlier times.

Persistence of primitive conditions explained. Before the application of steam as a motive force gave a new and tremendous stimulus to trade and manufacturing and brought about a great movement of population to the cities, only a very small per cent of people were so situated that they could not either produce what poultry and eggs they needed or procure cheap supplies from nearby sources. The value of products of this class was usually not great enough to warrant transportation from a distance. Except in the vicinity of a few large cities, a poultry keeper producing beyond the needs of his own family would not often find a profitable outlet for the surplus. Under such conditions poultry culture was necessarily almost everywhere a home industry producing for home consumption, and that is still the status of the industry in every agricultural section which has not easy access for its products to large cities or to manufacturing or mining sections.

Quality of common poultry. The ordinary native stocks of fowls, ducks, geese, and turkeys in America, at the time of the general awakening of interest in improved poultry and for some years after, were, even when compared with the average mongrel stocks of to-day, small birds of distinctly inferior table qualities and usually inferior also in egg production. This degeneracy of stock was due to the common practice of selecting for the table first. When a bird was wanted for food it was usual to take the largest and best. The result of this sort of selection, continuously operative, was that the poorest specimens of each year were left for next year's breeding. That such practice, persistently followed, did not quickly run the stock out was due to these saving circumstances: (1) the natural tendency of the stock to improve under (2) the very favorable conditions which small flocks at liberty on farms enjoyed, and (3) the occasional introduction of blood of improved native stock.

Improved native stocks. In fowls, especially, flocks of superior quality were without doubt numerous enough to have considerable influence on the general stock. With an occasional exception these improved stocks were of no fixed color type. They are perhaps best described as such mongrels, not much better than the general run of native stocks, as would be obtained by selecting the best for breeding instead of for eating. Now and then a person particularly interested in poultry would breed his flock to one type of color, but the prevailing belief was that the best breeding was that which combined the greatest variety; and, as a rule, specimens leaving such flocks were not bred to the type, but were used to give to the purchaser's stock such of their quality as they could. Hawk-colored or Dominique fowls were commonly thought to be superior layers, but in general, virtue was attributed to the color, without regard to breeding or other characteristics. This color type being also a most persistent one, hawk-colored fowls were numerous, and occasional references may be found to flocks in which this was the dominant color.

Interest in distinctive types. The first importations of foreign breeds to attract general attention were the importations of fowls from China in 1846 (?). Though details and dates are lacking, it is scarcely open to doubt that both Asiatic[1] and European fowls were occasionally imported in colonial times, — possibly some breeds by early settlers; but there is little evidence of interest in improved stock of any kind until after the Revolution.

With the awakening of interest in and inquiry for stock of reputedly pure and superior blood, it was found that there was altogether a great deal of such stock in the country, and that all the principal types were well represented. Until the sensational exploitation of the Asiatics they seemed less in favor than the Dorkings, Spanish, and Polish. All of these races, and others which came in later, were crude as compared with the carefully developed types of to-day. The wonderful stories sometimes told of their size, precocity, and productiveness greatly stimulated interest in them. On the supposition that these stories were authentic, the impression grew up in later times that the early

[1] Kerr, Domestic and Ornamental Poultry (1851), p. 270, says that Asiatic fowls were brought to the vicinity of Philadelphia about forty years before.

stocks were much superior in size, vigor, and productiveness to those of their kind known at the present day. What the truth as to this may be must always remain a matter of conjecture. The probable truth is that the early stocks were on the whole inferior to average specimens of their races at the present time. Certain it is that not one of the many foreign breeds introduced was of the type adapted to American ideas and conditions. No one of them ever appealed, or could have appealed, to the mass of poultry keepers as has the so-called American type, otherwise known as the general-purpose type.

Importations of ducks and geese of foreign breeds early made American fanciers familiar with the favorites, of both kinds, in various parts of Europe, and with the Chinese and African races of geese. Singularly, the most important of all foreign breeds of waterfowl, the Pekin duck, was almost unknown in this country until quite late in the nineteenth century. Coming into general notice just at the time when artificial methods of incubation and brooding had been brought to a practical stage, and being especially adapted to the intensive methods of culture which harmonize with these, the Pekin duck furnished the material for what soon became the most profitable line of poultry culture.

In the improvement of the turkey the greatest progress was made by crossing the domestic native with the original wild stock, still found in its natural state in certain localities over a wide area of country.

First effects of aquaintance with improved breeds. Observation of the striking new types could not fail to impress on the minds of those already interested in the improvement of poultry, the advantages of fixed type and of uniformity in the individuals of a flock, or to create an interest in methods of producing these. Naturally such persons procured and bred stock of these breeds, but from the beginning of public interest in them it was apparent that the mass of poultry keepers were more interested in the new breeds for the benefits to the native stock from crossing with them, than for the development of the breeds in their purity.

It was for this reason, and perhaps also because they had been quite widely introduced through all that part of the country which was in close touch with Asiatic commerce, that the Asiatic fowls were so extensively used to grade up the native stock. They, more than any other race, had the size which degenerate native stock everywhere lacks. They were also of more robust constitution than the European races. It is said on good authority that, as a result of the crossing of Asiatic on native stock, the average size of fowls brought to the Boston market was doubled within a few years.

Development of the American type. Familiarity with the foreign types and with the results of mixture with the native stocks quickly developed the idea of a type of fowl better suited to America than any of the others. While most poultry keepers were using stock of the new breeds with their native stock, without much thought beyond immediate results, some of the fanciers and the more intelligent breeders were trying to make and establish breeds having the characteristics generally desired. The ideal of the American type seems to have become fixed in many minds at the very beginning of efforts to improve poultry. In the few years following 1850 a great many crosses were made for this purpose and offered as new breeds.

While information concerning these is meager, it can hardly be doubted that many of these mixtures gave fowls differing but slightly in substantial characters from the type desired. The combination of such qualities with superficial characters attractive to the mass of poultry keepers was not produced until the Plymouth Rock appeared in the late sixties. This breed was first exhibited in 1869, and immediately entered upon the career of popularity which was soon to make it more numerous in America than all other standard-bred fowls combined. While in the duplicating of the original stocks, and in the perfecting of the breed, other elements were used, and the various lines subsequently mingled to such an extent that no accurate analysis of the blood lines of the modern Barred Rock is possible, the first stock was made by crossing a male of the hawk-colored type on black Asiatic hens, called by some Javas and by some Cochins. This cross gave birds of the color that had long been regarded as associated with peculiar merit, and at the same time gave a fowl of the medium size desired and having for its ancestry the hardiest native stock and the hardiest of the foreign races.

The Barred Plymouth Rock (which, until the white variety appeared, was called simply the Plymouth Rock) was the first thoroughbred fowl presenting the combination of characteristics more satisfactory to the farmer than what he secured from either the native stock or the indiscriminate mixture of breeds which popular authorities favored. The result was that, in all parts of the country, people who before had held aloof from "fancy" breeds began to breed the Plymouth Rock. The appearance of a stable type suiting the general idea gave a tremendous impetus to poultry culture.

After the Plymouth Rock came other varieties and breeds differing from it in color of plumage or in shape of comb, or varying somewhat from its size, shape, and weight, but still of the general type of fowl best adapted to the production of both eggs and meat and to the conditions under which most poultry is kept for profit. The Asiatic type continued to be bred, especially where large fowls for the table were wanted; and the Leghorn, the most serviceable European type, was improved in this country and became an important factor in the extension of interest in improved stock, especially where eggs were the most important product.

Artificial incubation. The hatching of eggs by artificial means has been practiced in Egypt and China from very early times. This fact and something of the methods used by these peoples have long been known, but the methods used were not adapted either to the conditions of the industry in Europe and America or to the habits and temperament of occidental races. Incubators of the types found practicable for general use were first introduced about 1875. The machines of that period have never been surpassed for efficient work when skillfully handled, but their management was too difficult for the average operator.

Toward 1890 more perfectly regulated machines appeared, and the incubator began to come into general use and to have a pronounced effect on the development of the industry. In the next ten years more marked improvements in the construction of incubators easy of operation were made. These improvements and the development of more practicable methods of artificial brooding made possible the production of poultry on a much larger scale than had ever been attempted before. Though that was the feature of the use of artificial methods which most fired the imaginations of those considering the financial possibilities of poultry culture, and though, in a limited way and in a few lines, the scale of operations with poultry has been greatly enlarged by the use of artificial methods, they are more generally valuable as supplementing natural methods than as a substitute for them.

Exhibitions. The first public exhibition of poultry in America was held in the Public Garden in Boston, in 1849. This exhibition, more than any other one event, gave impetus to the growing excitement over remarkable kinds of poultry. In England, a few years earlier, a great poultry show had been held in the Crystal Palace, London. Both of these shows were noteworthy for the number and variety of exhibits which they contained. Each in its own country may be said to mark, as exactly as such a change can be marked, the end of the ancient and the beginning of the modern period in poultry culture. With them began the organization of poultry interests. Following them, organizations of poultrymen multiplied, and shows were held in many places. In the United States the Civil War drew attention for a while from such interests, but hardly had hostilities ceased when the interest in poultry began to be active. Poultry exhibitions, both separately and as an adjunct of agricultural fairs, have been one of the most important factors in the development of the industry.

Poultry literature of the early period. Before 1815, when Moubray's first book appeared, the only books in the English language exclusively on poultry were a few treatises on gamecocks and cock fighting, and the work of Mascall, published in 1581. Moubray's book went through a number of editions and seems to have met the popular demand for twenty years or more. Then, just as the period was closing, a number of books appeared. Between 1840 and 1860, and especially in the ten years from 1845 to 1855, were issued more books undertaking a complete presentation of the subject of poultry culture than were produced in the following half-century. Compared with this output the latter period seems strangely barren of books, but a full analysis of poultry literature shows that the books which came out so rapidly, and relatively in such abundance, at the beginning of the modern period, are really the posthumous literature of the early period. Their influence on the development of the industry is practically negligible. They are best appreciated when considered as the concluding records of the early period. The merely curious reader, more impressed by what is odd than by what is familiar, may think he finds in them a great many errors now obsolete. The close student, acquainted with modern developments, is much more impressed by the practical knowledge of poultry culture in earlier times. To him the most unsatisfactory thing about these books is the faultiness of their descriptions of breeds, names and terms being used so carelessly that the identity of the birds alluded to is often doubtful. Their weakness in this particular is one of the chief sources of confusion in regard to the genesis of modern breeds and types.

Modern poultry literature. As we have seen that the book literature of the early period overlapped the beginnings of the modern period, so we find the beginnings of modern literature taking form in the closing years of the early period. The agricultural papers, established a little earlier, furnished the natural medium through which poultry keepers exchanged information and ideas, and made the first steps toward transfers of stock. At first, references to poultry matters in these papers were brief and intermittent, but before long many of them regularly devoted special space to poultry, — a practice still continued. The most intense interest in poultry, however, was not among agriculturists but among dwellers in towns and cities. As many of these people were but slightly interested in other agricultural subjects, and as those especially interested in poultry, whether in town or country, wanted more information on the subject than the agricultural paper could give them, papers devoted especially to poultry, or to poultry, pigeons, and pet stock, began to appear.

Journalism. The poultry press has been a unique factor in the development of the industry. The great number of periodicals devoted to this subject has often been cited as an illustration of the wealth-producing capacity of a specialty which could support so many more papers than any other of its class. As a matter of fact, in only a small proportion of cases has the support given these papers been sufficient to make them profitable to their publishers, with most of whom the publication of a poultry paper has been a side issue. But, regardless of its financial value to proprietors, the poultry press collectively has been a highly efficient organ for the distribution of detailed information about every phase of poultry culture. On the whole, it has been a rather indiscriminate purveyor of information, exploiting all sorts of ideas and articles without inquiring too closely into their merits. As a rule, it has been more prone to fall in with the delusions of the public than to make careful inquiries as to facts.

In all these things it has simply reflected, on a larger scale and publicly, the merits and the faults of the average poultry enthusiast, who conceives it his duty to spread the interest in poultry culture as far and as fast as possible. Whatever may be said of the morality of this sort of exploitation, or of the losses to individuals that it causes, in considering factors in the development of the poultry industry this must be reckoned as one of the most potent. It is impossible to make any accurate estimate of the numbers of people who have gone into poultry keeping with exaggerated ideas of the profits to be realized, who would never have been interested in it to that extent had they known the truth, but who, once in it, remained until they had made a success, though not of the proportions they had anticipated.

The poultry press has literally spread broadcast, as fast as it came to light, every bit of knowledge and every idea on the subject; but generally so discursively, and with so little effort to suppress misleading or superfluous matter, that those who went to papers for information were likely to turn from them in confusion. The situation created by so active an agency, constantly extending interest in the subject yet never satisfying the curiosity created, greatly stimulated the demand for books which would systematically present the essentials of the subject.

Books. With a few exceptions, recent books have been either monographs or symposia on special subjects. Some of those designed to cover the subject completely are really collections of several essays on subjects in which the authors were specialists, with brief and perfunctory treatments of such other topics as were taken up, and with many important matters omitted. Some of the most pretentious titles were given to works of small size and less importance.

While the need of comprehensive, authoritative works was everywhere recognized, and nearly every author confessed a purpose to meet this demand, so little confidence had either authors or publishers in the permanent value of these books that in over forty years there were issued, bound in boards, only three poultry books by American authors.[1] In all that time only one American book (Felch's "Poultry Culture") appeared which secured extensive recognition as an authority. The favorite work with American poultry keepers was an English book, "The Practical Poultry Keeper," by Lewis Wright. The information in this book was not always adapted to American conditions, but the book as a whole furnished the most complete and logical treatment of the subject from a modern point of view, and as such had a great influence.

It is not practicable here to go into a discussion of reasons for the scarcity of good books by American authors, but one most important reason should be mentioned. The common lack of confidence in the permanent value of books written during this period was due to the general recognition of the unsettled condition of the industry. This will be discussed more particularly in the next chapter. The point of interest here is that, because of the changes which have taken place, the literature of the first half-century of the modern period has ceased to be serviceable for instruction in so many particulars that the student of the subject, reading those books to-day, needs constantly to guard against teachings that progress has made obsolete. For this reason it is wise to postpone acquaintance with the literature of that period until one has acquired a fair general knowledge of present conditions and practice, and is thus qualified to distinguish between what is obsolete and the considerable quantity of valuable matter to be found in the literature of the period. A little of the same caution is advisable even in the study of more recent literature, for some writers on poultry draw more freely on past literature than on current experience.

Instruction and investigation. Public educational and experimental work was not seriously undertaken in America until near the close of the nineteenth century. The very abundance and

[1] I. K. Felch, Poultry Culture; I. K. Felch, H. S. Babcock, and J. Henry Lee, The Philosophy of Judging; The Standard of Perfection (published by the American Poultry Association).

breadth of periodical literature superficially meeting the demand for information was in part responsible for this, but the principal reason was that neither the general public nor the educators and investigators had outgrown the old idea of the insignificance of poultry. Though still in the rudimentary stages, these agencies are already making an impression on the industry. Work in either line requires, first of all, more careful consideration of facts than has been usual among poultry keepers, the reduction of actual knowledge to a form suitable for instruction, and a proper analysis and summary of the known facts in any problem as a basis for further investigation. The influence of these requirements is already apparent in many directions.

Individual influence. In the developments of the modern period personal taste and talent have figured on a much more extensive scale than formerly, because modern conditions furnished a vastly greater field for their exercise. One of the most notable differences between the ancient and the modern period in poultry culture is the difference in the relation toward poultry culture of men deeply interested in it. The conditions of poultry production throughout the whole of the early period were such that all poultry keepers and fanciers, not excepting writers regarded as authorities on the subject, were amateurs; the opportunities open to the individual anywhere for exploiting his interest in poultry were too limited to admit of making a trade or a profession of any line of work with poultry.[1]

The conditions which brought about the rapid development of the industry created a field for the profitable use of the knowledge and skill of the poultryman. It became possible for men to make a living by judging poultry and by writing for poultrymen, as well as by breeding poultry. By their activities along these lines, and in the opportunities that these incidentally gave them for meeting people interested in the subject over a very large territory, many men have had great influence on the development of poultry interests. Hundreds of such men have been known throughout the English-speaking world, and a lesser number more extensively. This is in striking contrast to the former period, in which many

[1] This statement may not apply strictly to a few producers in localities supplying the markets of such cities as London, Paris, and New York, but we have no certain knowledge of the fact as to these cases.

men must have been influential but few ever became known outside of their own localities.

Trade spirit. Commercialism in modern poultry culture is often denounced as the bane of the business. Such denunciations are applied to all manifestations of the commercial element in practical as well as in fancy poultry culture. While it must be admitted that the commercial spirit has developed grave abuses in both lines, it must also be remembered that the whole structure of modern poultry culture, with all its subsidiary industries, rests on a commercial basis. Commercial opportunity brought about the change from the old conditions, and has repeatedly opened up new avenues for the extension of the industry. It is not possible here to discuss in detail the influence that the invention and exploitation of articles used in poultry keeping has had upon the industry, but a correct idea of the growth and status of the industry requires recognition of the commercial spirit as an essential element in present and future poultry culture.

CHAPTER III

ECONOMIC ASPECTS OF POULTRY CULTURE

The first statistics of poultry. In the United States the first enumeration of poultry was made in the census of 1840, and covered only the number and value of the poultry. According to this census the total value of all the poultry in the country was $12,176,170.[1] The eggs and other products were undoubtedly worth enough more to make the aggregate $25,000,000. This may be accepted as the best available estimate of the farm value of poultry products at that time. In comparing these with later figures the difference in the purchasing power of money must be taken into account. It must also be considered that at that time much of the country west of the Mississippi was little settled. In this census report the state of Iowa, which now has an annual production about equal to that of the whole country in 1840, is credited with poultry

[1] In "The American Poultry Book" (Harper & Brothers, New York, 1843) is given (p. 143) the following abstract from the returns made by the census of 1840, exhibiting the total value of all the poultry in the various states and territories of the Union:

States	Value	States	Value
Maine	$123,171	Ohio	$734,931
New Hampshire	97,862	Kentucky	534,439
Vermont	176,437	Tennessee	581,531
Massachusetts	540,295	Louisiana	273,314
Rhode Island	61,492	Mississippi	369,481
Connecticut	176,659	Indiana	393,228
New York	2,373,029	Illinois	330,968
New Jersey	412,487	Michigan	82,730
Pennsylvania	1,033,072	Arkansas	93,549
Delaware	47,465	Florida (incomplete)	61,007
Maryland	219,159	Wisconsin	16,167
Virginia	752,467	Iowa	17,101
North Carolina	544,125	District of Columbia	3,092
South Carolina	590,594	Total	$12,176,170
Georgia	473,158		

to the value of only $17,101. In some of the older eastern states the value of poultry given is so large as to indicate a considerable development of interest in poultry some years before it began to spread widely. Thus in New York the value of poultry products in 1840 undoubtedly exceeded $5,000,000, and the annual production of the Empire State at that time was greater than to-day in Massachusetts.

Present value of poultry products in the United States. The Department of Agriculture estimates the total production at about $700,000,000 annually.[1] These figures, large as they seem, are probably much below the actual value produced.[2] They are very freely quoted to show the magnitude of the poultry industry, and comparisons with figures for other staples are often made, showing a total value of poultry production in excess of that in many other lines commonly supposed to be of greater importance. These comparisons generally give distorted and exaggerated views of the relative importance of poultry culture, suggesting developments which in practice are difficult or impossible. While large undertakings with poultry rarely succeed, the increase in production due to a general extension of interest is often amazing. In Kansas the average value of poultry and eggs sold annually in the state for the five years ending with 1896 was $3,333,562. The value for 1897 was $3,850,997; the value for 1907 was $10,300,082.

[1] This is estimated on the returns of the United States census of 1900 and of later figures for a number of states. So far as the author has been able to learn, no full census of poultry has ever been taken in the United States. Statistics for poultry have been taken as part of "statistics of the farm," and no account has been made of poultry not on farms or large plants. In Canada no general poultry census has ever been taken.

[2] An interesting and instructive exercise is to compute the cost of poultry consumed in a country on an assumed per capita consumption. Thus, if the population of the United States be taken as 90,000,000, and it be assumed that each individual consumes one egg per day, and that the value of the eggs is but one cent each, it will be found that the cost of supplying each resident of the United States with one egg daily for a year is $328,500,000, — almost half of the estimated total production of eggs and all kinds of poultry. Or, if it be assumed that the 90,000,000 people represent 18,000,000 families of five persons each, and that each family consumes weekly one chicken at a cost of twenty-five cents, it will be found that the total cost of these chickens would be almost exactly one third of $700,000,000. Such computations and comparisons enable one to realize what large figures actually mean.

The poultry industry. The production (for home use or sale) and the sale of poultry products constitute the poultry industry. "The poultry business" is a term applied to poultry keeping on a scale large enough to make it the business of one or more persons. The greater part, probably over ninety per cent, of all the poultry sold in the United States is produced by poultry keepers who do not make a business of poultry culture but keep poultry on a small scale while giving their attention chiefly to some other occupation, usually general farming. As the figures of the early census show, there was a poultry industry of considerable proportions before the idea of developing poultry culture as a business began to be entertained.

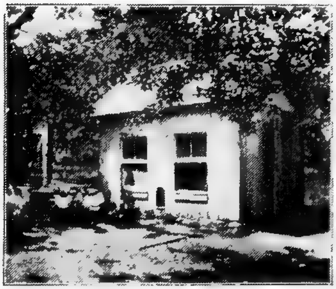

FIG. 1. Back-yard poultry keeping (Photograph from A. T. Grosvenor)

While the magnitude of the totals of volume and value of poultry products naturally suggests opportunity for the development of poultry production on a large scale, with correspondingly large profits, the fact that the demand is so nearly met by the produce of the millions of small flocks should be far more significant to those engaging in large poultry-producing enterprises. The poultry industry as a whole is permanent. It includes (as long as the business lasts) every poultry business. The stable factor in production is the farm flock, the produce of which is largely profit. The spectacular large enterprises rarely last long, and their nominal contributions to poultry production often represent only a waste and loss of money earned in other occupations.

FIG. 2. A back-yard poultry plant. House construction conforming to that of residence

Trend of development. The natural tendency of the poultry industry is not to develop production on a large scale but to extend and improve ordinary small operations as far as possible without changing the position that they occupy as subordinate to the other interests of the poultry keeper and to other uses of his land. The general development of productive poultry culture proceeds according to this tendency, with exceptions when local or temporary conditions stimulate to specialization in poultry. In the distribution of poultry products the natural tendency is toward concentration of collections and trade and the building up of large businesses.

The natural division of the poultry industry. Trade conditions separate the masses of producers and distributors (including collectors), though a considerable number of individuals may combine both functions. It is noteworthy that the greater number of "middlemen," as well as of producers of poultry, handle poultry with other lines, for this point is vital in plans for coöperative marketing of poultry produce. It should also be observed that, both in the combination of poultry production or selling with the production or selling of other lines of produce, and in the division of labor which makes one man a producer (of a variety of articles) and another a dealer (in perhaps a similar variety of articles), economic tendencies and laws operate to give individuals generally the kind of work and the combination of lines which each can pursue to the best advantage.

Limitations on development. The peculiar advantage of poultry culture as an occupation for persons with small capital lies in its limitations, — in the usual impossibility of developing productive plants on a large scale. This is a line of production in which most of the advantages are with the small operator, with whom it is an avocation. It is a branch of agriculture requiring so little capital for a beginning that even the poorest may make a start in it, giving returns quickly and regularly, and capable of rapid extension within the limits favorable to economic production. Occasionally these limits admit of the development of a poultry business, but even then a business is developed only by those able to use the opportunity. Many who do well with poultry on a small scale cannot handle a large stock of poultry profitably, and so cannot use an opportunity to build up a business when open to them. Usually natural and economic limitations so restrict operations that after a little time the poultryman ceases to use his surplus earnings to extend operations with poultry, and applies them to the development of some other interest.[1]

A farmer in New York state, who has become one of the wealthiest men in his section, and whose reputation as a poultry breeder is international, once told the author that, though he got his start with poultry and had always made what poultry he kept pay well, he would consider a poultryman very foolish who would stick to poultry exclusively, even though making it pay well, because there are so many other lines in which money, ability, and time may be used to better advantage.

Permanent poultry culture is a branch of agriculture. This fact the poultry keeper and the student of poultry matters alike should keep ever in mind. It is fundamental. Remarkable as has been the growth of the industry in modern times, the financial losses incidental to this growth have reached an enormous aggregate. The greater part of the appalling total of losses in poultry keeping could have been avoided if its true status had been generally understood. Until very recently, the most conspicuous feature of the exploitation of the industry was the widespread and persistent effort to develop it artificially, — following manufacturing methods and ideas.

The common result of the use of intensive methods on any considerable scale was failure, — sometimes after temporary or partial success had encouraged the poultryman to continue or perhaps to increase operations. There were exceptions in a few lines (to be

[1] Perhaps the best general illustration of this point that could be given is afforded by the poultry industry in such European countries as France and Belgium, which, though densely populated, export considerable quantities of poultry and eggs. The interest of the peasants of these countries in poultry is often cited as showing their appreciation of the possibilities of profit from poultry. As the matter has usually been stated, it is made to appear that poultry culture is of paramount interest in the lives of these peasants; but this is not the case. Its true status was shown by M. Louis Vander Snickt in an address at the Second National Poultry Conference, in England, in 1907, when he made the statement that "the more careful and thrifty" of the Belgian people in the Campine country ultimately ceased to breed poultry and engaged in horticulture. They made this change not entirely because horticulture was more profitable, but because their land, after long use for poultry, became unsuitable for poultry and adapted to fruit growing, as it was not in the beginning.

described presently), and occasionally instances of individuals who, because of special advantages, were able to make a living when the majority failed, or because they were satisfied with simpler living. The reasons for the persistence of efforts to establish poultry plants on intensive lines, notwithstanding the failures, are briefly:

1. The prevailing tendencies of the times to extend the application of mechanical ideas in all pursuits, to carry the division of labor to an extreme, and to specialize in production.

2. That the greatest actual production is obtained by intensive culture, and the common methods of reckoning profits make it appear that profit is in proportion to production.

3. That large projects on this basis are extensively exploited in print, both in advance of their establishment and while in operation, but notice of their abandonment is rarely published.

4. That persons becoming interested in the financial possibilities of poultry keeping almost invariably turn from information or advice not in accord with their wishes, and follow an alluring counsel, regardless alike of the warnings of better authorities, of the experience of others, and of their own common sense.

With such potent influences operating to induce men to exhaust both capital and ingenuity before admitting that intensive methods were not adapted to continuous poultry culture, the facts as to the general status of the industry, though obvious when seen from a right point of view, secured no wide recognition until the effort to establish poultry culture on an intensive basis had passed its culmination and the developments along natural lines had reached a stage where a fair general comparison of results plainly showed that permanent poultry culture must, as a rule, be part of a diversified agriculture. The reasons for this will become apparent as the subject is developed in this book.

Poultry culture is a necessary feature in agriculture. The various kinds of poultry, alike in their general adaptability to the land and to conditions of agricultural life, are so different in structure and habits that full utilization of the opportunities which a farm affords for the profitable production of poultry nearly always requires the keeping of more than one of the common kinds. Often fowls, turkeys, ducks, and geese may all be kept to advantage. When the area of land cultivated is too small to be called a farm, the best possible use of the land will still, in most instances, require that some poultry be kept. On still smaller areas poultry keeping may be carried on, but not on a scale or under conditions which admit of maintaining a stock at normal vigor without frequent renewals from outside sources where conditions are more favorable.

Poultry culture is a diversified industry. As a farm usually affords opportunity for the production of the common kinds of poultry, so in nearly all localities a demand is found for all kinds of poultry products. In many places the local production of some or all of these may be more than sufficient to meet the local demand, and this is the case in most sections where agriculture is the most important industry. In that event, production for shipment may include all lines or be limited to a few or, in rare instances, to one line, according to the requirements of available markets and the adaptation of local conditions to special lines of production. In manufacturing and mining sections, and in the vicinity of great cities, the local production meets but a small part of the demand. In such sections, and especially in the cities, there is apt to be a large demand for poultry products of a kind or quality for which the demand in small places is too limited to furnish inducements to local producers. In the nonagricultural communities, too, the bulk of the poultry products comes from a distance and is likely to have deteriorated somewhat before reaching the consumer. Hence near-by products of good quality command a premium. Under such conditions specialization in poultry culture may be carried much farther than is usually profitable, large farms may be devoted almost wholly to poultry keeping, and, if climatic and soil conditions are favorable, intensive practice may be followed for a long time without marked unfavorable results.

Branches of poultry culture. It being understood that poultry keeping is rarely an exclusive business, and that in practice two or more branches of poultry culture are usually combined, the various lines may now be described. Poultry products may be divided into two general classes, *market* products and *fancy* products.

The market products of poultry are eggs and meat, with feathers and manure as by-products.

Eggs used for food are almost wholly the eggs of fowls, the proportion of eggs of ducks, geese, and turkeys entering into consumption being insignificant. The value of the annual production of market eggs (mostly hens' eggs) in the United States equals or exceeds the total value of the meat product of fowls, turkeys, ducks, and geese. The production of eggs for food is the principal branch of poultry culture. With the vast majority of poultry keepers it is the prime object, other lines being incidental or supplementary. Under proper conditions even a very moderate egg yield will return a fair profit anywhere.

FIG. 3. An egg farm near Boston, on which the long houses, without yards, are grouped near the dwelling, and the fowls range over the farm

Poultry meat used for food is produced principally from fowls, though large quantities of all other kinds of poultry are used. The bulk of the crop of fowls and chickens marketed each year is incidental to egg production to this extent: Most farmers and poultry keepers maintain laying flocks of about the same numbers, or slightly increasing, from year to year. To keep these flocks at the most profitable stage of productiveness it is necessary to renew annually from one half to nearly the entire number (according to the breed). The cockerels not required for breeding and the old stock to be turned off make up the most of the meat of the fowls used for food. A large part of this stock is turned off at the convenience of the producer, without regard to market conditions or demands. To supply special demands, particularly at seasons when there is

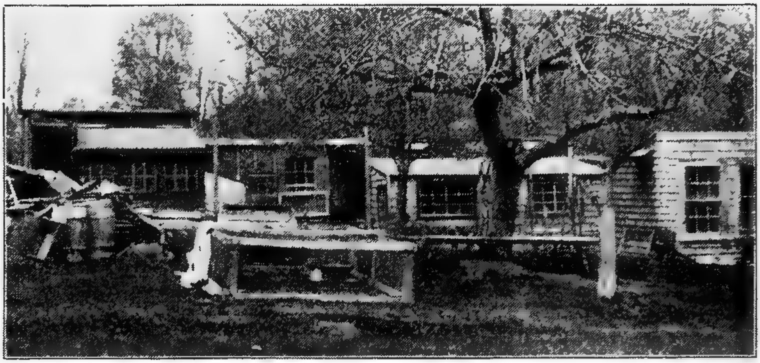

FIG. 4. A New England town poultry plant built up in spare time
Note the variety in houses

little poultry on the market and prices are high, poultry keepers favorably located engage in specialties like the growing of broilers and roasters.

Egg farming the most important branch of poultry culture. As has been stated, the production of eggs is carried on principally as an incidental line in general farming. In most cases the farm flocks of poultry are maintained primarily to supply the household with eggs and meat, the products marketed being the surplus remaining

FIG. 5. Intensive plant on a Philadelphia business man's country place
Land area small; investment large; labor costly

after home wants are satisfied. Ordinary farm conditions and methods need not be described here, but some of the special developments along this line must be described as to their general features, though discussion of these features will come more appropriately under special topics.

Factory methods in poultry culture. The intensive poultry plant devoted primarily to egg production, with the sale of market poultry and often of thoroughbred stock and eggs for hatching as accessories, was long the most conspicuous type of plant classed as

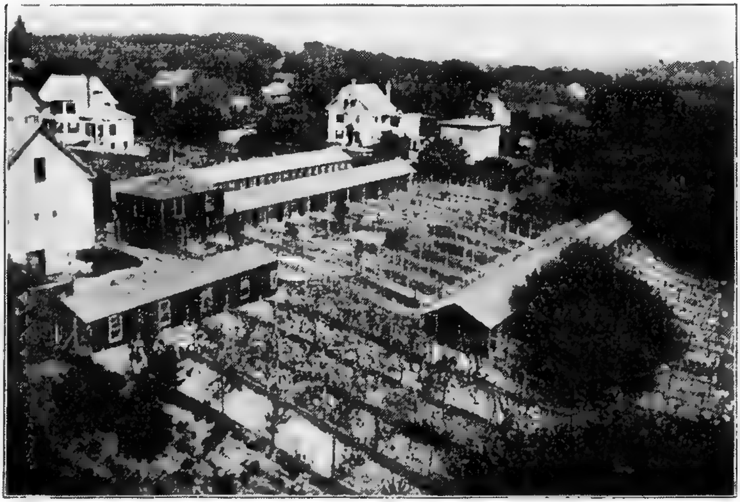

FIG. 6. Poultry plant of A. G. Duston, at Marlboro, Massachusetts. Considered a model plant when built, about 1890. Used about ten years, then moved to South Framingham, Massachusetts, and rebuilt on an extensive plan. (Photograph from Mr. Duston)

an "egg farm." This may be briefly described as an enlargement of the city poultry yard. The common object was to keep the largest possible number of fowls on a given area, keeping them closely confined and supplying them with all kinds of food needed. Usually the land accommodations were very limited, and the poultryman made no effort to grow any food — except perhaps a little green food — or to make any use of his land except for poultry.

This was the typical plant, in area from two to ten or twelve acres. Often the larger plots had little more actual capacity than plots of less than half their size, because the character of much of the land made it impossible to use it with this system. These plants, almost without exception, used artificial methods of hatching and brooding. On many of them the young chickens were grown under conditions not much better than those to which the old stock were subjected. On others conditions for the young stock were made as favorable as available land would permit. Those operating such plants generally considered it necessary to renew practically the entire stock each year. Hence it was necessary to grow each year about twice as many chicks as there were old birds on the place, which is difficult to do in a restricted area.

FIG. 7. The poultry plant on a fine estate at Goshen, New York, combining both intensive and extensive features. Buildings very expensive. (Photograph from Willowcrest Farm)

On large intensive plants it was necessary that much of the labor employed should be skilled labor, — expert in handling poultry under highly artificial conditions and in the use of artificial methods of hatching and brooding. Plants of this type were most numerous from 1890 to 1900, and were a conspicuous feature in southern New England throughout that period. Elsewhere they were not so numerous, though the total number throughout the country was very large. The prosperity of these plants was generally fictitious. Most of them were short-lived. In many instances good profits were made for a year or perhaps a short series of years, but, for reasons which will be stated in the discussion of systems, prosperity was ephemeral in all but a few cases. Unbiased persons familiar with the poultry industry now generally agree that this type of plant cannot be maintained on a large scale continuously.[1]

Farm methods. Egg farming by the colony system has been developed on an extensive scale in the district about Little Compton, Rhode Island. The colony plan is used to some extent in other places, but in this district almost every farm makes the keeping of poultry for eggs a specialty, and all use the same plan of housing, and in general the same methods.

By the colony plan the stock of fowls is distributed over the land in small flocks. Ideally the system is to move the houses at least once a year, but in practice they are usually allowed to remain in one place much longer. That, however, is largely dependent upon the convenience of the farmer and upon other uses which he may wish to make of the land. Land good for other purposes is not as likely to be continuously occupied by poultry as land which cannot be advantageously cropped. No fences are used.[2] The houses are frequently placed in pastures, and it is not unusual to see fowls, geese, and cattle in the same pasture. Houses may be only a few rods apart, or there may be but four or five houses (each holding about thirty-five birds) on as many acres of land. The usual practice is to renew about half the stock each year. This requires the rearing of not many more chickens each year than there are old

[1] A great many persons who profess to be, or are by some considered, competent to speak on this point may still be found who will assert that this statement is incorrect, and cite instances of large intensive plants said to be financially successful. To the author as a poultry journalist trying to learn and make public the truth about such things, these plants and the claims made for them were troublesome, until he adopted the plan of declining to accept the existence of such plants as proof of the value of their methods unless the plants had been in operation under the same ownership for ten years. Other tests might have been applied, but this was found sufficient. With the exceptions to be noted in this chapter, instances of large intensive poultry plants in operation for ten years under the same management are very rare. Of those started with large capital not one (so far as the writer can remember or learn) lasted so long. This fact puts the burden of proof on those who claim to succeed by such methods. The reader, if not convinced, by what he learns of the principles of poultry keeping, that such claims are not valid, should at least decline to accept them until they are established by evidence beyond dispute. As a rule the reports and financial statements put out are incomplete, inadequate, and therefore essentially false.

[2] Except when pullets are first put in the large colony houses, when a small yard is made, of stakes and poultry netting, to keep them from wandering off before they become wonted to the house.

FIG. 8. Field showing colony system at Little Compton, Rhode Island

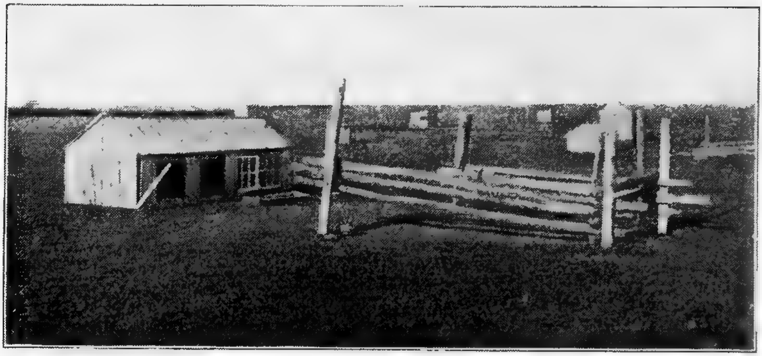

FIG. 9. One of the low houses in Fig. 8. When cattle are in the pasture the fence is adjusted to keep them from the hens' food and water

FIG. 10. Colony poultry houses on the farm of F. W. C. Almy, Tiverton Four Corners, Rhode Island

FEATURES OF THE COLONY SYSTEM OF EGG FARMING

FIG. 11. William Sisson's dough cart on its morning round. Note the rocky land

FIG. 12. Coops for young chickens on the farm of F. W. C. Almy. The hens are confined to the coops until the chickens no longer need brooding

FIG. 13. George Butler's dough cart returning from the evening collection of eggs

FEATURES OF THE COLONY SYSTEM OF EGG FARMING

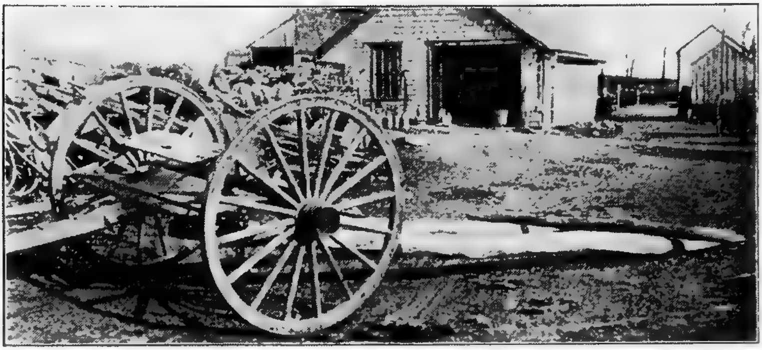

FIG. 14. Skids attached to front gear of wagon used for moving colony poultry houses

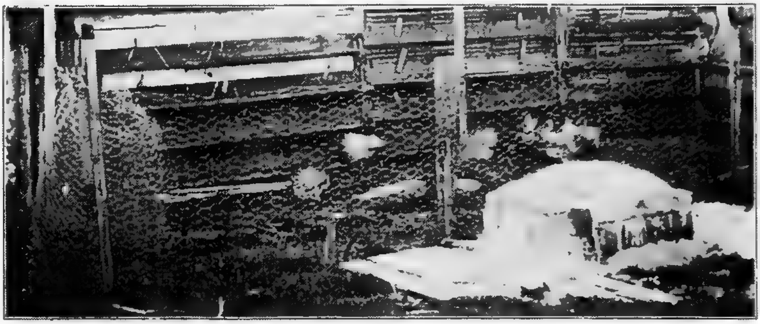

FIG. 15. Bank of outdoor nests for setting hens, at north side of building in Fig. 14

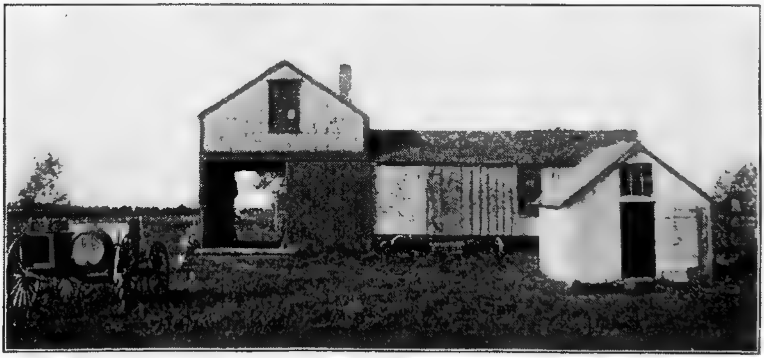

FIG. 16. Cookhouse, with drive through and feedhouse adjoining; a colony house at right

FEATURES OF THE COLONY SYSTEM OF EGG FARMING

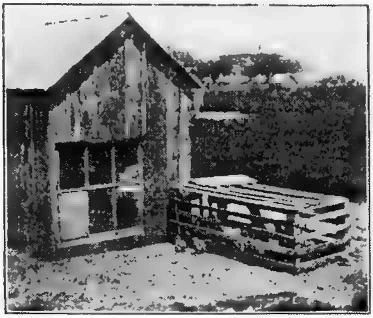

FIG. 17. A common style of coop for chickens

FIG. 18. A stack gives shade at all times

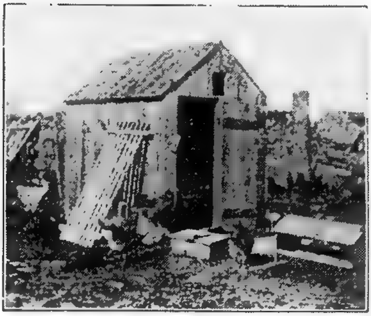

FIG. 19. Old-style coop, without windows

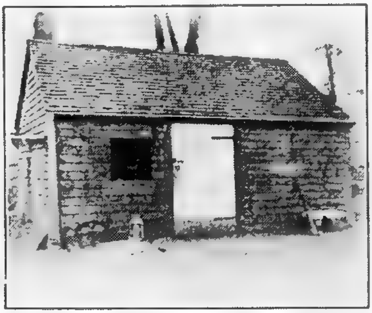

FIG. 20. Cookhouse on the farm of F. W. C. Almy

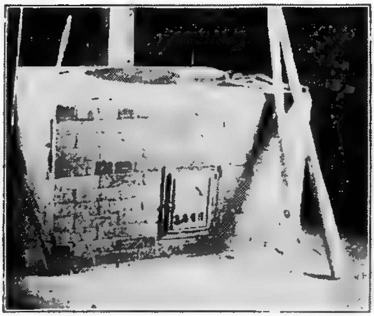

FIG. 21. Bricked-up set-kettle for cooking feed

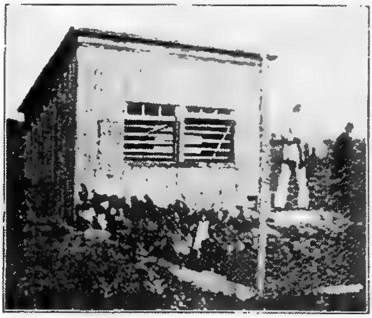

FIG. 22. Pullets confined when first put in laying houses

FEATURES OF THE COLONY SYSTEM OF EGG FARMING

birds on the place. Natural methods of incubating and brooding are used almost exclusively. The greater part of the grain is purchased, though nearly every farmer grows a few hundred bushels of corn each year. Inexpert labor is largely used, and much of the work is done with horse and wagon.

By the methods thus briefly outlined, the farmers of this section make "egg farming" continuously profitable, though the average profit on a "per hen" basis is small.[1]

The Petaluma district in California. This is better known, by name and reputation, to the general public, and perhaps also to most poultry keepers, than the district just described, though it may be doubted[2] whether the developments there are of as great importance. In many respects Petaluma conditions and methods are almost opposite those used in the Rhode Island colony section. In the Rhode Island district natural methods and primitive appliances are used almost exclusively; the Petaluma industry is developed along artificial lines and uses an intensive system. Producing for a market which prefers a white egg, it uses the White Leghorn, as do the egg farms supplying the New York market. The farms are mostly small,—from five to ten acres. Instead of small houses placed far apart, larger houses in groups are used. Hatching is done largely by men who make a business of hatching chicks for others. The chicks are brooded in lots of many hundreds. An incubator

[1] It is generally difficult to get exact figures. I have been told of profits as high as $1.50 per hen for flocks of 400 to 500, but for the flocks of double those numbers and upwards the best estimates I can get from the farmers place average profits estimated on the "per hen" basis at about 80 cents (a head) above the cost of feed. The routine work of caring for 1200 to 1500 laying hens takes about three or four hours of the time of an unskilled laborer, employed at $20 or $25 per month, with board. Irregular work for the poultry probably brings this up to make the laying hens chargeable for about half the wages of the man who cares for them. Other common sources of income on these farms are from cockerels and old hens marketed, from geese, from cows, and from the sale of hay. Thus the net cash income on a farm operated by one man, with one laborer regularly employed and occasional day help, may be very much larger than that of the average farmer anywhere. One farmer in this district, who maintains a stock of about 2000 laying hens and gives little attention to geese or cows, has made the statement that for a number of years he has been able to live well and still save not less than $1000 a year.

[2] Not being personally acquainted with the Petaluma district, I can make no positive statements in regard to the conditions there. Accounts of it by different persons are generally more or less contradictory, and accounts by the same person are sometimes inconsistent.

FIG. 23. The houses are closely grouped. (Photograph by M. A. Jull)

FIG. 24. A colony of 500 White Leghorns. (Photograph by D. J. Lane)

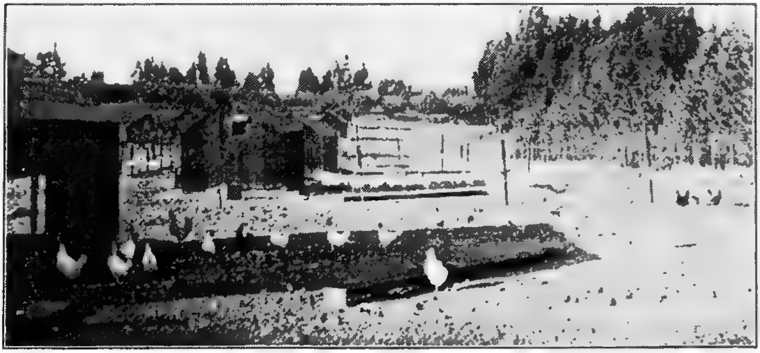

FIG. 25. Twenty-five hundred fowls on seven acres. (Photograph by D. J. Lane)

FEATURES OF THE PETALUMA POULTRY DISTRICT

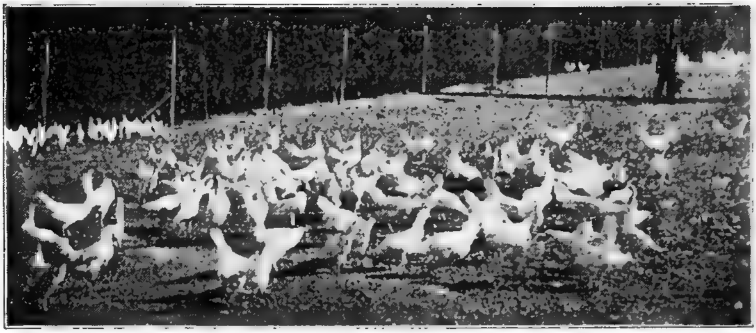

FIG. 26. Fowls on range. (Photograph by D. J. Lane)

FIG. 27. Brooder houses used at Petaluma. (Photograph by M. A. Jull)

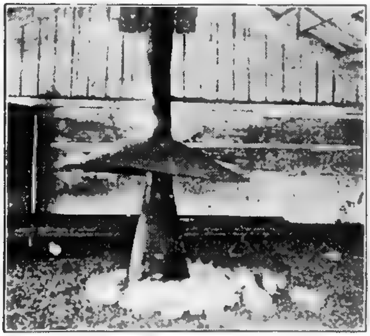

FIG. 28. Brooder stove to provide heat for 1600 chicks. (Photograph by D. J. Lane)

FIG. 29. As high as 400 cases of eggs a day shipped from this store. (Photograph by D. J. Lane)

FEATURES OF THE PETALUMA POULTRY DISTRICT manufacturer has been the moving spirit in the development of this industry here, and, like most far-western districts famed for any product, it has been widely exploited by real-estate interests. While the product is different, the egg farms of Petaluma in several important respects resemble the soft-roaster[1] farms of New England mentioned a little farther on. On general principles, as observed in developments elsewhere, it may fairly be presumed that, while the general accounts of, and claims for, the industry in the Petaluma district, and for the methods used there, are somewhat exaggerated, the industry as developed there suits the existing conditions and gives good profits to a fair proportion of those engaging in it. How long the present methods will continue will depend on developments beyond the district quite as much as on conditions in it. Almost invariably, specializing in poultry keeping succeeds only for a short time, the success of the specialist stimulating farmers generally to give more attention to that line, and so to increase the supply and reduce the profits of the specialist. Experience in other places also indicates that after a time the intensive methods used at Petaluma must be modified.

Broiler farming. Broiler growing as a specialty began to attract a great deal of attention about 1890. Interest developed at that period as a result of sensational stories published about the extent of operations in this line in and about Hammonton, New Jersey, and the large profits obtained. Broiler growing in this vicinity has been carried on principally as a winter occupation by men engaged in fruit culture, gardening, or other work which did not require all their time at that season. Their operations were not usually on a large scale. So conducted, the "business" brought the broiler grower some income at a time when he had little from other sources. When his results were unusually good, and he caught the market right, his profits might be considerable, but the average profit as stated by growers who kept careful accounts was only about twenty cents a bird. Instances were cited in the early days of as high as $400 profit in one season on a broiler plant of 1000 capacity run for seven months in the year.

[1] Chickens specially grown to be marketed as roasters are disposed of by the growers while the flesh is soft; hence the term "soft roaster," distinguishing such from the ordinary roasting chickens, which are often hard-meated.

The facts about the broiler business at Hammonton were widely published, but as usual the fictions gained wider credence, and for some ten or fifteen years big broiler plants were built up in various parts of the country, many of them undertaking to produce broilers the year round. None of these plants succeeded,

FIG. 30. Soft-roaster plant of Farrer Brothers, West Norwell, Mass.

and some of them involved their owners in heavy losses. The most celebrated broiler plant was that known as the "Mary L. Poultry Plant," at Sidney, Ohio. It is said that the owner admitted having lost over one hundred thousand dollars on the plant, and it is commonly believed among poultrymen that his losses were very much larger. In recent years few efforts

FIG. 31. Part of soft-roaster plant of Henry D. Smith, Hanover, Mass.

have been made to establish plants exclusively for the production of broilers. Broiler growing is now generally assigned its proper place, as a feature in diversified poultry culture or as a specialty for persons whose regular occupation will allow them to engage in the production of broilers in winter.

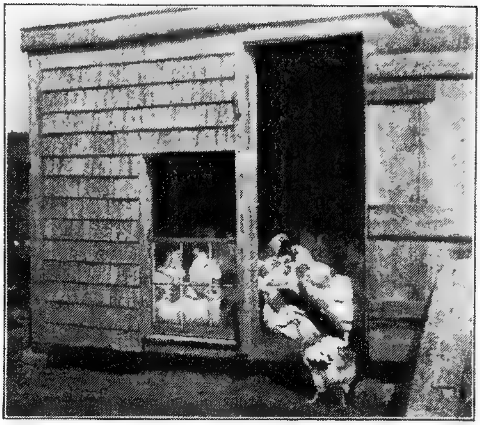

FIG. 32. Fifty half-grown Light Brahma chickens in house 6 ft. × 8 ft., which they occupy from weaning to maturity. The plan works well for winter chickens marketed before hot weather

Roaster growing. A special phase of poultry culture is the growing of large roasting chickens for the early summer trade in the large cities and pleasure resorts. It has been carried on for a great many years in a small way, chiefly by people in the vicinity of Philadelphia, its standing with those engaged in it being much the same as that of broiler growing. The roasters grown in this vicinity became

FIG. 33. Colony houses for winter chickens. (Continuing Fig. 31)

FIG. 34. Soft-roaster plant of Archie Torrey, Rockland, Mass.

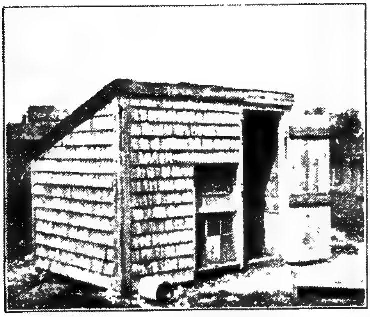

FIG. 35. Colony house for winter chickens, used by Farrer Brothers

FIG. 36. Colony house for winter chickens, used by H. D. Smith

FIG. 37. Row of colony houses for winter chickens on the farm of E. O. Damon, Hanover, Mass.

FEATURES OF THE SOUTH SHORE SOFT-ROASTER DISTRICT

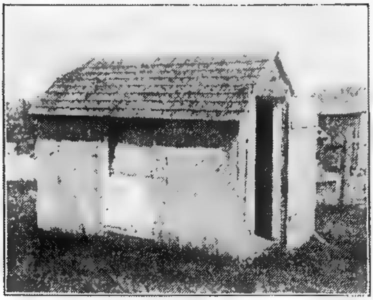

FIG. 38. Colony house for winter chickens, used by J. H. Curtiss, West Norwell, Mass.

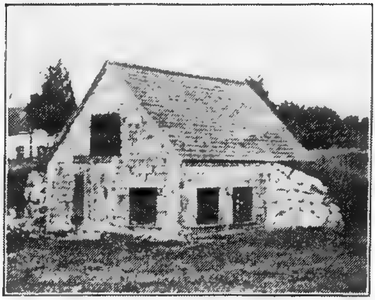

FIG. 39. Incubator cellar built into a bank on plant of Samuel Bates, West Norwell, Mass.

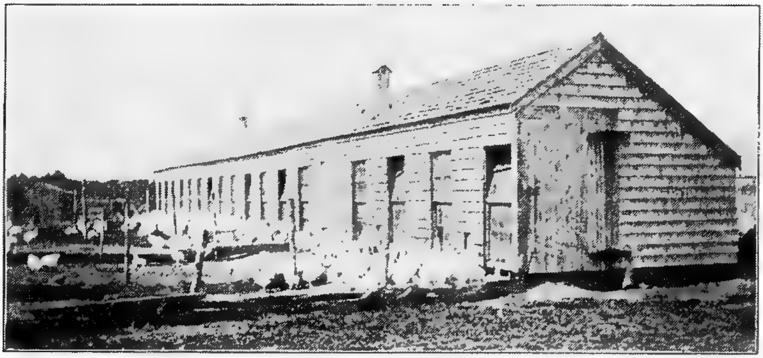

FIG. 40. Brooder house of Farrer Brothers, West Norwell, Mass.

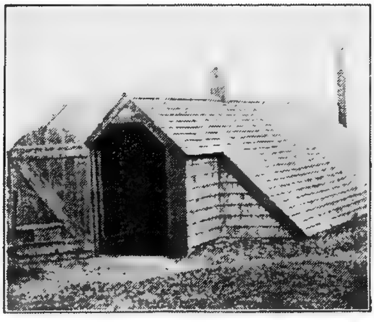

FIG. 41. H. D. Smith's incubator cellar; only the roof aboveground

FIG. 42. Oil barrel and tank connect with faucet inside. (Rear of Fig. 41)

FEATURES OF THE SOUTH SHORE SOFT-ROASTER DISTRICT famous in Philadelphia and other large eastern cities as "Philadelphia chickens." It seems probable that this line was carried on in the same way by a few people near other large cities in the East, though nothing definite can be learned. A few years previous to 1890 it began to develop on a more extensive scale in the vicinity of Norwell, Rockland, Hanover, and other towns in what is known as the South Shore district of eastern Massachusetts, and soon many people in these towns were engaged in it, some on a small scale, as a side line, others giving their time wholly to it and growing from 2000 to 4000 or 5000 chickens each year. The profits on this line of production were considerable, usually estimated at one dollar per bird, and sometimes a great deal more than that on the smaller lots.

The success of the business in this district has induced many to come here to engage in it, and has led others to attempt it elsewhere. Efforts to develop this line as a specialty outside the district[1] have almost invariably been discontinued at an early stage because of the difficulty of getting fertile eggs for hatching at the season at which they are required. Newcomers in the district experience some of the same difficulty, because the most reliable supplies are, as a rule, known and engaged by the growers acquainted with the farmers who supply the eggs. The grower in the district also has an important advantage in the marketing of his product,—a point which will be more fully considered when the matter of coöperation in selling is discussed. Artificial methods of incubating and brooding are used by all growers producing any considerable number of chickens, and skill in handling incubators and brooders is a most important element in success in this line.

Duck growing. This is the one branch of poultry culture in which plants of large capacity have been successfully developed. Factory methods have been applied much more satisfactorily in duck growing than in any other line of poultry culture. There are

[1] From the quantities of soft roasters now coming to Boston in small lots, it appears that an increasing number of poultrymen in other places in the vicinity are growing this class of poultry on a small scale, with other poultry lines. The effect of such a development on the industry in the soft-roaster section remains to be seen.

FIG. 43. Duck farms at Speonk, Long Island. The Hallock farm No. 1 in the foreground; in the distance, the Wilcox farm

FIG. 44. Another view of Fig. 43. There are 25,000 to 30,000 ducks in sight

FIG. 45. Ducklings on Hallock duck farm No. 2, Center Moriches, Long Island

VIEWS OF LONG ISLAND DUCK FARMS

two principal reasons for this. In the first place ducks are not as sensitive to the effects of filth in their food or on the land that they occupy as are fowls. In the second place they are less disposed to quarrel among themselves than fowls, turkeys, and geese. There are many plants in the eastern states growing from 5000 to 10,000 or 12,000 ducks a year, a number growing up to 20,000, and some with an annual production of over 50,000. One man on Long Island operates two farms, the combined annual output of which is about 75,000 to 80,000. Duck growing as a specialty is the production of "green" ducks, — that is, young ducks killed at about ten weeks of age, when they should weigh, dressed, five to six pounds each. Much of the weight at this stage is soft fat, which cooks away, but the epicures in the cities will pay as much for the duck at this age as later, when a greater proportion of the weight is meat, and the profit in ducks for market is in the "green" duck.[1]

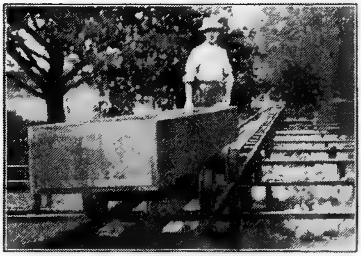

FIG. 46. Feeding young ducks from track over pens at Hallock duck farm No. 1

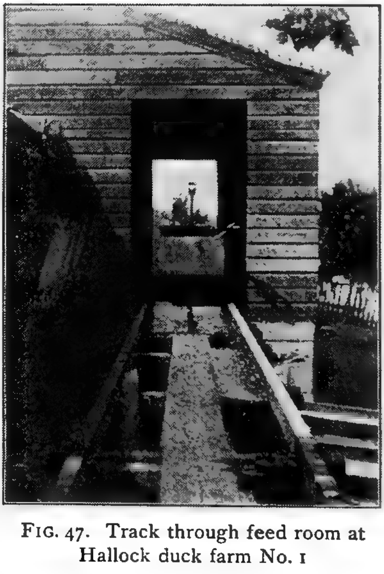

FIG. 47. Track through feed room at Hallock duck farm No. 1

This line of duck growing is said to have been conducted on a relatively large scale on Long Island since before 1860. The breed of ducks used prior to the introduction of the Pekin duck was the White Muscovy. Until about 1891 or 1892 the ducklings were hatched with hens, and the largest growers raised only a few thousand. Then artificial

[1] The marketmen say, "The green duck is a gold brick."

methods were introduced. Since that time the business has developed, sometimes to the numbers mentioned above, on a great many farms here and on some in other sections. The Long Island

FIG. 48. View of Weber Brothers' duck farm, Wrentham, Mass.

duck farms are quite invariably located on streams, with yards for both breeding stock and growing ducklings extending into the water. The inland duck farms usually give the ducks no water

FIG. 49. Breeding stock at Weber Brothers' duck farm

except for drinking purposes.[1] From observation of conditions and methods on coast and inland duck farms the author is of the

[1] Mr. James Rankin, in his "Duck Culture" (1897 edition), stated that his ducks seemed to have lost all desire for water for other purposes than drinking, and even the texture of their feathers seemed changed so that they would no longer shed water. I did not find this the case with stock bought of Mr. Rankin. It took to the water at the first opportunity as readily as any.

FIG. 50. Nursery brooder house (200 feet long)

FIG. 51. Baby ducks (one week old)

FIG. 52. Baby ducks (two weeks old)

FIG. 53. Cold brooder house. (Ducklings three weeks old)

BROODER HOUSES AT WEBER BROTHERS' DUCK FARM opinion that ducks are grown with less labor on the coast farms; but it would be a very difficult matter to determine any point of this kind in a comparison which, to be accurate, would have to consider the personalities of the proprietors, as well as other points

FIG. 54. Fattening sheds at Weber Brothers' farm. (From the east)

affecting results. Some of the coast farms have been used for duck growing for over half a century, and some of the largest inland farms for twenty-five or thirty years. When developed on a very large

FIG. 55. Fattening sheds seen in Fig. 54. Five thousand ducks feeding. (From the west)

scale, duck growing is usually an exclusive business. On a smaller scale it is usually combined with other branches of poultry culture.

As might be inferred from the comparative ease of developing the business, it is the branch of poultry culture in which supply oftenest overtakes demand. While the demand grows steadily, production constantly tends to more rapid increase. As a result, in the history of duck growing there has been, at quite regular intervals, an overproduction followed by a temporary curtailment of operations. While large duck plants flourish only near the markets where the demand is good, producers of market poultry

FIG. 56. Central grain storehouse

FIG. 57. Section of house for breeders

FIG. 58. Section of a fattening shed

FIG. 59. Killing and packing house

BUILDINGS ON WEBER BROTHERS' DUCK FARM

everywhere find sale for some ducks at good prices, and when good ducks are placed on a market, the demand rapidly increases.

Goose growing. Though less general than the growing of ducks, goose growing is carried on by a few people in almost every community. Throughout the greater part of the country, geese are grown in these scattered (and usually small) flocks, mainly for the Christmas market. In some parts of the East, notably in Rhode Island and parts of southeastern Massachusetts, the growing of "green" geese, to be marketed at about twelve weeks of age, is extensively carried on, almost every farm in a community growing geese, and the number of goslings grown on a farm sometimes reaching four or five hundred, though the average is perhaps less than half as many.

The colony egg-farming district of Rhode Island is perhaps the most important goose-growing district in the United States. Goslings are usually hatched by hens (few men have succeeded

FIG. 60. Flock of breeding geese in a Rhode Island pasture
(Photograph from Isaac Wilbour)

in hatching the eggs by artificial means), and the large stocks of laying hens kept here and the considerable areas of pasture land available for the goslings make the conditions especially favorable for goose growing on a larger scale than is usual. It is probable that this branch of the industry could be much more extensively developed in many localities than it is, for the demand is increasing, and good geese bring high prices not only at the holiday season but, in more limited quantities, at other seasons.

Goose fattening as a special line is carried on by some men in goose-growing districts, and also by some near the large eastern

FIG. 61. Hen with brood of goslings

FIG. 62. Three-weeks goslings grazing

FIG. 63. Captive wild geese with goslings

FIG. 64. Wild gander, African goose, and mongrel goslings

FIG. 65. Geese and fowls in same pasture

FIG. 66. Feeding and watering fattening geese

FEATURES OF GOOSE GROWING IN NEW ENGLAND

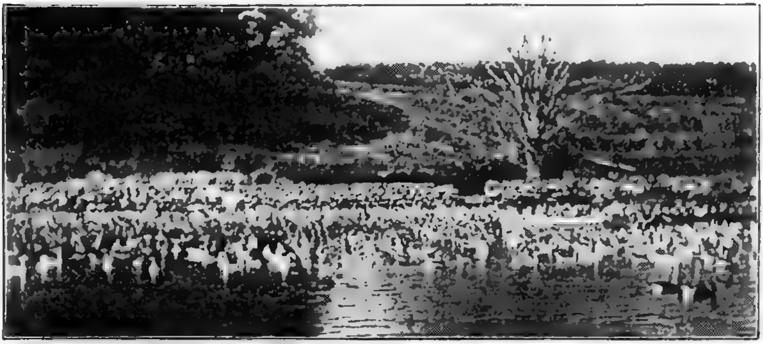

Fig. 67. Fattening geese on pond at Cornell Farm, Adamsville, Rhode Island

Fig. 68. View of the Austin Farm, Mansfield, Massachusetts

Fig. 69. Fattening geese in pens on the Austin Farm

SCENES ON GOOSE-FATTENING FARMS

cities who are engaged in buying and dressing poultry. The tendency, however, is for growers to fatten their own geese, hence the fatteners use mostly geese from districts where growers are rather indifferent to market demands.

Turkey growing. Although much more generally engaged in than goose growing, turkey culture is another branch never developed on a large scale. Unlike the other lines mentioned, special

FIG. 70. Bronze turkeys in woods at Simsbury, Connecticut. (Photograph from Valley Farm)

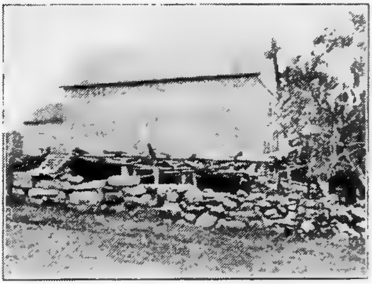

FIG. 71. Turkey roost in shelter of barn, on the Horace Miner Farm, Westerly, Rhode Island

FIG. 72. A family of White Holland turkeys

FIG. 73. A family of Black Norfolk turkeys

attention to turkey growing is oftenest found in the western states, and production in the East steadily decreases. This is due partly to changed labor conditions and partly to the fact that the large farms of the West afford conditions more favorable to the keeping of large flocks of turkeys. It is quite commonly believed that the decline of turkey growing in the East, and especially in Rhode Island and eastern Connecticut, where it was once an important industry, is due to the prevalence of the disease known as blackhead. That this view is erroneous is evident from the fact that, though the industry has declined in districts that once produced many turkeys, a number of persons continue to grow them as successfully as ever.

The greater part of the annual turkey crop now comes from the Central West and the mountain regions of the South, where, though they are grown in smaller flocks, the total production is large. Vermont and parts of New York and Pennsylvania produce large quantities of turkeys. In the situations most favorable to it the turkey lives largely by foraging in the fields and woods beyond the range usually covered by fowls. Turkeys may be grown in confinement, but not profitably. The conditions most favorable to their production include good range, little restriction on their movements, and still enough attention to provide for all their wants and insure protection from their enemies.[1]

Other kinds of poultry. Peafowls, guineas, pheasants, swans, and ostriches are not of general economic importance, though there are a few breeders of pheasants and ostriches growing them on quite a large scale.

Fancy poultry. Breeding fancy poultry is principally the production of *fowls* for exhibition. The interest in other kinds of poultry for this purpose is far less general and less intense. As a rule, competition in turkeys, ducks, and geese is not keen. In the rarer varieties there is almost no competition, most of the displays being for exhibition only. They are rarely seen except at shows of considerable importance, and even the managers of these often find it difficult to get as many of them as they wish, to add to the variety of the exhibit.

[1] I have made several visits to the turkey-growing district about Westerly, Rhode Island, and have interviewed many turkey growers there and in other parts of the East in regard to the causes of the decline in turkey growing in this section. The views of two middle-aged women who had been successful turkey growers from girlhood seem to me to sum up the matter. One of these, when asked what difference there was between her methods and those of her unsuccessful neighbors, who averred that she knew the secret of raising turkeys, said, "The only difference I can see is that I am more careful to look after my turkeys in bad weather, when they need attention." The other, when asked to what she attributed the decline in turkey growing, replied, "The men on the farms are now more interested in other things, especially gardening, while the girls as they grow up usually leave the farm and go to work in city stores or in factories or hotels; so that the class of labor that was abundant years ago is now almost gone."

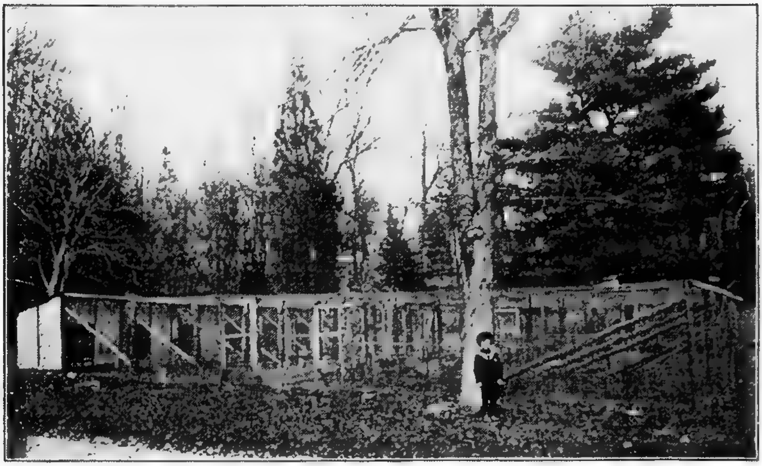

FIG. 74. A pheasantry in the suburbs of Boston. (Photograph from E. F. Conness)

The breeding of fowls for fancy points engages the attention of many thousands of people. The greater number of these breed on a small scale and primarily for their own pleasure and recreation, but many give all their time to it and have considerable capital invested in the business. Nearly all make some effort to sell stock and eggs for hatching. The profits in this line of poultry culture are much less than is generally supposed. Competition is strong and the cost of doing business is large in proportion to the volume of business. The seasons for the sale of stock and eggs are short, and sales are much affected by outside influences. Only a small proportion of breeders engaged in this line make more than a living, and a considerable number of the breeders most prominent at any time

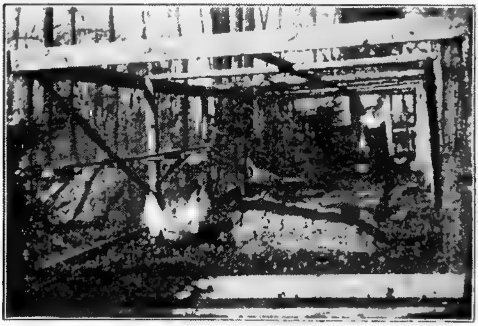

FIG. 75. Breeding pens of pheasants and fowls in same yard

are men who are trying to build up a business on capital accumulated from something else. No business started in this way has ever continued long. As in "practical" poultry keeping, those who succeed are men who have built up a business from small beginnings and understand it thoroughly. The others usually lose money a great deal faster than the successful ones make it. It is not unusual for men with capital, embarking in fancy poultry culture, to sink in a year an amount which would represent more than the total wealth of most poultrymen who are making money with poultry.

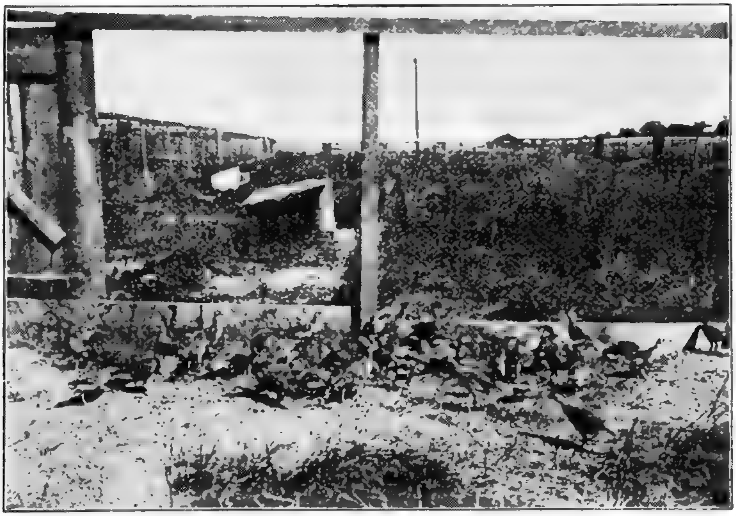

FIG. 76. Young China pheasants. (Photograph from Simpson's Pheasant Farm, Corvallis, Oregon)

Profitable combinations in poultry culture. Combinations are usually made to suit the poultryman and his circumstances. As far as the birds are concerned, with room and suitable locations and arrangements for all, nearly all kinds might be kept on one tract of land under one management. But poultry keepers are not equally interested in or adapted to the different lines of work with poultry. Whatever the original plan may be in any case, ultimately the work is developed along the lines that the poultryman can make most profitable, and usually consists of one principal line with several others incidental. The combination of market and fancy poultry culture is general, sometimes one, sometimes the other, being of primary importance. Naturally it is oftenest the market lines that are considered first, but if the poultryman develops special skill as a breeder and salesman, the relative positions of the two lines may soon be reversed.

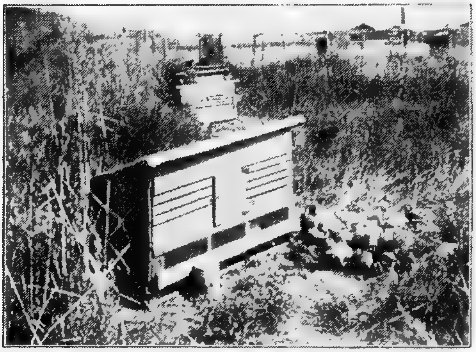

FIG. 77. Colony of young pheasants in an oat field. (Photograph from Simpson's Pheasant Farm)

Profitable combinations with poultry culture. Poultry culture is a necessary feature in diversified agriculture that develops all the possibilities of the ordinary farm. Poultry should be considered as a *crop* which, according to circumstances, may be grown in rotation with vegetable crops or in a system of double cropping. All special branches of agriculture afford opportunities for profitable combinations with poultry.

Supply and demand. To many the question of overproduction seems a most important one. An industry open to every one and capable of rapid extension from small beginnings appears at first thought one in which frequent periods of overproduction are likely to occur. In general, however, such conditions operate to check overproduction and, when it does occur, to quickly restore the balance between demand and supply. There are other factors, too, such as transportation and cold-storage facilities, which have served to equalize demand and supply. An overproduction in

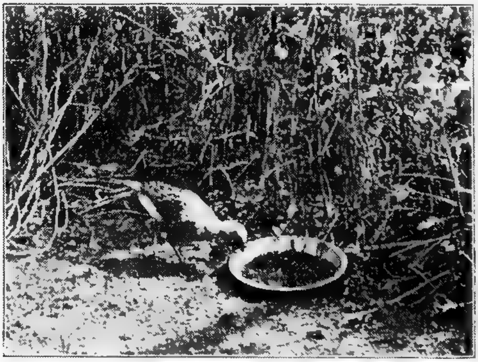

FIG. 78. Silver pheasant feeding. (Photograph from Simpson's Pheasant Farm)

one locality, or an excess of receipts in one market, is always (if the goods are in good condition) taken care of either by transfer to other points or by storage until receipts decrease in volume. Again, since so large a proportion of the general supplies of poultry and eggs sent to the markets are the surplus of flocks kept primarily to supply home requirements, any unusual reduction in prices is likely to be promptly followed by increased home consumption, as well as by increased market consumption, while on farms where the cost of food is not an important item, large flocks may be held for weeks or months. It is only in special lines like duck growing that overproduction seriously affects growers. Even in these the effects hardly ever continue for more than one season.

PART II. PRODUCTION

CHAPTER IV

THE POULTRY KEEPER'S PROBLEMS

The poultry keeper, as distinguished from the breeder and fancier, is the producer of poultry and eggs for table purposes, either for home use or for market. Theoretically the poultry keeper should be a breeder, if not a fancier; but as a matter of fact the proportion who merit that description is insignificant. Broadly considered, the function of the plain poultry keeper is to take the ordinary stocks of poultry as they run, and produce from them the poultry products that the country uses.

Common tasks of the poultry keeper are easy. In his routine work he finds few things in themselves difficult. The troubles of those who find poultry keeping an unending series of puzzling problems are mostly due to efforts to get certain results with factors which cannot give them, or by the use of unnecessarily complicated methods.

Hard problems in poultry culture. The complex problems — those which involve a number of comparatively simple matters difficult to adjust to the end desired — are relatively hard. A few examples will show the difference between common (or simple) and complex problems.

The housing of an ordinary small flock is a simple problem. Equally satisfactory results might be obtained in any of a dozen different types of houses. The arrangement of the houses for a large stock of fowls on a certain piece of land is a complex problem. The arrangement must be adapted to the lay of the land and also to methods of feeding and management. Differences in houses, also, which are immaterial when small numbers are kept may have to be considered when many buildings are used. The feeding of a flock of hens in laying condition is a simple matter;

the handling of a stock of hens to have them in laying condition when eggs are most in demand is a complex problem. Mating with a view only to the reproduction of the species is an extremely simple matter, accomplished by allowing males and females to come together; mating to preserve or improve breed or other desirable characters is a highly complex problem.

Hard problems may be easy if worked out step by step. The tendency of poultry keepers is to go too fast, and get into positions where they are confused by the variety of little problems pressing for solution. It seems the hardest thing in the world for enthusiasts beginning to specialize in this line to heed the oft-repeated warning, to "go slow." When poultry is kept merely from custom, and no special efforts are made to increase the flock, natural and environmental causes and conditions coöperate to keep the numbers about the same from year to year, and the question of taking care of a large increase hardly ever arises. But when poultry are kept with a purpose, and for the greatest possible profit under existing conditions, everything influencing the result sought must be adapted and adjusted to it. In many cases preparation for the work of one season must begin with the preceding season, or even earlier. An unsuccessful hatching season will certainly affect the egg crop of the next season, and may affect the breeding and hatching results of the following year. Delay in getting pullets into winter quarters may postpone laying for months. Neglect to provide ample coop room for chickens as they grow may cause heavy losses and retard the development of chicks that survive. A sick bird not promptly removed from the flock may spread a contagious disease which will ruin, for breeding purposes, all birds of the flock affected, even though they recover and may be used for other purposes. Conditions over which the poultryman has no control, or only partial control, may also unfavorably affect his results.

With so many contingencies to consider, an experienced poultryman rarely plans for a large increase, in one season, over the preceding season. The novice who does so rarely succeeds in doing more than make such advance as the expert would consider it wise to project. Not infrequently he fails to maintain his original numbers, simply because he undertook more than he knew how to do and look after every detail at the right time in the right way.

Problems are simplified by keeping as close to natural conditions as is consistent with the object sought. The application of this precept is much wider than at first appears. It applies to stock, — that is, to the type of bird; the "business type" of bird for any purpose is a plain type — the original type improved and modified with reference to use only. Large combs and crests, and feathers on legs and feet, are superfluous features which complicate the work of caring for the birds and limit their adaptability. It applies to housing; the house that provides only shelter from the elements requires least attention from the keeper, and the fowls in it are more thrifty. It applies to feeding; under natural or approximately natural conditions feeding ceases to be a problem. It applies to breeding; in nature the fittest to live survive to reproduce their kind. The poultry keeper who systematically breeds from vigorous birds retains and improves characters dependent upon constitutional vigor much more surely than one who, in breeding for those characters, uses specimens in which they are more highly developed but which are deficient in constitution. It applies to incubation and brooding; although artificial methods are necessary in some lines, and perhaps better for some persons or in some cases, as a rule it is very much easier to grow poultry by natural methods in the natural season. It applies to hygiene; under natural conditions little attention need be given to sanitary condition of houses, coops, or soil, while under intensive, unnatural conditions these things require constant attention. Its application might be shown in further illustrations, but these cover the points to be considered in this section. In no way can the poultry keeper so effectively simplify his problems and make his work easier from the start as by keeping as close as practicable to natural conditions.

Problems in practice may be essentially different from corresponding theoretical problems. The theoretical treatment of a subject (as of housing or feeding) is general, its object being to furnish information which will enable each one who uses it to determine what style of house or what method of feeding is best suited to his needs. The problems of housing, feeding, etc., as already stated, are complex problems. At the point of application the nature of the problems changes. Theoretically they become simple, practically they become complex.

For example, take the matter of selecting a breed or variety and securing stock of that kind. Intelligent selection must be based on a general knowledge of breeds and varieties. After the choice is made, the selection of stock would be a very simple matter if all stock of the kind desired were of the same quality. But since this is not the case, the selection of stock often becomes a most perplexing matter, because, while the general average of characteristics of a breed or variety as it may be described in a textbook is fairly constant, the quality of the stocks of individual breeders is variable, both in different stocks and in the same stock. A good decision as to the kind of stock required, the type of house, or the method of feeding may be made by a novice after a little study of any of these matters. The building of the house then becomes a question of his skill in carpentry (if he builds it himself). Learning to use the ration selected becomes a question of feeding it for a little while according to general directions, then gradually modifying to suit his stock and conditions. But to secure such stock as he wants, it may be necessary for him to buy and discard in succession the stock of several different breeders.

To get suitable foundation stock is the beginner's most difficult problem. This is as true for the beginner who only wants good utility stock as for one who wants exhibition stock. It should, however, afford some consolation to the beginner disappointed in results of purchases of stock to know that the problem of maintaining high standards of quality or performance, either within his own breeding lines or by judicious introduction of new blood, is the greatest and most difficult problem of the expert breeder. The novice will usually get his experience and his final start with suitable stock more cheaply if, following the policy of the old breeder, he buys stock[1] only on inspection or approval, selecting or accepting only stock that is evidently thrifty and in good condition,

[1] Whether to buy stock or eggs is usually considered a moot question. Personally, from experience and observation, I believe it is better for the beginner to buy stock for breeding, if for no other reason than because by so doing he gains a year's experience in breeding. He may buy eggs also, if he can handle more young stock than his breeders will produce, or if he wishes to get a line on the quality of the stock breeders. Experienced poultrymen (soft-roaster growers excepted) do not depend on purchased eggs for hatching, and even among soft-roaster growers the practice of buying eggs is decreasing.

well grown and well developed for its age and kind, free from serious faults, and of fair quality according to American Poultry Association standards. The descriptions of breeds and varieties in Part III will enable him to estimate the quality of stock with sufficient accuracy for his purpose. He should on no account accept a bird that shows any indication of ill health. If buying young birds, he should take only those that are full grown, especially avoiding birds said to be late hatched. Such birds are most likely to be undersized specimens from early hatches. In any case the novice should avoid the late-hatched birds; some of them make valuable breeders in their second breeding season, but they are of little service during the first season. As a rule he will find it better to buy near home, as he would buy a horse or a cow. The comparatively low cost of transportation for poultry tempts many to buy at a distance, of breeders who advertise extensively, but one is much surer of getting good stock of the kind under consideration if he buys the best that he can find in his vicinity. Without being extravagant the novice should be willing to pay a fair price[1] for suitable stock, not only because it is designed to be foundation stock, but also for the following important reasons:

1. *He cannot do good work without good stock.* An expert may. Every problem of the poultry keeper is made more difficult when the stock is weak or in any way unsuitable for the purpose for which it is used.

2. *Rugged, vigorous stock will stand mishandling when weak stock will not.* With the best of intentions a novice is likely to make some mistakes tending to the detriment of his stock. From humane as well as from economic considerations the beginner should select stock of great vitality.

[1] The price will depend much on the reputation of the breeder. A breeder with no general reputation will often sell at a dollar each birds that could not be bought from a breeder of wide reputation for less than five dollars. Those figures fairly represent the range of relative prices. One who finds birds to suit him at the lower price is fortunate, but if the low-priced birds do not suit, he had better pay the higher figures and, if his means are limited, take a smaller number of birds.

CHAPTER V

POULTRY TYPES AND THEIR RELATIONS TO OBJECTS, CONDITIONS, AND METHODS OF POULTRY KEEPING

Reference has been made to the influence of certain types of poultry on the development of the industry. It is necessary, before questions of location, equipment, and methods are taken up, to consider some properties of type which bear on these questions.

What is type? As used by poultrymen in a general sense the term "type" denotes a fixed combination of qualities especially adapted to definite results (as meat type, egg type, general-purpose type, game type), these being the distinct types of fowls to which nearly all breeds and varieties may be referred.

Type and breed. In a state of nature birds of the same kind living under the same conditions are, as a rule, of a common type. They are of approximately the same size and color, and so nearly alike that individuals are not easily distinguished. The type of the wild bird is fixed by natural selection. The individual which in any character differs greatly from the ordinary type is less likely to live and produce offspring; and when it does, the chance of its meeting with a mate like itself is remote. Variation always tends to be modified or lost in the common type.

When birds are brought into domestication, variations occur more frequently, and the conditions of the bird's life in domestication prevent the general destruction of individuals which depart from the usual type. As a result of the preservation of variations, and of miscellaneous unions of individuals diverging from the general type in many characters, a species in domestication soon reaches a condition of mongrelism, the original combination of characters becoming very rare, or perhaps entirely disappearing, and no fixed combination replacing it.

Among the numerous types occurring in a mongrelized species some are more serviceable than others and some more pleasing to the eye of the owner. For one or both of these reasons a particular type may become a preferred type. Such a type may closely resemble, either in general or in some conspicuous characters, the wild type, or it may be very different. Whatever the type, by continuous breeding of males and females nearest that type, it may in a few generations become so well established as to reproduce itself quite as uniformly as the original wild stock. Such a type, as distinguished from mongrel stock of its kind, is called a *breed.* The number of breeds which may be developed within a species is theoretically unlimited. Practically it is limited by the difficulty that most people experience in properly differentiating between types not strikingly dissimilar.

Breed type. A breed type may be described as a well-established artificial combination of characters peculiar to part of a domesticated species, plainly differentiating it from the rest of the species. True breed characters are very few in number. The basis of breed type is *form.* Poultrymen say, "Shape makes the breed." Characters determining breed type are size, shape of body, proportions, and adjustments to the body of head, neck, wings, legs, and tail. The length and texture of the plumage and the color of the skin are also features of breed type.

Breed divisions. Birds of the same breed type may differ in superficial characters, such as color of plumage, shape of comb, presence or absence of superfluous feathering on head or feet. By such differentiation within a breed *varieties* are established. Varieties, again, may be divided, according to some minor character, into *subvarieties.*

Breed relations. Breed (and variety) types distinct in appearance may still be so similar in everything affecting usefulness that they are equally well adapted to the general conditions of a region or to prevailing market requirements, and are, on the whole, equally serviceable. Such similar breeds constitute a *class.* In the selection of poultry for a particular location or purpose *class type* is the major consideration; breed and variety characters are of minor importance.

Economic classification of fowls. Among the numerous breeds, varieties, and subvarieties of fowls are found three principal class types, commonly known as the meat type, the egg type, and the general-purpose type. It is not necessary here to assign to each and every known breed a place in one or another of these classes. Only the more familiar breeds need be mentioned.

The meat type. The best examples of this type are the Brahmas, Cochins, and Langshans, comprising the Asiatic class of the fanciers.

The egg type is most commonly represented by the Leghorns, though Minorcas, Andalusians, and Anconas are well-known members of the class. These breeds, with the Spanish, constitute the Mediterranean class of the fancier. The so-called Dutch and Polish classes are of substantially the same type.

The general-purpose type is an intermediate between the meat and egg types. The Plymouth Rocks, Wyandottes, and Rhode Island Reds, known to fanciers as the American class, are the principal breeds of this class in this country. The English Orpington is of the same general type and economically belongs to the same class as the three American breeds mentioned.

Class properties. The designations of the different classes indicate in a general way their class characters, but taken too literally these terms may be misleading. Such terms as "meat type" and "egg type" do not mean that the bird is adapted to one purpose to the exclusion of the other. They merely describe dominant tendency.

The Brahma, the most popular representative of the meat type, grows to a large size, furnishing abundance of meat, and remains soft-meated until well matured, furnishing the somewhat rare combination of tender flesh in a large carcass. The tendency at maturity is to put on fat rather than to produce eggs, though in skillful hands Brahmas are good egg producers. The Leghorn, the most popular representative of the egg type, is a small, active fowl, maturing quickly, the males especially becoming hard-meated at a very early age, making the breed of little value for table purposes. But the active temperament of the Leghorn tends to keep it, for a longer period than is usual, in the physical condition favorable to reproduction under unfavorable conditions, and consequently, though the possibilities of egg production may be as great with the Brahma as with the Leghorn, good laying is more general among fowls of the Leghorn type than among those of the Brahma type.

In each of these types a superficial character limits the adaptability and use of the class. The profuse feathering of Asiatic fowls, and especially the feathering on the feet, makes them unsuitable for many situations. The Mediterranean fowls, with their large combs, are ill suited to cold latitudes. The general-purpose type of fowl, which is vastly more popular than all others combined, was developed objectively as a dual-purpose type with tendencies toward meat and egg production well balanced, but also subjectively as a type free from eccentric features, and so adapted to the widest range of circumstances.

In the kinds of poultry other than fowls, class distinctions are less sharply drawn. Breeds and varieties are not so numerous, and breed and class types may more nearly coincide; yet, as breeds and varieties multiply, the tendency to the creation of classes similar to the recognized general classes of fowls becomes apparent.

All breeds and varieties in a class are substantially alike. They require the same conditions and treatment and serve the same practical purposes. Hence in all questions relating to these points only class differences need be considered. If one variety of a class is adapted to certain purposes, or thrives under certain conditions and treatment, any other variety of the class may serve well the same purpose and will thrive under like conditions and treatment. If individuals do not, the fault is in the individuals or the keeper.

Necessary differences in conditions and methods are slight. The general-purpose type of fowl is adapted to the widest range of conditions and requires least attention, but the differences between conditions and methods for this type and the Asiatic meat type, on the one hand, and the egg type, on the other, seem, when stated, quite trivial. The Asiatics do best on sandy soils and in cool climates, and require, to make good development, more food than a good range affords and, to keep in laying condition, closer and more judicious attention than the ordinary poultry keeper gives. Fowls of the egg-type class, particularly the males with large combs and crests, need special protection from cold and dampness; but this class requires less attention to feeding than any other. In a comparison of classes the class characteristics are in a sense equalized, but this does not enter into the question as considered in any particular undertaking. What each poultry keeper has to consider is that, if he selects a breed requiring special attention, his buildings, yards, fences, appliances, and methods must be adapted to that breed. He should consider carefully in advance whether this is worth while, or whether it would be better to choose one not requiring unusual care. In some cases it pays to give the extra care; in others it does not. In a combination of fancy and utility poultry keeping with the same pure breed, it is also necessary to consider whether the conditions and methods established with reference to one object will also serve for the other. They may or they may not; and if they do not, it is usually better to develop only the line that they suit. As a rule, economies of space or labor which are profitable in market poultry growing have a detrimental effect on type, while the special care and attention which may profitably be given to high-class birds produced for exhibition or stock purposes do not pay when applied to the production of poultry and eggs for the table.

CHAPTER VI

PROBLEMS OF LOCATION

Phases of the question of location. In discussing the general question of location we consider the two following subjects:

1. Matters which directly affect production, — local climatic features, exposures, drainage, soils. Such things are of varying values in the problem of location as presented to different individuals in the same community.

2. Matters which, while not so intimately affecting production, influence and ultimately determine its volume, — general climatic conditions, markets, transportation facilities, and adaptation of poultry keeping to other interests. Such things are, on the whole, factors of like value in the same community. These aspects of the question cannot be wholly separated, even for purpose of discussion, but the reader should note that, broadly speaking, matters of the first class are mostly within control of the poultryman, while matters of the second class are mostly beyond his control.

Most of those interested in poultry have to adapt poultry keeping to a location and to conditions determined without reference to it. Only a small proportion of those engaging in this line try to locate themselves with a view to securing every advantage that location can give. From either point of view the facts and principles to be considered are the same. The difference is in the application. One who is already located must adapt poultry keeping to his location. One who can choose his location may decide first what lines of poultry keeping to follow, and locate accordingly. In practice, very few persons choose their location with reference to poultry keeping, even if able to do so. They usually locate in the section or place that they prefer to live in, and adapt their poultry keeping to circumstances.

Climate. General climatic conditions are of less importance in poultry culture than is commonly supposed. Wherever man can live and sustain himself, poultry can be kept and, if the scale of operations is properly adjusted, can be kept profitably. It is sometimes supposed, and occasionally stated as the result of an individual experience, that poultry cannot be kept in certain localities or under certain conditions, — as high altitudes, proximity to salt water, etc. In most cases these views are erroneous. Usually they are based upon instances where failure was due to causes not peculiar to the locality. Adaptability to a wide range of climatic and other conditions is, as has been stated, one of the most valuable characteristics of poultry, but individual birds are not always affected alike by radical changes of environment, nor is the same individual always equally able to adapt itself to all changes. The process of acclimatization requires time. An individual, or a stock generally, may be so unfavorably affected by a change that it is advisable to discard it and try other stock, but, as a rule, by judicious care and breeding a stock may be established anywhere within a few years.

Nor are there such differences in results from poultry under different climatic conditions as might be supposed, because, on the whole, the advantages and disadvantages due to such conditions are equalized in a year's work. Thus the long, rigorous winters of north temperate regions are offset by the long, hot summers of the South, and the undesirable features of each, though opposite in nature, may have the same effects on financial results.[1]

[1] Theoretically, there should be an intermediate belt in which conditions approached the ideal. If all other conditions could be made uniform for purposes of observation, it might be possible to make a survey that would locate such a belt; but no such uniformity can be obtained. The adaptability of poultry to climate alone presents an insuperable obstacle to exact computations of the effects of climate. The birds could not be kept standardized to one climate while living in another. The general tendency is for birds of the same breeding to give like results within a wide range of climatic conditions, if the food and care are appropriate. In milder climates cheaper buildings may be used, and the labor of caring for the poultry in winter is reduced; but in general, production is better where outdoor occupations are restricted in winter and the poultry keeper is compelled to give his birds careful attention to get any profit, than where many outdoor occupations can be carried on all winter and the birds may be given less care without hardship to them. Though the season of winter egg production begins earlier in the South, production during the period of high prices does not seem to be enough greater than in the North to give southern poultry keepers generally larger receipts for the winter than are obtained in other sections.

Special features. Local climatic conditions affecting poultry depend, as a rule, upon the character or formation of the land, features of the landscape, prevailing winds, etc. Their relations to poultry keeping are presented in connection with the topics of soil, sunlight, and ventilation. It has been stated that these conditions are under the control of the poultryman. This is not true in the sense that he can alter them, though sometimes he may; but when he cannot change he can usually avoid them, for in most cases an unfavorable local condition affects only a small area, and is escaped when buildings for poultry are placed on suitable sites.

Soils and drainage. That a light, well-drained soil, of little value for the production of vegetable crops, is best suited for poultry was long a maxim among poultry keepers. Of late years that view has been greatly modified. Such a soil has advantages. That it is the best soil for exclusive poultry keeping by intensive methods cannot be denied. Such land can be easily and continuously stocked with poultry longer than any other; but there is a limit to the capacity of any soil to convey excrement and disease germs so far below the surface that they will be harmless, and with the passing of intensive methods, and the increasing tendency to either stock land lightly or rotate poultry on it, the objections to heavy soils become of less importance. The special advantages of light soils will always be admitted, but such land is no longer regarded as the prime requisite, while the fact that under some conditions it has decided disadvantages is more generally recognized.

Clay soils. Clay soils are least suited to poultry, but if surface drainage is good, overstocking avoided, and the land frequently broken up for tillage, the character of the soil does not present a serious obstacle to poultry keeping.

It is desirable that land on which permanent buildings are placed should be of such character or conformation that water will not stand near them and that the poultry will always have the use of an area of approximately dry land. With this insurance against protracted exposure on cold, damp land, it will be found that poultry on a range which affords varied soil conditions are more thrifty and make better development than those restricted to light, well-drained soils. This is especially noticeable in hot, dry seasons.

Sunlight. So important is this element in poultry keeping that it is usual in all northerly latitudes to face the buildings in a southerly direction and, wherever possible, to place them on a slope with southerly exposure. Such disposition of buildings is a distinct advantage during the winter months, when conditions are most trying, but is not so essential that all other considerations should be subordinate. Lack of such land is no bar to operations with poultry. Even a northerly slope, rising from a building facing south, is less objectionable in practice than it seems in theory. If such a slope is not too abrupt, and is free from elevations, growths, or structures which would prevent the sunshine from reaching the buildings, as good results may be obtained on it as anywhere. In fact, while snow is on the ground and the birds confined to the house, the lay of the land makes little difference. A southerly slope is available earlier in the spring and later in the fall, and, when bare in the winter, is comfortable and attractive when the opposite slope is the reverse and birds avoid it. As a rule, situations having the best sun exposure in winter are too much exposed to the sun in summer, and unless the heat at that season is tempered for the fowls by shade, or by yards to the north of the house, the net advantage of a sunny situation may be slight.

Ventilation. Circulation of air is also an important matter and must be considered with reference to all seasons and to extreme conditions. A situation which in winter is well sheltered and notably comfortable may become intolerable in summer, when the heat of the sun is intense and the movement of air obstructed by foliage both day and night. To this condition in small open spaces in the woods is due the generally unsatisfactory results of efforts to keep poultry in parts of wooded tracts not adjacent to open areas of considerable extent. In such places, and in depressions between ridges, atmospheric conditions are very often unsuited to poultry. As between such conditions and exposure to strong winds, the latter is less objectionable, for where circulation of air is naturally obstructed, no remedy may be possible; but it is always possible to provide, in wind-swept situations, houses of wind-proof construction and such additional windbreaks or shelters as the fowls may require.

Markets. Every city and town furnishes a market for poultry products. A town or small city in an agricultural district is likely to be fully supplied from farms in its vicinity, at prices which offer no inducement for the extension of poultry growing in that vicinity beyond what the ordinary small farm flocks supply. But if poultry producers in such a district have easy access to the markets of a large city, the local price rises to the city price minus cost of transportation and distribution. In times of scarcity it may more nearly approach prices in the larger market, because of the tendency of shippers to that market to keep their goods moving in the usual channels and not to interrupt regular trade connections for temporary advantage. The large city furnishes an almost constant outlet for all supplies that reach it, for every large city is a distributing as well as a receiving center. The large cities of the Central West store their surplus receipts or ship them to the large eastern cities, and these in their turn store them or distribute to cities of lesser size in the eastern states, where a large proportion of the population is engaged in other than agricultural pursuits. The volume of produce shipped from the region between the Mississippi River and the Rocky Mountains, considerable though it is, comprises but a minor part of the total product of that region. Taking the country as a whole, the poultry-trade organization is so efficient that the question of a market rarely calls for special consideration, further than that, wherever he may be located, the poultry keeper should fully inform himself as to available market advantages.

Transportation. The hauling of supplies and produce between the plant and the railway shipping point is the phase of transportation to which those keeping large stocks of poultry should give special attention. The difference between the cost of a short haul and that of a long haul often makes the difference between a living profit and a profit so small that the enterprise must be abandoned. A plant selling fancy poultry and eggs, or selling table poultry and eggs direct to consumers, or one that buys large quantities of supplies, cannot afford to make long hauls locally. One producing most of its supplies, and making deliveries of produce only once or twice a week, may not be seriously handicapped by a haul of five or six miles. When hauls are not too frequent, the cost may be offset by some other advantage, as cheaper land. But if there is much hauling to be done, it is a mistake to develop a large poultry plant on a site not convenient to railway connections.

CHAPTER VII

SYSTEMS OF POULTRY KEEPING

Definitions. Method and system are not always clearly differentiated, and the terms are often used as synonymous. There are, however, many cases in which the difference is apparent. *Method* usually applies to processes, *system* to series of processes or to comprehensive plans, including a variety of more or less related processes.[1]

General methods. In poultry keeping methods are described as *extensive* (giving the birds as much room as they can use to their own advantage or to the saving of labor for the poultryman) or *intensive* (placing on a given area of land a much larger number of birds than the land can support, even for a very brief period, with proportionate increase of labor and expense for their maintenance). The common tendency in practice is to go to one or the other extreme. The practice best adapted to any particular place and conditions is usually some combination of extensive and intensive methods.

Essence of system. A system of poultry keeping is a comprehensive plan for adapting conditions and methods to the management of large numbers of poultry. In the development of systems of poultry keeping, conditions and appliances are of more importance than processes. The object of system is to simplify methods and reduce labor, while maintaining conditions favorable to the

[1] The way of killing a fowl is a method. The way of feeding a single lot of poultry for any particular purpose is a method. Several related methods of feeding poultry for different purposes may constitute a system of feeding. The housing of a single lot of poultry supplies a condition. The house is an appliance, a part of the permanent equipment of the poultry keeper. "Method of housing" would mean merely the act of putting the poultry into the house. The handling of a single flock of poultry, though systematic, cannot as a rule be said to constitute a system. In occasional cases a poultry keeper may carefully work out a routine of operations with a single flock which might be called a system, but in general the managing of single flocks is merely a combination of methods having no special logical relation to each other.

stock. A system which does not secure these results in any case is not adapted to that case. To be generally serviceable, a system must be adapted to continuous poultry keeping under ordinary conditions. There are two typical systems of poultry keeping,—*extensive* and *intensive*,—developed respectively from extensive and intensive methods of handling single flocks.[1]

Ordinary farm poultry keeping is theoretically by the extensive method. On most farms each kind of poultry is handled as one flock, though when the flock is large, several houses may be required by birds ranging over the same area. But when more birds are kept in one flock than can procure, in the area over which they range, the foods that they should procure by foraging, the method actually

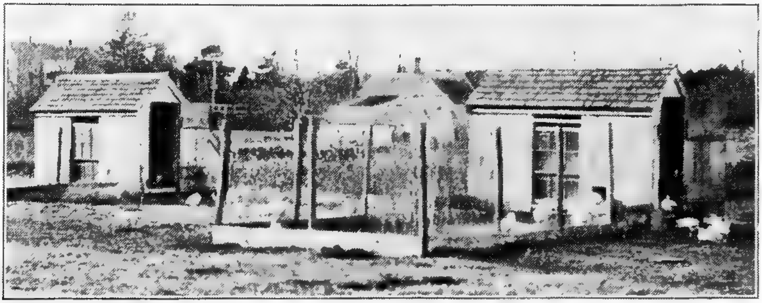

FIG. 79. Beginnings of an extensive system on the farm of Samuel Bates, West Norwell, Massachusetts

becomes intensive. It is not possible to indefinitely increase the size of a flock and at the same time to maintain conditions favorable to the birds and to economy of labor.

Extensive systems. By multiplying the number of flocks kept by extensive methods extensive systems are developed. The proper development of such a system requires that the houses be placed

[1] In this connection it is appropriate to state the facts in regard to the numerous so-called systems of keeping poultry, or of determining facts of value to the poultry keeper. The usual claims for a "system" are that it is based upon a discovery of the person exploiting it, and that by the system the results that poultry keepers desire are assured. The system is offered for sale, and the description of it represents it as something to be procured only from its originator. The author, in more than twenty years' intimate knowledge of poultry culture, has not found a single instance where what was of value in such a "system" was not a matter of common knowledge among well-informed poultrymen. In all these systems "what is true is not new, and what is new is not true."

at such (minimum) distance apart, and the number of birds in each be so limited, that the area serving as a range for them will provide a good foraging ground. The flock is divided into colonies. Hence

FIG. 80. Extensive system at the Provincial Poultry Breeding Station, Edmonton, Alberta. Colony houses with large temporary yards. (Photograph from the station)

the name "colony system," applied especially to the following most notable systematic development of extensive methods.

The Rhode Island colony system. The development of a colony system of housing poultry, with appropriate methods of management,

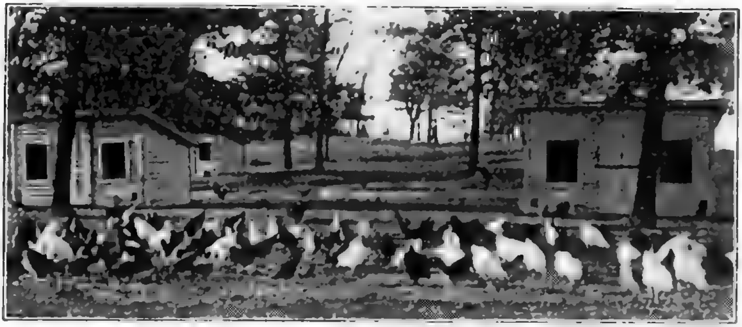

FIG. 81. Colony houses without yards at the Wisconsin Agricultural College (Photograph from the college)

seems so logical and natural that it might reasonably be supposed that, as farmers all over the country increased their stocks of poultry, this system would be generally adopted. On the contrary, in all but one locality, the usual practice was to increase production only as long as the stock kept could be handled in one flock.

Some one in the vicinity of Little Compton, Rhode Island, at an early stage of the awakening of interest in poultry keeping, saw the advantage of retaining the style of small house in use and of distributing small flocks over the land, and adopted that system. Others followed his example. The system was soon in general use in a limited area in that part of Rhode Island and the adjoining part of Massachusetts, poultry keeping became the most important interest of the district, and the district became one of the largest poultry-producing communities in the world. While occasionally individuals failed or, because of disease in the flocks, were obliged to discontinue operations for a period, on the whole poultry ventures flourished and grew to large proportions, were as permanent as other branches of agriculture, and were often carried on generation after generation by the same families on the same farms. The Rhode Island Red, a breed especially adapted to local conditions and methods, was developed and long remained peculiar to that locality.

FIG. 82. Large colonies on the farm of A. M. Shaw, Groton, N.Y. (Photograph by H. J. Blanchard)

FIG. 83. Colony system on a Pennsylvania farm

The development of the colony system in this section began about the middle of the last century, but attracted little attention outside the district until recent years.[1] This neglect of so important a development was due to the general faith in intensive methods and to the prevailing idea that poultry culture on an extensive scale could only be carried on successfully when artificial methods of incubating and brooding were used, and the supposed correct principles of housing, feeding, etc. (which made the

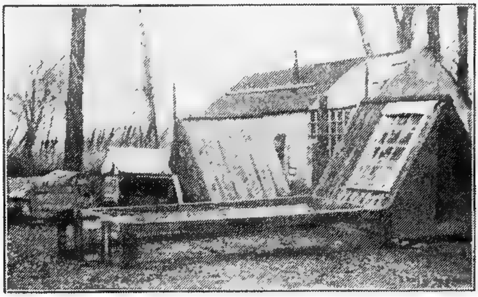

FIG. 84. Intensive back-yard plant. (Photograph from E. A. Day, Farmington, Minnesota)

FIG. 85. Intensive system on farm in central Massachusetts. Shelters with small attached runs. Note similarity between the unit in this system and the house and run in Fig. 84

ventilation of a house an engineering feat and the feeding of a few fowls a chemical problem) were carefully observed. Not until the

[1] I first visited this section and published an account of the system in 1901. No extended account of it had previously been published, and the occasional items regarding it appearing in one of the poultry papers were hardly noticed. Even to this day the greater part of the poultry press is not interested in these poultry keepers, who, with few exceptions, neither buy nor sell anything through advertising. I would not state positively from memory, and verification would be difficult, but to the best of my recollection it was not until five or six years later than the publication of my account that investigators of poultry matters began to visit this section, and these were mostly engaged in educational work.

limitations of intensive systems began to be widely recognized was any general interest shown in the Rhode Island colony system. Nowhere else are extensive methods applied so consistently and on so large a scale as in the Little Compton district. Interest in the system elsewhere takes the direction mainly of seeking to apply features of the system as practiced here in modification of the intensive system. Points relating to this will be considered in their place.

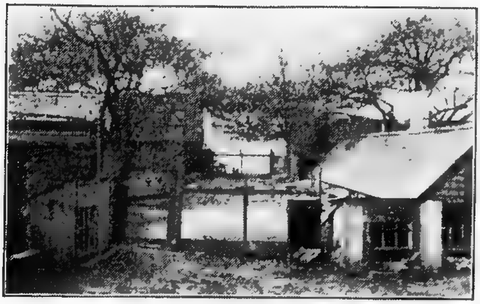

FIG. 86. View on an intensive plant (no system)

Ordinary town poultry keeping is by the intensive method.[1] Few town people who keep fowls are willing to give up to them as much land as the flock needs for range, even if they have the land. The townsman especially interested in poultry almost invariably wants to keep all the poultry that his land will carry by any known method. The average flock contains from twelve to fifteen or eighteen hens, is housed in a building having a floor surface of

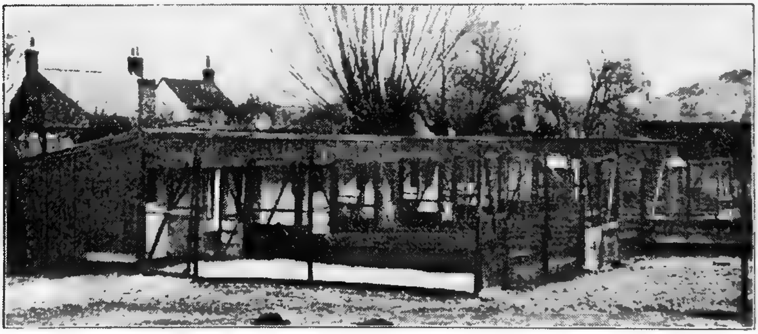

FIG. 87. An intensive plant (good system). (Photograph from E. T. Brown, London, England)

[1] This book does not treat at all the ultraintensive methods of the mushroom "systems," widely exploited for a few years but now dying out. The actual developments of such systems are insignificant.

from 80 to 120 square feet, and is given a yard of only two or three times the area of the house floor. Under such conditions poultry can be kept healthy and made productive only by the most careful management, including regular provision for exercise and the variety of vegetable and animal foods that they get when foraging on a good range. If carefully managed, small flocks so kept will usually show a better profit per hen and better returns for the area of ground that they occupy than flocks kept on range. Larger flocks under the same conditions do not, as a rule, give returns proportionate to those from the small flocks. Hence it was natural for the town poultry keeper, instead of adding to the original

FIG. 88. Typical breeding-stock house (intensive plan). The yards here are only 50 feet long, though available land is practically unlimited

flock when increasing his stock, to multiply his flocks, just as the Rhode Island farmer did, and thus to develop the intensive system.

Intensive systems. When the small flock in close quarters is made the unit, and the conditions duplicated indefinitely, an intensive system is developed. By such a system the apparent poultry capacity of any given area is very large. Four or five hundred hens to the acre the advocate of intensive methods did not consider crowding, and some systems were calculated for double those numbers. The difference between a system providing for four or five hundred hens to the acre and one providing for eight hundred or a thousand was principally in the allowance of yard room. The smaller numbers might be given yards large enough for a part of the yard to keep in grass under favorable conditions; the larger numbers were given small, bare yards. Houses were of the same style and the sections generally of the same dimensions, though to provide for large numbers the space requirements per bird might be figured on a smaller allowance and the estimated capacity of each section thus increased.

Seeing no occasion for separating houses, and a distinct advantage in joining them, intensive poultry keepers developed first houses several times as long as those used for a single flock, and finally houses ten, twenty, and even fifty times as long, making

FIG. 89. View of part of poultry plant at Pennsylvania State College, where both systems are in use

the common lengths from 100 to over 200 feet, and in extreme cases 500 and (approximately) 600 feet.

The intensive system has been in general use for about fifty or sixty years, but has never been long successful when the plant was larger than the owner could care for personally, and not often permanent when on such a scale that all of one man's time was required.[1] It is still widely used, though attempts to establish large plants of that type are less numerous than formerly. It is likely to be used for a long time, perhaps always, in many instances where it should be at least considerably modified, simply because of the common human tendency to undertake more than resources warrant.

[1] The writer has not known more than two or three poultrymen who have made a living on an intensive plant who would advise others to use the system on a large scale, or would continue to use it themselves if they could afford the cost and loss of making a change.

Comparison of extensive and intensive systems. The object of comparison of typical extensive and intensive methods and systems is to determine the values and applications of each. As indicated

FIG. 90. Colony houses placed end to the road, with yards running from road (Photograph from E. T. Brown, London, England)

in the statement of the present attitude of poultrymen toward the colony system, the best working system will in most cases combine extensive and intensive methods. These methods, while different

FIG. 91. A Massachusetts farmer's adaptation of idea shown in Fig. 90 Houses (with yards) on both sides of the road

in many points, are not mutually exclusive, but present the extremes, between which there may be as many grades of the two in combination as there are persons using them.

The advantages of the extensive or colony system are:

1. Conditions most favorable to poultry at all stages of growth.

2. Low cost of equipment; the house cost per bird may be lower for the same number of birds in houses of equal size. With good range the birds use the house less, when there is no snow on the ground, and a larger number of birds may be kept in colony houses than in the sections of the same floor area in a continuous sectional house with small yards.

3. Economy of labor (when snow does not lie long on the ground) and larger utilization of unskilled labor. Birds kept under natural conditions do not require the constant dieting and nursing

FIG. 92. Pittsfield Poultry Farm, Pittsfield, Maine, where intensive and extensive systems are combined, large yards for adult stock and young stock grown in orchards on the colony system

too often necessary on intensive plants, and many things to which the intensive poultry keeper must give his constant personal attention may safely be left to unskilled help. There is also less need of scrupulous cleanliness.

4. Economy of food; the birds pick a large part of their living.

5. Improvement of land, and sometimes double cropping of land, especially with young poultry.

6. Stability of value of equipment; when small, movable houses are used, they are salable at their full value at any time.

The disadvantages of the extensive or colony system are:

1. Added labor in bad weather, particularly when snow keeps the birds in the houses.

2. Unfavorable conditions for the birds when long confined to houses designed only for roosting and laying quarters.

3. Difficulty of controlling disease when the flocks mingle.

In a summary of advantages and disadvantages it appears that the colony system is a system best adapted to mild climates, where winters are short; and that for its extensive development a farm of considerable acreage is required.

The advantages of an intensive system are:

1. More favorable conditions for the fowls in winter weather or extremely rough weather at any season.

2. Comfort and convenience of poultry keeper in bad weather.

FIG. 93. The long houses are 200 feet long by 20 feet wide. The house at the extreme right has small compartments for special matings. (Continuing Fig. 92) (Photograph from Pittsfield Poultry Farm)

3. Admits of keeping a large stock of adult birds (and young ducks) on small areas.

The disadvantages of an intensive system are:

1. Unfavorable conditions for adult stock in warm weather and unsuitable conditions for the breeding birds and young stock.

2. Added cost of labor at all seasons when the birds should be on range.

3. Added cost of food at all seasons when the birds should be on range.

4. Increased cost of equipment, buildings costing, on the whole, considerably more than for colonized flocks, and the cost of fences being a comparatively large item.

5. Contamination of land and expense of keeping small permanent yards in good sanitary condition.

6. Instability of value of buildings; when an intensive plant is discontinued, the buildings on it can rarely be sold for more than a very small fraction of what they originally cost.[1]

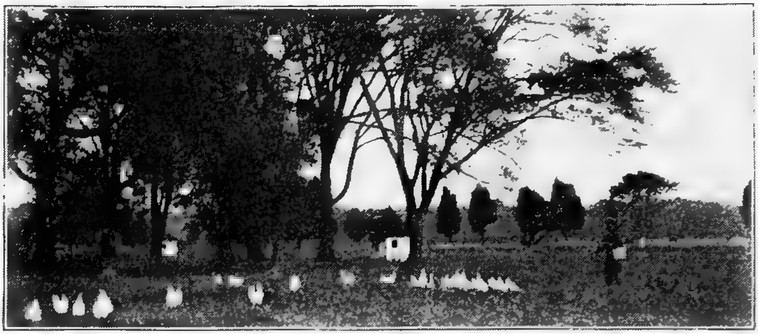

FIG. 94. The colony system in use at the Shellbanks Farm of the Hampton Institute, Hampton, Virginia

In a summary of advantages and disadvantages it appears that the intensive system is adapted to winter conditions and areas too restricted to admit of giving range to poultry, and that it is defective

FIG. 95. Another view of colony poultry farming at Shellbanks. (Photographs from Hampton Institute)

in that it is not suited to young and breeding stock. Continuous poultry culture by intensive methods is practically impossible. The land

[1] Usually they have been allowed to fall into decay. Near Boston some years ago three long houses, costing $3000 and used only a short time, sold at auction (to be removed) for less than $100.

becomes polluted by the excrement of the fowls and sometimes infected with disease germs, the stock deteriorates, and the poultryman cannot stand the stress and strain of working against natural laws.

Combining advantages of the two systems. While general practice on farms, as well as on town lots and on poultry plants, has tended too much toward intensive conditions, the marked and almost immediately apparent disadvantage of such conditions for breeding stock and growing stock forced a measure of departure from them, especially in the care of the growing stock to be used for laying and breeding purposes. It was usual, even when the intensive plant was at the height of its popularity, to give breeding

FIG. 96. Colony houses at one side of grain field at Iowa Agricultural College (Photograph from the college)

stock more room than the laying stock, either by colonizing or by reducing the number in the compartments allotted to them (thus giving more room in both house and yard), and to give range to the young stock,—although, too often, the range was so overstocked that the actual advantage of doing so was very slight. Sometimes, the birds being nominally on range, too much was assumed as to the advantages which they secured in being at liberty, and the variety of foods which, under suitable conditions, the range would have furnished was not provided. In the majority of cases the most serious obstacle to the adoption of extensive methods was the lack of land and the difficulty of securing adjoining or convenient land for the rearing of young stock.

Leaving out of consideration the cost of equipment and labor, if breeding stock is given grass yards of such size that the birds do not keep the grass down, and the young stock to be retained can be grown each year on fresh ground, without overcrowding their range, young birds which are to be marketed may be grown, and laying stock kept, under intensive conditions, without marked falling off in results, for a term of years the duration of which will be determined by the character of the soil and the attention given to maintaining sanitary conditions. Whether, when cost of equipment and labor are considered, it pays to adopt intensive methods for laying stock and market poultry is determined in each case by the circumstances in that case.

FIG. 97. Summer arrangement of colony houses at Macdonald College (Photograph from the college)

In the growing of soft roasters, one of the most profitable branches of poultry culture, the methods used are in some respects so intensive that when first published they were received by poultrymen generally with incredulity. But the soft-roaster growers in the South Shore district (with a very few exceptions) do not practice continuous poultry culture. As originally developed, the business [1] was exclusively the growing, under intensive conditions,

[1] This business, as developed in this district, is a fine example of an efficient extemporaneous and informal organization of producers. The farmers keep the breeding stock, selling eggs for hatching to the growers from about midsummer until about midwinter. The price paid was for many years fifty cents a dozen, but of late years sixty cents has been the standard price. A large grower usually requires the eggs of a number of farm flocks, and contracts for them in advance. As the eggs from the farms having the best reputation for furnishing fertile

of market poultry hatched from eggs purchased of farmers who kept their stock under extensive conditions. That is still the common practice, though a few growers keep their own breeding stock. Besides, the business is the growing of "winter chickens," and the stock is off the land during the summer and early fall, thus admitting of regular growing of crops that remove the fertilizer from the soil.

At Macdonald College, Quebec, the poultry department has adopted, with very satisfactory results, a plan of using colony houses in the summer and drawing them together in the winter (see illustrations). The houses are in fenced fields without division

FIG. 98. Winter arrangement of colony houses at Macdonald College (Photograph from the college)

fences, all houses in a field being occupied by fowls of the same variety. This gives the hens good range when they can be out on the ground, and brings the houses together for the season when, in that country, it would be impossible to manage poultry in widely separated colonies. This plan is more likely to be carried out as

eggs are most in demand, the newcomer among the growers usually experiences some difficulty in getting good eggs. Many of the growers, after getting out what chickens they need for their own business, use their incubators to hatch eggs for the farmers. Thus during the greater part of the year the eggs from the farm flocks are used for hatching purposes. The income of the growers all comes in during a few months in the spring and early summer. A grower whose credit is good is "carried" by his grain dealer, who perhaps is carried, in turn, by his bank, through the season when expenses are heavy and income nothing. The entire product of the district is marketed by a few men who buy chickens, as they become ready, from the grower, paying cash for the live birds, dressing them, and shipping to the Boston market.

projected in a region where winters are long and severe than where the shorter winters, sometimes with little snow, tempt the poultry keeper to leave the houses in the fields and thus save the labor of twice moving them.

Temporary range. A common practice of breeders who keep their breeding stock under intensive conditions is to put all hens in one large flock at the close of the breeding season, and from that time until winter give them range under conditions as nearly natural as possible. Often the land used for this purpose is rough, overgrown with weeds and brush, swampy, etc.,—of such character that it is not desirable to use it for permanent yards or for any purpose that necessitates much traveling over it. It is a matter of common observation that hens thus turned out to pasture not only store up vitality for the following breeding season but frequently lay well all through the summer and fall.

Weakest point in intensive systems. The common obstacle to the development of branches of poultry culture under intensive conditions supplied with stock from flocks kept under extensive conditions is the uncertainty of the source of supply. Many poultry keepers engaged in producing market eggs have tried to have their stock grown on farms, but usually with most unsatisfactory results.

CHAPTER VIII

YARDS AND FENCES

The subjects of this chapter, usually treated as supplementary to discussions of housing, are properly preliminary. The relations of poultry and the land that it occupies is a primary question in permanent poultry culture; the question of supplied shelter is secondary. Many kinds of poultry require no shelter other than that which nature provides in conditions favorable to their existence. All kinds of poultry thrive as well or better in the open during the greater part of the natural breeding and growing seasons. To a much greater extent than is generally appreciated, the advantage of human protection to these birds is in protection from natural enemies rather than in protection from the elements.

The methods and systems of poultry keeping applicable in any case depend (as shown in the preceding chapter) very much upon the amount of land available and the extent to which climatic conditions permit use of the land. While in order of construction fences follow houses, the first point to consider in planning is the amount of land available, or to be occupied, and how it may be used to best advantage. The type of house or other shelter to be used, as well as methods of management, will depend upon how the land is to be apportioned.

A yard for poultry is a necessary evil. The degree of the evil varies inversely with the size of the poultry yard. One man, who appears frequently as a poultry lecturer, is accustomed to say that the word "yard" should be banished from the vocabulary of poultrymen and that they should accustom themselves to consider poultry as creatures which need *pasture*. The idea is an excellent one to keep in mind, though a great deal of poultry must always be kept in small inclosures. To economize cost of fencing, most yards for poultry are made even smaller than the limits of space require. This is false economy, due usually to the fact that the poultry keeper does not understand that the height of fence necessary depends on the area of the yard, and does not know how to take advantage of the possibilities of the common wire poultry fencing. The desire to keep a number of varieties of the same kind of poultry also necessitates yards with fences so high and substantial that the different kinds cannot mingle, when if a single variety were kept on a farm, or in a community, it would not be so necessary to insure complete separation of flocks. A fence may serve to separate different flocks, or to keep poultry from places where they are not wanted, or to protect them. The amount and kind of fence used should depend on the needs of each case. Though commonly done, it is absurd to construct a fence to serve several purposes when there is occasion only for a fence that serves one, or where there is no need to fence at all.

Necessary height of fence. The height of fence required varies directly according to the kind of poultry kept, and inversely according to the area of the yard. It is not practicable to construct a fence high enough to keep turkeys and some of the lighter breeds of fowls in small, bare yards. The same birds at liberty might rarely attempt to cross a fence 3 or 4 feet high. Any of the medium-weight[1] and heavy-weight breeds of fowls may be confined by a fence of wire netting 3 feet high if the inclosure is large enough to enable them to gratify in a measure, if not fully, their natural propensity to forage. For ducks and geese at any age, and for small chickens, very low fences will answer. Adult ducks of the heavier breeds will rarely go over a fence 18 inches high. Young ducks and goslings may be kept in for some time in inclosures surrounded by boards 8, 10, or 12 inches wide, set on edge and kept in place with small stakes or pegs driven into the ground. Netting 12 inches wide will answer the same purpose, but when netting is used, 18-inch widths, which will serve until the birds are grown, are preferred. For fences to be moved often, it is advisable to use netting which, when new, is a little wider than

[1] It is stated on good authority that Leghorns may be kept in large yards with 3-foot netting if the stakes used are from 6 to 8 feet high and pointed at the top, offering them no inducement to fly over. The author has kept Silver Gray Dorkings that could easily fly over a 6-foot fence if so inclined, in yards fenced with 3-foot netting on low stakes and never had them break out. In Beverly, Massachusetts, at one time, a Mr. Fassett had a large flock of Leghorns on a vacant town lot some rods from his home, inclosed in part by an old stone wall and in part by a low wire fence, and the fowls gave no trouble by straying beyond bounds.

required, because, with the tendency to sag and the further gradual reduction of the width through repeated stretching, the width of a strip of netting, after being taken down and put up again several times, may be from 3 to 5 or 6 inches less than it was when new.

Turkeys, peafowls, guineas, and pheasants can be kept in confinement only by covering the yards. The pheasant is the only one of these birds which may be profitably grown in this way, and the profit in pheasants in close confinement is only obtained when they are of a quality that will bring high prices. For protection from foxes a fence should be not less than five feet high. Ostriches require as high and as strong a fence as cattle.

Area of yard. The use of low fences depends on the size of the flock, on the character of the soil and the kind and condition of the vegetation on it, and (to some extent) on the kind of fowls. As a rule, the lighter and more active breeds are most destructive. Occasionally individuals or flocks are found which differ from most of their kind in this respect. A permanent yard is kept in good condition with the minimum of labor and cost when in sod. On average soil, if grass is well established before fowls are allowed on it, in a yard allowing 100 square feet per bird, sod may be maintained in good condition over the greater part of the yard. It will be worn rather bare near the house, and the grass may not be kept down in the part of the yard farthest from the house. On poorer soil it may be necessary to allow 200 square feet or more per bird to maintain grass. A flock of from thirty to thirty-five hens would require from 5000 to 10,000 square feet of yard space. When temporary yards are used, they may be smaller, provided they are changed often enough to prevent the destruction of the grass. As long as the yard furnishes fairly good foraging, and there is nothing particularly attractive just beyond bounds, the poultry are not likely to go over the fences. They are much more likely to go under or through them if the wire is defective or does not follow the ground closely. When poultry are yarded on land occupied by a growing crop or by small fruits, they will rarely attempt to leave the yard. If the plot is overstocked with poultry, they are more likely to damage the crop than to go out of bounds. The poultry that is run in crops is usually young stock, and the number of any kind that may be kept in any given space varies with their age and size; no definite rule can be given.

Alternating yards. When poultry must be kept continuously on the same land, many poultrymen make such a division of the land available for yards that while the birds occupy a part (usually half) of the allotment for each flock, grass or some other crop is grown on the rest, taking up the impurities in the soil. When the yards are of good size, the advantage of this may be noticeable, but when the yards are small, the disadvantage of restricting the poultry to half the space is probably greater than the value of the green food grown on the land that they are not occupying. In this, as in many other shifts to overcome the disadvantages of too intensive conditions, the benefit is not always demonstrated in a short experience. In the long run results count against highly intensive methods, even when tempered by such practices as this. Another common practice in intensive poultry keeping is to have the yards connecting directly with the house compartments small, making no effort to keep vegetation in them, then have a large grass yard adjoining to which any flock may be admitted at will, and alternate the flocks on this for brief periods. One of the most common ways of arranging alternating yards with a continuous house is to have the yards both south and north of the house, using the former in winter and the latter in summer.

Fence material. *Wire.* The most common poultry fencing is the hexagonal- or octagonal-mesh woven-wire netting known everywhere as poultry netting. A number of brands of rectangular-mesh wire fencing for poultry have been put on the market. These have the advantage of "following the ground" without bulging, and it is easier to do a neat job of fencing with them, but the wires, being galvanized before weaving, rust quickly, and few poultrymen buy fencing of this kind a second time. The ordinary netting, galvanized after weaving, is cheaper and (so far) has proved more durable and altogether more satisfactory wherever a light fence will answer. For heavier fence for protection for poultry the other styles of wire fencing may be used, and though it has not been the practice to paint fences of this kind, it would undoubtedly pay to do so.[1] Even a well-galvanized fencing rusts very quickly sometimes,

[1] What is said here of the durability of rectangular-mesh wire fencing applies to brands that have been in use up to the time of writing (1911). The life of these varies; some begin to rust almost immediately; some are good for several years. Any fence of this style, with suitable-sized mesh, will be more generally satisfactory than the other when this fault of rusting is fully remedied.

when vines are allowed to run on it, the zinc coating often oxidizing much more rapidly where vines cling than along the ground where the grass binds it.

Posts. Any light wooden post will answer for poultry fences. When the fence is for poultry only, posts may be of small diameter, especially if of durable wood. Where many posts four or five inches in diameter are to be set, it is better to sharpen one end, square the other and trim to allow placing on it a heavy iron ring or cap (to prevent splitting and shattering), and drive the posts instead of digging post holes and setting. When posts for high fences are driven, the best way is to load the prepared posts onto a wagon, leaving room forward for a man to stand to drive them, start the holes with a crowbar, and let the man standing on the wagon drive them with a heavy maul, a man on the ground making the holes and holding the posts in place for the other to drive. Using a team and two men in this way, posts may be driven very rapidly and will be much firmer than if set. Old iron gas or water pipe cut into suitable lengths is sometimes used for poultry-fence posts, and is especially adapted to use in rocky land where wooden posts cannot be driven. The pipe post has the great advantage that it need not be driven straight but may go in the ground at any angle the stone permits, and when down deep enough the part above the ground is easily brought to the perpendicular by bending. Wire fencing is attached to such posts with wire. The fence is a very satisfactory one.

For all wire fences the posts may be about 12 feet apart, and when the ground at the point where a post should go contains stones or roots which make it difficult to dig post holes or impossible to drive posts, it makes no difference if that post is shifted a foot or even 2 feet in either direction; for, while it is not advisable to make the regular distance between posts more than 12 feet, an occasional increase or decrease of the distance makes no noticeable difference in either the looks or the strength of the fence. When a single board is used at the base, a post which comes in the middle of a board may be set out of regular position if there is any advantage in it. If, as is usual when boards are used, the base is carried up two feet, it is advisable to set the posts eight feet apart and break joints in putting on the boards, for with light posts even as low a tight board fence as this gets a strong pressure from the wind, and to make it durable the builder must make use of every device that will add to its strength without materially increasing the cost. In general, it is better not to use boards at all, but to make the lower part of a fence of fine meshed wire, using this on both sides of the posts if valuable males are to be kept in adjoining yards. The first cost of such a fence may be greater than when boards are used for the first two feet from the ground, but it gives better circulation of air in small or narrow yards, looks better, and is better adapted to construction on stony ground and for movable houses. For temporary yards, especially when low fences are used, the easiest way to prevent males fighting through the fence is to make parallel fences about a foot apart. In many cases the extra fence may be removed after a few days, when the birds have become familiar with each other and are less inclined to quarrel. When double fences are used on ostrich farms, the distance between the fences is three or four feet.

Openings in fences. Gates are the weak points in fences,—a constant cause of trouble to the poultry keeper whose work requires that flocks be kept separate. It is hard to make gates that will be quickly and easily opened and closed by a person carrying or wheeling a load, and that will at the same time be secure when closed. The best solution of the problem is to use gates as little as possible. The colony system does away with all gates for poultry, the gates or bars between fields being adapted only to larger stock. With low fences (up to three feet high) that a man of medium height can easily step over, gates may be provided or omitted according to the amount of use. If a gate is needed frequently, as for passage with a wheelbarrow or to drive stock from one yard to another, a gate on hinges should be provided. If an opening in the fence would be used only at rare intervals, a section of a permanent fence may be made movable. In a temporary fence of netting on stakes, openings are easily made at the end of a strip of the netting, the removal of a few staples admitting of opening the space between two stakes. The more intensive the plant, and the longer the houses, the more troublesome the gate problem appears. With high permanent fences, gates to give passage to all yards are necessary, even though used only at long intervals. If there is direct passage from each interior compartment of a poultry house to its corresponding yard, the outside gates need be used only in taking care of yards, removing and replacing litter, sand, etc., and with such infrequent use it is not necessary to make their opening and closing in any degree "automatic." None of the many (so-called) automatic hinges, springs, catches, bolts, etc. used on outside gates work well for both opening and closing and give security in strong winds and against dogs or other small animals that might try to force them. For this reason most poultry keepers whose stock is quite closely yarded, after a little experience with outside gates, abandon their use for regular passage in getting from flock to flock in the same building, and go through the house, where the use of spring hinges and weights to make doors self-closing and secure without fastening is practical.

Construction of gates should correspond to construction of fences, the gates being made as light as is consistent with strength. For fences up to four feet high small gates may be of either lath or wire netting on a light frame of furring. For higher fences heavier material should be used. For openings for the passage of a cart the frame must be stiff and well braced. The width of a single gate is usually adapted to passage with a wheelbarrow. The maximum requirement is three feet. For the ordinary-sized garden wheelbarrow two feet eight inches will answer, but there is no gain in cutting down the width, and it is an advantage to have gates so wide that a man with a wheelbarrow does not have to consider his knuckles.

Hinges for light gates, little used, may be as small as four inches, either a strap or a T-hinge being used. For gates much used, heavier hinges are preferable. A hinge too light for the use to which it is put not only gives out quickly but allows the gate to sag and rock. Hooks with staples or screw eyes make the most convenient and economical fastenings. They should be so adjusted that the gate is held snug when closed.

CHAPTER IX

COOPS AND BUILDINGS FOR POULTRY

Poultry architecture in general is conspicuous for endless, and often meaningless, variety in proportions and details. This variety extends to every form of structure for every purpose. From the fact that, provided a few simple rules are observed and other factors properly handled, equally good results may be secured in coops and houses differing in many details, such variety is inevitable. But variety is enormously increased because of the number of inexperienced builders who incorporate into the plans that they use untested ideas of their own. The features thus produced are sometimes objectionable, sometimes merely superfluous, rarely of any value, though some such features have at times been widely imitated because of their supposed relation to good results secured or claimed. In the treatment of the subject in this chapter, discussion of the various styles of structures required for different kinds of poultry, for different branches of the work, and for breeds at different stages of growth will be limited to the more representative styles illustrating the evolution

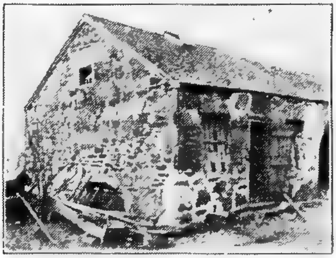

FIG. 99. Stone poultry house about 200 years old on the farm of F. W. C. Almy, Tiverton Four Corners, Rhode Island[1]

[1] This is the type of poultry house built by the early settlers in Rhode Island. The houses shown in this and the two following illustrations are supposed to have been built in the latter part of the seventeenth or early in the eighteenth century, and to have been used continuously for poultry ever since. As originally constructed, the ground floors were several feet below the outside ground level, but in both of these houses the floors have been filled in. Access to the loft in the Almy house is by inside stairway. The loft in the Borden house is entered direct from outside, as shown in Fig. 101. It is said that before the colony system came into use, nearly every farm in this district had one of these houses. A few remain in a good state of preservation, but most have fallen into decay.

of ideas of poultry housing, the principles now best established, and the range within which variations from approved plans may be made without disadvantage. This mode of treatment presents substantially every general design and significant feature that has at any time within the last seventy years been extensively used or seriously considered by experienced poultrymen.

FIG. 100. Old stone poultry house, well preserved and still used, on the Thomas H. Borden farm, Tiverton Four Corners, Rhode Island

Prime considerations in shelters for poultry. In building shelters for poultry there are three prime considerations: the comfort of the birds, the convenience of the caretaker, and the cost. These items are not always in accord. A building or coop that is comfortable for its small feathered occupants may be very inconvenient for the person who takes care of them, and structures planned with special reference to the convenience of the attendant do not, as a rule, furnish the most satisfactory conditions for the poultry kept in them. Neither the comfort of the birds nor the convenience of the attendant is necessarily proportionate to cost of construction. On the contrary, elaborate plans and expensive construction often mean more work for the poultryman and the least favorable conditions for the poultry. In planning a structure for any purpose the problem is to secure the best adjustment of these three things.

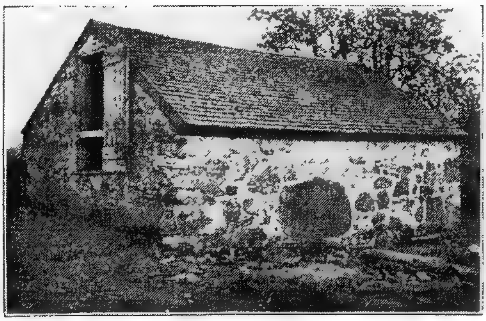

FIG. 101. Rear of Fig 100, showing door for entrance to loft and ventilation of lower room

Principal requirements in comfortable shelters for poultry. Poultry require *fresh air*, *sunlight*, *dryness*, and *room*. Of these by far the most important is fresh air. The essential condition of dryness depends much upon free circulation of fresh air. Air and sunlight are nature's best disinfectants and germicides, and if a coop or house is not overcrowded, and the birds are in normal, healthy condition, a properly aired and sunned structure requires much less attention to cleanliness than one that is deficient in these particulars.

Warmth is not a requisite in a house for birds which are well-feathered, healthy, and have no tender appendages, as large combs and wattles. For unfeathered young birds the quarters must be heated artificially, or so arranged that the heat thrown off by the birds, supplementing the heat of their bodies, will keep the temperature high enough to prevent chilling, while fresh air is still admitted in sufficient quantities. The latter requirement is the theory on which all so-called *warm* houses have been constructed. The point to be noted is that the unfeathered birds must have warmth, while the more mature stock does not require it. All these points will come out more clearly as the history of modern ideas in construction is briefly sketched in succeeding paragraphs.

Earliest form of shelter for poultry. An empty barrel (coop), still often used and recommended for a hen and brood, or for a nest for large birds (as the turkey and goose), was in all probability the first form of poultry shelter. Aside from the interesting fact that the adaptation of barrels to such uses gave us the name now used for a small shelter or inclosure, especially for poultry, the early and continued use of the barrel to shelter poultry has peculiar significance to the student of the subject because, though a makeshift with some features which would not be reproduced in a structure designed for poultry, the barrel placed on its side presents in a primitive way what are now recognized as the first principles in poultry-house construction: sufficient shelter, perfect ventilation, and height appropriate to the size of the creatures which are to inhabit it. The use of the barrel is necessarily limited to a few purposes and a small number of individuals.

Simplest form of shelter made for poultry. The familiar style of coop called the A-shaped coop, or tent coop, in which we have shelter provided at the minimum expense for materials and labor,

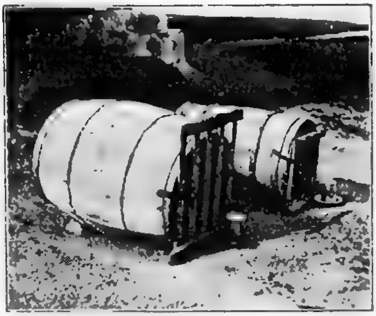

FIG. 102. Barrel coops in use in New England in 1911

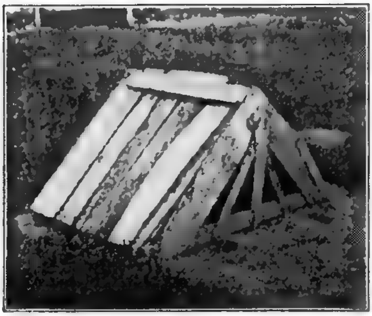

FIG. 103. Tent coop made of barrel staves

FIG. 104. Modification of tent coop, with open front. Hen tethered to coop by string attached to leg

FIG. 105. Like Fig. 104, with front partly closed. Tethering hens with broods was common a generation ago

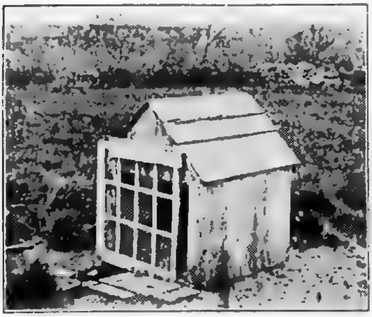

FIG. 106. Modern double-pitch roof coop on farm of F. W. C. Almy

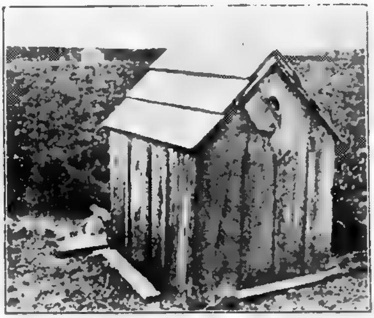

FIG. 107. Rear of coop in Fig. 106, showing small ventilator

EVOLUTION OF THE TENT COOP

FIG. 108. Old shoe box used as a chicken coop

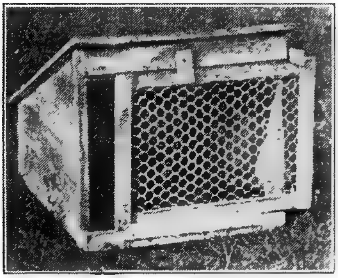

FIG. 109. Box coop with wire front, used without run

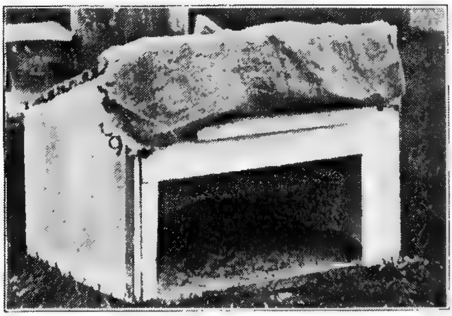

FIG. 110. Box coop used with run, as shown in Fig. 112

appears to have been first made of barrel staves. This style of coop has been made in all sizes, from the small coop, barely large enough for a hen to stand and turn in, to a building capable of accommodating a hundred fowls. Such large sizes are, however, unusual. The most common size of coop of this type for a flock of adult fowls is about 8 feet square on the ground and from 6 to 8 feet high, designed to accommodate from twelve to fifteen hens. This style of coop, in small sizes, was probably designed quite as early as the barrel was used, and has been used ever since. It is not known that at any time, down to within a few years, those making such coops gave any thought to the point of conformity to correct principles. The idea in building them seems always to have been to make the cheapest thing that would serve the purpose. Those who, within the past few generations, have tried to make the best possible coops and houses for poultry have generally kept away from this type, considering it not much of an advance over the makeshift barrel coop or the improvised shelter of poles and straw or corn-stalks sometimes used on farms. They overlooked

FIG. 111. Coops with A-shaped slatted runs. (Photograph from M. K. Boyer)

FIG. 112. Box coops like that in Fig. 110, with square-topped slatted runs

FIG. 113. Coop with large folding run for protection from cats. Sides of 1-inch, top of 2-inch mesh wire

FIG. 114. Showing wire run in Fig. 113 folded. Sides fold under top; ends, with parliament hinges, fold over it

FIG. 115. Brood of goslings in coop with stake and wire yard

FIG. 116. Ducklings in coop with wire yard. (Photograph from E. T. Brown)

COOPS WITH RUNS FOR YOUNG POULTRY

the fact that this type of coop, or house, if of sufficient depth from front to rear to keep the occupants protected from such storms as would beat in at the front (which was often open as in the barrel coop), provided the three essentials,— shelter, ventilation, and, in the common sizes, appropriate height.

Poultry housed under the same roof as their owner. In the British Isles the keeping of poultry in the dwelling house appears to have been quite common as recently as eighty years ago and possibly up to a much more recent date. In "The Poultry Yard: a Practical View of the Best Method of Selecting, Rearing, and Breeding the Various Species of Domestic Fowl," by Peter Boswell, of Greenlaw, the author, in describing primitive methods of keeping poultry, mentions three as specially suited to the cottager. What he calls the "simplest form" is a lean-to "at the gable end of the cottage, as near as possible to the opposite side of the kitchen fire, at which part, and for this purpose, the wall might be made thinner." As "the cottager's best" he recommends "a part of the space next the roof, so often unoccupied and useless," adding, "To accomplish the object, a part of it next the kitchen-fire gable end should be partitioned off, floored, and fitted up with baulks and laying places." When fowls were thus housed, they had access to their loft by means of a hen ladder from an opening through the outer wall to the ground. The third method, called "the cottager's own" but recommended only to those who could make no other provision for poultry, was to allow the fowls to roost in "the upper part of the space at the door" at night and run in the road by day.

The custom, among the poorest class, of keeping fowls in dwellings has a historical value, because it appears that the thriftiness and productiveness of many flocks so kept are largely responsible for the idea that, to lay in winter, fowls must be kept warm; this seems to have been made a fundamental principle in expert poultry-house construction long before the modern period, and until a few years ago was regarded as essential.

Tight houses. The theory that winter egg production depended upon high temperatures led naturally to the construction of tight houses. That having been assumed, it was necessary either to heat the houses artificially or to so construct them that they would

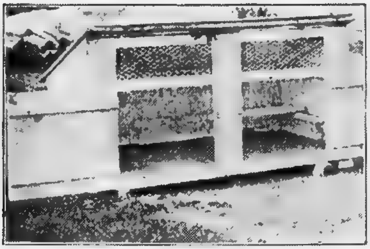

FIG. 117. Roosting coop for weaned chicks, used by Lester Tompkins, Concord, Massachusetts. Doors and ventilators open

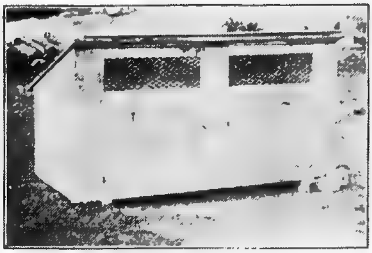

FIG. 118. Roosting coop for weaned chicks. Doors closed, ventilators open. Board shade thrown back on roof of coop

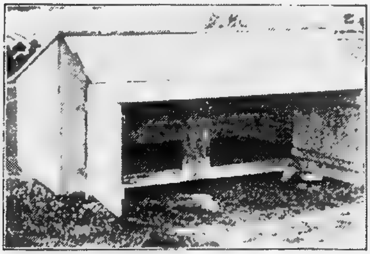

FIG. 119. Roosting coop for weaned chicks. Board shade resting on half-open doors

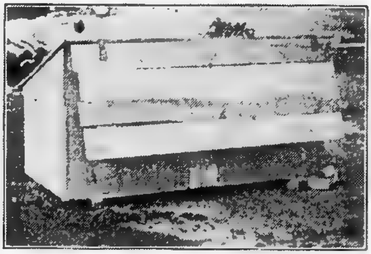

FIG. 120. Roosting coop with doors closed and shade down to close ventilators

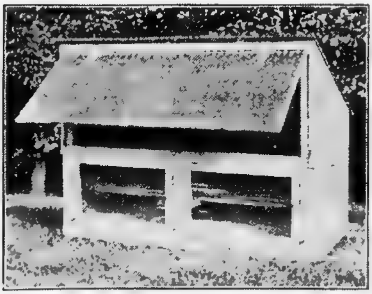

FIG. 121. Roosting coop used by C. H. Wyckoff and Son, Aurora, New York

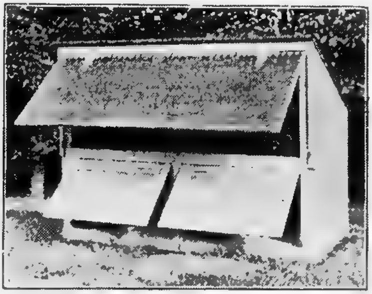

FIG. 122. Same as Fig. 121, panels in lower doors. (Photographs from Wyckoff and Son)

TWO NEAT, CONVENIENT ROOSTING COOPS

FIG. 123. Heated poultry house, in central New York

FIG. 124. Cold tight poultry house, in Massachusetts

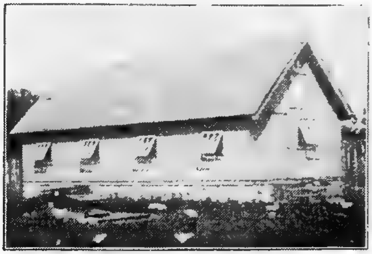

FIG. 125. Tight house with straw loft, in central New York

FIG. 126. House tight except front; has open joints between boards

FIG. 127. Section of scratching-shed house with a closed roosting room (Photograph from A. F. Hunter)

FIG. 128. Cold house; single boards with battens; doors closed only to keep out rain and snow

FROM THE HEATED HOUSE TO THE OPEN-FRONT COLD HOUSE exclude cold and retain the heat thrown off by the occupants. Artificial heating was often tried and usually discarded after a short trial as of no advantage, though in a trip through central New York some years ago the author found many poultry houses in which large stoves were used and considered an advantage. In general,

FIG. 129. Tight house with small windows; ventilation through doors

FIG. 130. Tight house with large windows always kept slightly open at the top for ventilation

it was thought better to build houses tight and warm. To accomplish this, various methods were used. The cheapest construction supposed to answer the purpose was made by covering the frame of the house with boards, and these with two thicknesses of building paper, the outer one weatherproof. For more effective protection from cold, it was common to use double boards with paper between and weatherproof paper over the outer boards. Sometimes the outside was shingled over a paper sheathing. Many houses were built with dead-air spaces throughout the walls, made by putting one layer of boards and one of paper on each side of the studding. Occasionally houses were lathed and plastered inside. The limit was probably reached by a poultryman in an eastern state who made his walls with three thicknesses of boards, three of paper, and two dead-air spaces. In harmony with such construction were the tight-fitting doors and windows used, both doors and windows often being double.

Ventilation in tight houses. Theoretically, ventilation was furnished either by ventilators alone or by ventilators supplemented, during fine weather or through the warmer hours of the day, by careful adjustment of doors and windows; but many houses were built without ventilators, on the theory that the building contained air enough to supply the fowls for several days, if doors and windows were closed as long as that. That the ventilators usually did not ventilate was shown by the fact that the houses, when closed, became damp and moisture condensed on the wall just as often when an approved method of ventilating through ventilators was used as when no ventilators were provided.

In the light of recent experiences with cold houses it seems probable that the failures of most of the old methods of ventilation were due to the small sizes of ventilators used. The ineffectiveness of these was often aggravated by obstructions in the ventilator designed to prevent a too rapid movement of air. In warm houses the problem of securing sufficient ventilation while retaining the heat is a serious one, especially when moisture collects on interior walls and the litter on the floors becomes damp and the air inside the house moist and foul. The most satisfactory solutions of the problem were the straw loft and the open-front scratching-shed house, the first designed to overcome by absorption the dampness in the closed house, the other providing abundance of fresh air in the daytime.

Beginning of the fresh-air movement. The scratching-shed house was a marked step in the direction of right principles of poultry-house construction, and toward the open, thoroughly ventilated house, which, it is now generally agreed, is, all things considered, the best type of poultry house. Houses of the open-front scratching-shed type have been used here and there since the middle of the last century, but it was not until after 1890, when the extension of interest in poultry was increasing the number of those who were having trouble in warm houses, that any general interest was manifested in them. Then for a few years they were exploited as a remedy for the difficulties in warm houses, and became very popular. The term "open-front scratching-shed house" was applied particularly to the plan used and exploited by one man, but the idea was applied, in variously modified forms, to many other styles of houses. As is usual, the merits were much exaggerated.

Experience with the open-front scratching-shed house showed that the fowls would remain in the open shed the greater part of the daytime, and that the capacity of the two compartments thus became only the capacity of the one compartment that the birds frequented. The open front of the scratching shed was intended to be open only during fine weather. At other times it was to be closed with curtains, which were at first of *oiled* cotton cloth on frames. This material was used and recommended as an economical substitute for glass sash. The difficulty, in many places, of getting oiled cloth led to a very general substitution of ordinary cheap cloth and burlap, both of which admitted considerable air through the meshes. Improved conditions as a result of better air thus supplied brought about a very general use of such materials in place of glass in a part or all of the windows of closed houses.

The idea that fowls must be kept warm was a fundamental principle in the management of fowls in scratching-shed houses and in the numerous adaptations of the plan made in houses of other types. The birds were to be kept warm by constant exercise in the litter in which their grain was fed on the floor of the scratching shed, or scratching room (as the case might be), while at night they kept warm in the close roosting room, or the reduced form of it called the roosting closet, or roost box, built with a hinged front or burlap curtain to retain the heat when the fowls were on the roost. It was commonly observed that fowls were likely to be more thrifty and free from disease in these houses when the keeper neglected to take precautions to keep them warm at night. Again, when curtains of cotton cloth and burlap exposed to the weather were rotted out, it was not uncommon to delay renewing them, and no bad effects seemed to follow. Such things, and numerous instances remembered or observed of flocks of fowls doing well through cold winters in mere shells of houses, gradually broke down in many minds the notion that fowls must have warm houses, until, in the early years of this century, progressive poultry keepers began to realize that many of the despised makeshifts and flimsy structures of more primitive times, and of shiftless poultry keepers of their own times, were essentially better than their best structures designed according to principles upon which they had been working.

Houses with open fronts. In these, as is to be expected, considerable variety is found, but in general a house of this type belongs to one of two classes: Either it is an *open* house of such proportions, and with roosts so placed, that, theoretically, the fowls, when roosting, are kept warm, because they are so far from the open front and the rate of movement of air in the house is so slow that a considerable part of the heat they diffuse benefits them; or it is a *cold* house, in which the heat thrown off by the birds can have no appreciable effect on the temperature about them. In houses of the first class the air entering the front is supposed to make no draft to which the fowls on the roosts would be exposed; in houses of the second class drafts are disregarded. Those who advocate and use the *warm* open-front house have apparently not fully abandoned the idea that the fowls must be kept in a temperature sensibly higher than that outside, and must be protected from direct currents of air entering the house from without. Those who advocate and use cold houses hold that, within a limit (practically the degree of frost that the combs of the male birds will withstand), fowls may be accustomed to low temperatures; that it is not the absolute degree of cold that injures them or stops egg production, but the variations of temperature; and that fowls accustomed to the lowest temperatures and free supplies of fresh air are least affected by these.

No best house. There are not marked regular variations of results in houses differing as to warmth or any other one feature. The fact that results equally good in every way have been obtained in many different types of houses under a great variety of

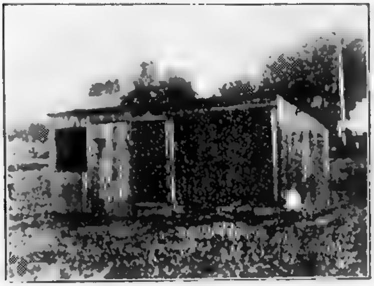

FIG. 131. Single-section scratching-shed house, used without yard

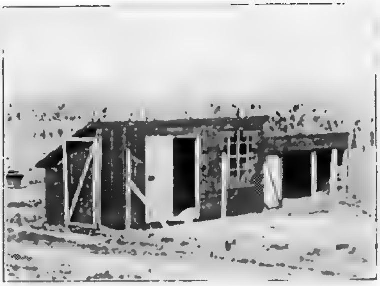

FIG. 132. Colony house with scratching shed attached

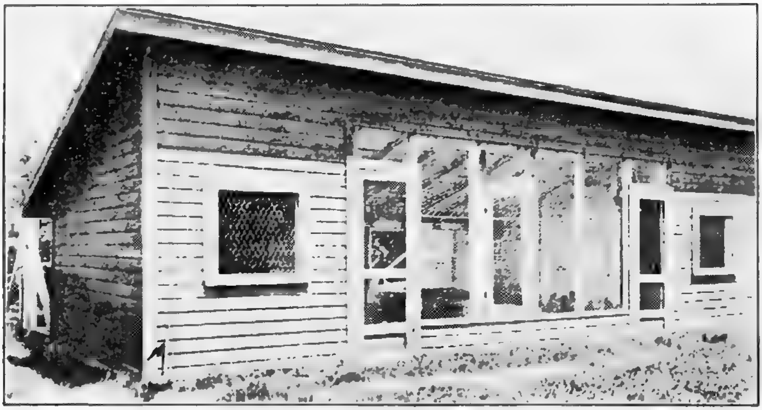

FIG. 133. Two sections of scratching-shed house at North Carolina Experiment Station. (Photograph from the station)

FIG. 134. Tillinghast house with scratching floor in front of roosts. (Photograph from Connecticut Agricultural College)

FIG. 135. Tolman and Woods houses at Colorado Agricultural College (Photograph from the college)

SCRATCHING-SHED AND SCRATCHING-ROOM HOUSES conditions shows that the important thing is not that a building for poultry shall be of a particular pattern, but that, whatever its pattern, conditions in it be regulated to meet the requirements of the birds for fresh air and dry quarters. This can be done in any type of house that is not radically wrong. But the warmer the birds are kept, — the higher the range of temperature to which they are accustomed, — the more necessary it is that the attendant give close attention to ventilating through doors and windows, and in practice it is too often found impossible to attend to this at the proper times. The cold open house may be so constructed as to require no manipulation whatever for ventilation and no attention to doors and windows except for the exclusion of rain and snow. Between these extremes are intermediate types requiring much or little regulation according to construction and arrangement. Each has its place. Whoever keeps a delicate breed, or one having a tender feature, in a cold locality must use warm houses and give as much attention as necessary to proper regulation of conditions in them. Whether it is more profitable to do this than to keep a hardier breed in a cheaper building, with less labor, is a point that each must determine for himself.

Floor dimensions. In a structure for poultry the floor area is determined on the basis of the number of birds to be kept in it and the proportion of time that they are to be confined to it. The space per bird required varies inversely with the number of birds in the flock, small flocks requiring much more space per bird than large flocks, because the bird is not like a plant or a tree, or like horses and cattle in barns, located in one place and constantly occupying it, but each bird in the flock has the use of the entire floor, less only the space actually occupied by its mates. A flock of ten or twelve hens can be comfortably housed in a building 8 feet square (which allows 5 or 6 square feet of floor space per fowl), if they can get outside for a good part of the time. If confined almost constantly to the house, the same flock should have about 50 per cent more floor space. With increasing size of flocks the "per hen" space may be reduced gradually until from seventy-five to a hundred hens have about 4 square feet each. Very small flocks need relatively large "per hen" areas. A single bird needs almost as much room as ten or twelve.

FIG. 136. Two-pen house built by two men in less than half a day. This suits fowls as well as any kind of house

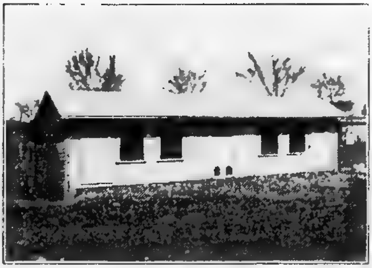

FIG. 137. Four-pen breeding house at Wisconsin Agricultural College. (Photograph from the college)

FIG. 138. Two-pen open-front house with front openings shortened to keep out rain and snow, giving same result as projecting roof in Fig. 137. (Photograph from C. M. Newton)

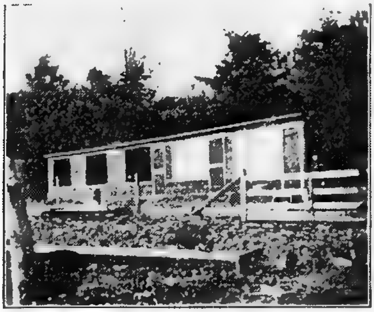

FIG. 139. Cotton-front house in Minnesota. (Photograph from D. J. Lane)

FIG. 140. Cotton-front house in Minnesota. (Photograph from D. J. Lane)

OPEN-FRONT AND COTTON-FRONT HOUSES

Height of poultry structures. In small structures which the attendant does not have to enter, or enters infrequently, the height of the building is usually adapted to the poultry; in larger structures it is adapted to the attendant. The lower houses furnish the best conditions for the birds, but, though that point has not been carefully investigated, it does not appear that the conditions in a house three or four feet high are so materially better than in a house high enough for a man to stand and work in (about six feet) as to make it advisable to reduce the height when that would mean a reduction of floor space and of the size of flocks.

Depth of poultry structures. The depth of poultry structures should be proportionate to their height. In order that an interior may be properly sunned and ventilated, the depth, or distance from the front to the rear wall, must bear such proportion to the height of the front wall that sunlight will penetrate well back. As the elevation of the sun varies with the seasons, it is manifestly impossible to make a structure of fixed height and width in which the desired condition will be obtained at all seasons, but if the height of the front be about half the width of the building, the average conditions will be as nearly right in this respect as they can be made. Since it has already been determined that the height of the larger shelter for poultry should be near the minimum height of a building in which a man can work expeditiously, it follows that the fixing of such a standard of height, and of the relation of height to width, limits the width to about twelve or fourteen feet.

In a single house, or in a two-pen house which may be lighted and ventilated with windows or doors on the sides in addition to those in the front (south), the depth may be as much greater as desired, the side openings carrying light and air back. This arrangement is not adapted to the continuous-house plan with more than two pens, because the side openings affect only the end compartments. It is not nearly so much used as the plan with all openings in the front. Its advantage is most obvious when it is desired to make for a larger flock a compartment that will be well lighted and ventilated without increasing the height or making the length so great that the faults of long, narrow houses will be introduced. Even with the use of side openings the depth is rarely increased more than 50 per cent over what it would be by the rule given.

Standard-size poultry-house unit. Taking 6 feet as the most convenient standard for a full-height poultry house, and 12 feet as the most appropriate depth for a house of that height, we have two of the dimensions for a standard unit of size of poultry house. The advantages of a square floor over others (to be explained shortly) make it fitting to have the third dimension the same as the second (12 feet). This makes the standard-size single house or compartment 6 ft. × 12 ft. × 12 ft. This is a medium in form and dimensions for single houses, and nearly all the common plans of houses may be treated as modifications of it; on the whole, the most convenient unit for a continuous or compartment house. Diagrams of a single standard-size poultry house will be found on page 121.

The use of such a standard or basic unit in the study of poultry-house plans should not be misunderstood. It may be, and often is, desirable to vary these dimensions, but such a house has capacity at all seasons, in all climates, for as large a flock of average adult fowls as the average poultry keeper handles to advantage, is convenient for a person of any height, may be fully sunned and aired by means of openings in the front, and is adapted to single-compartment construction or to any number of compartments; while the measurements are such that, in nearly all dimensions of lumber required in construction, 12-foot lengths cut to advantage. A house of these dimensions is no better than one differing somewhat from them, but these measurements are most suitable for a standard, for a basis of a comparison of features in poultry houses, and for a base from which to work in designing poultry houses. Variations from them should be made for a definite purpose. If they accomplish that purpose without introducing something objectionable, they give a better style of building for the purpose. If a change introduces objectionable features as well as advantages, these must be considered and the right adjustment found. These points will be illustrated in the descriptions and discussions of various features of poultry houses in following paragraphs.

Length of poultry structures. The length (front) of a single poultry house (or section) should approximately equal its depth or width. The greatest economy of space and construction is attained in a square building. There are, however, some advantages in making the length a little greater than the width. The floor space (and so the capacity of the house) may be increased without changing height and width or materially affecting any interior condition. If the outside runs must correspond with the width of the house, the width and area of the run are very materially increased. An increase of 25 per cent in area over the standard may be made in this way, but it is not advisable to attempt to add still more room in one house and run by this means. Houses have been built, of standard width and height, with length up to or over one hundred feet and used for one large flock. At one time, also, the continuous long house, divided into many compartments by partitions of wire netting or slats, was a favorite. Many houses of that type may still be found. But in common experience it is found advisable to limit the length of the house, or of a compartment, to very nearly its width. One reason for this is that the flock in an almost square room is less disturbed by the attendant moving about; the birds have more room to pass him. In a long house the birds, if at all shy, will rush to the end of the house, and if the flock is large, the disturbance and crowding may be serious. In all very long houses that the writer has seen in use, the flock, though large for a single flock, has been only about half the total number that could be carried in the same space in compartments of standard size.

The objection to the long house with many compartments and open partitions between is that the air draws through a long, narrow, low house as through a huge flue, making the house very uncomfortable. It is found in practice that it is not advisable to build a house of this type without making every third or fourth partition solid, and most poultrymen using houses of this kind prefer to make every other partition solid. In a house of the dimensions recommended, it does not appear that there is any advantage in making every partition between pens tight; but in long houses of greater height and width the draft may be so great as to make it advisable to do this.

Thus it is evident that, to make the best house conditions for the poultry, the quarters for each flock, or family, whether detached from the quarters of other flocks or adjoining them, must be complete. Then the long house of many compartments appears not as a single house but as a series of standard houses so placed that the sides and roofs are continuous, and that one end of each house, after the first, may be dispensed with.

The significance of the distinction is that when the continuous house is considered and constructed as a series of standard-size houses, the conditions desirable in a poultry house are obtained in the same way in every part of the series, but that when the series is regarded as the unit, almost invariably a construction seems admissible which gives different conditions in different divisions, and very unsatisfactory conditions in most of them.

Styles of roof. The equal-slope double-pitch roof and the shed roof are the styles of roof most used for poultry houses. In single, very nearly

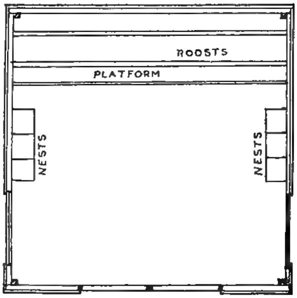

FIG. 141. Ground plan

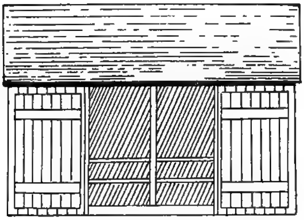

FIG. 142. Front elevation

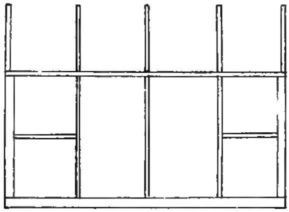

FIG. 143. Front frame

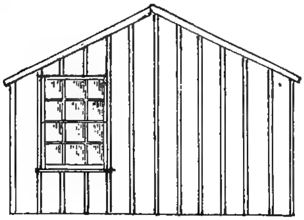

FIG. 144. East (end) elevation, battened

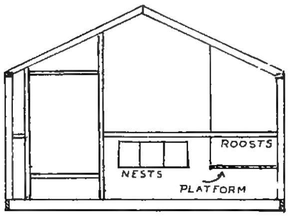

FIG. 145. End frame and cross section

DIAGRAMS OF STANDARD-SIZE POULTRY-HOUSE UNIT

(Scale, $\frac{1}{8}$-inch to the foot)

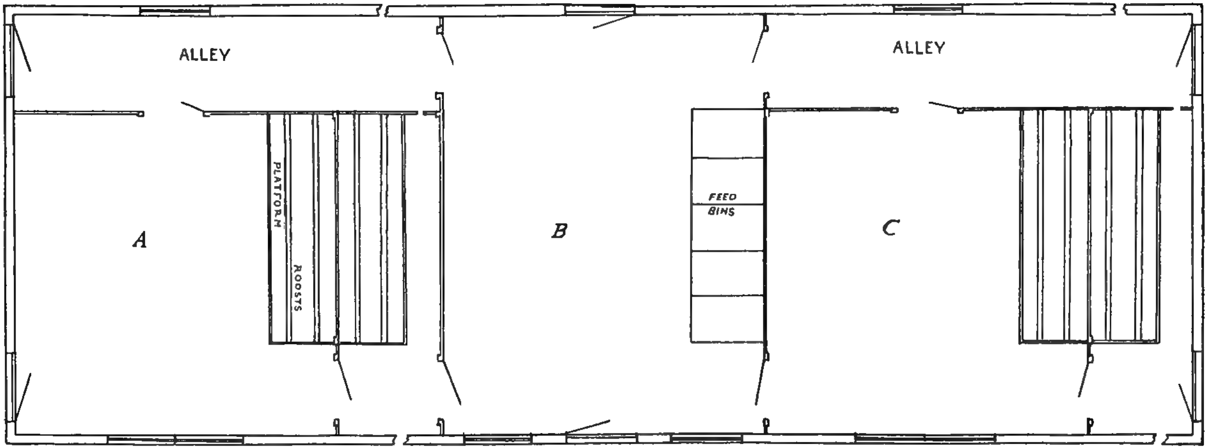

FIG. 146. Ground plan of long poultry house, breaks in outside lines indicating omitted sections. *A*, west-end pen; *B*, central store and feed room; *C*, feed pen east of center

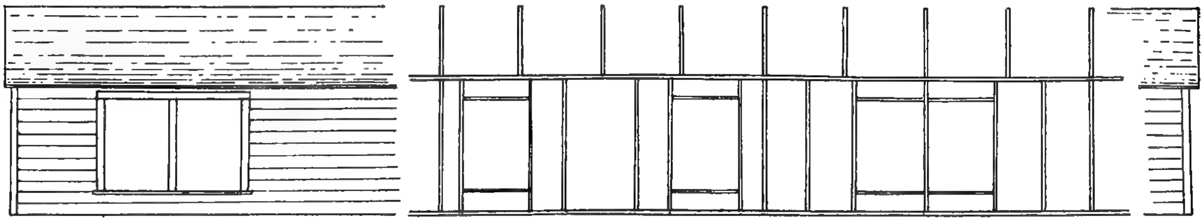

FIG. 147. Front elevation and frame of Fig. 146. Elevation of *A*; frame of *B* and *C*

square, structures the sides of a double-pitch roof may face either north and south or east and west. In houses with two or more compartments a double-pitch roof must, as a rule, face north and south; in single-compartment houses the tent-roof type of construction may be used (or approached), with sides very low and the slopes of the roof facing east and west. Shed or single-pitch roofs on single-compartment houses may pitch in any direction desired; on houses with two or more compartments they must, as a rule, pitch either north or south, — and preferably south, because that gives the greatest amount of sun in the house with the most economical construction. Besides these simple styles of roof several others are occasionally used.

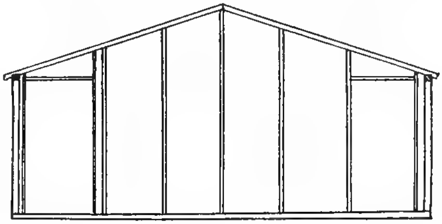

FIG. 148. End frame of long house in Figs. 146 and 147

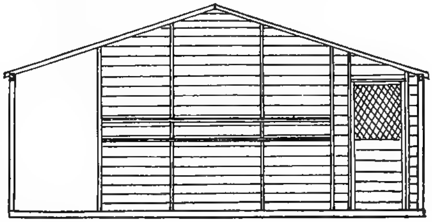

FIG. 149. Partition (next to roosts) between pens in house in Figs. 146 and 147

Double-pitch roofs with unequal sides are sometimes made to adapt the roof to other features of construction. Thus in some brooder houses with sunken walks in the rear, the roof has a long pitch to the south, over the pens, and a short pitch to the north, over the walk. In some of the open-front plans of houses, too, the front slope of the roof is longer than the other, and sometimes at a different angle. In what is known as the semimonitor-top style of construction the part of the house under the front slope is several feet lower than that under the rear slope of the roof, to allow placing windows in the

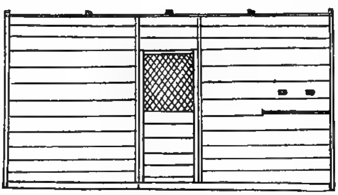

FIG. 150. Partition between pen and alley in house in Figs. 146 and 147

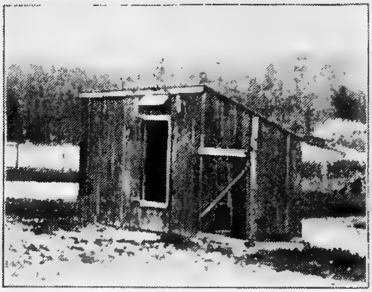

FIG. 151. Shed roof sloping to rear
Best style of this roof

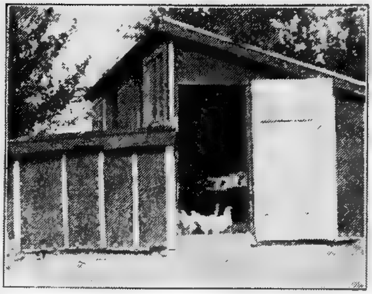

FIG. 152. Semimonitor-top roof
(Photograph from H. P. Nottage)

FIG. 153. Brooder house with double-pitch roof. Long slope to front, short slope to rear. (Photograph from Fisher's Island Farm)

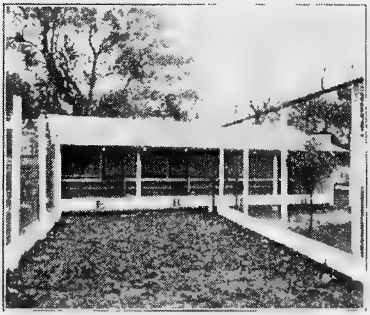

FIG. 154. Open-front house with shed roof sloping to front

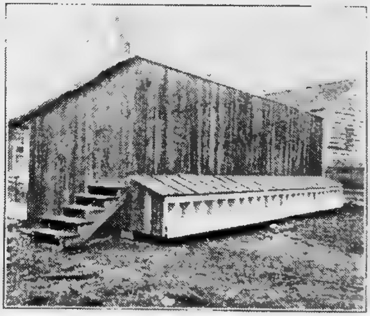

FIG. 155. Rear of Fig. 154. (Photograph from L. A. Doize, New Orleans)

STYLES OF POULTRY-HOUSE ROOFS

perpendicular space above the lower roof, for the better lighting and ventilation of the rear part of the house. Occasion for introducing such features usually indicates fault in the general design of the structure.

Walls. Walls of structures for poultry should always be perpendicular. This applies to every form and size of house or coop designed for poultry. Whatever may be tolerated in a converted coop or building, the walls of one designed for poultry should be perpendicular. When one function of the glass window was to warm the interior of a closed building by the sun, houses were built with sloping front walls, in order that the windows might be placed at the angle that would make them most effective for that purpose. This form of construction was unsatisfactory, even when it had supposed advantages.

Floors. Within the same walls and under the same roof, floors should be on the same level. They are always made so in small buildings, but when long houses are placed on ground which slopes with the length of the house, builders sometimes make a building with roof following the slope

FIG. 156. Breeding stock and feed house at Colorado Agricultural College. (Photograph from the college)

FIG. 157. Raised walk in front of house in Fig. 156. (Photograph from Colorado Agricultural College)

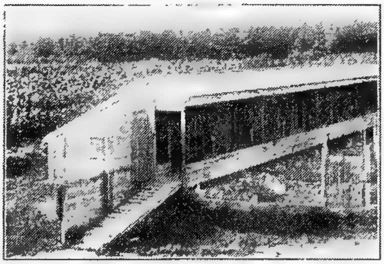

FIG. 158. House with covered raised walk in front

of the land. This may not be a serious fault if there are tight cross partitions at short distances,[1] but if the length of the space between close division walls is greater than about thirty feet, there is likely to be a quite marked difference in temperature between the higher and lower ends, and drafty conditions on that account. The exterior of such a building is unsightly. When the ground is so uneven, the best way is to make a series of sections on different levels, each higher section one or two steps above the next lower one, the length of the sections to be determined by the grade.

Eccentric features in poultry houses and coops are to be avoided. As a rule, the plainest, simplest style of structure that will answer the purpose gives best general satisfaction. Exterior features designed to give special adjustments of a coop or house to a variety of conditions are often objectionable because of the attention that they require. Elaborate interior arrangements designed to save labor rarely accomplish that object. Extra features, outside or inside, add greatly to the original outlay for equipment, and to the amount of investment on which interest, taxes, etc. must be earned before actual revenue is obtained. With capital limited, as it usually is, it is much better policy to cut out all unnecessary features and to save as much as possible for stock and for working capital. One of the most common mistakes in poultry keeping is that of putting so much of the available capital into buildings that the poultryman is hampered for a long time for money for other expenses.

Materials used for poultry structures. *Wood* is more extensively used than all other materials combined. Nearly all movable buildings and coops are made of wood, and it is the principal material in most of the larger structures. When it is desired to make the cost of construction as low as possible, and a tight construction is necessary, the cheapest of lumber is used, and the inside of the building covered with a substantial roofing paper. If it is not necessary to have tight walls and roof, a grade of boards as much better as the builder desires may be used. With common boards this gives the cheapest construction. *Shingles* were formerly used

[1] I have seen long nursery brooder houses for ducklings with floor following the slope of the land, that seemed to work well without partitions, but these were artificially heated, and the partitions between pens were much higher than the height of the ducklings.

very extensively to cover sides as well as roofs of poultry buildings, but as they have steadily risen in price and gone down in quality, while the quality of roofing paper has greatly improved, shingles are now little used, except when conformity to surrounding buildings requires it.

The extensive use of wood for buildings for poultry comes about because it is usually the cheapest available material, and because it is material in which almost every poultry keeper who wishes to build his own buildings can work. Any material used for other buildings may be used: iron, stone, brick, clay, cement, are all used occasionally for poultry houses. As a rule these are more economical than wood only when they can be had very cheap or the poultryman is expert in working in them.

Glass is used only as necessary to give light when doors and curtains are closed. For many years it was the practice to use as much glass as possible, in order to heat the house through the windows when the sun shone. With the introduction of fresh-air types of houses the area of glass used has been reduced, and sometimes glass has been discarded for cotton cloth or burlap.

Cotton cloth is extensively used in both door and window openings. Its use depends primarily on its porosity: it admits air. With a sufficient area of cloth to give what light is required on dull days with all openings closed, no glass is needed. The relative amounts of glass and cloth to be used must be determined according to the design of the house and local conditions.

Floor materials. Wherever the soil is of suitable character (sand or loam, or a mixture of the two), and drainage such that it can be kept in good condition, an earth floor is the best for all poultry buildings. Where drainage is defective or the soil contains much clay, movable structures should have floors of wood, and permanent structures floors of wood or cement.

Quality of construction. The question of durability is of less importance in the construction of poultry coops and buildings than in most other lines of construction. Movable structures of any size must be strong enough to stand the handling and moving to which they are subjected. Permanent buildings, being nearly all low, one-story buildings, may be of very light construction, as will be shown in illustrations. All that is necessary is that there shall be frame enough to hold the shell firmly, that it be securely nailed, and that the sills shall be either so placed or protected that they will not rot, or put in so that when decayed they may be easily replaced. Some of the most practical poultrymen put sills right on the earth and replace them when necessary, finding it cheaper in the long run to do this in buildings of light construction than to use heavy sills and protect them to prevent the decay of the wood.

FIG. 159. Incubator house at Ontario Agricultural College. (Photograph from the college)

Durability has to be considered most in connection with materials which are shorter-lived than wood, and with parts that receive wear. When roofing paper is used for covering, it is economical to use paper of good quality that with proper care may be expected to last from fifteen to twenty years. Cloth is now often preferred to glass for openings, because it is cheaper and admits some air; but cloth or like porous material is so short-lived, when exposed to the weather, that in the long run it may be cheaper to use glass and leave windows partly open, as we do in our dwellings. If cement floors are used they should be substantially built; a common mistake is to make them too thin and with an insufficient foundation. Such floors crack and settle and become uneven and very unsatisfactory, and the faults cannot be remedied except by taking off the old cement and remaking the floor.

FIG. 160. Rear of long poultry house at the Ontario Agricultural College. Gables and ventilators break the long straight lines. (Photograph from the college)

Warmth is not given such consideration as formerly in the construction of houses for adult and weaned birds, but in building incubator and brooder houses, or other special buildings which are to be heated, it is necessary to use double walls. For open-front or fresh-air houses all that is necessary is to make the roof, back, and ends wind- and rain-proof. The front need not be of tight construction; indeed, it has not been shown that, for birds not easily affected by frost, there is any advantage in making the house with perfectly tight roof, back, and ends. On the whole, the present tendency is to make all kinds and sizes of structures for poultry of the lightest construction that will serve.

Preservation of structures. When undressed lumber is used without covering, no paint or wash is required, nor is it necessary to put dressing or preservative of any kind on shingles. The wood will last long enough without paint to make the unpainted building cheaper in the long run, for such rough buildings cost more to paint than others. When dressed lumber is used for exteriors, it is advisable to paint it with oil and lead or mineral paints. There is no advantage in using dressed lumber unless it is painted. Sash should be kept well painted. Roofing papers last very much longer if coated with paint or tar about once in two or three years. The manufacturer's instructions as to the kind of coating to use should be followed, for some roofings require special dressings. No treatment for preservation is necessary on ordinary rough interiors, or on smooth surfaces of lumber used for frame or sides, but if any doors or frames have closely fitted, glued joints, it is better to keep them painted. Whitewash has been extensively used in poultry houses, but as a cleanser, disinfectant, and insecticide rather than for preservative properties. Many poultrymen will not whitewash interiors of houses, claiming that, as the whitewash accumulates on the walls, it holds moisture in damp weather to an objectionable extent.

Structures for different kinds of poultry. Poultry coops and houses are all designed on the same general principles and vary little in appearance or arrangement. The same coop will answer for small chicks, ducks, turkeys, or geese, but a brood of any of the others will so quickly outgrow a coop that would serve for chicks until weaned that it is advisable to provide larger coops or shelters for them from the outset. The same construction of individual brooder or brooder house will answer for young chickens and young ducks, except that for young chickens the partitions must be higher. After they are feathered, no young birds need shelter during the summer and fall except for protection from enemies. Ducks and geese will remain outside at night by choice even in severe winter weather, except when it is snowing or raining heavily. Duck growers hatching early ducklings usually confine the ducks indoors at night in winter and until all have laid in the morning.[1] This is done to prevent eggs being chilled and also because it is believed[2] that egg production is better than when the ducks are allowed to follow their natural inclination and remain much out on snow and ice.

Turkeys prefer to roost in the open the year round, either in trees or in sheltered places, as beside a barn where they are not fully exposed to winds from cold quarters. The roosting habit of peafowl is the same as that of turkeys. Guineas also remain out unless very severe weather drives them to cover, when they take refuge with hens or in any convenient place.

Pheasants prefer to roost in low trees or shrubbery, but even the wild birds will come to farm poultry houses when storms are very severe and shut off their food supplies. When coops or buildings are required to confine any of these, such a building as is used for fowls will answer.

NOTE. The photographs and diagrams on the preceding pages of this chapter were selected with reference to the accompanying text. Those which follow, supplementing them, show more fully the applications of principles, the details of construction, and the adaptability of the simplest designs and most desirable features to varied climates.

[1] As a rule, waterfowl lay their eggs about daybreak, not more than a few hours earlier or later.

[2] The author's personal experience in duck growing is not sufficient to enable him to say positively that allowing ducks to get their feet cold is not necessarily detrimental to laying. A great many poultry keepers consider that allowing hens to run on snow and eat snow hinders egg production, though in the case of hens the view is plainly a fallacy, as any one may discover who will allow hens comfortably housed in fresh-air houses with littered floors to follow their inclination about going on snow and ice and walking about in icy water. It will be found that even the feather-legged breeds with heavy foot feathering suffer no discomfort when they can go at will from snow or a sloppy yard to a floor of dry litter which quickly dries their feet. On a bare or damp floor the feathers and feet would dry slowly. On a bare earth floor they would become very dirty before drying. In either case the effects would be bad. Ducks and geese sitting (rather lying) out on snow or ice do not keep their feet on the ground but raise them and work them into the feathers at the side of the body, where they are well protected.

Fig. 161. Primitive coop. No window; small door. Used on a Rhode Island farm

Fig. 162. Primitive coop. No window; large door. (Photograph by H. de Courcy, Ireland)

Fig. 163. Neat coop used on a Rhode Island farm. Hen confined

Fig. 164. Coop like that in Fig. 163, with wire screen over part of window

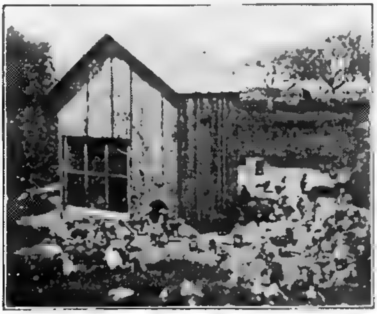

Fig. 165. Another common type of coop in Rhode Island

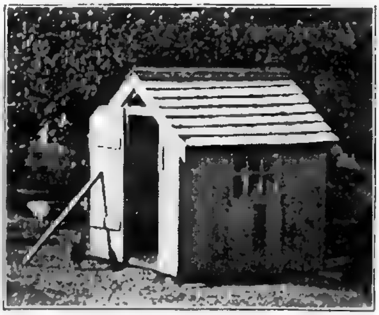

Fig. 166. Good coop or small house used on a Maine farm

ANCIENT AND MODERN POULTRY COOPS

FIG. 167. Two-compartment coop for one indoor brooder. (Photograph from J. C. Pattison)

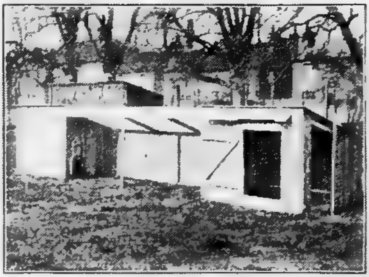

FIG. 168. Coops placed in pairs with cloth shade between. (Photograph from E. T. Brown)

FIG. 169. Small colony houses at Connecticut Agricultural College. (Photograph from the college)

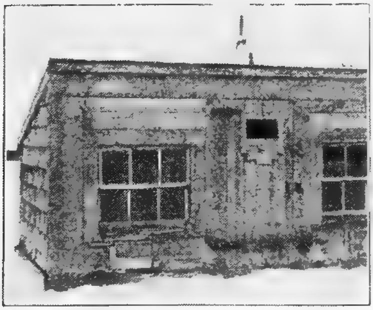

FIG. 170. Two-compartment house for two indoor brooders at the Maine Experiment Station

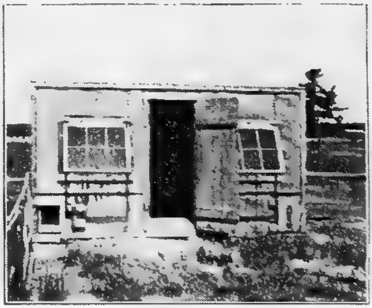

FIG. 171. Same style as Fig. 170. Different construction. (Photographs from the station)

COOPS FOR INDOOR BROODERS AND GROWING CHICKS

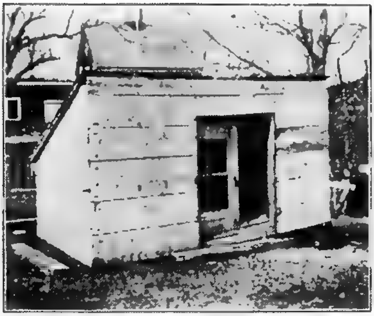

FIG. 172. Coop with window in door

FIG. 173. Coop with chick door

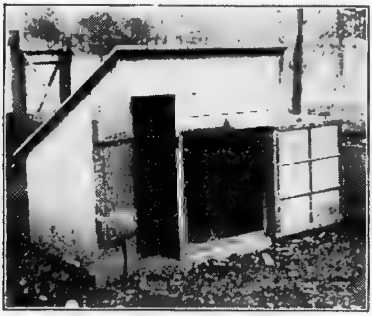

FIG. 174. Convertible front; either open or closed

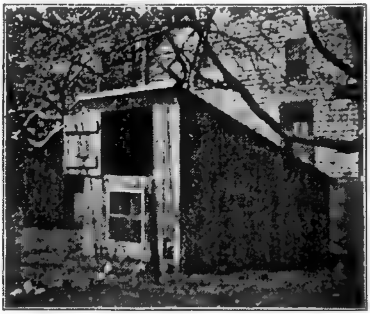

FIG. 175. With Dutch doors. (Photograph from J. C. Pattison)

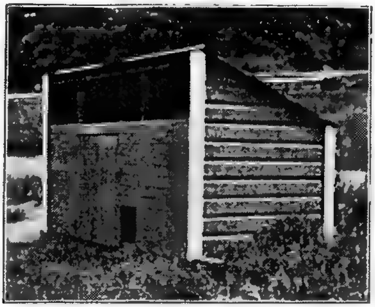

FIG. 176. Upper part of front open (Photograph from Department of Agriculture, Victoria, British Columbia)

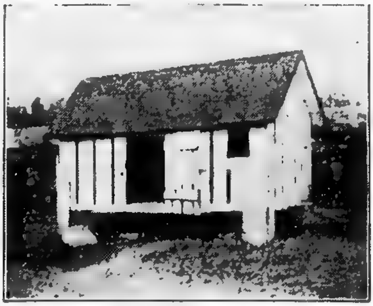

FIG. 177. Wide spaces between boards on front and one side. (Photograph from Rhode Island Agricultural College)

COOPS FOR INDOOR BROODERS AND GROWING CHICKS

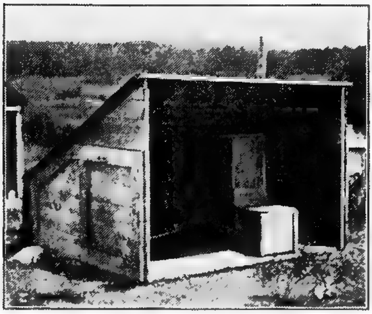

FIG. 178. Piano-box house used by P. R. Park for small pen of breeding stock in summer

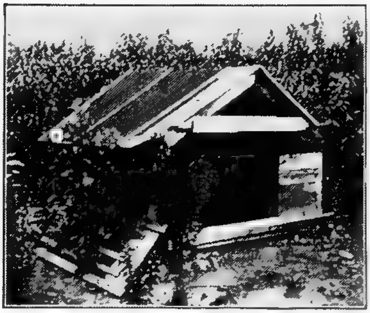

FIG. 179. House mostly of piano-box boards; made in an emergency; always satisfactory

FIG. 180. Open-front house at North Carolina Agricultural College. (Photograph from the college)

FIG. 181. Open front with hood. (Photograph from Department of Agriculture, Victoria, British Columbia)

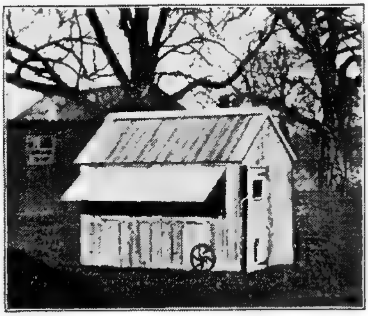

FIG. 182. English portable colony house on wheels

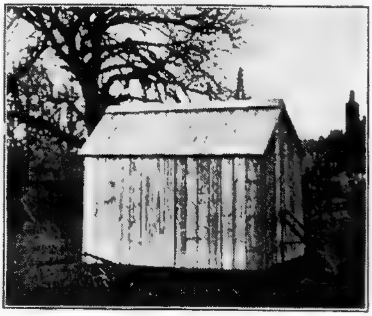

FIG. 183. Rear of Fig. 182. (Photographs from E. T. Brown)

SMALL HOUSES: STATIONARY AND PORTABLE

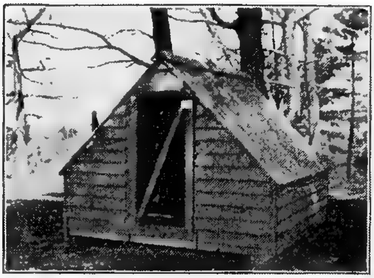

FIG. 184. Cornell house with open joints between clapboards made by placing wedges between boards and studs

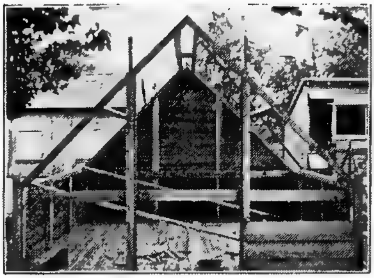

FIG. 185. Same as Fig. 184, half finished. (Photographs from New York State Agricultural College at Cornell University)

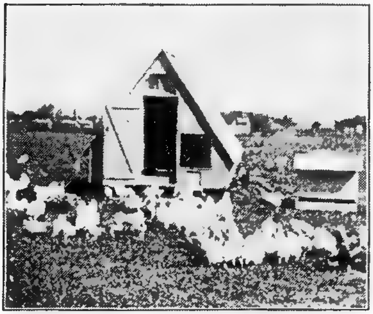

FIG. 186. Portable house at Macdonald College. (Photograph from the college)

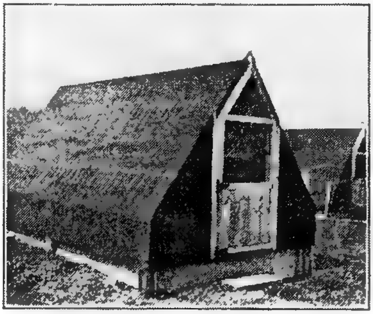

FIG. 187. Colony house used by J. H. Curtiss, West Norwell, Massachusetts

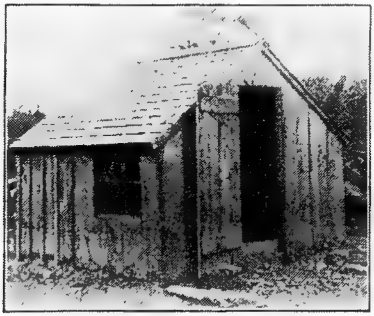

FIG. 188. Small house used by author. Battened only on back and rear half of sides

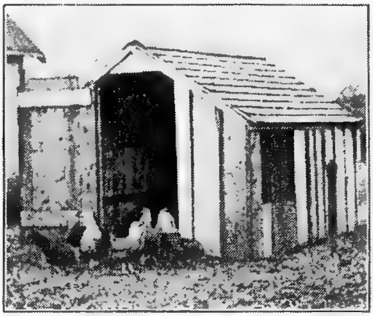

FIG. 189. Same as Fig. 188, with wider door. Better for sunny days, not as good for storms

SMALL HOUSES: STATIONARY AND PORTABLE

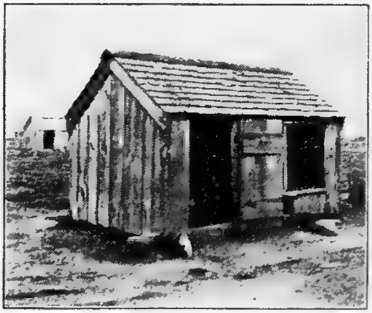

FIG. 190. Low colony house on farm of F. W. C. Almy, Tiverton Four Corners, Rhode Island

FIG. 191. Full-height house used by F. W. C. Almy; more window space in front

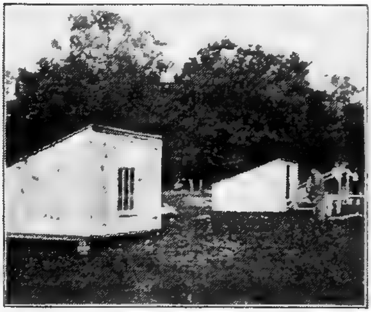

FIG. 192. Shed-roof colony houses at Cornell. (Photograph from Cornell Department of Poultry Husbandry)

FIG. 193. Rear of shed-roof houses used by F. W. C. Almy, showing small ventilating opening in rear wall

FIG. 194. Full-height colony house used at Macdonald College. (Photograph from the college)

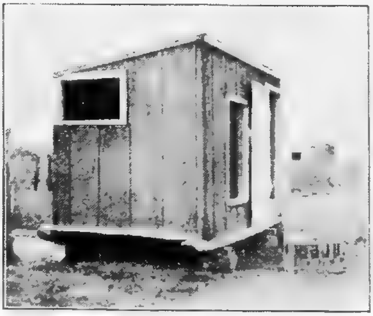

FIG. 195. Full-height colony house on round (pole) sills. (Photograph from J. C. Pattison)

COLONY POULTRY HOUSES

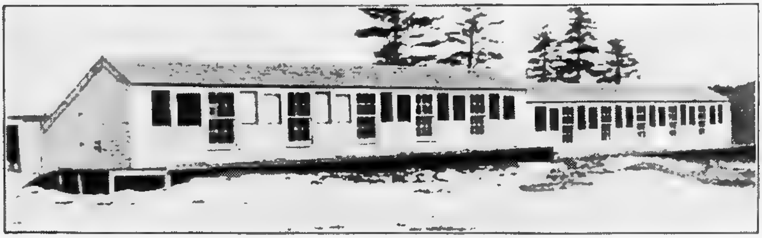

FIG. 196. House for breeding stock at Maine Agricultural College. Raised walk in front. (Photograph from the college)

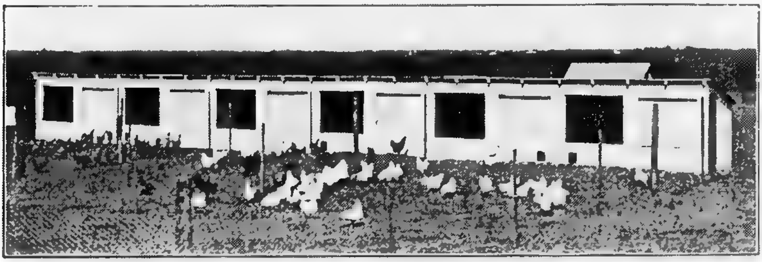

FIG. 197. Cotton-cloth-front house at Provincial Poultry Breeding Station, Edmonton, Alberta. (Photograph from the station)

FIG. 198. Interior of Fig. 197, showing nests and roost

CLOTH-FRONT POULTRY HOUSES IN NORTHERLY LATITUDES

FIG. 199. A summer location

FIG. 200. Moving a colony house

FIG. 201. Winter arrangement of colony houses

SMALL COLONY HOUSES AT MICHIGAN AGRICULTURAL COLLEGE
(Photographs from the college)

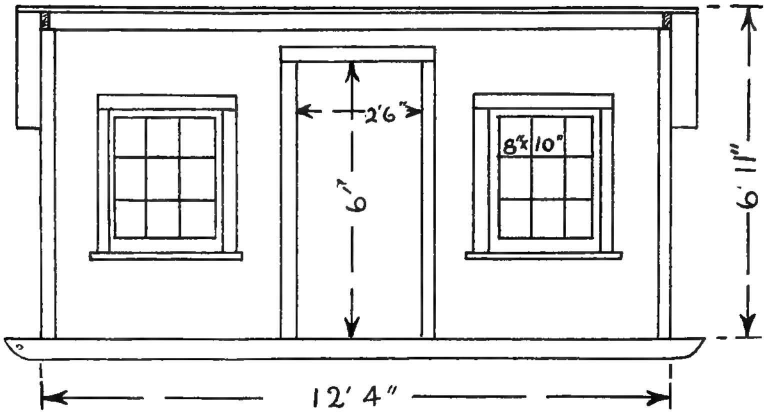

FIG. 202. Front elevation of small colony house on opposite page

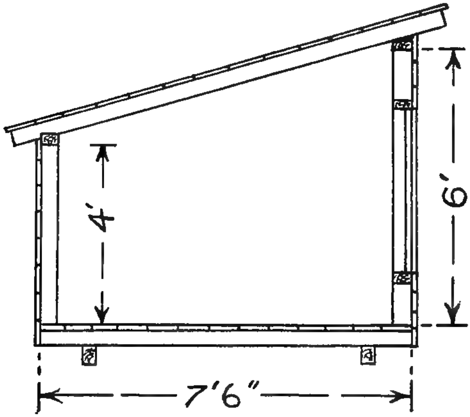

FIG. 203. Cross section of house on opposite page

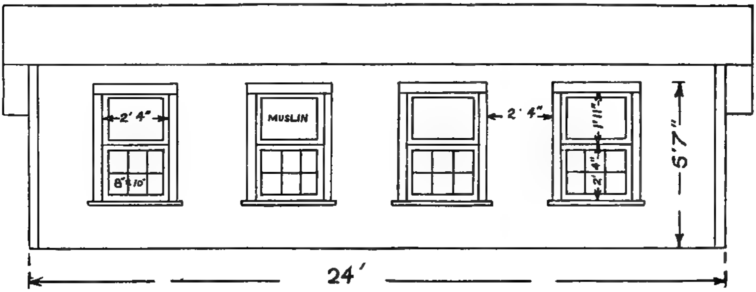

FIG. 204. Front elevation of farmer's large colony house (Fig. 207)

PLANS OF COLONY HOUSES AT MICHIGAN AGRICULTURAL COLLEGE

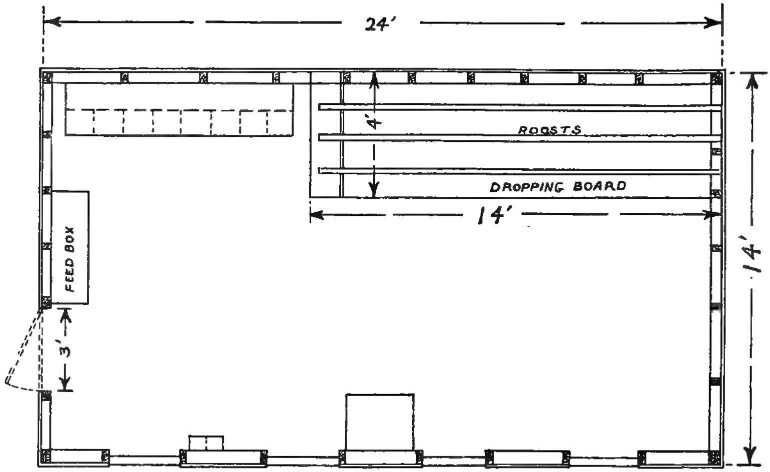

FIG. 205. Ground plan

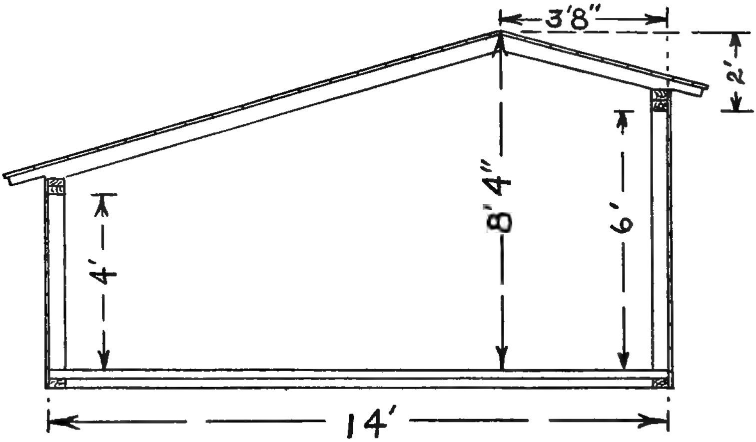

FIG. 206. Cross section

GROUND PLAN AND CROSS SECTION OF FARMER'S COLONY HOUSE IN FIG. 207

(Drawings for Figs. 202–207 from Michigan Agricultural College)

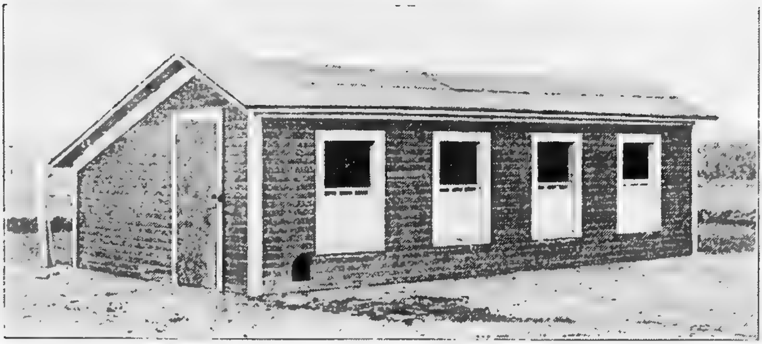

FIG. 207. Farmer's colony house at Michigan Agricultural College. (Photograph from the college)

FIG. 208. Front view of house, open both front and rear, at West Virginia Experiment Station

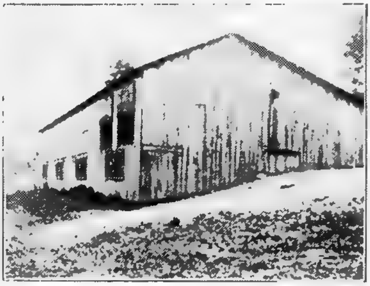

FIG. 209. Rear of Fig. 208. Basement scratching shed. (Photographs from the station)

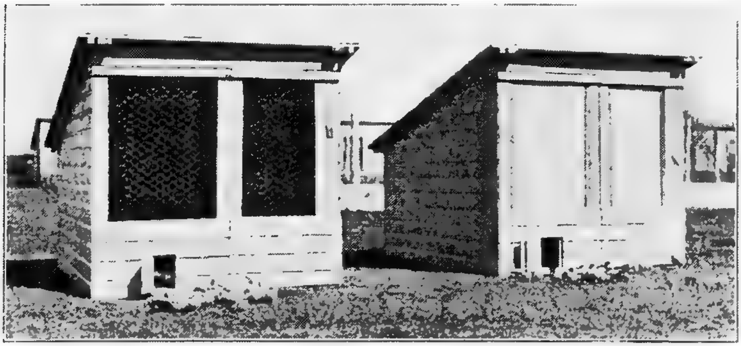

FIG. 210. Cloth-front colony brooder houses at Provincial Poultry Breeding Station, Edmonton, Alberta. (Photograph from the station)

LATE STYLES OF POULTRY HOUSES

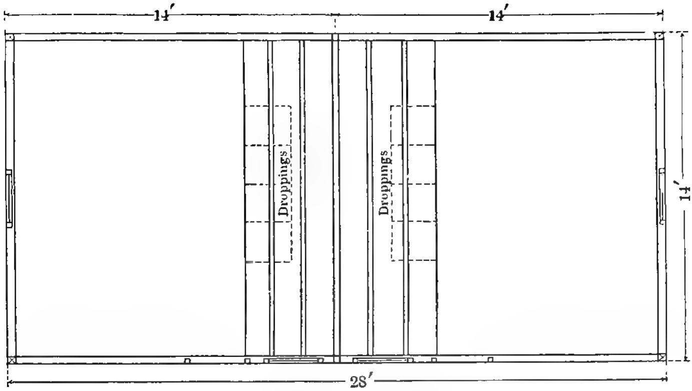

FIG. 211. Ground plan

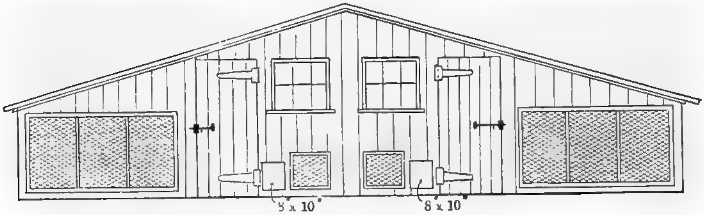

FIG. 212. Front elevation

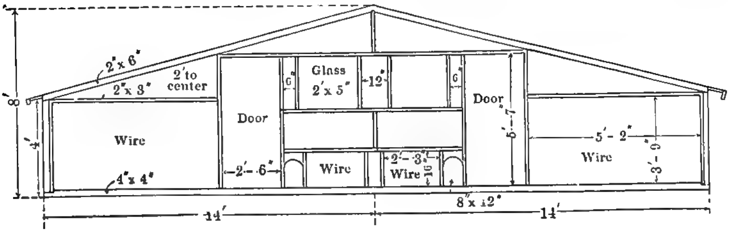

FIG. 213. Front frame

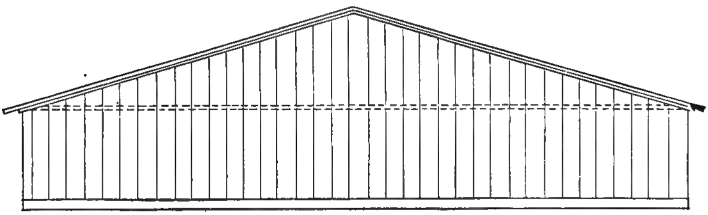
FIG. 214. Rear elevation

TWO-PEN HOUSE — DESIGNED BY D. J. LAMBERT

(Drawings from Rhode Island Agricultural College)

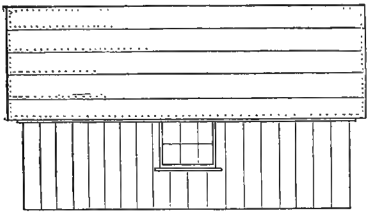

FIG. 215. Side elevation of house on page 142

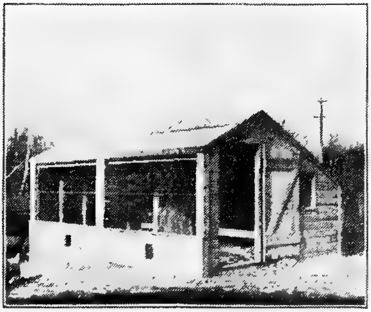

FIG. 216. Cloth-curtain-front house designed by D. J. Lambert. (Photograph and drawings from Rhode Island Agricultural College)

Description of house, Figs. 211-215. This house is designed for 100 hens in two flocks of 50 each. In winter the flocks may be increased to 60. The designer's object was to bring the roosts together at the middle of the house, use drop curtains in front of the roosts and so keep the birds warm at night, while the large open spaces in the front gave thorough ventilation of the interior apart from the roosting closets. As the reader will note, the design is an adaptation of the scratching-shed plan. In practice it was found that the use of curtains in front of the roosts was unnecessary — that the conditions and results were better without them. This is the usual experience when such direct comparisons are made. Mr. Lambert's house stands far from other buildings in a rocky pasture, and the flocks in it are given range on alternate days or half days as convenient. In most situations it would be better to have two large yards, or divide the pasture.

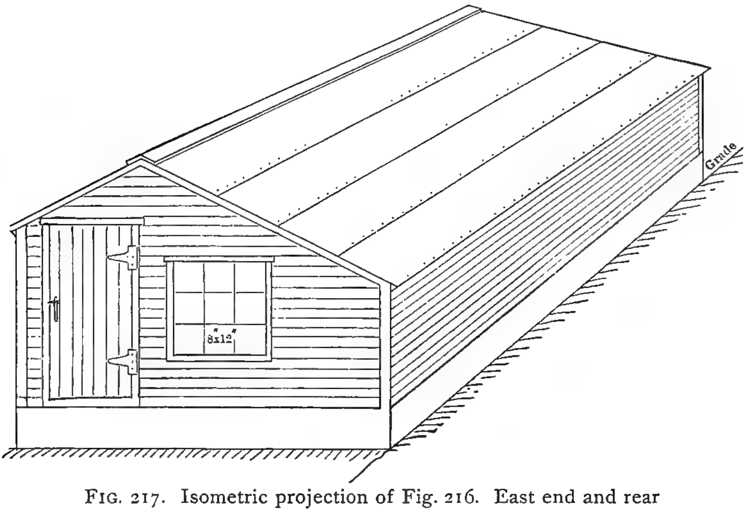

FIG. 217. Isometric projection of Fig. 216. East end and rear

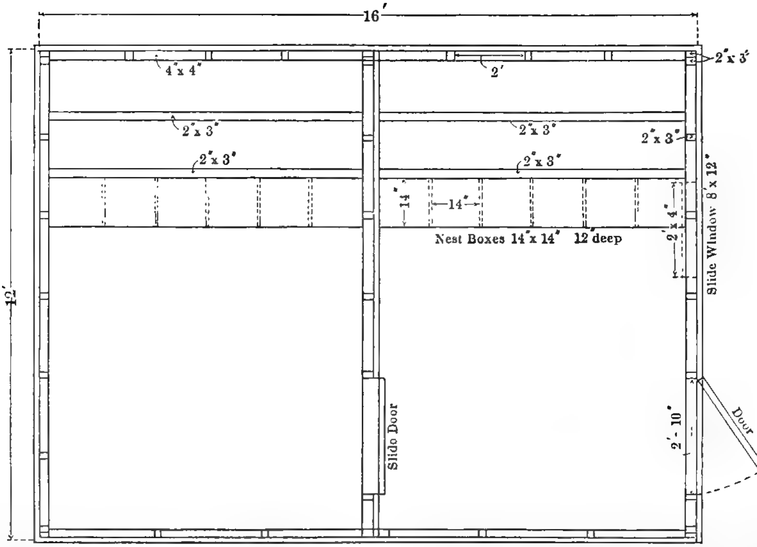

FIG. 218. Ground plan of Fig. 216

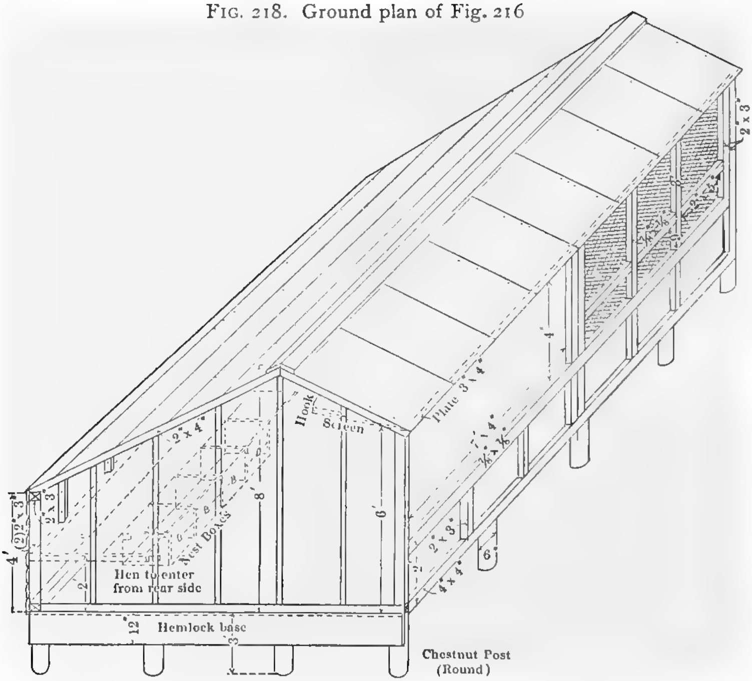

FIG. 219. Isometric projection of Fig. 216. West end and front

FIG. 220. Long house for breeding and exhibition stock at Wisconsin Agricultural College. (Photograph from the college)

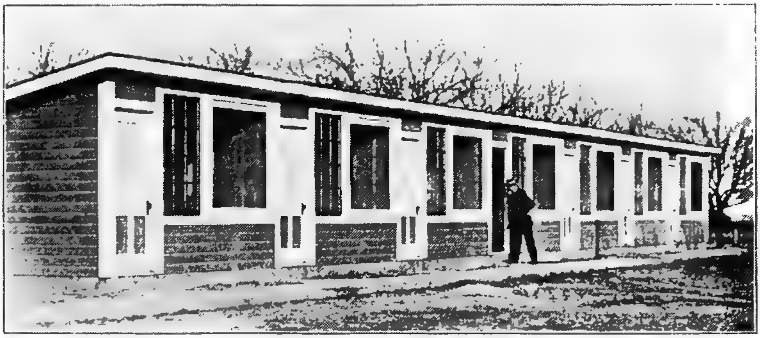

FIG. 221. House for breeding and exhibition stock at Iowa Agricultural College (Photograph from the college)

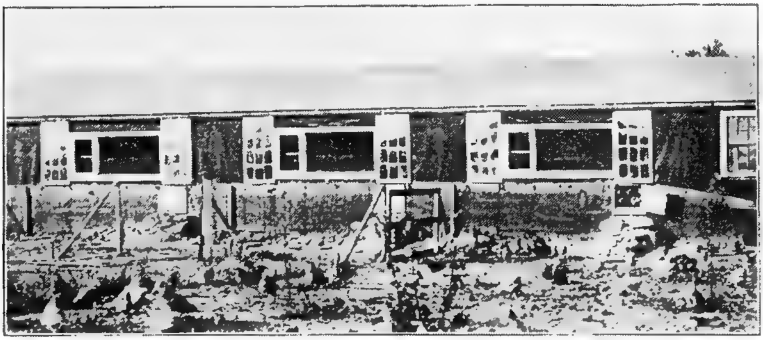

FIG. 222. Three sections of front of 200-ft. house at Pittsfield Poultry Farm (Photograph from Pittsfield Farm)

LONG POULTRY HOUSES

FIG. 223. Commercial laying house at Michigan Agricultural College

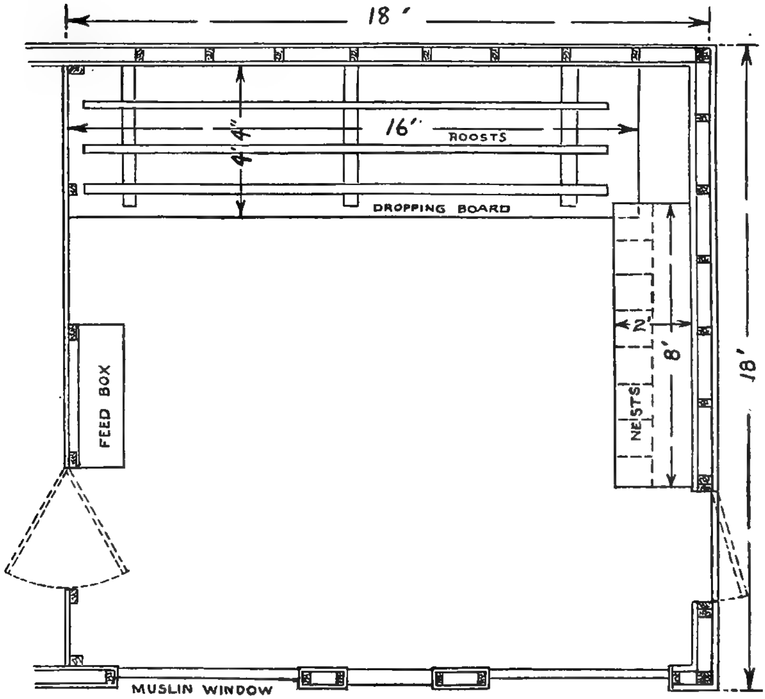

FIG. 224. Ground plan of Fig. 223, showing portion of roosts, nests, and feed box

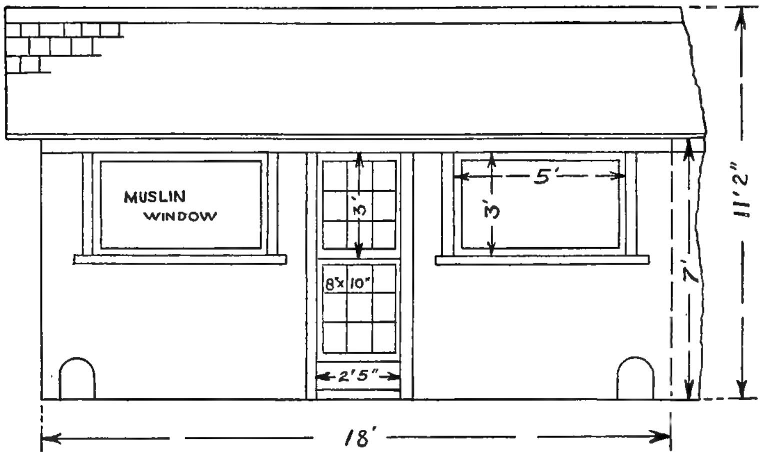

FIG. 225. Elevation of one section of front of Fig. 223

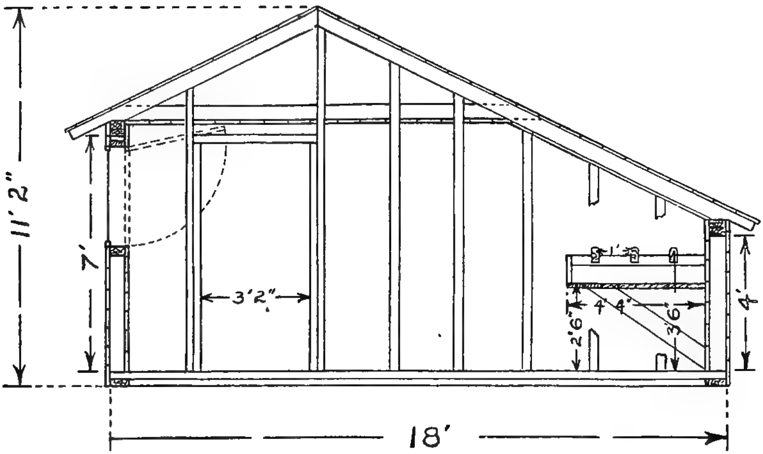

FIG. 226. Cross section of Fig. 223. (Photograph and drawings from Michigan Agricultural College)

FIG. 227. Concrete foundation and floor

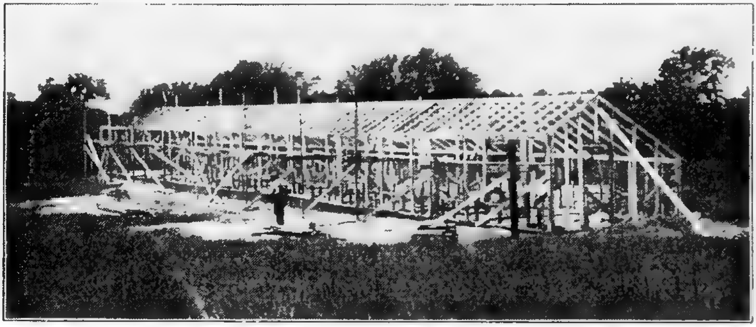

FIG. 228. The frame

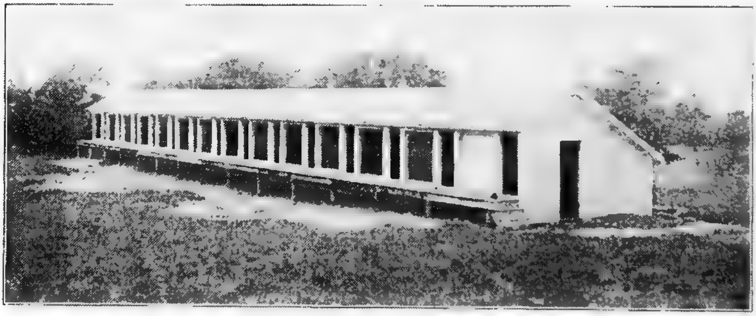

FIG. 229. The house closed in and covered

STAGES IN CONSTRUCTION OF A LONG POULTRY HOUSE
(Photographs from Massachusetts Agricultural College)

FIG. 230. Fattening and killing house at Macdonald College. (Photograph from the college)

FIG. 231. Fattening and killing house at Maine Agricultural College. (Photograph from the college)

FIG. 232. Brooder house at Connecticut Agricultural College. (Photograph from the college)

FATTENING AND KILLING HOUSES AND BROODER HOUSE

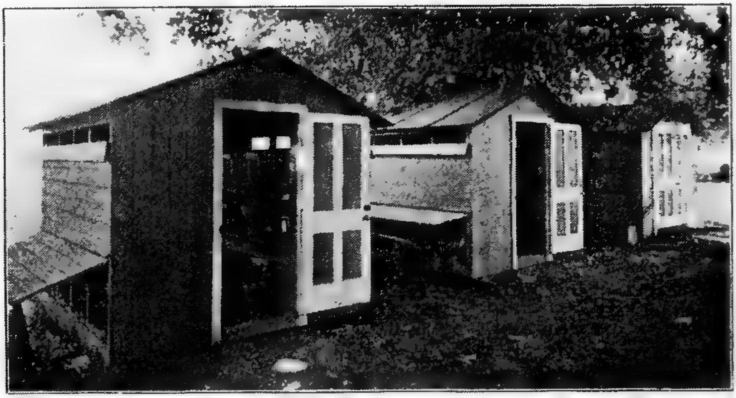

FIG. 233. Small fattening houses at Iowa Agricultural College. Note thorough ventilation

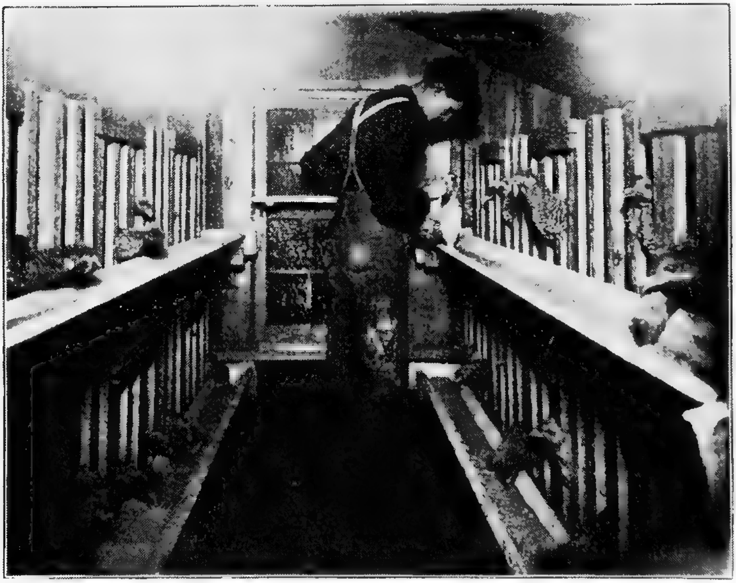

FIG. 234. Interior of a house in Fig. 233. (Photographs from Iowa Agricultural College)

SPECIAL FATTENING HOUSES

FIG. 235. Interior of brooder house with wide walk and pens on one side

FIG. 236. Brooder house with narrow walk in middle and pens on both sides
(Photograph from Pittsfield Farm)

LONG BROODER-HOUSE INTERIORS

FIG. 237. Long brooder house

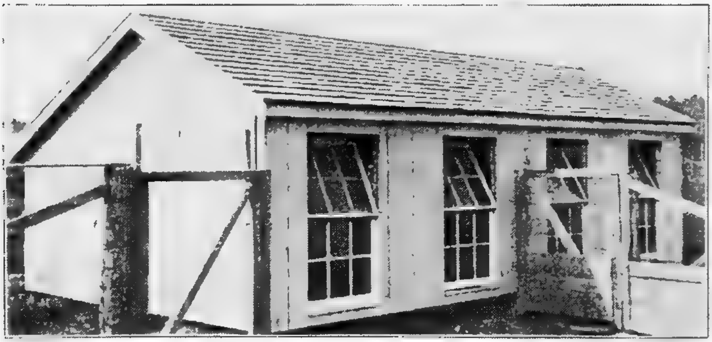

FIG. 238. Cold house for weaned winter chicks

FIG. 239. Rear of Fig. 238

BROODER HOUSES ON PLANT OF E. O. DAMON, HANOVER MASSACHUSETTS

Cockerel house. Figs. 240–243 show the exterior and parts of the interior of the large cockerel house at Grove Hill Poultry Yards, Waltham, Massachusetts. The house has an alley through the middle with small pens on the ground in front of the walk and two rows of coops for single birds at the other side of the walk. It has a monitor-top roof to give light to the coops back of the walk and for better ventilation. The pens in front of the walk connect with the outside yards. A house of this kind is almost indispensable on a plant which sells many

FIG. 240. Exterior view showing yards. (Photograph from Grove Hill Poultry Yards)

FIG. 241. Water pan

FIG. 242. Passage

FIG. 243. Front of coop

high-class breeding and exhibition fowls. The floor pens may be used in the breeding season for small matings. The only fault found in this house after years of use is that the lower coops in the rear of the walk are not sufficiently lighted. This could be corrected by making the passage wider (either by increasing the width of the house or decreasing the width of the pens), or by reducing the pitch of the front roof and enlarging the windows in the wall above it, or by slight changes in all these respects. Some cockerel houses have at one end or in the center a room the width of the building, to which the birds are taken for washing and special fitting.

Poultry houses on hillsides. While a slight slope is an advantage in a site for a poultry house, too much slope is troublesome. Fig. 244 shows a poultry house on a steep slope, with a high front wall and the area on which the building

FIG. 244. House on side hill; yards in front

FIG. 245. House on side hill; yards in rear

FIG. 246. Two-story house on side hill

stands filled in. The walk in this house is inside, at the rear. Fig. 245 shows a similar plan of leveling the floor, but with raised walk outside in front. Fig. 246 shows how an experienced poultryman planned his hillside house to make a two-story poultry house and give the fowls on both floors direct access to the ground outside.

CHAPTER X

POULTRY-HOUSE FITTINGS

In discussing poultry houses the position of the roosts was considered with reference to ventilation and the comfort of the birds; the availability of the earth floor for dusting was mentioned, and a few other like points came up incidentally. With such exceptions the treatment of coops and buildings for poultry considered only the structure as a shell, — a shelter from the elements for the birds and for the apparatus that it houses. In this chapter the various fixtures, apparatus, and appliances used by poultry keepers are considered with reference to their adjustments to the birds and to their adaptation to methods of work. Special attention is given to those things which poultry keepers may construct for themselves.[1] In general, simple appliances of home make are as good as any and are much less expensive than most articles sold for the same purpose. Usually it is advisable to buy such elaborate appliances as incubators and brooders, though persons with special aptitude for and skill in such work often make their own in whole or in

[1] In every kind of article that poultrymen use, and for every operation that they have to perform, special apparatus, utensils, tools, etc. are offered for sale. Many of these have been patented. In many other cases designers who regard themselves as inventors sell copyrighted drawings and instructions for making apparatus, appliances, and houses, with "permits" to the purchaser to manufacture for his own use. Very few patents on this class of articles hold when contested. Even in incubators and brooders a good feature introduced by one manufacturer is immediately imitated with impunity by as many other manufacturers as can see advantage to themselves in using it. Copyrights on plans and instructions cover only their exact contents and protect the publisher only from the use of his work by other publishers. The "permits" given with them have no force. Any one into whose hands such instructions come may use the designs as they are, or with such modifications as he chooses. None of the devices exploited in this way, however, is of such exclusive merit that it is worth while to consider it in preference to others in which no one claims proprietary rights. Good designs for all kinds of articles of this class may be found in experiment-station bulletins and in the poultry and agricultural press. As a rule, the simplest contrivance that will answer any purpose is the most economical and, all things considered, the most satisfactory.

part. Especially is this true of brooders. Some manufacturers make a specialty of supplying lamps and other brooder parts to those who build their own brooders.

Roosts. Perches are required for all kinds of poultry but waterfowl and ostriches. Some breeders of heavy Asiatic fowls dispense with roosts and bed their fowls on the floor, but this practice is not to be commended. It came into use as a result of the development of a type of fowl lacking in vitality and in strength proportionate to its size and weight, and unable to fly even to a low roost or to balance itself on it. Not only is it the natural habit of fowls, turkeys, etc. to roost at a distance from the ground, but their conformation and feathering are such that if their droppings are at all soft, the feathers below the vent become very badly soiled by voidings made when the birds are sitting on the ground or on a floor, while if the birds were on a perch, the soiling would be slight. Waterfowl which make voidings that are normally semifluid are so formed that the feathers are soiled little if at all by the passage of the excrement.

FIG. 247. Interior of compartment house. (Photograph from Henry Van Dreser)

The amount of roost room required depends on the size of the birds. An allowance of 7 inches for each adult Leghorn, 9 inches for a Plymouth Rock, 10 inches for a Brahma or a Cochin, and similar allowances for birds corresponding to these in size gives ample room. Fowls of these classes sitting close on the roost do not occupy so much space as this. The extra allowance of room gives abundant space for the birds to get up and down without crowding or knocking one another from the roost.

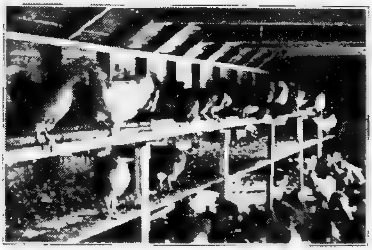

FIG. 248. Roosts and roost platform in long house without partitions

Material and form. Roosts are usually made of 2 × 3 or 2 × 4 inch scantling placed with a wide surface up. Occasionally roosts are used with the upper surface as narrow as two inches.[1] The upper surface is sometimes rounded, the idea being to give it the conformation of the branch of a tree. There is no discernible advantage to the birds in this. The chief gain in smoothing the scantling used for roosts is that rough places in undressed lumber afford resting places for red mites, and planing removes these. The advantage of this, however, is not as great as it appears; for if the mites are present, it is much easier to destroy them on the roosts than about their supports and in adjoining crevices.

Supports. When no droppings boards are used, roosts are usually cut the exact length of the space that they occupy, and supported at the ends by strips screwed or nailed to the wall. Roosts without droppings boards are placed from 18 inches to 3 feet from the floor (usually from 2 to 2½ feet) and all on the same level. Except for the very light breeds it is not advisable to place them higher, even if the height of the house admits of doing so. For guineas, pheasants, turkeys, and peafowl kept under cover, the roosts may be placed higher. All of these birds prefer the open, but some suppose that they are better satisfied indoors when roosts are 4 or 5 feet from the floor. In fixing the height of the roost from the floor the effect on the bird of *jumping* or *falling from the roost* needs consideration rather than the ability of the bird to fly up to it. Very few birds are injured by their own efforts to fly to a roost too high for them. Many are injured, and all are liable to injury, from jumping from roosts, or falling from them when crowded off

[1] The theory of the advocates of narrow roosts is that the narrow roost fits the foot of the bird better than the wide one, and allows the claws to grasp the roost, as is natural when the bird sits on a perch. This adaptation of the perch to the foot is plainly more characteristic of birds of the air than of land birds. Water-fowl, with few exceptions, do not perch. It cannot be observed that domestic birds which perch prefer narrow to wide, or rounded to flat, perches, or that there is any disadvantage in the use of wide roosts. On the contrary, young land birds usually begin to roost on perches relatively wider than the widest ever used for adult fowls. If fowls are slow about beginning to roost, one of the common methods of teaching them is to put a wide board (a *platform* for them) a few inches above the floor and close to the wall, and, when they have accustomed themselves to sleep on this, to substitute first a roost six or eight inches wide, and then one of regulation width.

by their companions. For roosts of scantling, as described above, up to 8 feet long, no intermediate supports are needed. For longer roosts supports at intervals of 5 to 8 feet, according to the length of the roost, must be provided. The intermediate support is usually a strip of furring placed under the roosts and at right angles to them, with one end attached to the wall back of them and the other to a similar strip or a wire suspended from the roof. By attaching the support to the wall and roof the floor space is kept clear. When droppings boards are used below short roosts, the roost may be supported independently. When long roosts have

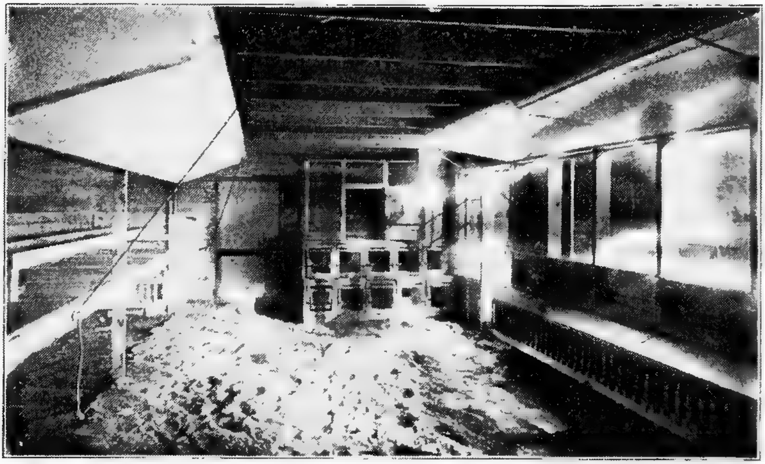

FIG. 249. Interior of compartment in long house of Maine Experiment Station (Photograph from the station)

droppings boards under them, intermediate supports (and sometimes all supports) may rest on the droppings boards. Various styles of support are used, some of wood, others of iron. As these supports interfere more or less with the work of removing the droppings, many poultry keepers prefer to attach intermediate roost supports to wall and roof, as when no droppings boards are used.

Droppings boards. Droppings boards seem to have been adopted first for the easy collection of hen manure free from other matter, at a time when it could be profitably sold to tanneries. The droppings board is a platform under the roosts, of such width that all droppings voided while the fowls are at roost fall on it. It is sometimes built into the house and sometimes rests on strips nailed to the wall at each end; more rarely the droppings board, with roosts attached, rests on legs like a bench or table. The platform is raised far enough above the floor to let the fowls get under it. The space between the platform and the roosts is about eight or ten inches. At one time the droppings board was considered indispensable in a properly kept poultry house. It was not used by the farmers who developed the colony system in Rhode Island, and it was rarely used, as intended, by commercial poultry keepers whose business was on a paying basis. Unless it is kept clean by removal of the droppings every two or three days, conditions in the poultry house are likely to be much better without it. On the whole, only about half the droppings are kept off the floor by its use. When kept clean, droppings boards add enormously to the work of caring for poultry,[1] without contributing any measurable benefit.

Roosting closets. As the roosts are usually placed, the space that they occupy may be partitioned from the rest of the room with very little expense. If they extend along one side, from wall to wall, a partition of boards brought part way down, with a drop curtain the rest of the way when desired, gives the same conditions as if the fowls were in a house similarly arranged and sheltered. When droppings boards are used, the roosting space, if inclosed, gives relatively more crowded conditions. If the roosts extend but part of the length of a side of the house, a roosting closet may be made by boarding up one or both ends of the roosting space and making the front of boards, or boards and curtain. This closet arrangement may be a decided advantage for a few birds kept in a large room, or for tender birds, or in extreme cold weather. It should, however, be used with care. Except in extreme cold snaps, hardy fowls in a well-stocked house will usually

[1] One winter, before littering the floors of the open houses that I use, I took the droppings from the floors under the roosts for a number of days, to get the average time required to remove the droppings daily. Then the floors were littered with leaves, and the droppings were removed from the floor under the roosts only when they gave an odor, — three times in the course of the winter. The actual time taken was three hours and a half; the time required to remove the droppings daily for the same period was thirty-four hours.

do as well if their roosting space is open and provided with curtains for emergency use.

Nests. Boxes and other receptacles which serve the purpose are used to keep eggs safe and clean. The birds often prefer to lay in a corner on the floor, and some will persist in doing this though as attractive a nest as the keeper can design is placed where they had made their nest. Ducks are most indifferent about the matter of nests, dropping their eggs anywhere. Most hens go readily to the nests provided for them, and though they may have a choice among several nests, will take the next nest if the chosen nest is occupied and they cannot dislodge the occupant. In the other kinds of poultry the general habit is for each female to make or choose her own nest and keep others from it. These birds, as a rule, seek out secluded spots in which to lay, and often go to a distance from the homestead. Even when at liberty, hens usually lay in the house that they roost in, if suitable provision is made for them, or if they can find a place there that suits them.

FIG. 250. Skeleton triple nest box

Dealing with each kind according to habit, the poultry keeper can consider his own convenience and requirements in making and placing nests for hens and, in less degree, for ducks, while with other birds he succeeds best if he gives the nests such protection as he can where the birds make them, or places boxes, barrels, or coops singly where they may attract a bird about to lay. The nests for ducks are usually made on the floor in the corners or at the sides of the pen by inclosing a space, or spaces, of suitable size, with a low strip in front and higher divisions between the nests.

Nest boxes for fowls are made in great variety. The minimum requirement for a single nest is a frame about 12 inches square and from 12 to 14 inches high, open on one side, except for a strip about 4 inches wide at the bottom, with or without top and bottom. If the nest is to be placed on the ground, it does not need a bottom and may be used without a top. If it is to be attached to the wall or placed under the droppings board, it needs a bottom but may be used with or without a top. Such a nest as this, sometimes slightly modified in form, or enlarged for very large hens, is the common unit in series of nests for both laying and sitting hens, and is the basis of most trap nests, the trap adjustments being attached to it directly or to an extension of it adapted to them. Wherever more than one nest is needed in a pen, the ordinary nests are usually made double, triple, or quadruple, — rarely more than four in a section, because of the increased difficulty of handling them. All nests should be movable. It is a serious mistake to build them into the house so that they are difficult to clean and treat for lice, and cannot be taken out and aired.

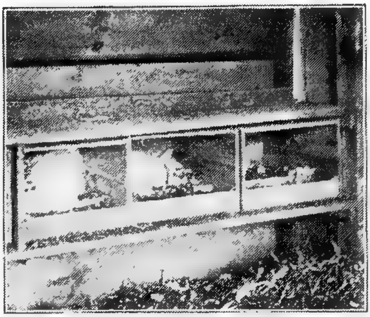

FIG. 251. Nests under roost platform, entered from front

The position of nests in the house may be decided according to other fixtures and the general plan, or according to the convenience of the keeper or the inclinations and habits of the hens in the flock, — points which it is sometimes necessary to consider, as when hens contract the vice of egg eating. Nests for laying hens are rarely placed on the floor (except when hens persist in laying their eggs there), because in this position they reduce available floor space; but when tiers of nests are used, they must begin at the floor, in order to get in the desired number of nests and have the higher tiers accessible. They may be attached to the wall and fully exposed to the light, or arranged to face the wall (making a partially dark nest), or placed under the droppings board with entrance from the rear and with a hinged cover in front,

FIG. 252. Nests under roost platform, entered from the rear. Long sectional nest box on casters, drawn out to collect the eggs

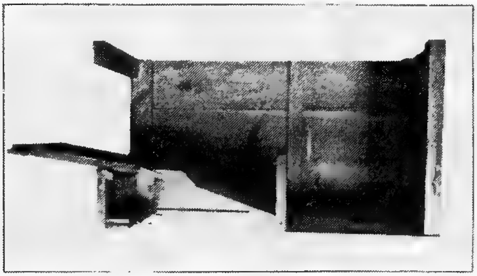

FIG. 253. Nest with side and top removed (trap open)

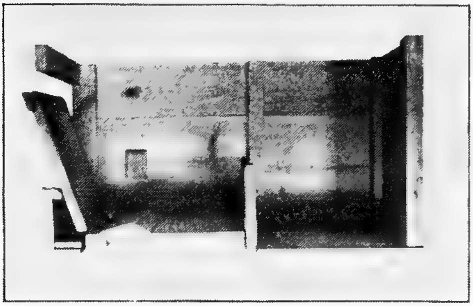

FIG. 254. Nest with side and top removed (trap closed)

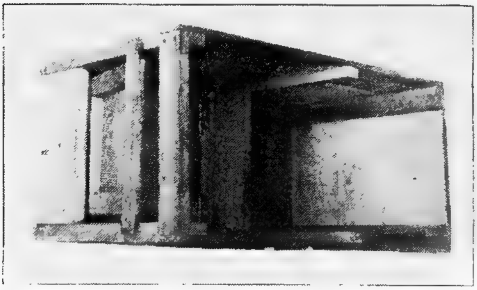

FIG. 255. View of nest from top (top removed)

THE MAINE EXPERIMENT STATION TRAP NEST

(Photographs from Maine Experiment Station)

which simple arrangement admits of using the same nests (with front closed) as dark nests and (with front open) as light nests.

Material. Most nest boxes are constructed of wood. Many poultry keepers convert second-hand boxes and crates of suitable size into nest boxes, or make them of old material which can be cut to the required dimensions. When such close economy is necessary, this is not objectionable, but on the whole it will be found more satisfactory if all nests used for one purpose and for birds of the same kind are of the same pattern, — of new seven-eighths-inch boards, surfaced on both sides and planed on the edges, to give smooth surfaces everywhere and close-fitting joints.

Trap nests are used to enable the poultry keeper to keep individual laying records and the full pedigrees of stock, without penning separately each hen under observation. In general their use is limited to experimental work, in which they are indispensable, and to special breeding operations. They cannot be used to advantage when attendants are not at hand to release the hens at frequent intervals during the day, nor is it practicable to use them for ordinary laying and breeding stock.

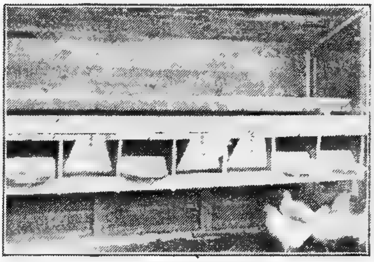

FIG. 256*a*. Cornell trap nests, under roost platform[1]

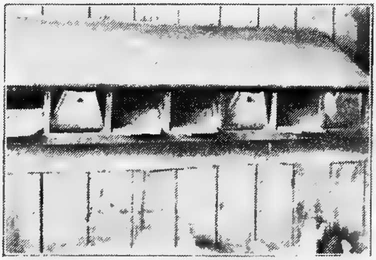

FIG. 256*b*. Cornell trap nests, attached to wall[1]

There are scores of different kinds of trap nests made. In all the entrance is so constructed that as the hen enters she springs the catch which holds the door open, and it closes after her in such a manner that she cannot leave the nest until released by an attendant. Some of these nests are very simple in construction; others are more complicated. Each designer claims greater accuracy for his nest than is found in others, but in their ordinary use absolute accuracy is not a vital point. In general, accuracy depends somewhat on the trap being kept clear of obstructions, the nesting material being the chief cause of trouble.

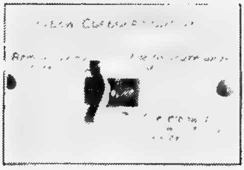

FIG. 257. Catch used on Cornell trap nest

Number of nests required. Of common nests one for every four to six hens is usually sufficient. When trap nests are used, these proportions will be satisfactory if the hens are removed from the nests at frequent intervals.

Feed troughs. Troughs are used principally for wet (or moist) mashes, but also occasionally for dry ground grains when fed in limited quantities. The pattern most used is a flat-bottomed, shallow trough. V-shaped troughs are also common. These plain troughs

[1] Photographs from New York State Agricultural College at Cornell University.

cost very little and are, on the whole, more satisfactory than the more elaborate ones designed to make it impossible for the birds to get their feet into the food. The *flat troughs* are made with bottoms of $\frac{7}{8}$-inch or $\frac{5}{8}$-inch boards (surfaced on one side) and with sides of furring or lath, according to the size of the trough and of the birds which are to feed from it. For sizes up to 6 inches wide and about 2 feet long, $\frac{5}{8}$-inch stuff with edges of lath will do. For larger troughs it is better to use $\frac{7}{8}$-inch bottoms, though if they are for young birds, the sides may be of lath. A favorite style of flat-bottomed trough is made by nailing the sides to the bottom so that they project equally on both sides of the board, making a reversible trough.

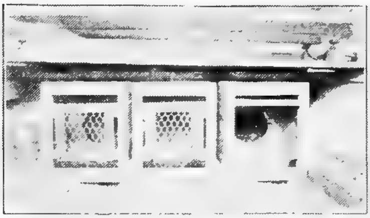

FIG. 258. Trap nest used at North Carolina Experiment Station (one trap set)[1]

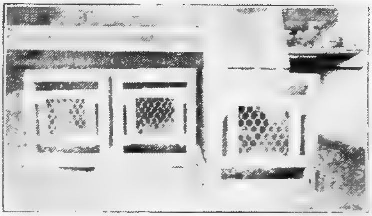

FIG. 259. Same as Fig. 258, one nest drawn out and opened at top to remove egg[1]

The advantage of this is that, by simply turning it over, the trough is emptied of the litter or dirt which accumulates in it between feedings, while a single trough must be turned over and back.

Very small V-shaped troughs may be made of $\frac{5}{8}$-inch boards, but in general it is better to make them of $\frac{7}{8}$-inch stuff. For very large troughs, used in goose fattening, this form is usually preferred.

For regular feeding, most poultry keepers prefer short troughs from 3 to 4 feet long and from 6 to 8 inches wide. A short, wide trough will accommodate more birds than a narrower and longer one with the same superficial area, and it is easier to feed in them (with birds crowding about) without scattering food on the ground.[2] A trough 12 inches wide by 16 or 18 inches long makes

[1] Photographs from North Carolina Experiment Station.

[2] This is an important point when the feed trough stands on the poultry-house floor or on bare or soiled ground. On clean sod no troughs are needed for moist mash; it may be fed on the ground. Some colony poultry farmers throw the mash from the wagon with a shovel as they drive from house to house.

a very convenient size for use in small flocks. One such trough should be allowed for each eight to twelve hens or ducks. On some of the duck farms, where feeding and watering is done in the yards, from a track, the troughs are made 18 to 20 inches wide and 5 or 6 feet long, and the feed is thrown into them from the car. When hopper feeding was less general, many poultrymen made troughs with high ends and a board on edge between, to prevent birds getting into the trough. For very small chicks some poultry keepers use shallow pans of galvanized iron, about 3 inches wide and 8 inches long, with sides ½-inch high.

Feed hoppers. Many styles of hoppers have been designed, to hold a store of food and feed it down into an attached box as fast as the birds consume it. They are made in all sizes, from the small hopper, with a capacity of a few quarts, to the large hopper, with a capacity of one hundred pounds or more. They are used for both whole and cracked grains, and for dry ground feeds. Small hoppers are also used for shell, charcoal, etc. The movement of the grain from the hopper to the feeding box beneath is designed to be automatic, the weight of the material in the hopper carrying it down through the opening at the bottom as food is removed from the box. Most hoppers work well except for ground grains, which always clog more or less. To overcome this a patent feeder holds all food in the food box, with a coarse wire screen so suspended that it rests on the ground grain, holding it piled high in the box, opening a larger surface to the birds, and making the food accessible as long as any remains. The other point of trouble in hopper feeders is the waste, through the birds pulling stuff out of the box. To overcome this an inturned edge, or lip, is put on the feeding box.

FIG. 260. Feed hopper in colony house

The prevention of waste from hopper feeders is not, however, simply a question of preventing the birds from scattering the contents of the box. The primary question is the quality of the food. There is nothing gained by retaining in the box the stuff that the birds reject. Hopper feeders are usually made of wood, but many of the smaller sizes manufactured for sale are of galvanized iron.

Drinking vessels. There are two kinds of drinking vessels: *open* vessels (as pails, pots, pans, and troughs) and *closed* vessels, of the fountain type. The open vessels are more generally used. If placed where they get the sun and air, six-quart wooden pails are very satisfactory for adult fowls. For indoor use when the sun shines on the drinking vessel for only a short time each day, it is better to use vessels of stoneware, or iron vessels with porcelain lining. The latter cost most, but in ordinary use are almost indestructible, will last a lifetime, and are the easiest of all to keep clean. For young chickens and ducklings with hens, any shallow dish or pan will answer. Earthen flowerpot saucers are inexpensive and, if not exposed to frost when wet, will last many seasons. For ducks and the larger kinds of poultry, full-sized wooden pails or small tubs or troughs are used. For ducks and geese that are given water only for drinking purposes, the drinking vessel should be too heavy to be easily upset, or should be secured. On the whole, V-shaped troughs are as satisfactory as any for waterfowl.

FIG. 261. Water pails on shelves

Drinking fountains are made on the same principle as hopper feeders, and are mostly commercial products. The primitive form is the homemade fountain, made of a tall tin can inverted in a shallow pan or dish of slightly greater circumference, the can having a few small holes at such distance from the open end as is required to make the water stand at the desired height in the other vessel. The commercial drinking fountains are made of earthenware, stoneware, galvanized iron, or glass. The advantage of using drinking vessels of the fountain type depends very much on circumstances. In general, open vessels are preferred, because they are more quickly filled and easier to keep clean. The extra labor of taking care of a large number of drinking fountains will usually more than offset what is gained in reducing the number of waterings. The best way for the individual poultry keeper to decide points of this kind is to try out a special appliance on a small scale and in comparison with the best arrangement that he can make without it.

Dusting boxes. Dust baths are required when poultry are confined on floors of wood or cement. They may be built into one corner, in which case all that is necessary to make the dusting place

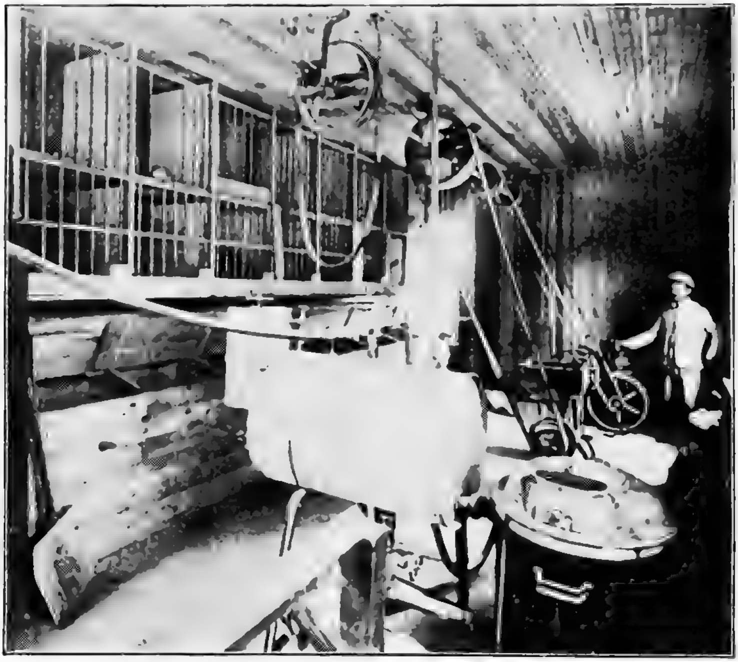

FIG. 262. Fully equipped feed, store, and conditioning house. (Photograph from Gardner and Dunning)

is two boards for the two outer sides, the walls forming the other sides and the floor the bottom. This is probably the best arrangement in small pens. In large pens it may be more satisfactory to use movable boxes (about thirty inches square and twelve inches high) with bottoms, and place two or more in each pen.

Common tools. In the work of caring for poultry houses and yards the ordinary garden and stable tools (rakes, hoes, shovels, spades, forks, brooms, wheelbarrows, pails, scoops, etc.) all have their places, the kind and size used being adapted to the work to be done. In the mixing and cooking of feed, also, appliances used in work with other kinds of stock are adapted to work with poultry. There are, however, a number of appliances and tools designed especially for the poultryman. Some of these are necessary in all lines of work, some in special lines, and some are useful only in certain conditions. It is not necessary to mention and describe them all. Following is a list of the more important appliances, with brief statements concerning the use of each. These and other appliances are catalogued by general poultry-supply houses, or advertised in poultry and agricultural papers by the manufacturers.

FIG. 263. Iron jacket and bricked-up kettles in cookhouse on farm of F. W. C. Almy

FIG. 264. Feed cooker and mixing trough in cookroom at C. H. Wyckoff's plant

Cooking apparatus. The best cooker for poultry feed is a bricked-up set-kettle. The bricks hold the heat much longer than the iron fire box under the ordinary feed cooker. The latter is less expensive. Either may be used for scalding poultry or for heating water for any purpose. Something of this kind is necessary on a poultry plant that carries more than a few dozen birds.

Food mixers. On a large plant where moist mashes are fed (as on duck plants and goose-fattening farms) mixing by hand becomes heavy work. Bakers' dough mixers have been satisfactorily used by some duck growers. One large duck farm uses a concrete mixer. Ordinarily a revolving barrel or box turned by hand will answer for mixing dry mill stuffs, and wet ground grains may be mixed with a shovel in kettles or in troughs. Grains to be fed in hoppers may be mixed in revolving mixers. For feeding by hand, grains may be sufficiently mixed by scooping alternately from the different bins to the pail in which the food is carried.

Bone cutters. The only machine that will reduce fresh bone to form suitable for poultry food is a bone *cutter*, which shaves the bone; green bone cannot be *ground*. The old-style bone mill for dry bones is now rarely seen. In general, it does not pay to use a bone cutter unless it can be run by power. When power can be secured, the most common difficulty is to get regular and sufficient supplies of bone at reasonable prices, for the supply is usually very limited.

FIG. 265. Homemade feed mixer, used by Henry D. Smith

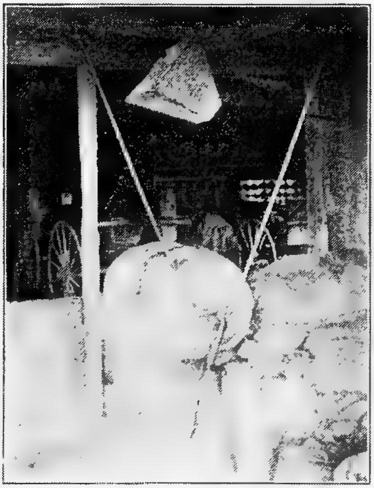

FIG. 266. Same as Fig. 265. Hopper hung up after filling barrel

Hay cutters. Every poultryman who has room to grow his own clover or alfalfa, or can purchase either (properly cured) from a farmer, should consider a hay cutter a necessity. Most poultry keepers pay too much for this class of food. One or the other of the grasses mentioned can be grown anywhere. Enough for several thousand fowls can be cut by hand power in a short time.

Root cutters. Root cutters are not often needed. It is usually much better to feed roots whole or simply split, letting the poultry pick them to pieces and eat them deliberately.

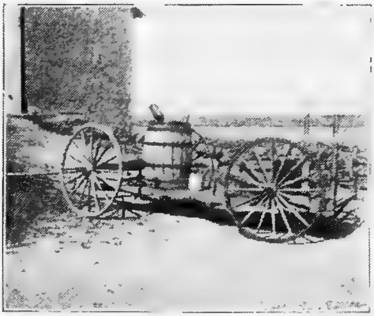

FIG. 267. Dough cart used by Sisson Brothers, Little Compton, Rhode Island

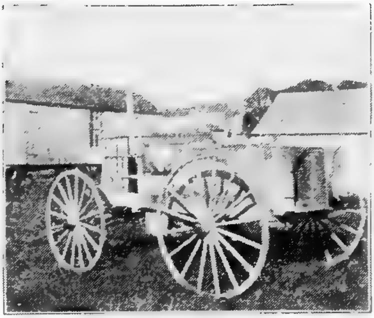

FIG. 268. Dough cart, with coop for moving poultry. P. H. Wilbour, Little Compton, Rhode Island

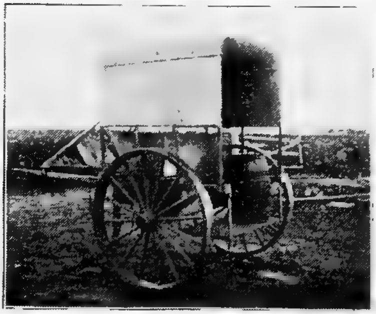

FIG. 269. Two-wheeled, covered dough cart

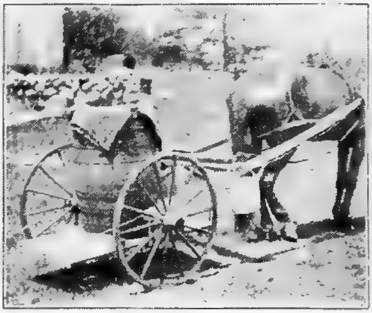

FIG. 270. Handy water cart. P. R. Park

FIG. 271. Feeding and watering cart, used by the Department of Poultry Husbandry at Cornell University

FIG. 272. Same as Fig. 271, with box sides on. (Photograph from New York State Agricultural College)

CARTS FOR POULTRY WORK

Egg testers. For testing the fertility of eggs, incubator manufacturers furnish a metal chimney, to be used on the incubator lamp. While this will serve the purpose, it is not as good as a homemade tester made from a high, narrow box (a six-pound wooden starch box will answer the purpose). In one side and at such a height that it will come directly opposite the flame of the lamp set inside, cut a hole a little smaller than the oval circumference of an egg; a hole a little larger in circumference than the top of the lamp chimney should be cut in the top of the box. The box tester may also be used with an incandescent electric light, but sunlight is the best light for testing eggs. Some poultrymen darken the incubator cellar and test eggs through a suitable aperture in a shutter on a window facing the sun.

Nest eggs. Artificial eggs are supposed to be of use in inducing hens to lay in the nests containing them, but their value for this purpose is doubtful. Hens sometimes lay where the nest eggs are; quite as often they do not. The china or other nest egg is really serviceable in nests of sitters moved to new quarters, before it seems safe to give them good eggs.

Transportation on the poultry plant. On a poultry plant of the extensive type a horse and cart can usually be used for distributing food and water, collecting eggs, and moving coops from place to place. The wheelbarrow is indispensable on all plants. On some duck plants a great deal of labor is saved by using tracks running above the fences, and in some of the long houses for fowls overhead tracks are arranged to carry a hanging car from pen to pen. The advantage of this inside track is not as apparent as that of the outside track used on the duck farms. On a large plant a great deal of time and labor is saved by having food storage bins so distributed about the plant that the grain does not have to be carried long distances at each feeding.

CHAPTER XI

NUTRITION OF POULTRY

Nutritive requirements. Poultry need the food constituents used by all creatures, but not always in the forms and proportions in which they are used by other domestic creatures. The composition of the flesh of poultry does not differ greatly from that of domestic animals used as food. In general it contains more protein and less fat.[1] The rapid growth of poultry, however, demands a larger proportion of concentrated food and relatively larger quantities of food than other domestic creatures, and in birds which lay nearly all the year round the heavy demand for concentrated food is continuous. For both growth and egg production mineral matter also is required in much larger proportion than in the diet of mammals.

Nutritive organs. The digestive organs of poultry present the same general characteristics as those of mammals, varied in the different kinds in accordance with their feeding habits and diet. Briefly, they consist of a mouth, furnished with horny lips (beak, or bill); a gullet; an esophagus, having an enlargement (the crop) in which the food taken in at the mouth is retained for some time and subjected to action of the secretions of the crop; a stomach (the proventriculus), where the food received from the crop is mixed with the gastric juice; a gizzard, a muscular organ with corrugated inner surfaces of tough, horny skin between which the food is reduced before passing into the intestines; large and small intestines; liver; gall bladder; pancreas; two cæca; rectum; cloaca; and anus, or vent. In a study of poultry culture special interest attaches to the mouth, crop, and gizzard, to the functions of these organs, and to their relations to feeding theories and practice.

[1] "Poultry as Food," *Farmers' Bulletin No. 182*, United States Department of Agriculture, also *Bulletin No. 270*, Storrs Agricultural Experiment Station.

In general, poultry use for food larger proportions of expensive food products than other domesticated creatures, but as, under suitable conditions, they collect much of this class of foods for themselves, the comparative cost of feeding them is not as much greater as the fact suggests.

NOTE. Some analogies between organs of nutrition of birds and creatures below and above them in the scale of evolution are also of peculiar interest to the student of poultry culture. The most conspicuous resemblances between domestic birds and animals in respect to nutrition are commonly noted and their importance is often exaggerated. Thus: Poultry, being omnivorous, eat everything eaten by cattle, which are herbivorous and granivorous; therefore it has been assumed by some students of the science of feeding that the nutritive rations worked out for cows will apply to poultry.[1] There is a double fallacy in this view. Cattle are principally herbivorous, but use small quantities of grain to advantage. Fowls are principally granivorous, but eat considerable quantities of vegetables. Were there no other difference in the diets of fowls and cattle, the fact that cattle eat chiefly of bulky foods and lightly of concentrated foods, while fowls subsist more largely (and may subsist for long periods exclusively) on concentrated grain foods, would suggest a necessary difference in feeding standards. But fowls are also carnivorous and insectivorous, using large quantities of highly nutritious animal foods. Such differences suggest that the same feeding standards will not serve for both classes of creatures.

Cattle and horses have strong jaws and powerful molar teeth for the mastication of the forage and grain that they consume. Hence, by analogy, it was assumed that birds eating grain must have powerful organs to grind and reduce it to form available for nutrition. Man and all domestic animals must reduce food to such consistency and form that it will pass through a gullet very small in comparison with the mouth and the size of the creature. Again, by analogy, it was assumed that birds, so much smaller than man and domestic animals, and having no teeth with which to reduce their food before swallowing, must have food especially selected or prepared to meet the supposed requirements of creatures of their size not provided with mechanical organs of nutrition such as larger and stronger mammals possessed. Such analogies have had a marked influence on the theory and practice of poultry feeding. The fundamental error was failure to assign to birds their proper place in the animal kingdom, and to consider the resemblances between their nutritive organs and processes and those of creatures lower down in the scale.

[1] Singular and absurd as it seems, it is a fact that the earliest investigators of the science of feeding poultry, instead of analyzing numbers of good rations for poultry and ascertaining their average and using that as the standard, simply took over the standards accepted for dairy cows and tried to apply them in poultry feeding.

Birds are most closely akin to reptiles, which differ strikingly from mammals in the structure and use of the organs for the prehension of food and also in the provision made for its final mastication. A cow may choke on an apple; a snake by extension of the mouth and dilation of the gullet will swallow animals which, even after constriction in its folds, have a circumference greater than the normal circumference of its body. In this respect birds occupy an intermediate position. A bird can usually swallow anything that it can get into its mouth. In the young of aërial birds the mouth is conspicuously large. A small chicken will swallow an insect apparently much too large for it; fowls often kill mice and frequently swallow young mice alive;[1] a goose will swallow a large apple core. No one who closely observes the feeding habits of poultry which have access to foods of various kinds, in pieces much larger than they can conveniently swallow, can fail to notice that, even when the bird has to pick the article to pieces to eat it, the last piece swallowed is always much larger than is commonly considered an appropriate size for morsels of its food. It has been usual to attribute this to gluttony and to the fear of having a choice morsel snatched away, but it is simply the natural habit of the bird to swallow the largest morsel adapted to its structure.

The crop of the bird corresponds to the rumen, or paunch, in ruminant quadrupeds, but in the provision for reducing food, after subjection to the action of the secretions of the crop and proventriculus, a bird resembles the orders below it in the scale of development. The food of the bird is masticated, or triturated, in the gizzard. Reasoning from analogies observed between birds and ruminants, and from the fact that small particles of stone, glass, earthenware, etc. were often found in the gizzards of fowls in course of preparation for the table, it was long ago assumed that the gizzard itself was inadequate for its function, and that the bird swallowed these substances because they were required for the mastication of its food. One of the common precepts of poultry culture is that poultry must be constantly supplied with "fresh, sharp grit" or it cannot properly digest its food, and the practice of supplying the birds with the teeth that nature neglected to provide is quite general.

In respect to the gizzard, as in capacity for swallowing, birds are more like some reptiles and insects than like the familiar animals with which their nutritive organs are usually compared. The crocodile has an organ resembling a gizzard, and some naturalists[2] have said that, like birds, crocodiles swallowed stones to aid "the gastric mill." Some insects have gizzards supplied with tooth-like processes. From these several analogies the reasonable presumption is that the bird does not require grit to grind its natural food, and that, while occasional eating of indigestible articles of this kind might be called an error in selecting food, the regular consumption of such stuffs would indicate unnatural feeding and an abnormal condition of the digestive tract as a result. This point will be further considered in a subsequent paragraph.

[1] I have seen a very large Brahma hen swallow alive a mouse more than half grown.

[2] James Orton, Comparative Zoölogy.

Differences in beaks and crops. In the gallinaceous birds the upper mandible forms a stout, sharp hook, and this beak is a most efficient tool for the prehension of food and also to supplement the claws in uncovering food concealed on or near the surface of the ground. In waterfowl the bill is much larger: in the duck it is long, broad and flat, shovel-like, and especially adapted to securing food in water; the bill of the goose is less flattened, stronger, and the edges of the upper mandible are more serrated. The serrations of the mandibles in waterfowl seem to serve a double purpose: they give a firmer hold on the coarse vegetation growing in water and in moist places, of which these birds eat great quantities; they also serve as strainers to retain in the mouth small forms of animal life taken in with water, which is forced out at the sides. The crops of gallinaceous birds are large and will hold considerable quantities of food; the crops of ducks and geese are small.

Natural foods and feeding habits of poultry. In a study of the subject of feeding, the natural foods and feeding habits of poultry must be considered. It is to these natural diets that the organs and habits of the birds were adjusted in the wild state, and though they readily adapt themselves to different diets, there are some features of the natural life and diet which must be preserved in every artificial method intended for continuous use. The *form* in which food is taken is of more importance in feeding practice than the proper balancing of nutrients in the ration; for while a badly balanced ration produces malnutrition, its bad effects develop slowly and are usually promptly remedied by a proper diet, but a ration that is unsuitable in form (however well balanced in its nutrient elements) if eaten by the bird reluctantly and in insufficient quantities may result in malnutrition, or, if eaten readily, may cause disorders of the digestive organs which develop quickly and are not easily remedied. The form in which food is taken also has an important influence on exercise and the general physical habits which affect digestion.

Gallinaceous domestic birds[1] *are conspicuously granivorous* when compared with carnivorous and herbivorous creatures, but under natural conditions, with opportunity to eat as much as they

[1] Fowls, turkeys, guineas, peafowls, and pheasants.

want of the different kinds of food, it is probable[1] that they derive about as much of their nourishment from animal and green foods as from grains and seeds. The form in which they take foods differs in nearly every case from the form in which it is supplied to them by a keeper. The grains and seeds that they get in the natural state are mostly small, and a large proportion of them are at some stage of germination. Very small grains and seeds are taken only in the absence of larger ones, but these small seeds, as of grass and many weeds, are eaten greedily, blade (or leaf), root, and all, after germination. There are few, if any, of our common plants and weeds that poultry will not eat in the first tender stage, though there are many for which they have little appetite when they have passed beyond that stage. They always prefer tender vegetation, and it has often been noted that their marked preference for certain plants was for the condition, not for the kind. The animal food secured under natural conditions consists principally of small creatures (insects, worms, etc.) *eaten whole*, bony and fibrous parts being swallowed with the rest. Under these conditions all poultry undoubtedly consume very much larger quantities of indigestible material than the poultry keeper usually gives them, but much of this is in such form that it mechanically assists the processes of digestion, giving greater bulk to the ration and preventing the more nutritious parts from massing, or lumping, so that the organs and secretions do not properly operate on them. The digestive organs of these birds are adjusted to a mixed diet containing a considerable proportion of indigestible material. Normally the food, even on good range, is secured only by effort which gives the bird all the exercise needed to keep it in good condition. The activities of the birds are manifested in walking and running after

[1] Such a point is much more difficult to determine definitely than at first appears. The birds may eat at one time or season larger quantities of one kind of food, at another time or season larger quantities of another kind of food, according to abundance of supply, temperature, etc. Habit and familiarity with articles also have a great deal to do with their selection of food, and so observations for short periods are often of little value. But whoever closely observes the feeding of a few of these birds on a range where food of all kinds is abundant and they can select just what they want, cannot fail to be impressed by the attention that they give to vegetation and insects, and by the difference in the consumption of grain between a flock on good range and a yarded flock supplied liberally with the vegetable and animal foods most used for poultry in confinement.

insects (sometimes with the assistance of the wings) quite as much as in scratching.

The common waterfowls (ducks and geese) are less alike in diet than the strictly land birds. Both frequent shallow water and the margins of streams, and feed largely on the small and minute forms of animal life found in such waters; but ducks are more disposed to supplement this with the insects which abound in such localities, while geese are more attracted to the vegetation in the water and on the lowlands near by. Neither ducks nor geese care much for whole grains, and efforts to feed them whole grains in considerable quantities generally give very unsatisfactory results, because their nutritive organs are not adapted to dealing with food elements in that form. Their bills, though excellent for securing small food in water, are not so well formed to picking up small grains, and, their natural diet being principally of soft foods which need not remain long in the crop, that organ is small and not adapted to a diet of whole or broken grains. Ducks in domestication are often grown on a diet which consists principally of ground grains, and may be fed meat much more freely than any of the other kinds of poultry. Geese thrive best when given good grass pasture as the basis of their ration, with ground grain to supplement it. Both ducks and geese are gross feeders, eating large quantities of bulky foods. They take exercise mostly in the water. The goose moves in a most leisurely manner on land. The duck's movements are more rapid for short distances (as when darting after insects), but if driven out of a slow walk, ducks which cannot fly break down and flounder about helplessly. Neither ducks nor geese seem to require much exercise to keep them in condition.

The swan feeds mostly from the surface of the water, living largely on coarse grasses and weeds. It is said to be very destructive to fish spawn and young fish.

The ostrich, in diet and feeding habits, has more resemblance to the goose than to any other kind of poultry. It is a grazing bird and may be kept on pasture without other foods.

NOTE. It should be observed that in the natural foods of all kinds of poultry there is a very large proportion either of fibrous matter or of water serving as a diluent for the principal nutrient elements; also, that in a natural diet, with its great variety of foods of all kinds, not only are the principal food elements obtained in a greater variety of forms, but the variety of minor food elements is much greater, including small quantities of many elements not secured when the birds eat only such food as man may profitably provide for them. The function of these minor elements in nutrition is little understood. The fact that our domestic animals and birds thrive better on a ration which gives them a variety of those elements or essences characteristic of different organisms that are about equal in the value of their principal nutrients, suggests that they have functions of great importance in nutrition, although, in the present state of knowledge of the subject, they cannot be included in food calculations based on the chemical constituents of food articles. Again, the fact that certain foods are evidently better foods for certain animals than other foods almost identical in the proportions of their principal nutrients indicates that the peculiar value of these foods is either in their form or in the form in which the principal nutrients appear in them, or in some of the minor elements.

Common poultry foods. In every place those foods (used by man for himself or his larger domestic animals) which can be fed to poultry most economically are the poultry foods in general use. In any section the grain that is most abundant and cheapest is likely to be the principal food of the poultry of that section. Throughout the greater part of the United States corn is the principal grain fed to poultry, but in wheat-growing sections wheat may be cheaper. In Japan rice is the principal grain fed to poultry. *By-products* of all kinds of food preparations form an increasingly important part of the common poultry foods. In a sense the greater part of all food used by poultry is waste product or by-product. The wheat, oats, barley, or other grain fed to poultry is usually of inferior grade, damaged, or, if of choice quality, only temporarily available because of an oversupply bringing the price to a point where it can be profitably fed to stock. Even of corn, which is produced in such enormous quantities, a large proportion of what is sold for stock feeding is of poor quality. As a result of modern methods of preparing and handling foodstuffs for man, by-products of mills and packing houses, in great number and quantity, are placed on the market for stock feeding. The profitable use of these requires some knowledge of the composition and feeding properties and values of foods.

Composition of foods. Nutritive elements in foods are proteids, carbohydrates, fats, and ash (mineral matter). All foodstuffs also contain fiber and water, the proportions of these varying widely according to the kind and condition of the article. Fiber is largely indigestible. Water is the necessary solvent for food solids. It is present in sufficient quantities for this purpose only in succulent vegetables and fruits and in fresh meats. As its function is mechanical, it is not considered in discussing and calculating nutritive values, but in feeding practice the quantity of water in the food may have an important bearing on results. Fiber also seems to have a mechanical function.

Protein is the common name for the nitrogenous substances which supply material for the structure of the body. The white (albumin) of an egg is protein, supplying the materials for a fully developed chick.

Carbohydrates are principally starches and sugars supplying fuel (for heat and energy) and fat (reserve fuel for the same purposes).

Fats (as food) are considered highly concentrated carbohydrates.

Minerals in animal nutrition are chiefly calcium and phosphate compounds. In poultry feeding, lime in available form is of special importance.

The common grains contain these food elements in such proportions that, so far as actual nutrients are concerned, any of them will make a good grain ration for poultry sufficiently supplied with green food and animal food, and so able to balance their own ration, as they do in the natural state. The differences in the composition of the whole grains are in some cases considerable, yet not so great that they cannot be equalized by variation in the quantities of other foods and by the power of organisms to utilize an excess of one kind of nutrients to supply a deficiency of another, or to conserve available supplies of another. Thus an excess of protein is converted into fat and stored in the body, and an excess of carbohydrates or fat, though not convertible into protein, is also stored up as fat in the body, furnishing a reserve of heat and energy. The by-products of articles manufactured for human beings often have nutrient elements in quite different proportions from the articles of which they are made. Usually the by-product is less valuable as a food, but in some cases it contains a larger proportion of some valuable element (see descriptions of foodstuffs in the next chapter).

Nutrient ratio. The relative proportions of principal elements in food articles are mathematically expressed in the form of a ratio, commonly called the nutritive ratio, but more correctly described as the "nutrient ratio." To obtain this the percentage of protein in the article is taken as the first term of the ratio; the percentage of carbohydrates and fats (the fats being reduced to terms of carbohydrates)[1] is taken as the second term, and the ratio is reduced to its simplest form, in which 1 represents the value of the protein. If the difference in the proportions of the two classes of elements, as thus expressed numerically, is small, the nutritive ration is said to have a *narrow* ratio; if the difference is great, the ration is said to have a *wide* ratio. Rations having a narrow ratio are called *narrow rations*, and those having a wide ratio, *wide rations;* but these terms are usually employed to describe the relations of rations compared, not to a standard, but to each other. The chemical values of the nutrients in a food are also expressed in figures which represent the total heat-producing value of all elements combined; this is called the *fuel value* or *potential energy* of the article.

The chemical composition of any food article may be accurately determined by the chemist, and the nutrient ratio and fuel value established and expressed. As different samples vary in composition, standards for general use are made by taking averages of numbers of analyses of each kind of food. The composition of ordinary lots of whole foods (as grain, hay, milk, and meat of any kind) will closely approximate these standards. The variations from them will not, as a rule, be great enough to materially affect results in feeding, and those who have occasion to calculate percentages may assume that a whole-food article which appears to be of average quality is of average, or standard, chemical composition. Nature makes no variations in foods so great as to disturb the nutritive processes of organisms using them.

In by-products nutritive values are less stable and uniform. Nearly all states now require such products to be sold under a guaranty of their most valuable nutrients. While this affords the purchaser protection from those who would unscrupulously pass

[1] This is done by multiplying the value of the fats by 2.25 or by 2.27. Authorities are not all agreed in regard to the fraction, and it makes no material difference, for all values in feeding are approximate and relative.

off an inferior article, it does not always inform him even approximately of the nutritive value of the article. Many, especially of the highly concentrated by-products, run very unevenly in composition, and the manufacturers, to be on the safe side, place their guaranty below the minimum (see "Beef scrap," Chapter XII). The bulletins of the various state experiment stations giving analyses of foods of this class offered for sale in the state afford the most trustworthy information in regard to their composition.

Neither nutrient ratio nor potential energy gives a generally applicable standard for accurately measuring nutritive values. Both, however, are serviceable in comparisons of food values, and comparison of either the nutrient ratios or the fuel values of two similar articles often shows their relative feeding values. Judged by practical observation, a comparison which considers both may be even more accurate. It might be so invariably if feeding value depended solely on the quantities and proportions of the principal elements; but, as the description of foods in the following chapter will show, there is sometimes a very great difference between the feeding value of two articles as indicated by their chemical constitution and as demonstrated in practice.

Nutrients vary in digestibility. Creatures differ in digestive power, and the same creature digests a certain kind of food more completely at one time than at another. Investigators of the science of feeding have determined, by careful experiment, "digestion coefficients" for most of the common food articles for the larger animals, and in a few instances for poultry; but, in the case of poultry especially, the observations are too few and the results too irregular to warrant the use of these coefficients in a study of foods and feeding.

Expression of nutritive values. Nutritive standards are commonly expressed in terms of nutrient ratio and fuel value. Although, as has been said, neither of these measures is accurate, they give the best basis that we have for the comparison of food values in numerical terms. They are found for each kind or class of animals, and for each purpose for which the animals are fed, by calculating the chemical values of rations the actual feeding value of which has been demonstrated in practice. What was said of the comparison of values of different food articles on the basis of nutrient ratio and fuel value applies as well to comparisons of rations containing a variety of foods, both with other rations and with single articles of food. For this purpose any article or ration may be taken as the standard with which others are compared; but it is most fitting that the ration or article selected be, if a ration, a complete, well-balanced ration, and if an article, that food article which in itself is nearest to a complete ration. For a comparative study of foods and food values it is advisable to use a single article rather than a ration compounded of a variety of articles differing widely in physical as well as in chemical properties. Such a single standard presents to the eye and mind of the feeder a tangible and simple standard with which to compare all other articles and combinations of articles used as food. The use of a standard of this sort has the added advantage that it compels consideration of the physical as well as of the chemical properties of foods.

The food article which best meets the requirements for a single standard food for poultry is *wheat.*

CHAPTER XII

POULTRY FOODS

The preceding chapter included a brief explanation of the general properties of foods and their relations to the nutrition of poultry. It was shown that the food value of an article was not determined solely by the quantities and proportions of principal nutrients that it contained, but was affected by physical properties and minor nutrients. In this chapter articles used for poultry food will be described as to chemical contents, physical properties, and feeding values as observed in practice. Wheat, the single food article which is the nearest to a complete food for poultry, is taken as a standard of comparison. The statement of the chemical composition and values of wheat is repeated for direct comparison with similar data for each group of foods described, and differences and resemblances which affect feeding practice are mentioned. Only whole articles and ordinary by-products are described. For descriptions of special brands and mixtures, and of proprietary articles, the reader is referred to the manufacturers and to the bulletins of his state experiment station. In making so full a list of articles which may be used as food for poultry, it was not possible to secure all statements of chemical analysis from the same source, and the figures given will not always correspond with others to which the reader may have access. Such differences are immaterial and may be disregarded. In the study of food values mathematically expressed the student should always bear in mind that the figures represent averages of samples of several or many grades.

Wheat. Wheat contains the principal nutrients in about the proportions that analyses of ordinary good complete rations of mixed grains show. Physically, as compared with other grains commonly used for poultry, a grain of wheat is medium to small in size, and is smooth, having no hull. Varieties and grades of wheat vary in

TABLE I. COMPOSITION AND VALUES OF WHEAT AND WHEAT PRODUCTS

	Water %	Fiber %	Ash %	Protein %	Starches %	Fats %	Nutrient Ratio	Calories in 1 oz.
Wheat (plump) . . .	1.05	1.8	1.8	11.9	71.9	2.1	1:6.3	102
Wheat (shrunken or screenings) . . .	11.6	4.9	2.9	12.5	65.1	3.0	1:5.8	97
Low-grade flour .	12.4	0.9	0.7	10.0	75.0	1.0	1:7.7	101
Wheat middlings [1]	12.1	4.6	3.3	15.6	60.4	4.0	1:4.7	98
Wheat bran . . .	11.9	0.9	5.8	15.4	53.9	4.0	1:4.1	90
Mixed feed [1]	10.6	9.7	3.6	12.0	59.9	4.2	1:5.8	94
Stale bread .	31.2			6.9	44.2	0.5	1:6.6	61

color, plumpness, and hardness. The harder and darker-colored wheats are richest in protein and most valuable as poultry foods. Whole wheat may be fed exclusively to poultry, without apparent detriment, for a longer period than any other grain. It is preferred by most kinds of poultry to all other grains except corn.

Wheat screenings. When free from foreign matter, wheat screenings and shrunken wheat are practically the same, and do not differ noticeably from plump wheat in feeding value. Screenings are often heavily adulterated with weed seeds, grain hulls, etc., and are very generally sold at too high a price, because many purchasers will take the lowest-priced article of its kind without considering quality. It is quite usual to find wheat screenings selling readily at only 10 or 12 per cent below the price of good wheat, when the value (because of adulterants) may be 15 to 20 per cent, or even more, less than that of the good wheat.

Low-grade flour. Wheat flour not suitable for bread making is a most valuable ingredient in mashes, both adding to the nutrients and improving the consistency of mashes made from coarse by-products. Low-grade flour is also called *red-dog flour*.

Middlings. Coarse flour and fine bran, in varying proportions in different lots and in the products of different mills, is called middlings. In many sections middlings, as a separate article, is rarely found on the market.

[1] The term "shorts" in some sections means *middlings* and in others a mixture of bran and middlings. It is sometimes applied indiscriminately to any and all kinds of wheat offals.

Bran. Bran is the coarser part of ground wheat. Pure bran is much lower in feeding value than is indicated by its analysis. Much of the product now sold as bran contains a large proportion of middlings and is also sold under the names "mixed feed" and "shorts."

Stale bread. The greater part of the stale bread used for poultry food is white bread, but often the refuse bread from city bakeries, hotels, and restaurants contains considerable proportions of other kinds of bread and of cake. All such articles are valuable foods for poultry and, at the usual prices, are cheap foods.

NOTE. *A comparison of the nutrient ratios and fuel values of these wheat products with those of whole wheat* indicates for them a feeding value closely approximating that of wheat, but stale bread is the only one of them that in practice gives the results that the comparison suggests. Though usually fed only as a part of the ration (in a mash), it has been used for long periods, with excellent results, as the only grain food for fowls and chicks on range. The nutrient ratio is nearly the same as that of wheat. The low fuel value indicated is due to the high per cent of water. Low-grade flour, differing little from wheat in the proportions and values of principal nutrients, can, because of its form, be fed only in combination with coarser and less glutinous materials. Middlings and bran both compare very closely with wheat, and good rations for continuous use may be compounded, having the nutrient proportions and fuel values of these by-products; yet neither of them alone, nor the two in combination, will go very far in feeding. The percentage of fiber is high in both, and especially high in bran. Their chief service in poultry feeding is to dilute and temper the corn meal, which is the basis of most mashes and which supplies in cheaper form some of the nutrients in the wheat flour of which these are by-products.

Corn. In nearly all parts of the United States field corn is the principal grain used for poultry food. In percentages of nutrients it does not differ greatly from wheat, except in fats. The grains of corn are from four to six times as large as grains of wheat. As a rule, when poultry have access to a variety of whole grains, they eat the corn first. When cracked corn is mixed with other grains, this preference is less marked, which suggests that the larger size of the grain may be the attraction. Yellow and white corn show in analysis no difference in principal nutrients. In feeding practice no difference is noted, except that yellow corn gives its color to the fat of birds fed on it and to the yolks of their eggs. Many

TABLE II. COMPOSITION AND VALUES OF CORN AND CORN PRODUCTS

	Water %	Fiber %	Ash %	Protein %	Starches %	Fats %	Nutrient Ratio	Calories in 1 oz.
Wheat	*10.5*	*1.8*	*1.8*	*11.9*	*71.9*	*2.1*	*1:6.3*	*102*
Field corn	10.9	1.9	1.5	10.4	70.3	5.0	1:7.9	106
Sweet corn	8.8	2.8	1.9	11.6	66.8	8.1	1:7.5	111
Pop corn	10.7	1.8	1.5	11.2	69.2	5.2	1:7.3	107
Corn meal (unbolted)	12.0	2.2	1.3	8.7	71.1	4.7	1:9.5	104
Corn meal (bolted)	12.0	1.2	1.0	8.9	72.0	4.9	1:9.5	106
Corn meal (granulated)	12.5	1.0	1.0	9.2	74.4	1.9	1:8.6	102
Corn and cob meal	15.1	6.6	1.5	8.5	64.8	3.5	1:8.6	94
Hominy meal	11.1	3.8	2.5	9.3	64.5	8.3	1:8.7	108
Gluten meal	9.6	1.6	0.7	29.4	52.4	6.3	1:2.3	111

poultry keepers consider hard (flint) corn a better food than soft (dent) corn, but in common practice no difference is observed. Sweet corn and pop corn are practically the same in feeding value as field corn but are not generally available for poultry feeding. Because whole corn may be eaten so rapidly that a full meal is quickly secured without exercise, the practice of feeding cracked corn has become general. Cracked corn, when fresh, does not differ in composition from the whole corn of which it was made, but after being cracked it may deteriorate rapidly, especially in warm weather. It is peculiarly subject to heating and to molds, and when stale or moldy is a most unsafe food, particularly for young stock. It is usually cracked in two sizes,—coarse, for general use, and fine, for small chicks. Corn is the most easily digested of the common grains. Because of this and its heating properties, the free use of corn for fowls in close confinement and not plentifully supplied with green food is usually followed, in hot weather, by digestive disorders. With due attention to exercise, and with abundant supplies of green food and the less concentrated animal foods (insects, milk), good results may be obtained from a diet in which corn is the only grain fed. In extreme cold weather it may be fed more freely.

Corn meal. Corn meal is the foundation of most mashes for poultry. Coarse, unbolted meal is to be preferred, and if mashes are cooked or given time to swell after mixing, the coarser *corn chop* will be still better. The corn meals on the market vary greatly in quality; a great deal of what is offered for stock feeding is made of inferior or damaged corn. Corn meal is very liable to heat in warm weather. The heating may be stopped by spreading the meal two or three inches thick in a bin or on a clean floor, but if the meal when cold smells musty or sour, it should not be fed to poultry.

Corn bran and corn middlings. Corn bran has considerably less food value than corn meal. Corn middlings is richer than meal in both protein and fat, and probably has a slightly greater feeding value.

Corn and cob meal. Unless a large part of the coarse, fibrous material of the cob is sifted out, corn and cob meal does not make a satisfactory poultry food. As a rule, poultrymen prefer to dilute corn-meal mixtures with wheat bran or finely cut hay.

Hominy meal. The soft part of the corn kernel remaining after the hard part has been separated in the manufacture of hominy grits is ground into hominy meal. It has about the same analysis as corn meal, and in localities where it can be obtained is often substituted for it, as the more economical of the two foods.

Gluten meal and gluten feed. Gluten meal is one of the products separated from corn in the manufacture of glucose; gluten feed is a mixture of this with other by-products of the same process. Both are very rich in protein and fat. They are not extensively used for poultry, chiefly, perhaps, because meat meals and scraps have been found so satisfactory in supplementing the supplies of those elements in the ordinary poultry foods.

Whole oats. When of good quality, whole oats are about equal to wheat in feeding value. The fibrous hull makes them less acceptable to poultry than a smooth grain, and when a choice is offered, they neglect the oats. When kept on an oat diet, however, they eat oats freely, provided they are of good quality. In oat-growing sections, oats are often the only grain fed. Clipped and hulled oats are sometimes used, but do not appear to be more attractive to poultry than whole oats of good quality. Birds familiar with other grains show a lack of eagerness for hulled oats and various milled forms of oats; this indicates that the fibrous hull is not the only feature objectionable to them. It is probable that the objectionable property is the fat, which is as abundant as in corn

TABLE III. COMPOSITION AND VALUES OF OATS AND OAT PRODUCTS

	Water %	Fiber %	Ash %	Protein %	Starches %	Fat %	Nutrient Ratio	Calories in 1 oz.
Wheat	*10.5*	*1.8*	*1.8*	*11.9*	*71.9*	*2.1*	*1:6.3*	*102*
Oats	11.0	9.5	3.0	11.8	59.7	5.0	1:6.1	96
Oatmeal	7.9	0.9	2.0	14.7	67.4	7.1	1:5.8	113
Oat bran	7.7	19.3	3.7	7.1	57.9	2.3	1:8.9	81
Oat feed	8.2	12.5	4.2	12.6	56.3	6.2	1:5.7	96
Oat middlings	9.2	3.8	3.2	20.0	56.2	7.6	1:3.7	108
Rolled oats	8.4	.	1.9	15.0	66.6	7.5	1:5.7	114

and has a less pleasing flavor. The generally poor quality of oats offered for stock food tends to diminish their use as food for poultry.

Oatmeal. Oatmeal was long considered the best of foods for chicks. This idea of its quality was based on tradition rather than on results. It was common, years ago, for poultry growers to buy the pinhead oatmeal prepared for human food, paying for it three or four times the price of corn products, which, with a little modification, could be made equal in nutrient values (if that were necessary) and which are much preferred by the poultry. Of late years the use of oat products for young chickens is less common, and *rolled oats* is generally used instead of oatmeal. At the usual prices they are not economical foods.

Oat bran and oat feed. As Table III shows, oat bran and oat feed contain very large percentages of fiber. They are rarely offered for sale as straight products, but appear in combination with ingredients which supplement their deficiencies.

Oat middlings. Oat middlings is a high-quality product, but is not extensively manufactured and is not much used for poultry.

Sprouted oats. Oats sprouted until the blades are from four to six inches long are much relished by poultry, but it is usually more economical to provide a green food which does not require so much care in preparation.

Barley. By analysis barley appears almost identical with wheat in feeding value. Its nutritive ratio is slightly narrower and by so much nearer to that of average good rations. As usually sold, with the hull on, it is eaten by poultry less readily than wheat,

TABLE IV. COMPOSITION AND VALUES OF BARLEY AND BARLEY PRODUCTS

	Water %	Fiber %	Ash %	Protein %	Starches %	Fat %	Nutrient Ratio	Calories in 1 oz.
Wheat .	*10.5*	*1.8*	*1.8*	*11.9*	*71.9*	*2.1*	*1:6.3*	*102*
Barley	10.9	2.7	2.4	12.4	69.8	1.8	1:6	100
Barley screenings	12.4	7.6	3.6	12.2	61.6	2.6	1:5.5	92
Barley meal	11.9	6.5	2.6	10.5	66.3	2.2	1:6.8	93
Malt sprouts	10.2	10.7	5.7	23.2	48.5	1.7	1:2.3	87
Brewer's grains (dry)	8.2	11.0	3.6	19.9	51.7	5.6	1:3.3	97

but in barley of good grade the proportion of fiber is small compared with the fiber content of good oats, and fowls habituated to the use of whole barley, and not also supplied with wheat, will eat it quite as freely as they would wheat. In practical feeding, wheat and barley show no difference in results. There is an increasing use of whole barley as poultry food in barley-growing sections. Its use in other sections is less general, because of irregularity of supply. It is usually sold at a figure enough lower than the price of wheat of corresponding quality to make it the more economical food.

Barley screenings. Barley screenings consist of the less-developed grains and often contain broken hulls, particles of straw, etc. If clean they may be equal to good barley in feeding value.

Barley meal. Barley meal is almost unknown to American poultry keepers, very little of this grain being milled.

Malt sprouts. The sprouts removed from barley sprouted in the manufacture of beer are used principally for cattle feed but occasionally for poultry.

Dried brewer's grains. The residue from barley in the manufacture of beer consists of a small part of the starch with most of the gluten, the germ, and the hull and is called brewer's grain. Its use as poultry food has not been extensive enough to determine its value. At an appropriate price it should be a valuable food.

Rye. From the poultry feeder's standpoint rye is an anomaly among grains. As analyzed it closely resembles wheat and is not markedly unlike it in appearance; the grains are smooth and a little smaller in size. When fed to poultry accustomed to other grains, rye is eaten by them reluctantly and in small quantities.

On the other hand, the fact that poultry having access to ground recently seeded with rye, though liberally fed on other grains, eat it as readily as any grain, suggests that the changes incident to germination make it more palatable to them. The extent to which rye is used as food for both human beings and live stock in some

TABLE V. COMPOSITION AND VALUES OF RYE AND RYE PRODUCTS

	Water %	Fiber %	Ash %	Protein %	Starches %	Fat %	Nutrient Ratio	Calories in 1 oz.
Wheat .	*10.5*	*1.8*	*1.8*	*11.9*	*71.9*	*2.1*	*1:6.3*	*102*
Rye	11.6	1.7	1.9	10.6	72.5	1.7	1:7.2	100
Rye bran	11.6	3.5	3.6	14.7	63.8	2.8	1:4.8	98

foreign countries indicates that it does not differ greatly from the other grains in actual feeding value, and that, if necessary, it might be more extensively used here. With abundance of other foods there is no occasion to force poultry to a rye diet.

TABLE VI. COMPOSITION AND VALUES OF MIXED MILL FEEDS

	Water %	Fiber %	Ash %	Protein %	Starches %	Fat %	Nutrient Ratio	Calories in 1 oz.
Wheat	*10.5*	*1.8*	*1.8*	*11.9*	*71.9*	*2.1*	*1:6.3*	*102*
Corn and oat chop (equal parts) . . .	11.9		2.2	9.6	71.9[1]	4.4	1:8.6	106
Corn (8 parts) and bran (5 parts) feed . .	11.5		2.7	10.6	71.2[1]	4.0	1:7.6	105
"Provender" (corn, 45 lbs.; oats, 125 lbs.; bran, 100 lbs.)	9.4	10.4	3.1	13.0	58.8	5.3	1:5.5	97
Corn, rye, and oats (equal parts)	10.4		1.9	10.6	73.7[1]	3.4	1:7.4	106

Mixed mill feeds. Under this head are described ground mixtures of the common grains and of their by-products. Such mixtures are usually made for a special demand, or to work off grains, like rye and low-grade oats, that are not readily salable in their natural form. They are, as a rule, more uniform in quality and

[1] Including fiber.

more satisfactory than mixtures of by-products, because all nutrients are present in natural proportions. The chief fault in mixtures containing oats is the presence of the loose, broken hulls, which, apparently, irritate the digestive organs much more than when swallowed on the whole oat. On this account these mixtures are particularly injurious to young poultry, and when fed to them should be sifted before wetting. They are also liable to heating in warm weather.

TABLE VII. COMPOSITION AND VALUES OF BUCKWHEAT AND BUCKWHEAT PRODUCTS

	Water %	Fiber %	Ash %	Protein %	Starches %	Fat %	Nutrient Ratio	Calories in 1 oz.
Wheat	*10.5*	*1.8*	*1.8*	*11.9*	*71.9*	*2.1*	*1:6.3*	*102*
Buckwheat	12.6	8.7	2.0	10.0	64.5	2.2	1:7	83
Buckwheat groats	10.6	0.3	0.6	4.8	83.1	0.6	1:17	103
Buckwheat bran	14.0	14.7	3.4	17.1	46.4	4.4	1:3.3	85
Buckwheat middlings	13.2	4.1	4.8	28.9	41.9	7.1	1:2.1	101

Buckwheat. As a food for poultry, buckwheat appears much oftener in grain mixtures than alone. Its analysis compares quite closely with that of wheat, except as to fiber and ash. It is a large seed, angular, with hard hull, and poultry are quite indifferent to it in the whole form.

Buckwheat groats, buckwheat bran, and buckwheat middlings. Buckwheat groats is hulled or crushed buckwheat. Buckwheat bran is sometimes used in place of wheat bran and is very satisfactory. Buckwheat middlings is also used occasionally in mashes. None of the buckwheat products, however, are extensively used for poultry in this country. In Europe their use is more common, as the preference there for white fat in poultry makes corn an objectionable food.

Rice. Rice and rice products are little used as poultry food except in countries where rice is the staple food for human beings. In this country the quantities available at prices which warrant feeding to poultry are too limited to admit of their general use. Broken rice is often used in chick-feed mixtures. Occasionally a poultryman secures a lot of broken or slightly damaged rice, or of a rice by-product, at a price proportionate to its feeding value and to the price of staple grains fed to poultry.

TABLE VIII. COMPOSITION AND VALUES OF RICE AND RICE PRODUCTS

	Water %	Fiber %	Ash %	Protein %	Starches %	Fat %	Nutrient Ratio	Calories in 1 oz.
Wheat .	*10.5*	*1.8*	*1.8*	*11.9*	*71.9*	*2.1*	*1:6.3*	*102*
Rice .	12.4	0.2	0.4	7.4	79.2	0.4	1:10.9	102
Rice bran .	9.7	9.5	10.0	12.1	49.9	8.8	1:5.9	95
Rice hulls	8.2	35.7	13.2	3.6	38.6	0.7	1:11.2	48
Rice flour	10.0	6.3	6.7	11.7	58.0	7.3	1:6.5	80

Sorghum seed. Sorghum seed is more like corn than wheat in its constituents, but is smaller than wheat, round and smooth. It is not generally available for poultry food but, when procurable at a price not higher than that of wheat, makes a desirable food. *Sorghum-seed meal* may be used, in whole or in part, as a substitute for corn meal.

TABLE IX. COMPOSITION AND VALUES OF SORGHUM- AND BROOM-CORN SEEDS AND THEIR PRODUCTS

	Water %	Fiber %	Ash %	Protein %	Starches %	Fat %	Nutrient Ratio	Calories in 1 oz.
Wheat	*10.5*	*1.8*	*1.8*	*11.9*	*71.9*	*2.1*	*1:6.3*	*102*
Sorghum seed . .	12.8	2.6	2.1	9.1	70.0	3.6	1:8.6	102
Sorghum-seed meal .	13.2	1.8	1.6	8.3	71.3	3.8	1:9.2	102
Broom-corn seed	14.1	7.1	2.0	9.6	64.7	3.5	1:7.6	95
Broom-corn-seed meal	13.5	6.9	2.1	9.7	64.2	3.6	1:7.3	95

Broom-corn seed. Broom-corn seed is nearer wheat in nutrient ratio than sorghum seed and lower in fuel value. In appearance it greatly resembles sorghum seed. Poultry may not eat it freely with the hull on, but will eat the cleaned seed quite as readily as wheat, and thrive just as well on it. Broom-corn-seed meal may be used to some extent as a substitute for corn meal and middlings.

Flaxseed and cotton seed. Whole flaxseed and cotton seed can hardly be considered as poultry foods, but their analyses are given for purposes of comparison. If available, either could be used in small quantities, but it would not be advisable to compel poultry to eat more of seeds so rich in vegetable fats and protein than they would take freely when fed a liberal general ration.

TABLE X. COMPOSITION AND VALUES OF FLAXSEED AND COTTON SEED AND THEIR PRODUCTS

	Water %	Fiber %	Ash %	Protein %	Starches %	Fat %	Nutrient Ratio	Calories in 1 oz.
Wheat .	*10.5*	*1.8*	*2.8*	*11.9*	*71.9*	*2.1*	*1:6.3*	*102*
Flaxseed	11.8	7.9	3.4	21.7	19.6	35.6	1:5	141
Ground linseed . . .	8.1	7.3	4.7	21.6	27.9	30.4	1:4.8	137
Linseed meal (old process)	9.2	8.9	5.7	32.9	35.4	7.9	1:1.7	99
Linseed meal (new process)	10.1	9.5	5.8	33.2	38.4	3.0	1:1.4	91
Cotton seed . .	9.9	22.6	4.7	19.4	23.9	19.5	1:3.5	101
Cottonseed meal	8.2	5.6	7.2	42.3	23.6	13.1	1:1.3	111
Cottonseed hulls .	10.4	44.4	2.6	4.0	36.6	2.0	1:10.1	52
Cottonseed feed . .	5.9	21.57	4.4	23.9	37.5	6.8	1:2.3	89

Ground linseed. Ground flaxseed from which the oil has not been extracted is called ground linseed.

Linseed meal. Linseed meal is ground flaxseed from which the oil has been extracted. Old-process meal is made from seed from which as much as possible of the oil has been extracted by pressure. New-process meal is made from the residue of seed from which a large percentage of the oil has been removed by a chemical process. Old-process linseed meal is often called simply oil meal. New-process linseed meal often goes by the trade name "Cleveland flax meal."

Cottonseed meal, cottonseed feed, and cottonseed hulls. Cottonseed meal is the only one of the three by-products of the manufacture of cottonseed oil in which a poultry feeder would usually be interested. Cottonseed feed might be used (at the right price) in a ration which did not otherwise contain much fiber and fat. The meals of this class are sometimes used in poultry feeding, but are not popular as poultry foods, because it is found generally more satisfactory to use animal foods to add to the protein and fat in grain and vegetable rations. Cottonseed hulls are of little value for poultry.

Peas and beans. In limited quantities peas and small beans are readily eaten by poultry. They will regularly eat a little, but object to large proportions of them in their rations. *Pea meal* is sometimes used in mashes, but more by amateurs and experimenters trying to secure maximum results than by others. All these products are

TABLE XI. COMPOSITION AND VALUES OF PEAS AND BEANS

	Water %	Fiber %	Ash %	Protein %	Starches %	Fat %	Nutrient Ratio	Calories in 1 oz.
Wheat	*10.5*	*1.8*	*1.8*	*11.9*	*71.9*	*2.1*	*1:6.3*	*102*
Peas	13.4	6.4	2.4	22.4	52.6	3.0	1:2.4	85
Cowpeas	14.8	4.1	3.2	20.8	55.7	1.4	1:2.8	92
Pea meal	10.5	14.4	2.6	20.2	51.1	1.2	1:2.6	85
White field beans	15.0	3.2	3.1	20.4	56.7	1.6	1:3	93
Navy beans	12.4	7.2	3.7	22.2	53.1	1.4	1:2.5	90
Soy beans	10.8	4.8	4.7	34.0	28.8	16.9	1:2.1	117
Soy-bean meal	10.4	2.6	5.1	36.0	27.0	18.9	1:2.6	123

unquestionably good poultry foods when properly combined with others in rations, but supplies are irregular and prices usually too high as compared with staple grain products to warrant using them extensively.

Miscellaneous seeds. Of the seeds given in Table XII only *Kafir corn* and *millet* are of any considerable importance to American poultry feeders. In regions where it is grown, Kafir corn has been quite extensively used for poultry, and is reputed equal to wheat, with which it corresponds quite closely in analysis. Chinese and Egyptian corn and durra are akin to Kafir corn. These seeds are rarely available for poultry feeding. Millet is useful in a combination of fine grains for small chicks, or as a light feed for fowls, but can be profitably used only when below wheat in price, and then only to a limited extent. In feeding millets of different varieties it will be observed that poultry prefer those having the largest seeds. *Sunflower* seed has a traditional reputation as an excellent conditioner, adding luster to the plumage. Its value for this purpose appears greatest when fed to fowls whose ration is deficient in fat, as is the case with many flocks whose keepers are prejudiced against the use of corn and meat. Birds having a ration sufficient in fat do not usually show any eagerness for sunflower seed offered to them in the hull, or shell (the seed might be classed as a nut), though they eat the meat greedily when it is removed from the hull.

TABLE XII. COMPOSITION AND VALUES OF MISCELLANEOUS SEEDS

	Water %	Fiber %	Ash %	Protein %	Starches %	Fat %	Nutrient Ratio	Calories in 1 oz.
Wheat	*10.5*	*1.8*	*1.8*	*11.9*	*71.9*	*2.1*	*1:6.3*	*102*
Chicken corn[1] .	14.8	8.7	4.3	10.0	58.9	2.7	1:6.2	87
Chinese corn	7.9	1.8	1.5	9.6	75.5	3.7	1:8.8	108
Durra . .	7.6	1.5	1.7	9.0	76.0	4.2	1:9.6	110
Kafir corn .	9.3	1.4	1.5	9.9	74.9	3.0	1:8.3	106
Egyptian corn .	12.6	1.9	1.9	9.9	69.7	3.9	1:8	103
Millet	13.5	9.5	3.0	12.7	58.0	3.3	1:5.3	82
Hempseed .	8.0	14.0	2.0	10.0	45.0	21.0	1:9.7	119
Rapeseed . . .	13.8	10.0	3.9	19.4	10.4	42.5	1:6.3	147
Sunflower seed	8.0	28.5	3.0	13.0	23.9	23.6	1:6.3	105

Green foods. The common things available for green food are quite similar in composition and very low in feeding value when

TABLE XIII. COMPOSITION AND VALUES OF GRASSES AND LEAVES (GREEN)

	Water %	Fiber %	Ash %	Protein %	Starches %	Fat %	Nutrient Ratio	Calories in 1 oz.
Wheat . . .	*10.5*	*1.8*	*1.8*	*11.9*	*71.9*	*2.1*	*1:6.3*	*102*
Grass (clippings) .	76.4	4.1	2.4	2.3	13.8	1.0	1:7	15
Clover, red . . .	70.8	8.1	2.1	4.4	13.5	1.1	1:3.7	23
Alfalfa . .	80.0	4.7	1.7	4.9	7.9	0.7	1:1.9	17
Alfilaria[2] .	80.0	4.7	1.7	2.8	9.8	0.9	1:4.3	17
Barley . .	79.0	7.9	8.8	2.7	8.0	0.6	1:3.5	14
Corn . . .	79.3	5.0	1.2	1.8	12.2	0.5	1:7.5	18
Cabbage . . .	90.5	1.5	1.4	2.4	3.9	0.4	1:2	8
Lettuce	95.9	0.5	0.8	1.0	1.6	0.2	1:2.1	4
Spinach .	92.4	0.7	1.9	2.1	2.4	0.5	1:1.7	6
Beet tops	90.0		0.1	1.3	2.3	0.3	1:2.3	5
Rape	86.0		2.0	1.5	8.6[3]		1:5.4	12
Onion tops .	91.0		0.1	0.8	3.0	0.2	1:2.7	8

[1] *Sorghum vulgare.*

[2] Akin to alfalfa. It grows wild in Southern California. [3] Including fat.

compared with wheat. The feeding value of all these things is not so much in the principal nutrients as in their succulence and the elements peculiar to the green state. In the grasses these may be preserved in part by careful curing, but the vegetables are useful only when green.

Cabbage. Because it is easily kept green, cabbage is the most valuable of all foods of this class for poultry. Cabbage, sown thickly in rows and fed from these sowings without waiting for heads, has been found one of the most economical of green foods.

Lettuce. Poultry often, if not usually, prefer fresh lettuce to cabbage, but it has not the keeping properties of cabbage.

Spinach and beet tops. Unless very young and tender, the leaves of spinach and beets are eaten freely only when the poultry are short of favorite green foods.

Rape. Rape may be pastured or cut continuously, and is much in favor with poultry keepers for sowing in yards, or for feeding to birds in close confinement.

Onion tops. The tops of onions are eaten in small or moderate quantities by all kinds of poultry. They are usually kept from birds about to be used for table purposes, and from those producing eggs for the table, because they impart their flavor to flesh and eggs.

Green-corn leaves and stalks, wheat, barley, oats, rye, etc. Any succulent fodder may be used for green food if cut up so that the birds can eat it. Such things are usually fed where green crops in considerable quantities must be grown especially for poultry and must be available before crops like lettuce and early cabbage are harvested, and the unmarketable surplus can be used for poultry food.

Ensilage. All kinds of ensilage can be fed to poultry, but it is usually found more convenient to use cabbage and succulent roots.

Clovers and alfalfa. The only hays that specially interest the poultry feeder are the clovers and alfalfa. It is desirable that both be cut while immature and very succulent, and that the green color be preserved as much as possible in the curing. These hays, as cured for other stock, usually contain a large proportion of coarse stems. When they are fed to cattle on the place, it is a common practice to reserve for the poultry the leaves shaken off in handling the hay.

TABLE XIV. COMPOSITION AND VALUES OF HAYS (DRY)

	Water %	Fiber %	Ash %	Protein %	Starches %	Fat %	Nutrient Ratio	Calories in 1 oz.
Wheat	*10.8*	*1.8*	*1.8*	*11.9*	*71.9*	*2.1*	*1:6.3*	*102*
Red clover	15.3	24.8	6.2	12.3	38.1	3.3	1:3.7	67
White clover	9.7	24.1	8.3	15.7	39.3	2.9	1:2.9	71
Alfalfa	8.4	25.0	7.4	14.3	42.7	2.2	1:3.4	71

Clover meal and alfalfa meal. Hay meals are in no way better than finely cut hay, while it is much easier to adulterate them or to mix with the leaves a large proportion of the woody stems.

TABLE XV. COMPOSITION AND VALUES OF ROOTS AND ROOT BY-PRODUCTS

	Water %	Fiber %	Ash %	Protein %	Starches %	Fat %	Nutrient Ratio	Calories in 1 oz.
Wheat	*10.5*	*1.8*	*1.8*	*11.9*	*71.9*	*2.1*	*1:6.3*	*102*
Potatoes (white)	78.9	0.6	1.0	2.1	17.3	0.1	1:8.3	22
Potatoes (sweet)	71.1	1.3	1.0	1.5	24.7	0.4	1:17.1	31
Beets (mangel-wurzel)	90.9	0.9	1.1	1.4	5.5	0.2	1:4.3	8
Beets (red)	88.5	0.9	1.0	1.5	8.0	0.1	1:5.5	11
Beets (sugar)	86.5	0.9	0.9	1.8	9.8	0.1	1:5.5	13
Beet pulp (fresh)	90.0	2.1	0.4	1.2	6.2	0.1	1:5.4	9
Beet pulp (silage)	88.9	3.6	0.5	1.5	5.4	0.2	1:4	8
Beet molasses	25.7		8.8	7.3	58.2[1]		1:8	75
Turnips	90.5	1.2	0.8	1.1	6.2	0.2	1:6	8
Rutabaga	88.6	1.3	1.2	1.2	7.5	0.2	1:6.6	10
Carrots	88.6	1.3	1.0	1.1	7.6	0.4	1:7.8	11
Parsnips	81.0	6.3	1.0	1.6	8.5	1.6	1:7.8	15
Onions	87.6	0.7	0.6	1.4	9.4	0.3	1:7.2	13
Artichokes	79.5	0.8	1.0	2.6	15.9	0.2	1:6	22

Potatoes. Though the most important roots in the diet of human beings, potatoes should be fed to poultry sparingly. In a cooked mash they are eaten readily, but if the proportion of potatoes in the mash goes above 15 to 20 per cent, and the birds are full fed of mash, it seems to cloy them and spoil the appetite for the next meal. Raw potatoes are sometimes fed to poultry, but are not eaten readily unless the birds are very hungry for succulent food.

[1] Sugar.

Mangel-wurzel and sugar beets. The most valuable roots for poultry are the mangel-wurzel and sugar beets. They are eaten freely and have no bad effects. They cannot take the place of *green* food fully but, being sweet and very succulent, are as good a substitute for it as can be obtained. They are easily kept and require no preparation before feeding.

Beet by-products. The by-products of beets are now attracting attention as food for poultry, but have not been used enough to show how they can be fed to best advantage.

Turnips. Turnips are fed both raw and in cooked mashes. When fresh and sweet they appear to be as good raw as mangels, but they do not keep so well and, as soon as they begin to decay, are likely to give a disagreeable flavor to the eggs of fowls eating them. The feeding of turnips not perfectly sound is probably responsible for the general belief that any turnip will taint eggs.

Carrots and parsnips. Carrots and parsnips are fed mostly in cooked mashes, small, unsalable roots being used.

Onions. In any form onions are much relished by poultry. Only very small quantities of raw onions can be given without flavoring eggs and flesh. Cooked onions may be fed more freely, as cooking drives off the volatile oil which gives the onion its peculiar pungency.

TABLE XVI. COMPOSITION AND VALUES OF FRUITS

	Water %	Fiber %	Ash %	Protein %	Starches %	Fat %	Nutrient Ratio	Calories in 1 oz.
Wheat	*10.5*	*1.8*	*1.8*	*11.9*	*71.9*	*2.1*	*1:6.3*	*102*
Apples	84.1	1.9	0.2	0.2	14.3	0.3	1:7.5	17
Tomatoes	91.3	0.7	0.7	1.0	5.8	0.5	1:7	9
Cucumbers	96.0	0.7	0.5	0.8	1.8	0.2	1:2.8	3
Pumpkin (flesh)	93.5	1.0	0.6	0.9	3.9	0.1	1:4.6	6
Pumpkin (seeds and stringy part)	76.9	3.9	1.5	6.0	4.8	6.9	1:2	31
Pie melons	94.5	1.2	0.4	0.8	2.9	0.2	1:4	7
Watermelons	92.4		0.3	0.4	1.7[1]	0.2	1:5	9
Grapes	77.4	4.3	0.5	1.3	14.9	1.6	1:14.2	28
Peaches	89.4	3.6	0.4	0.7	5.8	0.1	1:8.6	12
Pears	80.9	1.5	0.5	1.0	15.7	0.5	1:17	10
Plums	78.4			1.0	20.1[1]		1.20	24

[1] Including fiber.

Apples. All fruits and berries of temperate regions are eaten with relish by poultry, but the apple is the only one that seems to contribute substantially to their nourishment. The others may be eaten in considerable quantities without any notable decrease in the amount of grain required, but birds having access to all the apples that they can eat will often eat much less grain than usual and thrive remarkably.

TABLE XVII. COMPOSITION AND VALUES OF MEAT BY-PRODUCTS

	Water %	Fiber %	Ash %	Protein %	Starches %	Fat %	Nutrient Ratio	Calories in 1 oz.
Wheat	*10.5*	*1.8*	*1.8*	*11.9*	*71.9*	*2.1*	*1:6.3*	*102*
Green bones	6.9		24.5	22.3		16.5	1:1.8	69
Beef scrap	1.3		8.0	58.0		32.9	1:1.4	154
Pork scrap	0.8		2.2	57.4		39.6	1:1.7	170
Dried blood	6.7		6.6	65.1	5.3	16.3	1:0.6	124
Blood meal	9.6	2.2	3.8	74.1	8.8	2.1	1:0.2	103

Green bones. As usually collected, bones have some meat adhering. Different lots vary considerably in protein and fat. Green cut bone of average composition is generally considered the best of all animal foods for poultry. Its use is limited by the difficulty of securing regular supplies, by the labor of preparing it, and by the impossibility of keeping the prepared bone on hand in quantity in any but extreme cold weather.

Beef scrap, pork scrap, meat meal, blood meal, dried blood, etc. are cooked preparations of the offal of slaughterhouses and packing houses. The scraps and meals are usually the residue of rendered lard and tallow, scraps being coarsely, and meal finely, ground. Goods of this class are often adulterated with material fit only for fertilizer. Even when composed wholly of edible elements, there are wide variations in quality, due to differences in condition of material used. A good article may usually be known by its appearance and by its odor when scalded. It should have the odor of cooked meat, not that of fertilizer. The great advantages in using these preparations are their convenience and their keeping qualities. Most of them will keep for some months under any ordinary conditions. Stored in a cool, dry place, goods of this kind have been kept for several years without apparent deterioration.

In the general experience of poultrymen the use of cooked-meat preparations has been found the best way to add protein and fat to rations deficient in those elements. While they are very valuable articles, their use is attended always with more or less risk. In addition to the dangers of unfit food already mentioned, there is danger of overfeeding a good article. These preparations are so highly stimulating that the poultryman is tempted to feed all of them that he dares; and, to further increase the risk, manufacturers, in their desire to sell the largest possible quantities, recommend feeding much larger percentages than it would be safe to feed continuously if the goods contained even the minimum quantities of protein and fat guaranteed. As they often contain much greater percentages of these elements, it is not at all unusual for poultry keepers following manufacturers' instructions to get into serious trouble through overfeeding products which are so much more concentrated than fresh meat. In special cases (to be mentioned later) they may be fed very heavily; usually it is safest to use only about half the amounts that the manufacturers suggest.

TABLE XVIII. COMPOSITION AND VALUES OF FISH, FISH SCRAP, AND SHELLFISH

	Water %	Fiber %	Ash %	Protein %	Starches %	Fat %	Nutrient Ratio	Calories in 1 oz.
Wheat	*10.5*	*1.8*	*1.8*	*11.9*	*71.9*	*2.1*	*1:6.3*	*102*
Fresh fish (general average)	44.0	42.0[1]	1.0	10.5		2.5	1:0.5	18
Fish scrap				34.0		6.5	1:0.4	56
Oysters (in shell)	15.4	82.3	0.4	1.1	0.6	0.2	1:1	3
Long clams (in shell)	48.4	43.6[1]	1.5	4.8	1.1	0.6	1:0.5	8
Round clams (in shell)	27.3	68.3	0.9	2.1	1.3	0.1	1:0.7	4
Mussels	42.7	49.3	1.0	4.4	2.1	0.5	1:0.7	9
Lobsters (in shell)	31.1	62.1	0.6	5.5		0.7	1:0.3	8
Crabs (in shell)	34.1	55.8	1.4	7.3	0.5	0.9	1:0.4	11

Fresh fish. All kinds of poultry seem to like fresh fish, and it could probably be fed to the limit of their appetites without detriment, but it is usually available for poultry food only in small

[1] Refuse (bone, skin, shells). This analysis is taken from a table of analysis of foods for human beings, — for which purpose shells are offal. The ash content is of the fish without shell.

quantities in kitchen waste. Tainted fish is likely to give a strong flavor to the flesh and eggs of birds to which it is fed.

Fish scrap. Fish scrap is not in high favor as a poultry food. A possible reason for this is the poor quality of what is offered. The same quality is often sold for poultry food and for fertilizer. The bad effects of such articles are more quickly apparent when fed in moist mashes than when fed in dry mashes. A good, clean fish scrap should make an excellent poultry food, but too much of what is sold does not answer this description, and the price, as compared with the price of beef scrap, is usually far too high.

Shellfish. Poultry keepers living near the sea often give shellfish very freely. A common practice is to grind shell and all together. Fed in this way they are eaten with avidity and give most excellent results.

TABLE XIX. COMPOSITION AND VALUES OF MILK AND MILK BY-PRODUCTS

	Water %	Fiber %	Ash %	Protein %	Starches %	Fat %	Nutrient Ratio	Calories in 1 oz.
Wheat	*10.5*	*1.8*	*1.8*	*11.9*	*71.9*	*2.1*	*1:6.3*	*102*
Whole milk	87.2			3.5	4.8	3.7	1:4	18
Skim milk (raised)	90.4			3.1	4.7	0.8	1:2	11
Skim milk (separated)	90.6			2.9	5.2	0.3	1:2	10
Buttermilk	90.1			3.9	4.0	1.0	1:1.6	11
Whey	93.8		0.4	0.6	5.1	0.1	1:8.5	7
Cheese	34.4		3.4	23.7	1.7	36.9	1:4	107
Milk albumin	24.8	3.5	3.9	13.9	50.9	3.0	1:4.4	83

Milk. All milk products are good poultry foods. The extent of their use in any case is determined by the supply and the price.

Separated skim milk and buttermilk are the forms of milk most generally available for poultry feeding. In the vicinity of a creamery separated skim milk and buttermilk are often very low in price and can be obtained in any quantity. Milk is usually given as a drink. When the supply is sufficient, many poultrymen use milk instead of water, to mix the mash. In this way the birds consume more of it than they otherwise would. No bad effects have been observed in such forced feeding of this article; indeed, from the experience of Dr. C. F. Hodges, of Worcester, Massachusetts, in growing quail in captivity, it appears that the occasional feeding of buttermilk separately is most distinctly beneficial. Investigations at the Ontario Agricultural Experiment Station have also indicated a measurable feeding value for whey, which, when separated from the curd, had usually been thrown away by poultry keepers as of no value.

Cheese. Cheese unsalable as food for human beings is sometimes available for poultry. Products of this kind are, as a rule, best fed after being cut up (in a meat or bone cutter) and mixed in mash, thus insuring approximately uniform distribution and the minimum of waste.

Milk albumin. The albumin separated from milk in the manufacture of milk sugar is a valuable poultry food, but supplies of it in the market are irregular.

TABLE XX. COMPOSITION AND VALUES OF EGGS

	Water %	Fiber[1] %	Ash %	Protein %	Starches %	Fat %	Nutrient Ratio	Calories in 1 oz.
Wheat	*10.5*	*1.8*	*1.8*	*11.9*	*71.9*	*2.1*	*1:6.3*	*102*
Eggs (hen)	65.5	11.2	0.9	11.9		9.3	1:1.8	40
Eggs (duck)	60.8	13.7	0.8	12.1		12.5	1:2.3	47
Eggs (goose)	59.7	14.2	0.9	12.9		12.3	1:2.2	48
Eggs (turkey)	63.5	13.8	0.8	12.2		9.7	1:1.8	40
Eggs (guinea)	60.5	16.9	0.8	11.9		9.9	1:1.9	40

Eggs. The eggs fed to poultry are usually infertile eggs tested out at different stages of incubation. Wherever considerable numbers of poultry are hatched, the infertile eggs are of much importance as food. Even those containing dead germs may be used for this purpose, if decay has not reached the stage where an offensive odor is produced. When mixed raw with ground grain or mixed in cake batter and cooked, eggs may be fed very freely. The hard-boiled egg, traditionally the best first feed for young chickens, is as well omitted from their diet. The preparation in this form is unnecessary, and if the eggs are stale, or if the cooking makes the white very tough, digestion may be difficult. As its analysis shows, the egg is a highly concentrated food. All

[1] Shell.

such foods need to be used with caution, when their natural form is changed, as by cooking.

Mineral foods. The mineral elements (ash) in foods, disregarded in calculations of food values, are of great importance in nutrition and more important to poultry than to any other kind of domestic creature. The rate of growth of young poultry is very much more rapid than that of young horses, cattle, sheep, and swine. A chick weighing $1\frac{1}{2}$ ounces when hatched, and 27 ounces at ten weeks of age, has in the ten weeks multiplied its original weight eighteen times. In ducks and geese the rate is even more rapid. In all young poultry adequately supplied with material for making bone, the rate of growth of the skeleton is more rapid than that of the flesh (muscle). The adult female laying regularly requires (for the shells of the eggs) much larger percentages of lime in her food than any other creature consumes. Although (as the tables of analyses show) nearly all foods contain some mineral elements, and many contain quite large proportions of these elements,[1] green bone is the only common article of food carrying a percentage of mineral matter large enough to make it valuable for its special supply of elements of this kind. Because green bone (from its limited use) is not a dependable source of supply of mineral foods, it is usual to supply pure mineral foods, sometimes in small quantities finely ground in mashes, but more generally in coarser form in receptacles from which the birds take what they want as appetite directs. *Dry bones*, *shells*, and various kinds of *rock* ground or crushed to convenient size are used for this purpose. *Charcoal* is also commonly used as an accessory to poultry rations. The actual need of these accessories and the quantities needed depend in any case upon the amounts of mineral elements that the birds may secure in other foods, or may pick up for themselves. The subject has not received much attention from investigators, and nearly all studies along this line have included observations on grit based on the assumption that the primary function of grit is to grind food in the gizzard. From such investigations as have been made, and from common observation, it appears that in ordinary good feeding of mixed rations under good conditions (range) young birds get quite all the mineral

[1] Some foods low in protein and fat are especially valuable for their ash content; thus, bran is rich in phosphorus in an especially useful condition.

elements that they require,[1] and that adult birds get all that they need except for the formation of eggshells when they are laying heavily.

Dry bone. Granulated or finely broken dry bone and *bone meal* are the commercial forms in which bones are supplied for poultry feeding. Left to themselves, poultry will not injure themselves with bone in any form unless the ration they have been receiving has been very deficient in mineral elements. *Bone meal* is usually given in the mash and is a frequent cause of trouble. It should be used only occasionally and always in very small quantities.

Oyster shells. Crushed or ground oyster shells are the most popular shell food for laying hens. As a rule young stock do not care for ground shell. If they are forced to eat it, no injury may follow, but neither will there be any apparent benefit. The need of material for eggshells and the value of oyster and similar shells for this purpose may be easily and quickly demonstrated in practice. When shell supplies have been insufficient, the beneficial effects of feeding shell will appear within two or three days.

Digestible minerals. The digestible minerals are principally in the form of grits, the chief value of which is in the soluble mineral elements, that either contribute directly to nutrition or assist chemically some vital process. When fed with indigestible grits, hens whose ration lacked mineral elements have frequently been known to consume and void very large quantities of grit daily.[2]

[1] How far these are derived from other foods and how far from minerals picked up on the range is a question for investigation. The question of grit, whether for grinding or as a supply of mineral elements required in nutrition, is much more easily disposed of in practice than in theory. Poultry keepers in practice generally leave it to the poultry. Grit is cheap, and, keeping a supply of it before the birds, they know that if the birds need it, they have it. That disposes of the question in practice but does not affect its merits. I followed the common practice long after I was convinced in my own mind that the birds had no need of *grit* to grind their food, but finally abandoned it, and since about 1902 have given no grit to poultry except coarse gravel in the first feeds of young ducks and geese. The function of this appears to be mechanical and to relate as much to the operation of the crop as to the operation of the gizzard. This is sometimes apparent, also, in feeding adults fowls and ducks. *The beneficial effects of coarse material are sometimes seen immediately on feeding that material*, and long before it reaches the gizzard.

[2] In two such cases reported to me, consumption was at the rate of over a quart per day for twelve medium-sized hens. A pen of twenty-five extra large hens in my yards, supplied with indigestible grit and oyster shell, consumed in eight months less than a pint of the grit, but frequently ate a quart of shell a week, the consumption varying regularly according to egg production.

Charcoal. Charcoal is usually recommended for its medicinal value. It is said to be a blood purifier and an absorbent of noxious gases generated in indigestion. The practical poultry keeper usually holds the same attitude toward charcoal as toward grit: it is inexpensive, and by keeping it before the birds he makes sure that they get what they need. The occasional practice of feeding powdered charcoal in a mash is not to be recommended. From consideration of the properties claimed for charcoal it is obvious that there can be little need of it when all conditions are favorable and when the diet is right.

CHAPTER XIII

RATIONS AND METHODS OF FEEDING

A ration. In poultry feeding, the term "ration" refers particularly to the composition of the daily diet of a flock. The quantity of the ration is sometimes stated for flocks of given numbers, but the numbers in flocks and the sizes of birds are so variable that determinations of quantity must be made separately for each case. By the *daily ration* is meant, usually, the *food given*. If the birds are in yards large enough to supply them with green food and with some animal food, the *ration given* might be wholly of grain and the *ration eaten* might still contain all the green food that the birds would eat and enough animal food to make the failure of the keeper to supply that kind of food a matter of slight consequence. In such a case the ration given is a *grain ration;* the ration eaten is a *mixed* or *varied ration*. Poultry wholly dependent on their keeper for food require that varied rations be given them. They may subsist for long periods on one kind of food or on a ration giving little variety, but variety in the forms of food is one kind of *quality* in a ration, and a ration lacking this is as insufficient as one that lacks the required *quantity* of any nutritive element.

A balanced ration. In the usual technical sense of the phrase, a balanced ration is a ration in which nitrogenous and non-nitrogenous elements are properly proportioned to meet the requirements of the creature considered and the purpose for which the ration is used,— that is, a ration having the correct nutrient ratio. In the broadest practical sense *a balanced ration is one in which all properties perceptibly affecting nutrition and results are in equilibrium*. A ration may have the right proportions of principal nutrients and yet carry too much fiber or too much mineral matter; or it may be too concentrated and "burn" the digestive organs; or it may be so bulky that the greatest quantity the creature could consume would not provide sufficient nourishment. The proportions of *hard* and *soft* foods must also be balanced in some rations to secure the advantages of soft food and yet avoid the digestive disorders which may result from using it too freely.

A balanced ration is an average ration. From the nature of the case it is impossible for the feeder to make the adjustment of a ration to requirements accurate. The requirements of a creature vary from season to season and from day to day. Different lots of the same food article differ in composition. It is not possible to exactly determine the requirements of a creature at any point of time, nor is it practicable to analyse foods as used; but as average requirements of creatures can be determined from observations covering long periods of time, as the average of analyses of many samples of a food gives approximately the composition of ordinary lots of that food, and as experience has taught the right general proportions of concentrated and bulky, hard and soft, dry and wet foods for rations for different kinds of poultry and for different purposes, a ration balanced according to average analyses gives an average ration which will serve as a standard, and which, properly used, should give good results in every case, though in many cases some modification of it would give better results. Such modifications of standard, balanced rations can be made only by each feeder on personal knowledge of the results of using the standard ration in any case, and with an understanding of the properties of foods and of the probable results of making changes in the ration.

In practice, such an adjustment of rations to requirements of poultry is a much simpler matter than it seems when stated; for, as far as opportunity is given them, the birds select their food to meet their physiological needs, and hence nice judgment in feeding is not needed except to get results which, however profitable to the poultry keeper, and however necessary for his purpose, are inimical to the physical welfare of the birds (as in feeding young chickens for very rapid growth, or hens for great egg production, or in fattening poultry of any kind). In reality, in such cases the feeder's object is not to feed a balanced ration but to get as far as possible from it in a particular direction. Thus, in feeding for rapid growth, development of the body may be secured at the expense of vitality, while in fattening, the rations are so rich in fats and non-nitrogenous matter that many birds cannot stand them at all. Good judgment in selecting birds to be fed for a special purpose is the prime thing in feeding for that purpose.

In common practice, feeding poultry is simple, easy work. The best feeding is, in fact, so simple that the most of those who undertake to feed correctly and fail, do so because they make the work unnecessarily complicated, and rely too much on their own understanding of the science of feeding and too little on the natural capacity of the birds to balance their own rations. Given normal, healthy, rugged birds and favorable conditions, a bright child of ten, sufficiently interested in a flock of poultry to give it regular attention, can feed it as well as any one. On the other hand, when debilitated stock is kept under unnatural conditions, all the knowledge of foods and all the skill and ingenuity in feeding that can be applied may be needed to get the same results.[1]

Methods of feeding are determined by foods, conditions, objects. General practice in any line of poultry feeding comes ultimately to the cheapest foods and the simplest methods that can be used.

Foods. When the work is actually on an economic basis, the greater part of the rations used for poultry in any locality is determined by supplies in that locality, — either the surplus suitable for poultry food produced there or the surplus shipped in from other sections. The available foods are not always those which give absolutely the best results, but they usually give the greatest profits.

Conditions affecting feeding require as much consideration as the composition of the ration. When the birds are kept under such conditions that they secure a part of their food for themselves, the kind and quantity thus secured have to be considered in deciding what food shall be given them. When conditions are such that they secure little or no food by foraging, it may be necessary to devise methods of feeding which will insure the normal exercise of the functions of or relating to nutrition. It is this incidental service, and not any special virtue in the feature or method, which gives

[1] To any one familiar with the practice of many poultry keepers under many conditions this seems the best explanation of the fact that many flocks do require very careful attention. Birds bred for generations under highly intensive conditions are, with rare exceptions, so lacking in vitality that feeding them successfully for any purpose becomes a system of *dieting*, and the ordinary routine of caring for them is more in the line of *nursing* than of practical husbandry.

value to many methods of feeding which are supposed by those using them to have peculiar merit.

The condition of most importance in relation to nutrition is exercise. In a state of nature poultry of all kinds feed, as a rule, slowly and continuously for periods which are long or short according to the abundance and variety of food. Thus, in feeding they take a great deal of exercise, using up physical energy and the surplus carbohydrates and fats in the food. Under such conditions poultry rarely accumulate fat to such a degree that vitality or any function is impaired. If fed with grain strewn thickly on bare ground, or grain or moist mash in troughs, the birds can eat in a few minutes, and with no effort except for the taking of the food, as much as they would ordinarily secure by foraging for several hours. The result is that fat is stored in the body until finally it interferes with many functions, and at the same time, through lack of use, the muscular system deteriorates and the bird becomes debilitated.

In every continuous line of poultry culture, exercise is necessary to maintain the physical vigor of the stock. Were the bird a mere machine, it might be possible to keep it in working order by limiting the quantities of fat-producing foods consumed. But poultry (and especially the gallinaceous birds) are organisms of a very active habit, requiring a great deal of physical exercise to keep them in condition, and even when all the food they consume is given them, it is usually found better to supply energy-producing foods freely, and have the birds keep themselves in condition by exercise. This practice has the further advantage of being more economical, for the non-nitrogenous elements are, on the whole, less costly, and a supply of them ample for all purposes insures conservation of the more costly nitrogenous elements in the ration.

The common method of providing exercise for birds (particularly fowls) in restricted quarters is to feed the whole or cracked grains in a litter of straw, leaves, or other suitable material, from which they can get it only by scratching.

Objects of feeding have a direct bearing on the selection of rations and methods only when the object is a special one requiring a special ration, — and not always in such cases, for occasionally it happens that the cheapest food and the simplest method will serve quite as well as the most elaborate plan of feeding that could be devised. This is most likely to be the case when poultry produced for a special purpose is kept under very favorable conditions. Many poultry keepers use somewhat different rations and methods of feeding for birds destined for different uses. Thus, in growing poultry of all kinds, those that are to be killed as soon as fit may be fed without regard to the effects of heavy feeding and lack of exercise, while those that are to be reserved for laying and breeding purposes must be managed with care to secure sound constitutions and good physical development. Then the hen that is to be used only for egg production, and marketed as soon as she ceases to be a profitable layer, may be fed, after maturity, for heavy egg production at the expense of vitality, while the hen that is to be used for breeding purposes must be fed and handled with due consideration for the maintenance of constitutional vigor.

Conditions are of more importance in all these cases than the composition of the rations. It is quite a common thing to find poultry keepers who use special rations for special purposes getting from two different rations results just the opposite of those which the rations are designed to produce, — as, for instance, hens kept on a light or "maintenance" ration laying much better than others of the same stock on a "heavy laying" ration.

Rations for special purposes. Special rations are necessary only when the object can be accomplished within a comparatively short period. A special ration for such use is properly a finishing ration, or a heavy forcing ration, and its profitable use is limited by its tendency to put the birds out of condition, and so, if too long continued, to defeat the purpose for which it is used. Makers of proprietary poultry rations sometimes offer special rations for almost every conceivable purpose, their claim being that each is exactly balanced for its purpose. The good foods of this class (except fattening rations) are merely average balanced rations, and the differences between them are insignificant, if not imaginary. Not infrequently neither inspection, analysis, nor use will discover any difference in these rations. As the poultryman buys them they are almost invariably more expensive than grains, though the principal ingredient in most of them is corn, the cheapest grain that the poultryman uses. They often contain large percentages of weed seeds, which the birds do not eat, and are sometimes heavily adulterated with grit.[1]

The sole advantage in using these mixtures is that the corn that they contain has been carefully selected and kiln dried, and is, therefore, when the food is reasonably fresh, a safer food than much of the cracked corn found on the market during spring and summer.

As a rule, *a ration adapted to continuous use for any purpose for one kind of poultry is adapted to continuous use for that kind of poultry for all purposes.* The only difference[2] in the requirements of the growing chicken and of the laying hen are that the hen needs more lime, which is fed separately. The only difference in the requirements of the laying hen and of the molting hen is that the latter needs less lime. Between the requirements of the molting hen and those of the growing chick there is no difference requiring variation in rations. Even fattening (as will be shown when details of feeding are given) can often be done very quickly, with the ration slightly modified, by simply changing the conditions so that all the fat-forming food consumed goes to fat.

Different rations are needed for different kinds of poultry. Yet, as natural rations are similar at many points, the feeding of several different kinds of poultry does not require that every feed be different. In the use of mashes especially, the same mash may[3] serve for all the common kinds of poultry, the variations necessary in the ration as a whole being made in other foods. This point is of no particular importance to specialists growing only one kind of poultry for one purpose. As a rule, the great majority of poultry keepers find it more profitable to keep several kinds and a small stock of each, and they save considerable labor by making parts of the various rations identical. Comparisons of specimen rations will show how far this may be done.

[1] Between 30 and 40 per cent of grit has been found in mixtures of grain for small chicks. Nearly all mixtures contain some grit (usually from 5 to 10 or 12 per cent), though the chicks do not need it at all.

[2] That is, difference which in the present state of knowledge of the science of poultry feeding can be considered in balancing rations.

[3] The conspicuous exception to this is that a few of the first feeds of mash for young waterfowl, and an occasional feed for a week or more, should have coarse sand or fine grit mixed with the mash. I am inclined to think that in this case the benefit is due to the supply of mineral matter rather than to that of a grinding substance.

The same ration may be used for young and old poultry of the same kind. Young birds do as well on feed given to old birds as on rations designed especially for their size and tender age. Not every ration that might be used with good results for half-grown and adult stock is suitable for small birds, but a number of the rations in common use are suitable, or may be made so by very slight modification. The almost universal practice of babying and coddling young poultry has added greatly to the trouble and cost of rearing them. The feeding in particular has often been made a burden by the use of methods which hardly touched at any point the methods used for adult stock. It is natural for the young of all kinds of poultry to eat from the first the same foods as the adult birds. Their ability to feed themselves from the start is one of the principal points determining their usefulness in domestication. It is easily demonstrated that, under favorable conditions, normal, healthy young birds will thrive on rations appropriate for old birds. If the stock is weak, or badly hatched or brooded, or kept under unfavorable conditions, the simpler diet and methods used for rugged adult stock may be insufficient,[1] because, like debilitated adult stock, the young birds require dieting and nursing. Young poultry intended to be marketed at a very early age (as squab broilers and green ducks) can be brought to marketable size more quickly on a special ration. This exception is in accordance with the statement that special rations are needed only when the object can be accomplished within a short period.

Forcing rations. A forcing ration is any ration which furnishes food in excess of what birds would take of their own inclination, if abundantly supplied with food in general variety (grain, green stuff, and animal food). The same ration may be a forcing ration for one bird, not for another, and for the same bird a forcing ration at one time, not at another. The most familiar illustrations of this point are found in the relations between rations, conditions, and results in feeding laying hens in extreme warm weather and in warm winter weather. In extreme warm weather hens which can select their own

[1] Insufficient to keep the weakest birds alive, or to secure as good results under the conditions; but, as a rule, it will be found that when weak and debilitated young poultry are given natural conditions and simple diet, those which survive the hardening process develop better than they would under treatment which brought a larger proportion to maturity.

ration often eat so much green food that they have no appetite for grain and will not consume enough to furnish the material for constant egg production. In such cases the only way to keep up egg production is to cut off or diminish the supply of green food. In warm winter weather the regular ration, suitable for normal winter conditions, may become a forcing ration. Poultry in winter quarters are rarely supplied with all the green food they will eat. In sudden changes from cold to warm weather they continue to eat the usual quantity of the heavy winter ration, and many birds very quickly break down under it.

Forced feeding is almost universal among poultrymen.[1] All regular, good feeding is in a sense forced feeding. Even under natural conditions, with opportunity to balance their own rations, full-fed poultry develop faster and better individually, but at the cost of shorter life and reduction of vitality in the offspring. The poultryman's object is to get as much as possible out of the birds in the shortest possible time; that is, to market as soon as possible those destined primarily for the table, and to keep laying and breeding poultry only as long as they are highly productive. He forces by feeding, but not (intentionally) to the danger point, just as a careful horseman often drives his horse much faster and farther than the horse would go of its own accord, yet avoids overdriving.

Forced feeding is done not only by increasing the proportions of proteins and fats in rations, but also by increasing the quantity of the food consumed. In the cramming method of fattening, the birds are actually forced to eat larger quantities of food than they would take for themselves. The use of a variety of foods, and of variations in the form in which food is given, has the effect of inducing poultry to eat more food. This is much the safest way of forced feeding, and the only one adapted to long periods. It may be carried to its limits without perceptible injury to vigorous birds.

[1] The usual declaration of the poultryman describing methods or reporting results, that he does no forced feeding, is erroneous, though not always intentionally so. There is a great deal of misconception on the subject. Some think that feeding a ration in common use is not forcing. Some call feeding animal food forcing. One foreign authority on feeding calls feeding green bone forcing, but feeding meat meal not forcing, — a most absurd distinction, for of the two the use of meat meal is attended with much greater risk.

Special preparation of food for poultry. With the exception of cracked corn the hard grains fed to poultry require no preparation. Though they are sometimes mixed before feeding, it has never been shown that there is any advantage in the practice. Ground grains and by-products usually require some preparation. Vegetables, fruits, and hay are fed with or without special preparation, according to the nature of the article and to circumstances. In general, the poultry keeper who has reduced the labor of poultry keeping to the minimum does nothing in preparing food for the birds that they could do for themselves without undue waste. Variations in this practice are usually for economic reasons, economy of time as well as of feed materials being considered. To some extent custom and habit fix practice, many continuing to do some parts of their work by methods not the most economical for them, though in general their work is on an economical basis.

Mashes. Ground foods as fed to poultry are called mashes. Primarily and properly the term "mash" applies to a moist mixture of ground grain stuffs, either raw or cooked. The term "mash" was generally used in that sense until a few years ago, when the practice of feeding these foods without wetting gained some popularity, and the food in this form began to be called a *dry mash*.[1]

The practice of feeding mashes possibly arose first in connection with the feeding of kitchen and table waste containing large proportions of liquid or semiliquid foods (as soups, gravies, puddings, etc.), full utilization of which required that they be thickened with ground grain. As the numbers of birds increased until the table-waste mash was insufficient, cheap vegetables and meats were often cooked and, with the water they were cooked in, made the basis of a mash. When these were not available, mashes were made of ground grains alone. The great advantage of the mash of table waste was in the variety of rich and palatable foods that it added to the ration. This advantage is continued in less degree in mashes containing vegetables and meat, though mashes of the latter kind have far less variety and are often altogether lacking in the seasoning articles, — salt, pepper, mustard, etc., — considerable quantities of which are in refuse from the table.

[1] The term "*dry* mash" is a misnomer, but as it has come into general use, it is retained to avoid confusion.

The supposed advantage of the mash (principally of grain) as it came to be used by those keeping large stocks of poultry was that the ground grain furnished food elements more quickly available than those in the whole grain. While it was the almost universal practice to feed mashes in the morning, the idea that there was a great advantage in giving poultry a breakfast that would be quickly digested and assimilated seemed very plausible. When the fashion of feeding mash in the evening became popular, it was found that as good results were obtained by one method as by the other. Those who fed mashes at noon were able to report equally good results. So common experience showed that it made no difference at what time the mash was fed. Comparisons also show that equally good results may be obtained, whether the mash is raw (mixed with cold water or milk), partly cooked (scalded), or thoroughly cooked. Poultry seem to do as well on a mash of good consistency in whatever way it may be made. Sometimes those accustomed only to a mash made in a certain way do not at first like one made in another way. It is possible, too, that the digestive organs of birds accustomed to mashes prepared in one of the ways mentioned do not immediately adjust themselves to mashes prepared in another way.

In general, the method of preparing the mash is determined by the character of the ingredients used, and by the custom or convenience of the feeder. The use of thoroughly cooked mashes is decreasing, and the tendency is to scald only when necessary to give the mash the proper consistency, — a point which depends mostly on the ingredients. Thus, a mash of corn meal and bran will not stick together unless the meal is swelled by scalding, but if a sufficient quantity of middlings or red-dog flour be added, it will give cohesive quality to the mass, without the treatment necessary to get that property immediately from the corn meal.

Making mashes. A *dry mash* is made by simply mixing the dry ingredients. *Moist mashes* may be made in a number of ways. The methods of making them vary according to the degree of cooking and according to the kinds and proportions of adhesive elements that the ingredients contain. Leaving out of consideration the effects of cooking, the object secured by moistening the dry ingredients is the cohesion of the particles so that the finely ground stuffs are eaten easily and without waste. This condition of the food is brought about not simply by moisture but by a proper degree of moisture, and by the application of the moisture to suit the condition of the ingredients used. It depends, first of all, upon the presence in the foodstuffs of a sufficient amount of elements having cohesive properties. These are found chiefly in the finer and heavier ingredients (as meal and flour) and are lacking in such foods as pure bran and finely ground or cut hay. In any mixture, given a sufficient proportion of foodstuffs having cohesive properties, the development of a cohesive condition of the mixture requires that there be added to it only as much water as is necessary to establish cohesion. If an excess of water be added, the adhesive elements are too much diluted and so fail to hold the mass together, and it becomes sloppy. If the proportion of adhesive elements is very large, the mass, though containing too much water, still holds together as a soggy dough. A mash that is merely sloppy is usually unpalatable and not so readily eaten by poultry as a mash of better consistency; it adheres to the feed troughs and so may give as much waste as a dry mixture. A soggy, doughy mash is very indigestible.

The adhesive materials commonly used in mashes are corn meal, shorts (proper), red-dog flour, low-grade flour, and ground oats. The adhesive properties of corn meal can be developed instantly only by scalding, — wetting with boiling water. They are most pronounced in corn meal of good quality. The adhesive qualities of wheat and oat products may be developed quickly by wetting with cold water. Hence, a mash of corn meal and bran can be made of the proper consistency only by scalding or cooking, while a mash composed largely of corn meal may be given the desired consistency without cooking, by the addition of one of the glutinous wheat products in sufficient quantity.

When corn meal is to be scalded it is advisable to scald it separately, making a stiff mush, and then stir in the other ingredients. If vegetables, clover, or hay are cooked for the mash, enough water may be added to them to scald the required quantity of meal; after the vegetables are cooked, and while the water is boiling, the meal should be stirred in and then the other ingredients. When the mash is mixed cold, the meals may be mixed before wetting. If a scalded mash turns out too crumbly because of a poor scald, or because of the addition of too much bran, the fault may be corrected by adding water and flour until the desired consistency is obtained.

Oatmeal and ground oats work better when scalded, but will work up better with cold water than corn meal. When milk, either cold or scalding, is used for mixing mashes, less cohesive material is needed in the mash than when it is mixed with water under the same conditions. Good beef scraps and animal meals have highly cohesive properties, which develop quickly by scalding and more slowly when wet with cold water. Soaked overnight with a sufficient amount of water they swell enormously, and a good mash may be made by soaking them thus in a pail or, if a large quantity is to be used, in a mixing trough or box, then mixing in the grains in the morning. If preferred, they can of course be soaked all day and the mash mixed in the evening. The amount of water required varies and must be determined by experiment.

Infertile eggs and eggs dying in early stages of incubation may be used in mashes. All sorts of juicy and pulpy vegetable and fruit refuse may be used freely in mashes by mixing with them the kinds of ground foods required to give them proper consistency.

Small quantities of mash may be mixed in a pail with an iron spoon or with a paddle, but for more than five or six quarts it will be found easier and more satisfactory to use a mixing box and mix with a spade. In this way the mixing is more quickly and thoroughly done, and a much smaller proportion of water is required.

Standard mashes. While the composition of mashes in use among good poultrymen varies somewhat, the differences in proportions are largely influenced and offset by differences in other parts of the ration or by differences in conditions. For convenience of description and comparison three standard mashes may be taken: (1) a *standard grain mash*, made of ground grains exclusively; (2) a *standard grain and meat mash*, like the first with the addition of meat scrap or meat; (3) a *standard complete mash*, containing ground grain, meat, and vegetable foods in such proportions that it furnishes enough of these elements to keep the birds in good condition, if not as much as they would take if fully supplied and selecting their own ration. The proportions given are *by measure*.

1. *Standard grain mash.* 1 part corn meal, 2 parts wheat bran.
2. *Standard grain and meat mash.* 1 part corn meal, 2 parts wheat bran, 5 per cent of beef scrap or animal meal added.
3. *Standard complete mash.* 1 part corn meal, 1 part wheat bran, 1 part vegetables, 5 per cent of beef scrap or animal meal added.

NOTE. Supposing each of these mashes fed to adult birds once a day (all that the birds will eat): Mash No. 1 requires with it hard grain and animal and vegetable food; Mash No. 2, hard grain and vegetable food; Mash No. 3, hard grain. The mash appropriate at any time and place depends upon how far the requirements of the birds are supplied outside of the mash, and whether it is more economical and convenient to supply animal and vegetable foods in the mash or separately. The mashes described represent the minimum requirements under ordinary conditions. The use of whichever of these is appropriate should give good results, though not, perhaps, the best possible results. All are rather light, safe mashes which, if properly mixed, may be fed freely. They are often improved by the addition of other articles, as noted in examples to follow; but with other parts of the ration as indicated, markedly bad or poor results could not be due to feeding. Nos. 1 and 2 make good dry mashes for birds otherwise full fed. No. 3 is not adapted to dry feeding.

Popular standard mashes approximately chemically balanced rations. Since the common whole grains have very nearly the nutrient ratio of a standard ration, the ratio of nutrients in the mashes fed with them should be about the same. Wide variations (amounting to errors) from common nutrient standards in the mash cannot be corrected in the hard grains of the ration, but must be corrected either in the mash or by furnishing special supplies of foods of the required character. The use of mashes — and especially of wet mashes mixed from day to day as used, and varied in composition according to the judgment of a skillful feeder — gives opportunity to use to full advantage many waste products or cheap food products, to add to the variety of the ration by occasional changes in the ingredients, composition, and consistency of the mash, and, when desired, to make quick modifications of the whole ration without changing other parts of it. The mash used in this way gives the greatest possible flexibility to a ration. Considering results without reference to cost of labor, it is generally agreed that a skilled feeder can get better actual results by using wet mashes than it is possible to get in any other way. As to the advantage of using wet mashes when labor is considered, there is less unanimity of opinion.

Errors in the use of wet mashes. The wet mash, being capable of great variation in composition and consistency, may become a dangerous factor in the hands of an unskillful or of a careless feeder. The greatest risks attend the misuse of the mash in feeding poultry lacking in vitality and digestive power. Such birds may be very seriously affected by sloppy, doughy, or sour mashes when rugged birds would eat them with impunity.

Dry mashes. Dry mashes came into use because of the difficulties that many poultry keepers experienced in using wet mashes, and because of the apparent saving of labor in preparing and the greater convenience (in many instances) in feeding them.

Personal estimates of the value of dry mashes, as of all features in feeding, are usually based on a comparison of the results of feeding dry mashes with the results secured by the same person without them, rather than on comparisons with any general standards of results, or with the net results of the various changes in items affecting the cost of handling poultry which the use of a dry mash introduces. On the whole, the dry mash has not the advantage as a labor saver claimed by those who exploit[1] it, though there are features of its use which often give it a very distinct advantage.[2] These are:

1. *Convenience*. Though it deteriorates with age, a dry mash does not spoil so quickly as moist mashes do. Hence it may be fed in hoppers always accessible to the birds, and the supply may be replenished at any convenient time,—at intervals of a few days, a week, or even longer, according to the capacity of the hopper and the size of the flock.

2. *Full feeding*. In the hands of an inexpert feeder a dry mash of the right composition, kept constantly before the birds, will almost invariably give better results than a wet mash, *provided the same hard grains are given with the dry as would be given with the wet mash.* If (as is often the case) an effort is made to compel the birds to consume certain considerable quantities of the dry-mash mixture by reducing the grain until they will eat the desired quantity of the dry mash, the results are likely to be disappointing, for the birds do not like dry mashes well enough to eat them freely, and are likely to be underfed. With a sufficient supply of hard grain the dry mash becomes a supplementary feed, not

[1] It is doubtful whether dry-mash feeding would have become prominent among poultry methods but for the advertising of trade mixtures represented as special balanced rations for various purposes. For several years after dry mashes began to be exploited in the poultry press, it was noticeable that those advocating and reporting remarkable results by their use were, almost without exception, directly or indirectly interested in the sale either of dry mashes or of hoppers to contain them, and this method is still very much dependent on the advertising of interested parties for the attention that it gets. The fact does not condemn the method, but it must be considered in estimating its actual value and status. Usually the complete "balanced ration" is procured by buying a mixture of hard grains from the same concern. Many of these feeds make good rations, but as many advertisers labor, with some measure of success, to convince customers that they must have these preparations and none other, it not infrequently happens that a poultry keeper short of a supply of his favorite commercial ration puts his birds on short allowance of it rather than take chances of spoiling the supposed exactly balanced ration, the "formula" for which is the proprietor's "secret."

[2] In correspondence with a large number of poultry keepers using dry mashes, I was surprised to find a large proportion of them not making use of the advantages of the method. Many fed dry mash in limited quantities, giving it daily. Many fed both wet and dry mashes, this practice actually making more labor than when the dry mash was not used.

attractive in form yet fed in such a manner that it may be eaten quite rapidly. Being always before the birds, it gives the weaker ones and the slow feeders an opportunity to eat all they want; being unattractive in form, it does not tempt others to overeat; and so the food consumption of the flock is more equal. As far as growth and production are concerned, full feeding, uniform throughout the flock, is the principal advantage in the use of the dry mash.

Dangers in the use of dry mashes. Ground grains fed to poultry in a dry state have a marked costive property. If the remainder of the ration is too laxative for general use or for birds with a tendency to looseness of the bowels, an appropriate quantity of dry ground foods may be a corrective or preventive of diarrhea. Under any other conditions a dry mash may be too constipating. The costive property of dry mashes is particularly dangerous when a mash contains a high percentage of animal food or other substance rich in protein or fat, because it may prevent the slight diarrhea which would give immediate warning of the injurious effects due to an excess of concentrated food. Makers of commercial dry mashes take advantage of this to use in their mixtures large proportions of highly concentrated foods (not always of good quality), which stimulate for a time but in the end bring about the usual results of too heavy feeding of such articles. The tendency to produce constipation may be offset by the liberal use of succulent foods, and by feeding hard grain so freely that the consumption of mash is small. The danger due to excess of concentrates is avoided by the feeder mixing the mashes himself and limiting the percentage of concentrates, or it may be greatly decreased by free feeding in other parts of the ration.

Examples of Rations

Of the examples of rations which follow, some are common rations in general use among practical poultry feeders who have worked them out in practice, without considering their chemical elements, — often without acquaintance with the science of feeding. Rations of this kind can rarely be accurately described. Each one who uses them knows about what quantities of different ingredients he uses, but few know exact quantities and proportions, and the more skillful a feeder is, the greater and more frequent are his variations from the standard which would express the general average of his rations. The skillful feeder comes, in time, to have a nice judgment in varying rations to suit conditions, and, to break the monotony of the usual routine of eating, will often, for brief periods, make very radical departures from his usual practice. Thus he gives at one time a very rich mash, at another time a very light one; but he selects the time for such changes with judgment, with a thorough knowledge of his stock, and with an eye to the effect of the change on the general ration. Some persons using approximately a common ration can describe their own ration exactly. Two or more persons approximating a common standard, but with different variations, may each suppose his the better ration. Usually in such cases the rations are of equal value, the differences being immaterial either in themselves or because of modifying circumstances.

All rations in common use have wide adaptability. The kinds most useful for examples are those used at the various experiment stations. These are more accurately described than most of the rations used elsewhere, and the results of using them are more fully stated, in reports of regular work, as well as in reports of special experiments. The rations selected for examples are not all good. The poor ration is sometimes valuable for purposes of illustration.

Examples of all kinds of rations are given and discussed as far as seems to serve the general purpose of giving a comprehensive understanding of the subject of feeding.

The examples are arranged (1) according to the character of the rations,— first *growing* (including *producing*), then *finishing*, or *fattening*; (2) according to the kind of poultry for which they are used; (3) to show the sequence of rations used in a system or in a certain practice.

Quantities are *by measure* except as otherwise stated.[1]

RATIONS FOR FOWLS — ALL AGES

1. *For young chickens on good range.* Cracked corn and water.

This method of feeding young chickens was used for years by a farmer in Massachusetts, who grew each season about five hundred White Wyandottes to keep up his stock of laying hens. The range was in orchard and later in the season over mowing land, supplying abundance of green food but not of animal food. The ration was defective. Chickens grown in this way deteriorated in size, but the average size of stock was maintained at a little below the average for Wyandottes by using for sires large males from other flocks. This farmer also engaged quite extensively in gardening. His method of handling his chickens was developed because it was not possible for him, without neglecting other interests, to give them the time and attention that more elaborate methods required.

2. *For young chickens on good range.* Mash (table scraps mixed, cold, with corn meal, shorts, and bran, equal parts) once a day; cracked corn in troughs or hoppers before the birds at all times.

[1] In common practice it is more convenient to mix feeds by measure than by weight. When large quantities are mixed it is usual to measure *by the bag* and part of a bag. Then the mixing is still by measure, but the weights of measures of various ingredients are known. In experimental work parts are usually given *by weight*.

The chickens in this case were kept in an orchard, about seventy-five chickens having the range of about an acre of land. As the chicks grew, the allowance of mash for each was quite small, but this was made up in the waste apples falling from the trees. Under the conditions the ration was ample, securing the full development of the birds. Practically the same results would be secured by feeding any good mash in place of that used.

3. *For chickens (for market) in brooder houses and on poor range from weaning to maturity.* Cracked corn and beef scrap always before them in separate hoppers; limited pasture of winter rye; occasional feeds of cabbage.

This is the ration in common use among the soft-roaster growers of eastern Massachusetts, from the time when the chickens leave the brooder houses. The supply of green food is usually much less than the birds would take. The ration is a fattening one and does not, as a rule, secure the fullest development (growth) of the birds, but in some cases remarkably large, fine birds are produced. The birds are not confined, but the range after the early part of the season affords scant picking. They take only exercise enough to keep digestion good, and become as fat as the American market requires, without any addition to this ration.

4. *For young chickens.* Baked "johnnycake" (or any similar cake) fed as often daily as desired, either without hard grains or in alternation with them. Fine table scraps and infertile eggs may be mixed in johnnycake, making it a more complete ration. To make such a cake, add a little soda to sour milk, put in the scraps finely broken and the eggs (including shell), stir in coarse corn meal to make a very stiff batter, bake well.

This is a convenient way of providing the "soft" food for small flocks of chicks in a form in which it may be kept in good condition for a number of days. Clean, sweet table scraps (broken small) and infertile eggs (with shells) may be mixed in the batter and baked, making the cake a complete ration, except for the green food. Chicks on young grass can get all the green food that they need for themselves. Chicks in confinement will do very well on this cake alone for a while, but are better for regular supplies of green food. After a few weeks chicks which do not get green food begin to show lack of development. Some poultry keepers bake cakes for quite large numbers of young chickens, but it is neither necessary nor economical to do so.

5. *For young chickens on good range.* Mash in the morning; cracked corn at 9.30 A.M.; cracked corn, whole wheat, or mash at 2 P.M.; cracked corn at 6 P.M.

The difference between this and example 3 is only in the method of feeding, the grains (and sometimes one mash feed) being given, in about such quantities as are required, at stated times. This is often advisable for small lots of chicks when keeping supplies of food before them attracts pigeons or sparrows. Some poultry keepers who grow large numbers of chicks also prefer to give regular feeds, especially if the conditions are not favorable to exercise or if it seems advisable to keep quite close oversight of the stock.

6. *For weaned chicks and fowls on good range.* Mash in the morning; cracked corn or any grain or mixture of grains desired, — a day's allowance scattered broadcast over the range; mash in the evening.

This is one of the simplest and most satisfactory ways of feeding stock birds in summer, to develop frame and muscle and constitution in the young and to keep the adults in good condition. The grain may be scattered in grass several inches high or in brush. The birds will get it all and require no attention from morning until evening.

7. *For fowls in houses with littered floors.* Mash once a day (morning, noon, or night); the day's allowance of grain (any common grain or mixture) scattered in the litter at any time of day. Cabbage or mangels before the fowls at all times.

This is example 6 adapted to winter conditions. In summer the feeding may be done at any time of day, but usually morning and evening are more convenient. In winter it is often an advantage to give the food at noon or in the evening. If the quantity of litter on the floor is sufficient, and the grain is well concealed, there is no objection to giving the grain and mash at the same time. As a rule, the birds will eat the mash first. They may pick up a little of the grain at that time, but most of it is left until they are hungry again.

8. *For brooder chicks.* Start the chicks on commercial mixtures, given five or even six times a day in troughs, with occasionally a feed of beef scrap instead. After the first few days, give two or three of the feeds of dry mash (two parts shorts, or mixed feed, to one part corn meal) by measure. After the chicks are three or four weeks old the commercial mixture is discontinued, and the ration consists of dry mash and beef scraps, and a "scratch feed" consisting of one part hulled oats, one part cracked wheat, and two parts cracked corn. This, with green food as available, is continued until the chicks are about ten or twelve weeks old.

This is the ration used by a soft-roaster grower up to the time when his chickens go into the colony houses and are given the ration in example 3. Frequent feeding is advisable when chicks are kept in large numbers under artificial conditions. This is to keep them occupied and to prevent the development of vices and the soiling of the food (on the floor or in shallow troughs) rather than because (as is commonly supposed) the chicks need feed so often. By feeding often, and feeding a considerable amount of soft foods and concentrated foods, little chicks grow faster at first, up to about ten or twelve weeks. After that those brought up on three or four meals a day, of which a large percentage is hard grain, will usually outgrow them, because they have better digestion and greater vitality. The use of commercial mixtures does not always indicate that the feeder regards them as better than corn or than such a mixture as he might make himself. Some do prefer certain brands, but it is not unusual for manufacturers to offer inducements to poultry growers of reputation to use some of their feeds, if only a few bags annually. In the above ration, feeding is not reduced to the simplest form, as it is in the rations used by the growers in this section for the weaned chicks.

9. *For laying stock on good range.* Mash, corn meal, bran, and beef scrap in varying proportions, from one third to one half of the ground grains

(by measure), corn meal, and from 5 to 10 per cent of the total beef scrap or animal meal; cooked overnight; fed in the morning; grain in hoppers accessible at all times.

This is the method of the colony poultry-farming district of Rhode Island. Different poultry keepers here vary the proportions of ingredients in the mash, often according to habit or individual custom rather than on judgment. Cracked corn is the principal grain fed. Mixtures of grains are sometimes used, or variety may be introduced by occasionally filling a grain hopper with wheat or oats. The point of chief interest in connection with practice in this district is the general uniformity of results in spite of considerable superficial differences in feeding practice, and the generally good condition of the stock in spite of features of feeding which, under less favorable conditions, are apt to cause trouble. To illustrate: One may find one farmer feeding to young chickens, goslings, and ducklings a very carefully made and cooked mash, his next neighbor feeding a very carelessly compounded, sloppy mash, and all the youngsters thrifty.[1] The general conditions and the abundance of other food reduce the advantage of careful, and minimize the ill effects of careless, feeding. Data for close comparisons of results and profits are not obtainable, but it is easily seen that some of the most prosperous poultry keepers in the Rhode Island district would soon put themselves out of business if they should undertake to apply their feeding practice under intensive conditions.

Maine Agricultural Experiment Station Rations

Examples 10–16 give the various rations used at the Maine Experiment Station.

10. *For young chickens in brooders.* For the first two or three days, infertile eggs boiled for half an hour, ground (shell and all) in a meat chopper and rubbed together with about six times their bulk of rolled oats, and fed with chick grit on the brooder floor. About the third day the following mixture of small broken grains is given:

	Parts by weight
Cracked wheat	15
Pinhead oat meal	10
Fine cracked corn	15
Fine cracked peas	3
Broken rice	2
Chick grit	5
Fine charcoal	2

[1] In a trip through this district in May, 1911, a number of the farmers whom I met complained to me that rations always before satisfactory did not seem to agree with young chickens, geese, and ducks. This is easily explained. Both the spring and the preceding winter were bad seasons for poultry. Consequently, the stock was weakened and the young birds could not stand errors in their diet which, under more favorable circumstances, had produced no ill effects.

This is fed at daylight in such quantity that the chicks will be hungry for a nine o'clock feed of the boiled-egg and rolled-oat mixture. At 12.30 the hard-grain mixture is fed again; at 4.30 or 5 the egg-and-oat mixture.

When the chicks are about three weeks old the following wet mash is substituted for the egg-and-oat mixture:

	Parts by weight
Wheat bran (clean)	2
Corn meal	4
Middlings or red-dog flour	2
Linseed meal	1
Beef scrap	2

This mixture is slightly moistened with water and fed in troughs. When the chicks are five or six weeks old the fine-grain mixture is discontinued and the feeds given in the litter are wheat and fine cracked corn.

This ration and the method of using it may be taken as typical of practice with brooder chicks. The frequent feedings appear to be necessary when chicks are kept in large groups (from fifty to one hundred or more in each brooder or section) under artificial conditions. In the prevailing view the danger of keeping food by them is the danger of overfeeding. It is more likely that the true causes of the disorders that sometimes result from that practice, in the conditions under consideration, are slow poisoning through eating food soiled by the excrement of the birds, weak constitutions or weak digestion requiring dieting, and the concentrated nature of the mashes used. In this case the egg-and-oat combination is a very rich food; so is the mash with every ingredient but wheat bran (two elevenths of the whole) a heavy food. Wrong temperatures in brooders are also often responsible for troubles for which the food is blamed. In using rations of this kind it is not essential that the proportions of different ingredients be carefully adjusted. It is not always certain that all the foods in a hard-grain mixture like this are eaten. Comparison of results with simpler rations indicates an equal feeding value for rations containing fewer articles. Many poultry keepers prefer to feed such foods as peas, rice, millet, etc. in small quantities separately, so that they may observe just how they are eaten, and feed accordingly. Grit and charcoal are usually given separately in small troughs or hoppers. As has been stated, the necessity of these food accessories is doubtful. It is certain that they are not required regularly in the proportions here used.

11. *For young chickens in brooders.* Same as above, except that fine beef scrap is substituted for eggs in the oat mixture and the mash used is a dry mash of the following composition:

	Parts by weight
Rolled oats	2
Wheat bran	2
Corn meal	2
Linseed meal	2
Beef scrap	1

12. *For young chickens in brooders.* Same as above, except that the first mash for the chicks is compounded as follows:

	Parts by weight
Wheat bran	4
Corn meal	$3\frac{1}{2}$
Linseed meal	$\frac{1}{2}$
Beef scrap	2
Alfalfa meal	1

To this mixture when scalded is added one part of rolled oats to three parts of the mixture, the oats being added after scalding, to prevent the sogginess produced when rolled oats are scalded in the mixture. This mash and the grains as in ration 10 are fed until the chicks are about three weeks old, when the following mash is used until the chicks are from six to eight weeks old:

	Parts by weight
Wheat bran	2
Corn meal	3
Linseed meal	$\frac{1}{2}$
Daisy flour	1
Beef scrap	1

Ration 12 is preferred at the Maine station. If the criticism on the concentrated nature of the mash in ration 10 is sound, a ration preferred to it in practice must be less concentrated. The first mash used in ration 12 has in the dry mixture four elevenths of wheat bran and one eleventh of alfalfa meal, a still more bulky article. The rolled oats, introduced after scalding, still further lightens the mixture, so that this mash, as fed, is only about half as concentrated as that in ration 10.

13. *For young chickens in brooders.* Same as above, fed later in the season, when the chicks could get out on the ground. The mixture of grains described in 10 and the mash described at 11 (fed dry in troughs) always before them.

As reported, this worked well except in bad weather, when the chicks remained under cover and, it is stated, "would hang around the troughs and overeat, would grow rapidly for a few days, then commence to go lame, eat little, and seek the warm hover never to recover." Such a result is in accordance with what was said (p. 220) of the dangers of dry mashes rich in concentrated foods. With food of the right composition and consistency, overfeeding healthy chickens on a good range is practically an impossibility.[1] In this case the range was not large enough to furnish full supplies of green and of animal food. It did not afford the full advantages of a range.

[1] I think that it will be found, on close investigation, that this applies to chicks under all conditions. That it applies to natural conditions is certain. I have not, in recent years, been so situated that I could test its application to artificial conditions. An adequate test of this point would require experiments more extensive and elaborate than an individual poultry keeper can make.

14. *For weaned chicks on range (one thousand chicks to two acres).* Cracked corn, wheat, cracked bone, and oyster shell and grit, in separate slatted troughs, in constant supply; also, in separate trough, the following dry-mash mixture:

	Parts by weight
Wheat bran	1
Corn meal	2
Middlings	1
Beef scrap	1

This method of feeding has been found satisfactory under the conditions described. The dry-mash mixture is too rich for general use, but the constant supply of cracked corn and wheat, and the range conditions, enable the birds to balance the ration:

15. *For laying hens.* This is the ration first adopted at the Maine station and published and widely adopted as a model ration.

	Parts by weight
Dry mash	2
Wheat bran	1
Corn meal	1
Middlings	1
Gluten meal or brewer's grains	1
Linseed meal	1
Beef scrap	1

With this mash constantly before them the hens were fed, to each hundred hens, early in the morning, 4 quarts of whole corn scattered from six to eight inches deep in the litter, and at 10 A.M., 2 quarts of wheat and 2 quarts of oats in the litter.

The dry mash used was a very rich one for any combination, and far too rich to be given with such limited hard-grain rations. In the flocks fed on this ration at the station and elsewhere cases of indigestion were numerous, and the mash has recently been modified.

16. *For pullets just off range.* Hard grains as above; for the first month (September) in the laying house, mash as follows:

	Parts by weight
Bran	3
Corn meal	1
Middlings	1
Meat scrap	1

For the second month (October):

	Parts by weight
Bran	2
Corn meal	1
Middlings	1
Gluten meal	1
Meat scrap	1

Green food is supplied in the form of sprouted oats. In succeeding months one half part of linseed meal is added to the mash every other month.

It is reported that better results followed the change in the mash. Judged by conditions in general feeding practice, the mash as used in September is a better mash for continuous use than those used afterwards, and an increase in the amount of hard grain given would be likely to give better average egg production, though it might reduce the production of some of the heaviest layers. This ration, even as modified, is a very heavy forcing ration.

Ontario Experiment Station Rations

17. *For chicks in indoor brooders.* Dry mash of equal parts of bran, corn meal, low-grade flour, and middlings, to which is added 5 per cent of beef scrap and a teaspoonful of charcoal to the gallon of mash. Mixed grains (cracked wheat, cracked corn, pinhead oatmeal), equal parts. Fed in alternation, five times a day until chicks are about three weeks old, then three times a day until they are about six weeks old, after which they are hopper fed. The chicks are given milk to drink as regularly as the supply permits. The milk is considered especially valuable in starting the chicks.

It will be noted that this is a simpler and much less concentrated ration than those used at the Maine station. It should give, and apparently does give, as good results with less risk and perhaps at a little less cost. Exact comparisons of such points for different rations used by different persons, for different stock, under different conditions are manifestly impossible. Observation of the stock and information supplied incidentally in reports of various experiments seem to the author to warrant the statements made as to value and cost.

18. *For chicks on range (either in brooders or with hens).* Same as above, but fed in hoppers from the start, with hulled oats and wheat substituted for pinhead oatmeal and cracked wheat after the first few weeks.

The range in this case is an exceptionally good one, orchards, cornfields, and pastures being available on the college and station farm of over five hundred acres. With good range and a mash not overloaded with heavy foods, the hopper feeding of chicks has been practiced here for a number of years without the occurrence of troubles commonly ascribed to overfeeding. Equally good range conditions are found on any large farm and on many small farms. With good range the beef scrap is not essential, but at this station it is supplied, to make sure that there is no lack of animal food.

19. *Summer ration for fowls (yarded).* Dry mash, in hoppers; for old hens, wheat bran; for pullets, equal parts bran, low-grade flour, and barley chop or meal. Grain fed twice a day, wheat in the morning and wheat and barley or corn in the evening, corn being used only when very cheap.

20. *Winter ration for fowls confined to the house.* Dry mash as above. Morning feed, whole wheat from six to eight inches deep in the litter; about noon, a little more wheat and whole mangels or clover hay; about 3.30 P.M., wet mash of boiled vegetables, waste bread, and occasionally kitchen scraps thickened with the same meals used in the dry mash, about 10 per cent beef

scrap or animal meal added, except when green cut bone is given as a separate feed; just before dark, all the whole corn the birds will eat.

The two rations above used, each in its season, make a good "system" for the year. The yards in this case give fair foraging conditions. The winters are long and hard. With sufficiency of litter the labor may be reduced by bringing all feeding but the mangels and clover into the latter part of the afternoon, giving all the wheat at the same time as the whole corn in winter, and all the grain at one feeding in summer.

West Virginia University Agricultural Experiment Station Ration

21. *For laying hens.*[1] Dry mash:

	Parts by weight
Corn meal	$3\frac{1}{2}$
Bran	$5\frac{1}{2}$
Middlings	3
Oil meal	1
Beef scrap	$2\frac{1}{2}$

Fed in hoppers in constant supply. Grain, whole corn and wheat, in approximately equal parts.

This ration was used in an experiment in feeding six hundred laying hens (Leghorns) which returned a net profit of almost exactly one dollar per hen ($602.28), on a rather low average egg production (113). The hens had free range except in bad weather, and for green food had also ensilage, of which they consumed about three fourths of a ton.

Kansas Agricultural College Experiment Station Rations

22. *For young chickens.* Dry mash:

	Parts by weight
Corn meal	2
Shorts	2
Bran	2
Beef scrap	2
Charcoal	$\frac{1}{2}$

Grain mixture:

	Parts by weight
Corn chop (sifted)	2
Cracked Kafir corn	2
Cracked wheat	2
Millet	1

[1] Taken from *Bulletin 115* of the West Virginia Experiment Station. The description of the method of feeding in the bulletin does not give the proportions of articles used, but gives the total weights of each consumed, from which the proportions work out approximately as I give them, a few minor items which do not materially affect results being disregarded.

Dry mash kept before the chicks all the time. Grain fed in litter five times a day for the first few days, and after that three times a day. After a few weeks whole grains were substituted for the cracked grains.

The amount of charcoal in the dry mash is excessive, even granted that charcoal is necessary; compare 6 per cent of charcoal with the amounts used in the Maine and Ontario rations. The proportion of beef scrap is greater than is advisable. The ration as a whole is reported to give good results, but the relative proportions of mash and grain eaten are not noted. With a sufficient supply of grain the chicks themselves avoid the danger of the too concentrated mash by eating more of the grain mixture (see p. 220). The use of Kafir corn in the ration illustrates the adaptation of locally available foods to general formulas for feeding. Kafir corn can be grown when and where Indian corn cannot, and under such conditions may be the cheaper food. In the eastern feed stores Kafir corn is in small supply and at high prices, and under such conditions is not used by poultry keepers who understand feeding.

23. *For laying hens (confined).* Dry mash:

	Parts by weight
Shorts	6
Bran	3
Corn meal	6
Beef scrap	5
Alfalfa meal	1

Grain mixture:

	Parts by weight
Wheat	2
Corn	2
Oats	1

Mash fed in hoppers; grain scattered in litter. Used in the proportions by weight of twenty-one pounds of mash to twenty-five pounds of grain, the ration has a nutrient ratio of 1 : 4.

As fed, this was a heavy forcing ration and gave a large egg yield. The report on it is based on a short period,— less than a year. The hens were forced to eat mash by having the grain cut down until they would eat the amount of mash required to make the ration of the nutritive ratio designed. The ration is not suitable for breeding stock or for hens intended as layers for more than one season, but may often be profitably used with laying stock from which it is desired to get the largest possible egg yield in a short time.

Cornell University Agricultural Experiment Station Rations

24. *Variety ration for young chickens.*[1] First to third day: Bread crumbs, 8 pounds; hard-boiled eggs, 2 pounds; this mixture moistened slightly with sweet skimmed milk and fed five times a day. Finely cracked grain,—

[1] *Bulletin No. 282*, Cornell University Agricultural Experiment Station.

wheat, 3 parts; corn, 2 parts; hulled oats, 1 part,— kept before chicks in shallow trays containing a little bran.

Third to seventh day: For the bread and eggs was gradually substituted a well-baked johnnycake (fed twice daily, all that the chicks would eat) made as follows: corn meal, 4 pounds; infertile eggs, $1\frac{1}{2}$ pounds (1 dozen); sour milk, 2 pounds; baking soda, 5 level teaspoons; grain in litter two or three times daily, bran in separate dish.

One to three weeks: Johnnycake and grain as above; bran, 8 pounds, beef scraps, 2 pounds, in place of clear bran.

Three to six weeks: Grain as above; one feed of johnnycake daily. During the early part of the period the johnnycake was mixed with equal parts of the cracked grain; gradually the cake was discontinued, and in place of the bran and beef scrap dry mash was given: corn meal, 100 pounds; wheat middlings, 100 pounds; beef scrap, 100 pounds; wheat bran, 200 pounds; fed in hoppers always accessible. Green food was available at all times.

25. After the sixth week chicks given the above ration were changed to the following *fattening ration:* a mixture of ground hulled oats, 1 part (by weight); corn meal, 1 part; ground buckwheat, 1 part; moistened with sour milk and fed twice daily. Grain in litter (one feeding daily), — cracked hulled oats, 1 part; cracked corn, 1 part; cracked wheat, 1 part. Grit and beef scrap fed in hoppers.

Ration 24 was the most satisfactory of seven rations compared for the period, the others being (*a*) cracked grain and bran; (*b*) cracked grain; (*c*) cracked grain and dry mash; (*d*) dry mash; (*e*) and (*f*) wet mash. It is an excellent ration, but as good results are usually obtained on a simpler system without the changes according to age. The ration given from one to three weeks would probably have given as good or better results not only for the first six-weeks period but also through the second six-weeks period, when the fattening ration 25 was used. The report says that the chicks started on ration 24 did not like the change, though some of the others on poorer rations during the earlier period ate the fattening ration readily. Ration 24 is a very good standard ration, adapted to all ordinary purposes in feeding and quite as effective when simplified, as for the first to the third week. As fed during the last three weeks it could readily be changed to a moist mash ration by wetting the ground grains and feeding the beef scrap separately, or by reducing the scrap to about thirty or forty pounds.

26. *Experimental rations for laying hens* (*pullet year*).[1]

(*a*) Grain mixtures as follows (parts by weight):

July 28 to Sept. 8. — 1 cracked corn, 1 wheat, 1 oats
Sept. 9 to Dec. 8. — 3 cracked corn, 4 wheat, 1 oats
Dec. 9 to Jan. 18. — 4 cracked corn, 3 wheat, 1 oats
Jan. 19 to Feb. 16. — 3 cracked corn, 3 wheat, 1 oats, 1 buckwheat
Feb. 17 to July 27. — 4 cracked corn, 3 wheat, 1 oats

[1] *Bulletin No. 249*, Cornell University Agricultural Experiment Station.

Mash:

	Parts by weight
Corn meal	2
Wheat middlings	2
Wheat bran	1
Beef scrap	2
Alfalfa meal	1

Grain fed morning and evening in litter. Mash fed wet at noon.

(*b*) Same as (*a*) except mash fed dry in hoppers.

(*c*) The same grain mixture as (*a*) and (*b*) morning, noon, and night in litter, and beef scrap in hoppers.

(*d*) The same grain mixture as (*a*), (*b*), and (*c*) in hoppers, and beef scrap in hoppers.

All lots were given mangels and green cut bone at intervals while closely confined.

The pullets (White Leghorns) in this experiment were also under observation for data on other points than relation of ration to egg production, and were subject to some conditions unfavorable to egg production, and so gave a relatively low egg yield (averages: (*a*), 121.4; (*b*), 129.3; (*c*), 110.7; (*d*), 107.5); but as conditions were uniform, and the stock selected to make the different lots strictly comparable, the results are valuable to the student of poultry feeding. It is at once noted that the highest and the lowest egg yield came from hopper-fed hens; but the high yield came from the lot that, with grain in litter (for exercise), had a rich dry mash accessible at all times, insuring full feeding and the working off of any surplus of concentrated food, while the low egg yield came from a lot kept through a year with only such exercise as full-fed hens would take without compulsion. With hens of another type a much lower egg yield and higher mortality would result from the use of ration (*d*). Both (*a*) and (*b*) are heavy forcing rations, as they were designed to be; but (*b*), though carrying a dangerous percentage of beef scrap, gave (conditions considered) good results, while (*a*) gave lower results in egg production, and extraordinary mortality, due to the high percentage of beef scrap in a wet mash. The tendency of the bird to balance its ration and to limit the quantities of concentrated food taken is shown in a comparison of the relative proportions of mash and grain eaten in rations (*a*) and (*b*). The hens fed on the wet mash ate a smaller proportion of mash and a larger proportion of hard grain than those fed dry mash, appetite warning them against the dangerous food. The consumption of grit and shell in connection with these rations affords some interesting data bearing on the question of the use of grit and the attitude of the birds toward grit. The hens fed on ration (*c*) consumed more than twice as much grit as those fed on (*b*) and (*d*). The hens fed on (*a*) consumed about 40 per cent more grit than those fed on (*b*) and (*d*). The hens fed on (*c*) consumed from one fourth to one third more shell than those fed on the other rations, and consumed nearly *equal amounts of shell and grit*. The differences in consumption of grit between (*b*) and (*d*), and in consumption of shell between (*a*), (*b*), and (*d*) are insignificant. The large consumption of grit by those fed on (*a*) — that is, hens among which mortality was high, owing to faulty mash — is in accord with what has often been observed. The large and equal consumption of grit and shell by the hens fed on ration (*c*) is significant. Grit, shell, and meat scraps were given them in hoppers. For everything else they had to scratch. There is a question as to whether the grit and shell were all consumed or a considerable part merely pulled out of the hoppers, as hens are often seen to do in expectation of finding something more palatable among the contents of the hopper.

27. *Crate-fattening rations.* (*a*) *To make yellow flesh:* corn meal, 3 parts; red-dog flour, $\frac{3}{4}$ part, mixed with milk to consistency of cement. (*b*) *For white flesh.* pearl oat dust, 2 parts; buckwheat flour, 2 parts; barley meal, 1 part; white corn meal, 1 part, mixed with milk.

When color of flesh is immaterial, crate fatteners use, as one says, "almost anything we can mix." The proportions of ingredients are of less importance than the consistency of the food. Many mix the food some hours before feeding, in order that fermentation may begin before the birds eat it, and so the process of digestion be advanced.

RATIONS FOR TURKEYS, PEAFOWLS, GUINEAS, AND PHEASANTS

All gallinaceous birds in domestication may be fed on the same rations as chickens and fowls on range, the number and times of feeding and the quantities of food being adapted to the habits of the birds and to the conditions. The young of these other kinds are commonly considered more difficult to feed and to grow than chickens. This is true only so far as concerns growing them under like conditions. Fowls, as we have seen, are, generally speaking, thoroughly domesticated, which accounts in part for the fact that the others are not; for as far as fowls, ducks, and geese preëmpt foraging ground near the homestead and its outbuildings, they force the less domestic poultry to range farther away and in a measure prevent their complete domestication. Instances of all the other gallinaceous poultry becoming as tame as many fowls and thriving under the same conditions are numerous enough to indicate that if they could get, in close contact with man, the range conditions that they prefer or need, they would ultimately become very tame. It may reasonably be assumed that under such conditions they would gradually become as well adapted to conditions of life in closer contact with man as do fowls, ducks, and geese. Under existing conditions it is, on the whole, of advantage to man that several valuable kinds of poultry prefer to live a little aloof from the others and from him, and so utilize food and give such service as they may on land outside the range of the others.

Given conditions adapted to their dispositions and habits of life, the feeding of these birds does not differ at all from the feeding of fowls under similar conditions. Given conditions which fret them, and feeding them becomes difficult, — a matter of delicacies and dieting, — not because the ordinary food is unsuitable to them under normal conditions, but because of the sympathetic relation between the nervous and digestive systems. It does not appear that their digestive organs are originally and normally less robust than those of fowls, but it is plain that in general their nervous systems are more sensitive, and most sensitive in infancy, when every part of the organism is most susceptible. For that reason the poultry keeper who grows these birds must cater more to their natural habits. When he does this, and arranges the feeding accordingly, it is found that the same foods may be used for all, and that there is no more need of special diets for the young of each of these rarer kinds of poultry than for young chickens.

28. *For turkeys on farm range.* For the young poults, coarsely ground corn mixed with milk (sweet or sour) or baked in a cake and moistened with milk. This is gradually mixed with cracked corn until, when the poults are about eight weeks old, cracked corn is given clear. Through the summer they are fed on this twice a day. In the fall they are fattened on whole corn, fed two or three times a day.

This is the method of many growers in the turkey-growing district in Rhode Island and Connecticut. Some growers feed to both young and old one feed daily of dough or mash, as fed to fowls and other poultry. Compare this with ration 1. The success of this method shows that with suitable foraging conditions all that is needed to supplement the natural ration is what heavy grain (corn) they will eat. When range is good, many growers do not feed at all through the season when insects, especially grasshoppers, are most abundant. The fattening of turkeys in the late fall depends largely upon the weather. If the weather is seasonable,— that is, quite cool in northerly latitudes,— less insect and vegetable foods are to be secured by foraging, the appetite for heavy food is also keener, and the turkeys eat corn freely and fatten well. If the weather is warm there is more food available on the range, the appetite is not so sharp, they will not eat corn so freely, and it may not be possible to fatten them as much as desired. Turkeys do not fatten well in confinement. Some of the fattening plants in New England have tried fattening them in large flocks, like geese, but results have not been satisfactory. It is not necessary to multiply examples of turkey rations. Any of the rations given to fowls and chickens on range may be successfully used for turkeys on range.

For peafowls. In size and habit these birds are very similar to turkeys, and may be reared in the same way. Usually they are found in much smaller flocks, a male and one or two females with their young. They forage widely, as turkeys do, and small flocks on good range are self-sustaining except in winter.

For guineas. In the conditions in which they are usually grown, guineas need little attention. They may be fed just the same as fowls and chicks on range. They prefer to keep away from other poultry much of the time, but when they come among fowls, they are very domineering.

For pheasants. For a long time pheasants were considered especially delicate, requiring special feeding until well grown. The most successful growers in

America to-day feed them about the same as chickens. The prepared chick-food mixtures are used for them with very satisfactory results. The half-wild pheasants protected in the woods in some of the states often come to the farms for food, especially in winter, when they sometimes take up their quarters with the fowls. At planting time, too, they sometimes become quite as tame as fowls.

For ostriches. In South Africa, where ostrich farming is carried on more extensively then in America, the most approved method of feeding is to pasture the birds on alfalfa, supplementing this with occasional feeds of corn. For winter feeding, or when pasture is short, hay, mangels, turnips, melons, etc. are used. In feeding habits, ostriches resemble geese (on land) more than they do any other poultry.

RATIONS FOR DUCKS

29. *For ducklings.* Corn meal 1 part, bran 2 parts; add 5 per cent of beef scrap and a little fine grit or coarse gravel; give an occasional feed of vegetables or green food: feed five times a day until five weeks old, then three times a day. Fatten on this, feeding all that the birds will eat.

This is practically an irregular alternation of standard rations 2 and 3. It is the ration used by one of the most successful of the smaller duck growers of New England. On comparison of reports it appears to have been as good a ration as any of the heavier rations following. One of the largest duck growers on Long Island used for years this ration slightly modified by adding small proportions of ground oats, middlings, or anything available. Such additions to a simple standard ration vary the flavor, make it more appetizing, induce the birds to eat more heartily, and (probably) add somewhat to its nutritive quality. When such a ration is fed to ducklings intended to be marketed at about ten weeks, and kept closely confined, the necessary variation for those to be grown for stock purposes is made, without altering the proportions of the ration given, by simply putting the birds on pasture.

30. *James Rankin's duck rations.* First food for ducklings, corn meal, 1 part; bran, 4 parts; low-grade flour to hold together, 5 per cent of grit or coarse sand; about the third day, add a little beef scrap and (cut) green rye; feed five times a day for a few weeks; after that feed three times daily and gradually substitute meal for bran, until at eight weeks the ration is three fourths meal and the beef scrap increased to 10 per cent or more. Describing his fattening ration separately, Mr. Rankin has given it as corn meal, 3 parts; low-grade flour, 1 part; beef scrap, $\frac{3}{4}$ part; green stuff, 1 part; fed three times a day, from the eighth to the eleventh week.

Compared with ration 29 this is a lighter ration at the beginning and a heavier toward the finish of the period of making green ducks. In remarks on ration 29 it was said that it appeared to give as good results as the heavier rations. Results by rations 29 and 30 were practically the same. The inference is that the flour used in ration 30 at first was sufficient to supply much of the deficiency in meal, and that when more meal was added, growth and fattening were accelerated, and so results of the two rations for the full period were equalized.

31. *For stock ducks (in autumn and early winter).* About equal parts of corn meal, wheat bran, and boiled vegetables, with 10 per cent of beef scrap, fed morning and evening; at noon a little cracked corn, wheat, or oats. After the birds begin laying, increase the proportions of meal and scrap and add low-grade flour, making mash about as follows: meal, 1 part; bran, 1 part; low-grade flour, 1 part; vegetables, 1 part, with from 12 to 15 per cent beef scrap.

This is practically a standard ration until the ducks are laying, then a very heavy ration to keep up condition under the drain of laying. Ducks lay almost daily from about January first until about midsummer.

32. *Weber Brothers' rations.* For the first three weeks, corn meal, 1 part; bran, 1 part; low-grade flour, 1 part; dry bread (ground) and rolled oats, 1 part; add 5 per cent of beef scrap, a little grit, and a little cut clover or alfalfa or other cut green rye. Mix this dry, then moisten with water and mix to a doughy consistency. Feed five times a day. Water at each feeding. From the third to the eighth week the above ration is modified to corn meal, 1 part; bran, 1 part; low-grade flour, $\frac{1}{2}$ part; green stuff, $\frac{1}{2}$ part; beef scrap, 1 per cent; fed at first four times, then three times, a day. From the eighth to the eleventh week, ducklings for market are fattened on corn meal, 3 parts; low-grade flour, 1 part; beef scrap, $\frac{3}{4}$ part; about 3 per cent of oyster shells and grit, with occasionally a little green stuff. Those saved for breeders are fed corn meal, 3 parts; bran, 3 parts; low-grade flour, 2 parts; beef scrap, 1 part; (root) vegetables, 1 part; green stuff, 1 part, with about 1 per cent of grit, and a little salt; about once a week 1 per cent of ground charcoal is added. The mash is fed morning and evening, about 4 quarts to every 10 large ducks, and when ducks are laying heavily, they are given at noon about 1 pint cracked corn to every 10 ducks.

The ration as used for the youngest ducks contains a greater variety of ingredients, because these growers could get only limited quantities of stale bread and of rolled oats at prices which made them economical foods, and it was judged best to use these for the youngest ducklings. The regular use of grit and shell was necessary with the ration as fed after the eighth week, because of the small proportion of bran. Whether it is better to omit bran and use grit and shell is doubtful. The period in which this ration was used is not long enough to fully develop results of feeding it. The ration fed to stock birds is heavier than the standard rations given.

While it is customary to feed young ducks five or six times a day for the first few weeks, it is not certain that there is any advantage in feeding more than three times, except when the ducklings get no feed but what is given. Ducklings on grass in spring and summer will come on as fast on three meals of mash as on five, and will be stronger. For rapid forcing, young ducks may be fed meat much more heavily than in any of these rations. They will stand for a while a ration nearly one third beef scrap. Whether that is a profitable ration has not been fully demonstrated. In feeding small flocks of ducks (up to two or three hundred) the author has not found it necessary to give grit and shell continuously. In fact, he has never found it necessary except with a few feeds at first, and thereafter at rare intervals if ducks showed symptoms of leg weakness.

RATIONS FOR GEESE

33. *Ration for goslings (on pasture).* First day, grass only; after that, two or three feeds daily of mash or scalded cracked corn. If confined to grassless yard or on tough grass which they do not relish, feed, with several grain foods daily, all the succulent green food that they will eat.

This ration as given for birds on pasture is that used in the goose-growing section of Rhode Island. Compare it with ration 1 for chicks and ration 28 for young turkeys.

34. *Fattening rations for goslings.* After six weeks, feed corn meal, 1 part; bran, 1 part, all that the birds will eat, three times a day. For geese reared on pasture, with light feeding of grain until three or four months old, goose fatteners use a mash of all corn meal, feeding this for four or five weeks.

35. *Ration for breeding geese (on pasture).* One or two light feeds of grain, or a feed of mash and one of grain daily. When pasture is not available, feed one mash and one grain feed daily, and supply liberally with vegetables and green stuff.

There is essentially no difference between such rations and those used for fowls, ducks, and turkeys. In every case the feeder supplies approximately a common standard grain ration, with a little animal food and some green food. The birds balance their own rations, as far as quantities permit. Unless the food supply is very deficient in some kind of food, they keep in good (if not perfect) condition, and soon get in condition after they begin laying. In grazing, geese (even more than fowls and ducks) will take the roots of grass and many plants after the supply of tops is exhausted.

36. *Swans* may be fed the same as geese. Being grown in small numbers on ponds and lakes, they are usually left much to themselves. They secure food from the water, being very destructive of small fish and other creatures found in the water. When such supplies of food are insufficient they may be fed grain mashes or stale bread, a most convenient food for them in many cases.

CHAPTER XIV

INCUBATION

Incubation the beginning and the end of the common cycle of operations in poultry culture. By incubation the bird is produced from the egg. For incubation and the perpetuation of its kind the bird, according to its sex, produces eggs or contributes to their fertilization; and then, in birds of the air, both male and female take part in the incubating of the eggs, the substance of which has been furnished almost wholly by the female. With poultry in domestication, as shown in Chapter I, the male has no part in incubation, and the female may often be relieved of it to the very great economic advantage of man; but, whatever the attitude of the poultryman toward the process, incubation is one of his most perplexing problems, affecting and affected by many other important problems, and seldom presenting itself in the same form twice in succession. From the nature of the subject its proper place in a systematic study of poultry culture is doubtful. Equally good reasons may be given for beginning and for concluding a detailed description of a generation of birds with the subject of incubation. But, considering the close analogy between the egg of an oviparous creature and the seed of a plant, it seems most natural and appropriate to begin a practical study of those details with the egg considered simply as material for the purpose, and without regard to either its antecedents or its possibilities beyond the mere production of an organism of the kind which produced it.

The egg. Considered from the point of view just indicated, an egg consists of four parts:

1. A *germ*, which is the true egg.

2. A mass of *albumin* (the *white* of the egg), — nitrogenous matter which the germ, quickened into life, will, as it grows, appropriate to form the substance of the embryonic being.

3. A supply of food (the *yolk* of the egg) for the first nourishment of the young bird after exclusion.

4. A protective covering which is composed of a double membrane within a hard *shell.*

The *germ* may be seen, when the egg is broken, as a little white speck on the yolk, and always on the upper side of the yolk, which position it keeps because the yolk is suspended in the white by two albuminous strings, and in whatever position the egg may lie, the yolk turns, bringing the germ to the upper side.

NOTE. An egg as described may be produced by the female bird without association with the male. In the ordinary natural course the female on arriving at maturity (or at the breeding season) produces eggs which are complete for commercial purposes and also, as far as her contribution to the egg goes, for breeding purposes; but the egg will not hatch unless the germ furnished by the female has been fertilized by union with the sperm contributed by the male at the proper stage of its development, nor will the germ thus fertilized produce a creature of sufficient vitality for normal development if the germinal elements contributed by the parents are lacking in vitality. Just how far a superabundance of vitality contributed by one parent may compensate for a deficiency in vitality in the contribution of the other is not known. That there is a tendency to equalization is often apparent, yet it is just as evident that there must be a certain degree of initial vitality in an element before it can unite with its opposite sexual element for the production of a new organism. This is illustrated best in the case of those hens of great laying capacity which produce few or no chicks, their eggs rarely becoming fertile even with every opportunity to do so. The fact that a hen can produce, in extraordinary numbers, eggs each of which apparently furnishes the material for a chick, though the accompanying germ lacks the vitality which would enable it under proper conditions to utilize that material, indicates that capacity to transmit vitality is more restricted than capacity to produce material for the building of new organisms. Of like significance in this connection is the fact that, though the male's contribution to the egg is but a minute quantity of sperm, the capacity of the average male to "strongly fertilize" eggs is plainly limited. These points are considered more fully in the chapters relating to breeding. Mention is made of them here to show that, in the nature of the case, the ordinary lot of eggs used for incubation is unlikely to be high in "hatchability," — which fact must be given due consideration in every effort to estimate causes of unsatisfactory hatches.

A fertile egg. Technically, a fertile egg is an egg which has fertilized germs possessed of sufficient vitality to develop so far that development can be seen through the shell when the egg, after having been incubated for a time, is tested by being held before a light in the usual way. Fertility cannot be determined without incubation. The amount of incubation necessary to show whether an egg is fertile varies with the vitality of the germ, the color and texture of the shell of the egg, and the intensity of the light before which it is observed. A thin-shelled white egg in a strong light may show fertility inside of twenty-four hours. A dark-shelled egg, weak in fertility, tested in a poor light, may appear doubtful after a week of incubation. Ordinarily tests made at the fifth to the seventh day give an experienced operator reliable indications of the fertility and vitality of eggs that have been incubated under proper conditions. Though not invariable, it is the general rule that the fertility of eggs from a mating is quite constant through a season; so that when the degree of fertility of eggs from a pen, flock, or stock is once found, it is likely to be maintained for some time.

As a rule, fertility and vitality reach their highest point of combination at the natural hatching season. Fertility is lowest and vitality highest in advance of this season, and fertility highest and vitality lowest after it; but numerous special cases furnish exceptions to these general conditions. Fertile, hatchable eggs are the prime factor in incubation, and a knowledge of the hatching properties of the eggs used is absolutely necessary for intelligent judgment of other factors when hatches are unsatisfactory. Self-evident as this seems when stated, a great deal of work in incubation is done without this basic knowledge, the operator working quite in the dark. Detailed instructions as to determination of fertility are given in the paragraphs relating to the operation of incubators.

Heat the energetic factor in incubation. Given a hatchable egg, the continuous application of a proper degree of heat for a definite period of time, varying in different kinds of birds, will produce an embryonic bird which, when it has attained the fullest possible development within the shell, will break the shell and emerge from it. In nature the heat for incubation is usually applied by the bird which laid the egg, relieved at intervals, perhaps, by its mate. In artificial incubation, oil, coal, gas, and electricity are used. The source of heat, however, is immaterial. All that is necessary is that the proper degree of heat be continuously maintained (not absolutely, but approximately) for the required time, under such circumstances that atmospheric conditions affecting the development of the embryo within the egg will not be markedly unfavorable.

The fact that, in natural incubation, eggs seem to hatch equally well under very different atmospheric conditions indicates that as close adjustments of ventilation and moisture as of heat are not required, — that within limits (not definitely ascertained) these may vary considerably without materially affecting the hatch. The normal temperature of fowls is about 106°, of other poultry about the same. The temperature in natural incubation, therefore, would be a few degrees lower, or the temperature at which eggs could be kept with a body at about 106°, applying heat from one side only. The usual temperature of eggs under hens has been found to be from 102° to 104°, with a mean of 103°.

Antiquity of artificial methods. Artificial incubation has been practiced by the Egyptians and Chinese for some thousands of years. As developed by these peoples the appliances are crude and the success of the process depends largely upon the judgment, skill, and careful attention of the operator. Knowledge of the art is confined principally to families in which it has been handed down from generation to generation. Operations are on an extensive scale, and the operator remains with, and sometimes in, the "incubator" continuously throughout a period of incubation. Modern artificial incubation as developed in America and Europe is on different lines. The constant effort of the occidental inventor has been to devise an incubator that might be operated by any one anywhere, on any desired scale, and with the least possible personal attention.

The problem in artificial incubation. To maintain a temperature of approximately 103°, with suitable atmospheric conditions, — to duplicate, as nearly as possible, in an artificially heated chamber, the conditions to which an egg incubated by a bird is subjected, — is the incubator operator's problem. This problem presents two phases. The first of these, the designing and construction of incubators, is a matter for the inventor and manufacturer, and does not directly interest the ordinary student.

The individual poultryman's problem in artificial incubation is to take a "machine" which, when properly attended, is self-regulating for heat, give it the attention requisite for this, and adapt ventilation and moisture to local atmospheric conditions. To reduce to the minimum the variations in these conditions, the incubator is usually placed in a basement room or in a cellar. Under the most skillful management, results in artificial incubation are likely to be more variable than when eggs of like hatching quality are incubated with equal care by natural methods, because the judgment of a man guided by experience and observation works less accurately in such matters than the inclination of the bird guided by instinct and sensation.

Experience and skill count in the operation of incubators, as in all things, but the incubator operator has a slightly different problem in every machine that he uses, and a new problem in every hatch, and a high degree of efficiency in this line of work is only attained by careful study of the behavior of machines in the positions in which they are placed, and by such close attention to the lamp, or other source of heat, that the eggs are never subjected to injurious temperatures.

Value of both methods of incubation. When incubators were perfected to the point where temperature was easily controlled, there was a general tendency to substitute the artificial for the natural method. As it became generally known that, notwithstanding the progress made, the artificial hatchers had their faults and limitations, and still required close attention on the part of the operator, this tendency was checked. It is now generally recognized that the natural method is the better method for the great majority of poultry keepers, provided they can get birds to incubate when they need them, but that whenever the natural method is for any reason inadequate, the artificial hatcher must be used. On this principle one or more incubators (of suitable capacity) and the necessary brooders become a part of the equipment of most poultry keepers, to be used in emergencies and for special purposes, even though hatching is done mostly by the natural method; and whenever operations are on a large scale, incubators are relied upon to do the hatching, the only important exception to this being in the colony poultry-farming section of Rhode Island.

Hatching by Natural Methods

Broodiness. The inclination to incubate is a normal character in birds, which in some races and stocks has wholly or partly disappeared. The length of the period of laying, before broodiness, varies greatly. Some hens will become broody after laying only six or seven eggs. Usually hens of stock strongly inclined to broodiness will lay from one to two dozen eggs before becoming broody. In strains or stocks in which the broody habit is present, but not strongly established, hens often lay for two, three, or even five or six months without becoming broody. As a rule, increased egg production is accompanied by decrease in broodiness. Among ducks the Pekin and Indian Runner are mostly nonsitters. In geese, turkeys, and the less common kinds of poultry broodiness is general.

Broodiness is shown first in the inclination of the bird to remain on the nest after laying, then by a change of attitude toward the keeper, and by a change of voice. Usually birds, unless very tame, are shy about being approached on the nest, and leave it if molested. The broody bird in most cases becomes bold, sometimes vicious, and even if she will not allow herself to be handled on the nest, will plainly show as much anger as fear when molested. Hens and other gallinaceous poultry, when broody, make a clucking noise, which is obviously meant to guide the young and keep them from scattering too widely, and when disturbed give a harsh, warning cry. Female waterfowl, when broody, give a warning hiss, as the male is likely to do at any time when molested. The attitude and voice of the bird are surer indications of broodiness than her remaining on the nest, for sick birds frequently do that.

When broody hens are to be used for incubating, it is advisable to let them remain for several days on the nests that they have laid in, until broodiness becomes confirmed and they have ceased laying. The duration of broodiness is not (as is popularly supposed) determined or influenced by the time required to incubate the eggs of the bird. Unless broodiness is interrupted by a resumption of egg production, or she is compelled by exhaustion to leave the nest, a bird will remain on eggs until young appear, and may even keep for an indefinite time to a nest containing no eggs.

System in natural incubation. If more than two or three birds of any kind are set, arrangements for managing them should be systematized. A great deal of the dissatisfaction with natural methods of incubation is due to mismanagement. The sitting hens should always be separated from the rest of the flock and made as secure as possible from disturbing influences of all kinds;

yet they should be in a place convenient for the attendant to have oversight of them as he goes about his regular work. Most hens may be moved from their laying nests to any desired place, if moved after dark; many may be moved at any time. But the other kinds of poultry usually resent interference of this kind, and will incubate only in the nests in which they have been laying. For this reason it is customary, especially with turkeys and geese, before the birds begin to lay, to place, in locations attractive to them, nests that will be suitable for them during incubation. An empty barrel placed on its side in some partly secluded place is often used for both turkeys and geese. When the birds insist on making nests for themselves the careful keeper furnishes protection (see illustrations, p. 247) and, as far as the birds will tolerate it, tries to make them secure from molestation.

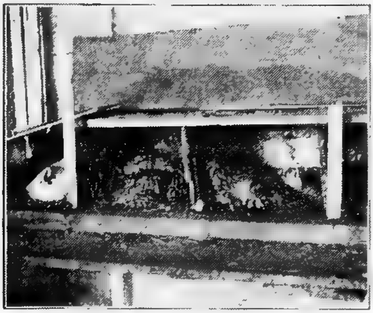

FIG. 273. End of long row of nests for sitting hens

From the greater ease of controlling fowls, and because the larger kinds of poultry lay comparatively few eggs even when not allowed to incubate those produced during their first laying period, by far the greater number of eggs of all kinds of poultry hatched by natural methods are hatched under hens.

FIG. 274. Half-barrel nests for sitting hens, out of doors. (Photograph from H. de Courcy)

Nests for sitting hens. Nest boxes should be uniform in pattern and size, and should be so constructed that they may be opened and closed at will, thus insuring control of the hens. Where the number to be set is not large, nests of the pattern shown in Fig. 275 may be used. When large numbers are set it is better to have them made in sections of four and arranged in tiers or banks three or four sections high. When nests are placed on the ground the earth bottom should be shaped before putting into it the nest material, particular care being taken to remove any small stones that it may contain.

For nest material. Short, fine hay or straw is preferred for nest material, but fine shavings or excelsior may be used. Some poultry keepers use tobacco stems, which are objectionable to lice. Whatever material is used should be shaped and well pressed down by hand. If this is carelessly done, eggs are likely to be broken, and the hen blamed for what was none of her fault. Those who have had no experience or have been unsuccessful in shaping nests will find it a good plan, after doing their best, to put a few china eggs into the nest and let the hen shape it as she sits on these for a day or two.

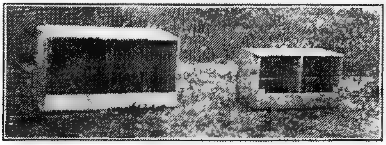

Fig. 275. Nest boxes, made in pairs, for sitting hens. Inside dimensions: large, 16″ × 16″ × 18″; small, 12″ × 12″ × 15″

Selection of eggs. Eggs to be incubated should be selected with care, all that are irregular in shape, defective in shell, or abnormal in size being discarded. Leaving out of consideration all other objections to the use of such eggs for hatching, their liability to break is sufficient reason for not using them. The eggs should be as fresh as possible, and should be clean. Eggs three weeks old when set may hatch well, but the young birds are likely to be much less vigorous than those from fresh eggs. Little difference is noted between chicks from eggs ten days or two weeks old when set, but it is the general opinion that the fresher eggs produce somewhat better young. Hatches reported from eggs' kept six weeks or more are not well authenticated.

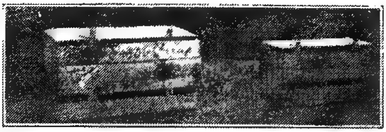

Fig. 276. Same as Fig. 275, with nest boxes closed

Eggs kept for hatching should not be exposed to either extreme cold or extreme heat. The best temperature is from 40° to 50° F. It makes no appreciable difference in what position they are placed, nor is it necessary to turn them at intervals; the position does not affect eggs held only a week or two. It is not advisable to put under the same hen the eggs of birds of different kinds or distinctly different types, but it is often advisable to place in the same nest eggs from different flocks, yards, or individual hens, especially if the hatching qualities of some of the matings are known, and it is desired to determine whether, in case of failure of other eggs to hatch, the fault is in the eggs or in incubation. For such purposes eggs must be marked. In general it is desirable that all eggs used for incubation be marked, or that the nests be marked to identify eggs set in them.

Number of eggs placed in a nest. The number of eggs in a setting varies according to the size of the bird, the kind of eggs, and the season. A medium-sized hen can cover from 9 to 15 hens' eggs, —usually (of average eggs) 11 in winter, 13 in early spring, and 15 after the weather is settled. The same hen would cover 6 or 7 turkey eggs, from 9 to 11 duck eggs, or 4 or 5 goose eggs. A duck will cover about the same number of duck eggs as a hen of like weight. Geese and turkeys cover from 12 to 15 of their own eggs. In warm weather much larger numbers of eggs may be given and large hatches secured,[1] but because of the risk of the entire hatch being spoiled by a sudden cold snap, big sittings are rarely made except from curiosity. Bantams laying eggs larger for their size than the large fowls will cover only from 7 to 9 of their own eggs, and about the same number of the eggs of pheasants.

Advantages of keeping hens shut on the nests. Except when they are let off to eat and drink, the nests of sitting hens should be kept closed. This is necessary, not so much on account of the individual hen that may leave her nest too long, as to prevent interference and quarreling, with the breakage of eggs and the general disturbance that such incidents occasion. If any are restless they may be kept quiet by darkening the nests with burlap curtains, either over the nest or on the windows. Hens that will not settle down in a darkened room or nest should be discarded.

When only a few hens are set in nests on the ground, and it is desired to manage them with as little interference as possible, they may be let out to feed singly or in pairs, and left to return to the nests of their own accord. When large numbers are set in the same

[1] I have seen a little native hen weighing less than 4 pounds hatch 19 chicks from 19 eggs. A Brahma hen set on 27 Leghorn eggs hatched 21 chicks.

FIG. 277. Turkey's nest in cleft rock, covered with loose boards for protection

place it is better to let all out at the same time, preferably late in the afternoon, and as soon as they have had feed and drink, return them at random to the nests. The largest average hatches are obtained by not letting hens return regularly to the same nests. One reason for this is that hens differ in temperature, and some are so low in temperature that, if they sit on the same eggs continuously, they will hatch no chicks, or weak chicks. It is possible also that some hens do not move their eggs as much as necessary. It has often been noted that hens that sit closely and are always quiet and in the same position on the nest do not bring off as good hatches as the more energetic and restless hens.

FIG. 278. Turkey's nest with tent-shaped roof as protection

While the hens are feeding, nests should be examined for broken or soiled eggs, and attention given to any that are not in order. Some poultrymen, hatching on a large scale, by natural methods, make banks of nests with an alley in the rear and with access to the nests from the back as well as from the front. When the hens are let off to feed, the keeper closes the fronts of all the nests and, going into the alley, can clean the nests, or give other attention, without interfering with the hens or being annoyed by them.

FIG. 279. Box with one end cut out, covering nest of goose in pasture

Whatever arrangement or system of handling sitting hens is used, they should be released to eat and drink at about the same time each day, and at that time nests and eggs soiled by broken eggs or by dung should be cleaned, for there is nothing more detrimental to incubation than fouled eggs and nests. This trouble may be reduced to the minimum by good judgment in the selection of the hens and eggs used, by care in making the nests, and by regularity in attention; but under the best of conditions there will be some breakage, and occasionally a hen unable to retain her feces through twenty-four hours will soil her eggs and nest.

Food of the sitting hen. Only hard grain should be fed to sitting hens. Whole corn seems to suit them best, but any of the ordinary grains may be given. Soft foods and wet mashes, which tend to cause looseness of the bowels, should be avoided, but a little green food may be given as a relish. The grain should be in a hopper, trough, or box, and fresh water should be supplied daily.

Cleanliness. During incubation, and especially if the birds are confined to indoor quarters, as they usually must be early in the season, and as may be most convenient at any time, cleanliness is of the utmost importance. The droppings of the incubating birds are likely to have an unusually offensive odor,[1] and if allowed to accumulate, to dry, and to be broken up and mixed with the litter or earth of the floor, affect the whole atmosphere of the place, besides making an earth floor so objectionable that hens will not wallow in it and thus keep themselves free from lice. Even when the hens have, and avail themselves freely of, the opportunity to dust, it is advisable to take precautions to prevent lice from getting a start in the nests. The easiest way to do this is to dust hens and nests with insect powder when set (or soon after), again about the middle of the period of incubation, and a third time just before the eggs are picked. If this is done, the birds and nests should be almost entirely free from lice when the chicks hatch. When only a few hens are set, and the keeper is quick to observe indications of the presence of lice and to take steps to check them, routine preventive treatment may be omitted. Under other circumstances preventive measures are safest and, in the end, more economical.

Testing eggs. Eggs should be tested about the seventh day of incubation. When the work is carefully systematized it is usual to set hens always on the same day of the week. Then if the test on

[1] The extraordinary offensive odor of the droppings of sitting hens seems to be due in part to their long retention before evacuation and in part to the tendency of nature to take advantage of a period of rest from usual activities, to clean up the system and rid it of impurities.

the seventh day shows any considerable proportion of infertile, or unhatchable, eggs, the good eggs remaining may be "doubled up" and a part of the hens reset with the next lot. A second test is usually made about the fourteenth day for the detection and removal of dead germs. It is much more important that these should be removed than that the infertile eggs should be taken away, for the composition of the infertile egg is not changed during incubation, while the egg containing a dead germ may rapidly decompose, is more likely to be broken than an infertile egg or one with a live germ, and, if broken in the nest, may spoil the hatch.

The method of testing eggs in incubation is substantially the same as the candling of market eggs, but the work is usually done with a little more care. The ordinary incandescent electric light, when convenient, makes a most satisfactory tester. An ordinary hand lamp or lantern may be used, or if the place in which the testing is to be done has a window toward the sun and can be completely darkened, the eggs may be tested by sunlight by placing over this window a shutter, or thick curtain, having in it a hole of suitable size (an inch in diameter, or a little larger), before which the eggs may be passed. When an artificial light is used it may be either placed in a small box with a suitable hole directly before the light, or fitted with a metal chimney with a hole on one side.[1] The egg to be tested is held, large end up, at the hole before the light. A strongly fertile egg at the seventh day will appear through the tester as in Fig. 294. An infertile egg will be clear, but the yolk may throw a light shadow. The apparent density of the egg will usually be in proportion to the vitality of the germ, and those in which at this time the shadow is relatively faint and the line of the air cell not well defined will not usually hatch. Many poultrymen leave these doubtful eggs until the second test; but it is as well to discard them at the first test, for the germ that does not start well is not likely to produce a strong embryo.

The average hatchable egg, tested with an ordinary light, shows its development only by the increasing density of the shaded portion, the enlargement of the air cell, and the sharper definition of the line between the air cell and the growing embryo. Thin-shelled eggs, or any eggs in very strong light, may show more of the detail

[1] See description, p. 171.

of development. As eggs are usually tested with an ordinary lamp, anything noticeable in the shaded portion (as a dark spot, ring, or lines) indicates a dead germ, and vacillation of the lower line of the air space shows that decomposition is well advanced. By slightly turning the egg as held large end up before the light, the condition of the contents may be observed; in the normally developing fertile egg they appear solid, in the decaying egg, fluid.

Period of incubation. The time required for incubation is for fowls, 21 days; pheasants, from 22 to 24 days; turkeys, peafowl, and guineas, 28 days; ostriches, 42 days; ducks, 28 days; geese, from 30 to 35 days; swans, 35 days, — these figures giving the average periods for different types of each kind of poultry and for normal development. It is noticeable that for the smaller kinds of poultry the period of incubation is generally shorter. This is true also of different types of .the same kind of poultry. The eggs of small, active birds hatch sooner than those of the larger, more sluggish ones. Broody birds of high temperature will (other things being equal) hatch the same eggs sooner than will those of lower temperature. The young birds hatching long in advance of the normal average time are likely to be precocious individuals. Those much delayed are likely to lack vitality. As a rule, the best specimens are those which hatch promptly after having taken the full period for embryonic development, due allowance being made for differences in the type of the bird and in the birds incubating the eggs. In fowls a hatch of Leghorns might be complete in twenty days; a hatch of Brahmas under the same conditions show not an egg picked at that time. A difference of a day, or even two days, in the apparent period of a hatch may occur, either through failure of the incubating birds to sit closely on the eggs at the outset, or because of partial chilling of the eggs at a later stage of incubation. In the first case the vitality of the young birds may not be at all affected; in the other they are likely to be weak.

Chilling of eggs during incubation. The chilling of eggs cannot be wholly avoided. A bird may become sick, or perhaps die on the nest, before its condition is discovered; and occasionally one, though to all appearances in good health, quits sitting and stands up in the nest. Such a case the novice may at first fail to distinguish from the case of the bird that stands up occasionally (especially in hot weather) because her eggs are making her uncomfortably warm. Unless it is known that eggs have been chilled beyond recovery, the damage due to chilling can be ascertained only by continuing incubation, and testing after a sufficient time has elapsed to plainly show whether development has stopped. In cold weather, eggs left by a bird for only ten or fifteen minutes may be fatally chilled, while in warm weather a bird may remain off for hours at a time without impairing the hatch. An actual chill probably always does damage, but circumstances or superior hardiness sometimes save the germs in some eggs. Cases have been known of vigorous chicks hatching from eggs in nests where most of the germs were destroyed by a chill.

When the eggs begin to hatch. The inclination of the mother is to keep the nest until she is ready to leave it with her young. In houses where the sitters are under control, it is well now to keep the nests closed. The advantage of protecting an outside nest is emphasized at this stage. A nest cover like those shown in Figs. 278 and 279 can be completely closed by a board in front of the entrance, and the sitting bird protected from outside interference at the time when it is most dangerous to her brood. If she is in good condition it will be no serious hardship for her to go without food and water for two or three days, while if she leaves the nest, the air may dry the membranes in pipped eggs and there is risk of her crushing in the shells as she returns. On all accounts she should be allowed to remain quiet. Birds that become too restless and crush their eggs should be removed and others substituted, or (if that cannot be done) the eggs should be taken away.

To avoid losses at this stage some poultrymen who hatch mostly with hens transfer the eggs to incubators at about the eighteenth day, returning the chicks to the hens when dry and ready to begin eating. When this is not practicable, and the mother seems likely to lose many of the young as they hatch, the eggs may be put (in the old-fashioned way) into a flannel-lined box or basket and kept in any safe, warm place until they hatch. The nests should be examined only to observe in a general way how things are progressing, and to correct anything going wrong. As a rule, the hen that seems to be doing well should be let alone, the hen that is not doing well relieved of responsibility. When things are going well, all that is necessary is to remove the empty shells, in order to give more room in the nest and to prevent an unhatched egg from being "capped" by a shell.

Helping birds out of the shell. On the principle that the bird that has not strength to get out of the shell unassisted is not worth keeping, most experienced poultrymen consider it inadvisable to help them out. Few, however, rigidly follow this rule. Especially in hatching by natural methods, where the eggs are easy to get at, the attendant is likely to help out of the shell every chick that seems to need help, and discard the weaklings later, when removing the chicks from the nests. This saves the chick that is held in the shell by something else than lack of strength to make its way out under normal conditions. Such cases occur when the membranes dry as the chick picks around the shell, and when the chick is "mispresented" and picks at the small instead of the large end of the egg. If the drying of membranes as eggs are picked is general, it is a good plan to moisten the nest with tepid water, and also, if conditions are very bad, to sprinkle the floor of the apartment liberally. Except in such circumstances, it is not necessary to moisten eggs in process of incubation by the natural method. In removing the shell from a chick which seems to need help, the condition of the blood vessels in the membrane should be noted. While the blood still circulates in them, nothing should be done. The chick will be injured or killed by the bleeding that would follow the removal of shell and membrane.

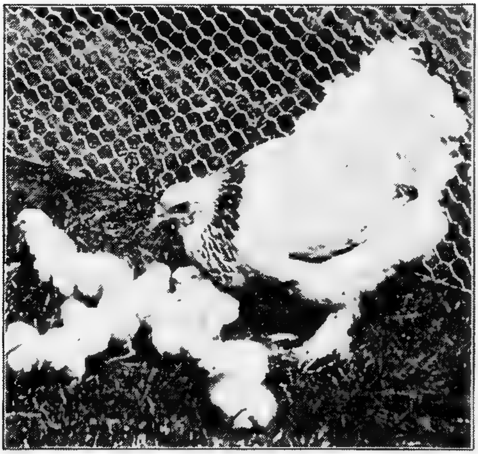

FIG. 280. Hen with brood of newly hatched chicks

Conditions of good hatching. Success in hatching by natural methods depends on constant and careful attention to every detail that may affect results. While the natural method is the only one available for those who cannot give an incubator as close attention as its heater requires, the poultry keeper who leaves sitting birds to themselves is taking chances. Under favorable conditions a single bird sitting by itself may make a good hatch. A few birds may do as well if they get along amicably, but good or even fair hatches are exceptional under such circumstances. As a rule, good results by natural methods are secured only by careful selection of eggs and sitters, careful preparation of nests, regular attention to the wants of the birds, and prompt correction of any condition unfavorably affecting either the germs in the eggs or the mothers at hatching time. The natural method of incubation, at its season and in its place, is the more economical method, and taxes the thought of the operator less than the other, but to get full results from it the operator must do his part as faithfully as he expects his birds to do theirs.

Hatching by Artificial Methods

Responsibility of the operator. The modern incubator is a cleverly designed, serviceable mechanism, but it has its limitations. Many of the troubles of incubator operators are due to overestimates of the automatic capacity of incubators, and to the consequent neglect of things to which the operator should give his personal attention. The most successful operators are those who watch their incubators very closely, quite ignoring the manufacturer's claim that the machine will do its work with a little attention every twelve hours, and that no serious harm will result if the operator happens to leave it alone for twenty-four hours. The facts as to this are, as the experienced operator has learned, that while an incubator may run for weeks without requiring attention except at the regular intervals, it may go wrong at any time, and many hatches are lost which might have been saved had the operator been on the lookout to promptly correct wrong conditions. When operations are on a large scale the risk of loss is so great that the wise poultry keeper takes no unnecessary chances, but looks after his incubators and brooders early, often, and late. In small operations it may not seem profitable to give the time to this, and on the actual value of the eggs, or of the chicks when hatched, it may not be profitable;

FIG. 281. Stone incubator house on plant of E. O. Damon, Hanover, Massachusetts

but considering such points in their general relation to his work, the poultry keeper will find that he cannot afford to leave undone anything that it is in his power to do in order to hatch, at the most favorable season, the young stock that he needs. Special emphasis has been laid upon this point, because economy of attention which amounts to neglect of incubators is the great stumblingblock of the small operator.

Selection of an incubator. The choice of an incubator is a less important matter than is commonly supposed. Although there are manufactured in America over a hundred differently named incubators, most of them are imitations of popular machines, the imitation being sometimes inferior in construction or different in some particular, but as often equal to, and occasionally an improvement on, the model. It is notorious that some of the best-known incubators on the market are substantially identical and as nearly equal as may be in hatching results, the differences in hatches of machines of different makes being no more noticeable than differences in hatches from machines of the same make. It is not unusual to find poultrymen in the same locality preferring different machines. Even men operating in the same room, with the same eggs, may not agree in their

FIG. 282. Laboratory building at Maryland Experiment Station. Incubator room in basement. (Photograph from the station)

FIG. 283. Laboratory building at Massachusetts Agricultural College. Incubator room in cellar. (Photograph from the college)

choice of an incubator. Some operators can get good results from any machine, others cannot successfully run at the same time machines requiring different adjustments.

With rare exceptions new incubators of all makes will hatch fairly well if given sufficient attention, but the cheaper machines usually require much closer watching than the higher-priced ones, and at best are short-lived. It is generally advisable for a beginner to select an incubator popular in his neighborhood, because then he may profit more by the experience and suggestions of other operators. Hot-air machines are now commonly preferred for individual incubators of ordinary capacity. In the so-called mammoth incubator, consisting of a series of egg chambers on the same heating system, hot-water heaters are necessarily used. These mammoth incubators have the advantages of being more economical of fuel, requiring less labor to care for heaters and causing less risk of fire, but the regulation of temperature throughout the series has not yet[1] been brought sufficiently under automatic control to satisfy most operators.

Manufacturers' directions for operating incubators. The directions furnished with an incubator should be followed at first and until the operator has a well-defined purpose in departing from them. These instructions are not exactly adapted to every situation, but afford the best starting point for the operator in determining the mode of operation best adapted to his locality. While incubators are in the main similar, most of them have some minor differences which may affect the mode of operation, and it is presumed that the manufacturer's instructions cover these points. The manufacturer's instructions usually presuppose certain general conditions. They are based on the assumption that the incubator will be operated in a dry, well-ventilated cellar or room. Such instructions are manifestly inaccurate for an incubator placed in a damp cellar, — where the circulation of air is slow though perhaps sufficient to provide oxygen as fast as needed,— and also inaccurate for machines in an extremely dry location. A machine which requires no moisture under average conditions may require moisture in a dry place, and in a damp location may need more ventilation. A machine which requires

[1] 1911.

some moisture under ordinary conditions may hatch better with no moisture if operated in a damp place, and may require much

FIG. 284. Cheap incubator cellar; a common type

FIG. 285. Small incubator house. (Photograph from F. A. P. Coburn)

more moisture than the manufacturer's instructions call for if operated in a very dry place. This topic will be considered further in a subsequent paragraph.

Manufacturers' instructions should be supplemented by such further attention as is necessary to give reasonable assurance that

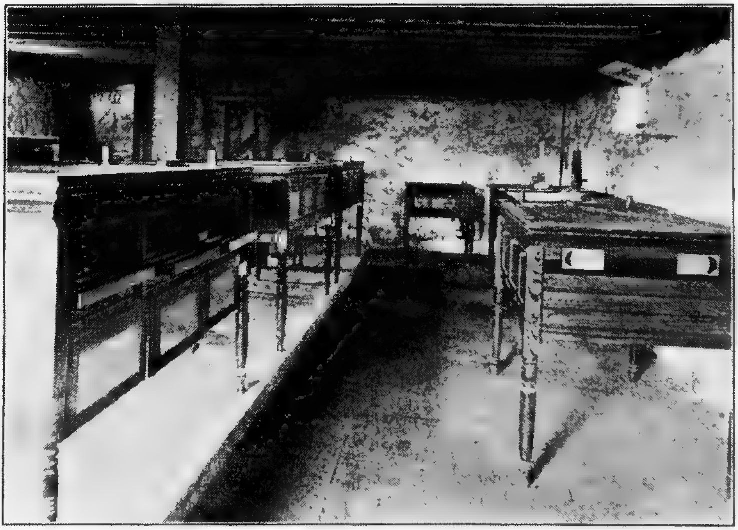

FIG. 286. Interior of an incubator cellar equipped with small incubators

right conditions continue in the intervals between the regular hours for attending the incubator. This will depend mostly upon the faithfulness and skill with which instructions have been followed, and upon the judgment used in modifying them to suit local conditions, but occasionally also upon weather changes. Thus, after filling lamps and trimming wicks, many operators return in the course of fifteen or twenty minutes to see that lamps are burning well. They also take a look at the incubators, noting the temperature and the condition of the flame whenever they happen to be

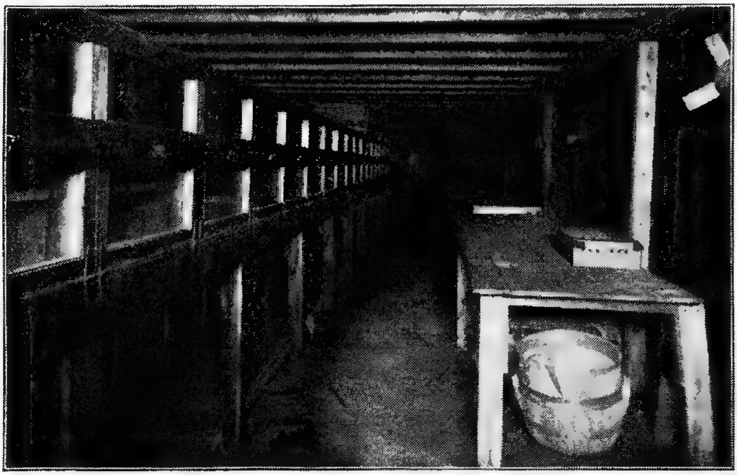

FIG. 287. Interior of incubator cellar at Pittsfield Poultry Farm, Pittsfield, Maine, showing one side of a mammoth (Hall) incubator of six-thousand-egg capacity (Photograph from Pittsfield Farm)

near them. In extreme cold weather or in high winds they watch the incubators very closely, for it is under such conditions that the ordinarily automatic regulator is most likely to become erratic.

Selection of eggs for artificial incubation. Considering only the matter of incubation, selection of eggs need not be as rigid for artificial as for natural incubation. When the eggs are to be turned in the trays they must be of uniform size or many may be broken in turning. When eggs are turned by hand, by shuffling on the tray, uniform size is not so essential, although as a rule it is not desirable to use those varying much from the average size of the lot. Eggs with irregular and defective shells are often hatched artificially, when by the natural method they would be likely to be broken. Even a cracked egg may be patched with sticking plaster, or with a piece of paper gummed over the crack, and successfully incubated. The use of ill-formed and defective eggs is not advised except in case of scarcity of perfect eggs, when it may be better to fill up the incubator with such eggs as are available than to wait until the required number of selected eggs can be obtained. The eggs used should be as fresh as possible. It is desirable that they be from vigorous stock that is known to be producing strongly fertile eggs, but as a rule the quality of the eggs secured for first hatches is doubtful — to be determined only by the result.

Preliminary regulation of heat. A new incubator, or one that has been out of use for some time, should be run empty for several days, no eggs being put into it until it is adjusted to and running steadily at 103°. It will require several hours to bring the egg chamber back to that temperature after cold eggs are placed in it. Then the actual process of incubation begins.

Routine work of incubator operation. The ordinary routine of incubator operation is as follows: The lamp is filled once a day, and the wick trimmed at that time and also, if it seems necessary, after twelve hours. If the lamp is small, or if oil of inferior quality is used, it is better to remove the charred scale from the wick twice a day.

Turning the eggs is begun on the third day and continued twice daily until the eighteenth day (for ducks' eggs, the twenty-fourth day), after which the eggs should not be turned. For a long time it was the common practice to turn the eggs by placing an inverted tray over the tray containing the eggs, and, holding the two trays tightly together, turning them so as to place the eggs, turned half over, in the new tray. The method now generally preferred is by shuffling, which only slightly changes the position of the egg and more closely conforms to the conditions in natural incubation. Some machines have attachments for turning the eggs without removing from the machine, but operators generally prefer to take them out.

Cooling the eggs begins simultaneously with turning. Until the seventh day the cooling incident to the removal of the eggs for turning is sufficient. After that, at one turning each day they are kept out of the machine until cool to the touch, the time ordinarily required being from ten to thirty minutes, according to the temperature of the room and the development of the embryos, which, as they increase in size, retain the heat longer. In warm weather a much longer time may be required. Cooling is discontinued at the same time as turning. Cooling is sometimes done by simply leaving the door of the egg chamber open, but that does not expose the eggs uniformly to the air.

Testing is done at any time from the third or fourth to the seventh day, and again from the twelfth to the fourteenth day. The object of testing as early as development will show is to remove the infertile eggs, which, if taken out early, are salable for culinary purposes.[1] At the later tests the eggs containing dead germs are removed.

A record of each hatch is usually kept by the incubator operator, either on a card kept on the machine, or in a notebook. In this record is noted the number and description of the eggs set, the temperature of the egg chamber at regular intervals, the number of infertile eggs and dead germs removed at the tests, and any irregularities which might affect the hatch. This routine work is all simple and essentially mechanical.

Factors in artificial incubation. To correctly adjust ventilation and moisture is the special task in incubator operation. This will be found easy or difficult according to whether the operator has so placed the machine that its ordinary adjustments suit, or, if it is placed otherwise, has used good judgment in estimating in what way and how much the conditions vary from conditions in which the machine was designed to be operated, and in making the appropriate changes.

Ventilation and moisture questions in incubation are very closely related — interdependent. It is claimed for some incubators that they need no moisture, and for others that the ventilation in them is automatic. Such claims hold only for the average condition to which a machine is adjusted as it leaves the

[1] An infertile egg that has been incubated is stale (the staleness depending on the period of incubation) but may be as good as the ordinary run of market eggs in hot weather.

factory. Even for approximately average conditions it is found that if the instructions of the manufacturer indicate that moisture is to be supplied in uniform quantity, they leave ventilation to be regulated by the operator; and if ventilation is to be constant, moisture is to be regulated according to the judgment of the operator. These things are generally implied, if not always plainly expressed. Though the operator may overlook them at first, experience soon shows him what he must do.

The source of moisture in incubation. The eggs incubated furnish the moisture in incubation. An egg is from 60 to 65 per cent water and has a porous shell. Exposed to ordinary temperatures, the contents of an egg gradually dries up through evaporation of its water. The rate and amount of evaporation under incubation may be found by weighing the eggs at intervals. Experiments to determine this point have been made at several experiment stations. In nineteen days of incubation a fertile egg may lose by evaporation as much as 17 per cent of its original weight; the least loss recorded in an experiment is 11 per cent. On this (11 per cent) basis a setting of eggs weighing 26 ounces would lose by evaporation 2.86 ounces. It is estimated[1] that this amount of moisture, if distributed evenly through nineteen days, would be sufficient to saturate the air in a nest *four times an hour* throughout the entire period. In other experiments the percentage of evaporation was still higher. Atwood[2] estimates that "one hundred fertile eggs of average size will lose 234.9 grams, or 8.28 ounces, during the first five days of incubation; 341.8 grams, or 12.05 ounces, during the next seven days; and 352.8 grams, or 12.44 ounces, during the next seven days."

Use of ventilation. The essential function of ventilation in artificial incubation is to remove the moisture and gases exhaled by the eggs. In an improperly designed incubator, ventilation might be necessary to carry off the fumes of the lamp entering the egg chamber. In any incubator, ventilation must provide for the removal of moisture to allow normal evaporation from the egg. As the condition of the egg is affected by the condition of the egg

[1] Day, "Humidity in Relation to Incubation," *Bulletin No. 163*, Ontario Department of Agriculture.

[2] *Bulletin No. 73*, West Virginia University Agricultural Experiment Station.

FIG. 288. Eighteen hours

FIG. 289. Second day

FIG. 290. Forty hours

FIG. 291. Third day

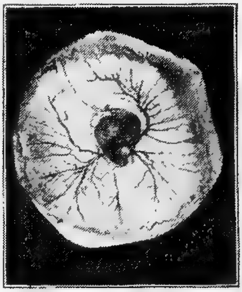

FIG. 292. Fourth day

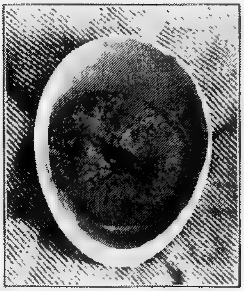

FIG. 293. Fifth day

FIG. 294. Fertile egg seen through tester, seventh day

FIG. 295. Fertile egg, fourteenth day

FIG. 296. Chick just before hatching

DEVELOPMENT OF CHICK IN INCUBATION

(Photographs from E. T. Brown, made by E. C. Hearson, London, England. Figs. 288–293 and 296 show contents of egg with shell removed) chamber, so the condition of the egg chamber is affected by the condition of the apartment in which the incubator is operated. Thus the problem of ventilation becomes a matter of the proper adjustment of the machine to its atmospheric environment, to secure the normal evaporation of the eggs. If the atmosphere of the apartment is relatively dry, a ventilator of fixed opening may remove moisture from the egg chamber too fast, and the air in it will become so dry that the rate of evaporation from the eggs will be too high. Then evaporation could be checked by moistening the air (wetting the floor) of the room, by placing moisture pans in the egg chamber, or by reducing the ventilator opening. Deficient evaporation would be remedied, in an incubator with supplied moisture, by removing water from the egg chamber, by increasing the ventilator opening, or by increasing the ventilation and reducing the humidity of the air in the room; in a nonmoisture machine the deficiency would be remedied by the two means last mentioned.

FIG. 297. Egg just before exclusion and partially excluded chick

Measuring ventilation. The standard gauge of ventilation is the rate of evaporation in natural incubation. Comparison may be made either on a basis of the size of the air cell as observed by testing, or by weighing eggs artificially incubated from time to time and comparing the loss of weight with the standards experimentally determined from natural incubation. With suitable scales each tray used may be weighed empty and the weight marked on it, weighed with the eggs when filled, and afterwards as often as desired. The data as given for one five-day and two seven-day periods are not adapted to this purpose. As it is desirable to discontinue the handling of eggs after the eighteenth day, the best arrangement is to make the weighings at the close of the sixth, twelfth, and eighteenth days. For six-day periods the loss of weight is approximately ten ounces on each hundred average eggs, and on this basis the proper loss of weight for any number of eggs is readily computed. It should be understood that the shrinkage in natural incubation is not uniform, and that equally good hatches would probably be obtained on any evaporation between the 11 per cent observed at the Ontario station and the 17 per cent observed at the West Virginia station, — possibly between wider limits, though it seems improbable that the limit could be moved much farther up or down without affecting the result. When it is not convenient to weigh eggs, it is advisable (especially for the novice) to run check lots of eggs under hens, using two or more hens if possible, that the check may not be invalidated by a poor sitter or by accident. A further advantage in check hatching with hens is that a right amount of evaporation does not necessarily insure a hatch, and that the results from the hens afford checks on other points which may need investigation.

Management of the incubator at hatching time. The excuses for disturbing the hen at this time do not apply to the incubator. From the time when the eggs are last turned and cooled (on the eighteenth day) until the chicks have ceased hatching, it is as well to let them alone. The temperature tends to rise at this time, and may be allowed to go to 104° or 105°, but if it runs higher, the flame should be reduced. All chicks that are to hatch should be out within twenty-one days (ducks, twenty-eight days) from the time of the beginning of incubation, though the eggs of large breeds may run a little longer. Eggs that have been run at too low a temperature, or have been chilled, are likely to be delayed and to give rather weak chicks. Such matters, and any other points shown by the record which would affect the hatch, should be given consideration in dealing with belated hatches. It is usual to leave the young birds in the incubators from twelve to thirty-six hours after the conclusion of the hatch. When the incubator is provided with a nursery (under the egg tray) the birds are allowed to drop into it, where they have more room and leave more room on the tray for the late comers.

Accounting for results. Consideration of results and the causes affecting them should be made with some care after the hatch. This is as important when the hatch is good as when it is unsatisfactory. When good results are obtained notwithstanding some unfavorable condition or irregularity during incubation, it is especially important to note carefully the amount of deviation from the normal condition or from approved practice. As a rule, occasional or moderate variation from prescribed conditions will not materially affect results, although a wider deviation, or too many slightly unfavorable conditions occurring simultaneously, might cause a poor hatch. On this account any noticeable variation from conditions which it is designed to maintain throughout the period of incubation must be regarded as a possible cause of an unsatisfactory hatch, and must further be considered a possible cause of mortality in the young birds, and perhaps of lack of vitality in those that survive to maturity.

Causes of poor hatches. The causes of poor hatches have been indicated in preceding paragraphs, but it is worth while to summarize them here and to comment on some points. A fertile egg with germs of normal vitality, when incubated naturally, will (barring accident) produce in due time a vigorous bird. Failure to do so indicates lack of fertility or vitality, or is evidence of neglect or accident. It cannot be assumed that, with all conditions and factors right, the failure of the embryo to develop is normal. It must be assumed that, if all the facts were known, the cause of a poor hatch in any case would be plainly apparent. It is not always possible to know all the facts, yet in a majority of cases the known facts show causes sufficient to account for the results, as will appear if the operator, instead of making mental comparisons, will write down systematically the conditions of a good hatch, and opposite each item note the condition in the hatch under consideration.

The general causes of poor hatches are (1) poor eggs and (2) wrong management. For the quality of the eggs the responsibility is with the breeder or, where all operations are in the same hands, is to be considered in connection with the subject of breeding. The determination of the hatching quality of the eggs is a necessary preliminary to consideration of the conditions of incubation. In by far the greater number of cases of poor hatches with incubators, the quality of the eggs is unknown, the operator having no check of any kind on his results. In such cases he is all at sea, and any consideration of how points in management may have affected results is mere speculation, except when it is known that some fault in incubation would have made a good hatch impossible, no matter how good the eggs. If it is known that eggs from a certain lot are hatching 80 per cent, either under hens or in other incubators, a much lower hatch in any case is reasonably conclusive evidence that the hatch was not properly handled. In such a case the experienced operator knows that something went wrong during incubation, though he may not know what it was;[1] the inexperienced operator is likely to blame the machine. In a sense it may be the fault of the machine, but the operator is responsible for the machine. It is his business to know its limitations and to see that everything essential to successful incubation is done.

Common errors in operating incubators. The most prevalent faults in the management of incubators are (1) irregular and deficient attention and (2) poor judgment in ventilation and moisture. Errors of the first class are easily corrected if the operator can look after the work at frequent intervals, and if he gives his attention to it. Errors of the second class are more difficult to overcome. They can be definitely ascertained only when other causes of poor hatches have been eliminated. They are affected by variations in general atmospheric conditions, by the volume of air and the ventilation in the apartment in which the incubators are placed, and by the number of incubators in the apartment. The best adjustments are soonest found when several incubators of the same make are operated at the same time on eggs of the same kind, and slight variations in ventilation and moisture are made in the different machines.

[1] The most remarkable case of this kind that I have known was reported to me by one of the most successful growers of winter chickens. From two incubators of 360-egg capacity, set with eggs from the same lot, he took, on the same day, from one machine 299 chicks, from the other a few over 300 (the exact number I do not now recall). Three months later he still had the 299 chicks from the first incubator, but not a single chick of the second lot remained alive. They had died at first by the score, then in smaller numbers until all were gone. As far as the operator knew, the incubator was run correctly throughout the hatch, but from the results (the chicks being brooded under exactly the same conditions) he knew that something went wrong.

CHAPTER XV

GROWING POULTRY

Growth a natural process. Organic creatures grow by the consumption and assimilation of suitable nourishment. Each, according to its kind, takes from the food elements with which it comes in contact as much of what is serviceable to it as it can secure and use. The growth of an organism depends (1) on its *constitution* (organic soundness and vitality, which determine its capacity for growth); (2) on its *environment*[1] (fixed conditions which affect its vital functions); (3) on the supply of *food;* and (4) on *protection* from its natural enemies and from accidents.

Constitution fundamentally a matter of inheritance. From the beginning of its development as an embryo each creature is subject to environmental influences. Within the comparatively brief period of the development and growth of poultry, environment has little power to mend and much power to mar constitution. Under normal conditions of incubation a young bird, as it comes from the shell, possesses unimpaired the constitution transmitted to it by its parents. Any unfavorable condition or circumstance during incubation tends to destroy the bird's constitution and to diminish its vitality. Conditions of incubation under which many eggs fail to hatch usually impair the vitality of the birds which do hatch. It is only in rare cases that all birds in a brood are perfectly developed and apparently of good constitution and vitality. There is nearly always a small percentage of weaklings, and often a large proportion of birds which, even under the best of care, will never make ordinarily good specimens.

Initial selection. Elimination of weaklings is the first step in the profitable management of young poultry. Although under favorable conditions nature works steadily to bring constitution, vitality, and

[1] Strictly, environment includes food and protection, but for convenience of discussion the division is made as above. The feeding of young poultry is treated in detail in the chapters containing the general discussion of the subject.

every organic function to the normal condition of efficiency, the growing period is so short that it is not worth while to attempt to work with young birds that are crippled, underdeveloped, or conspicuously lacking in vigor. Unless a bird is lively, bright, and strong on its feet when the time comes to take it from the incubator or the nest, it should be killed at that time. Such birds rarely live to marketable age and condition, and the sooner they are put out of the way the smaller is the loss on their account. In addition, the weak birds easily become the hosts of parasites and are least able to resist disease, while their presence in a flock adds greatly to the risk of epidemics. The natural reluctance to destroy birds which might live and develop satisfactorily makes many poultrymen too lenient in culling at this stage. Those who succeed in growing, with an insignificant percentage of loss, poultry hatched and reared by the natural method get their results, as a rule, by good judgment in separating the weak from the strong birds at the earliest opportunity. When the birds have been artificially hatched, their appearance at the time of taking from the incubator is not so reliable an indication of soundness and vitality, for troubles due to faulty incubation may not be plainly developed at that time. Such, however, can be removed as cases develop. Their cases do not affect the first culling. Culling at any time in the first few weeks of the life of young poultry is done on the principle that the bird that goes wrong at this time is not worth keeping longer.

Preservation of vitality in young poultry. Under natural conditions, physical and constitutional soundness is easily secured, and notable progress may be made even in building up weak constitutions. Though not commercially profitable, a little work in this line may have great educational value. The improvement of weak birds under favorable conditions clearly indicates that when strong birds deteriorate, either the conditions or the rations are at fault. It is usual to look to the feeding for the cause of trouble, but in by far the greater number of cases the cause is to be found in the conditions to which the birds are subjected. Unfavorable conditions have much more serious effects on young poultry than upon adults. Though independent of their parents to the extent that substitutes for the parents' care are easily provided, the young birds are very sensitive to unfavorable conditions, and much more susceptible to disease than adults.

It is commonly said that the first three weeks are the critical period in the life of a chick, — that the chick which lives to that age is likely to live to maturity. That is not a general truth, for at later periods there are many losses of chicks which were thrifty in early life, but it is true for certain classes of cases, particularly for cases of acute disorders directly due to wrong conditions at that time or during incubation, and to improper feeding. In the first few weeks of the life of young poultry mortality is, as a rule, heavier than at any other period, not only because the birds are actually more delicate then, but because, during the early part of that period, those greatly lacking in vitality, and those affected by unfavorable conditions during incubation, or by wrong brooder temperature, die or begin to show marked symptoms of disease, while it is not until after the second or third week that birds that were originally vigorous begin to show the effects of other conditions that are radically wrong, especially of wrong feeding. Favorable conditions and good management at this time help (sometimes a great deal) to remedy troubles originating in the parent stock or in incubation. On the other hand, unfavorable conditions and bad management at this stage of development will have bad effects and often spoil young birds beyond remedy. It is possible by good care to grow good birds under unfavorable conditions, but it is doubtful whether in any case this can be done at a profit when the value of labor is considered. Most poultry keepers who persist (unsuccessfully) in trying to grow poultry under unfavorable conditions fail because they either will not or cannot do for the poultry the work which the circumstances demand.

Overcrowding the prime cause of trouble in growing poultry. Although other causes may seem more disastrous at times, there is no other wrong condition as prevalent as overcrowding. Whatever the kind of poultry kept, and whether natural or artificial methods of rearing are used, the almost universal tendency is to overcrowd the birds both as to the numbers in a specified area and as to the continuous use of land for poultry. The remarkable results occasionally secured under intensive conditions seem to make more impression on the average poultry keeper than do the failures which are the common experience of those who overcrowd growing poultry. One reason for this is that, taking the exceptional instance as proof that crowding is not itself detrimental, they look elsewhere for the cause of their troubles. In cases where crowded poultry gave good results a full statement of conditions will invariably show that other conditions were exceptionally favorable, — the stock was uncommonly vigorous, the land was fresh, the weather was favorable, the keeper was very skillful, and, it may be added, very fortunate. The different kinds of poultry differ in capacity to withstand the effects of crowding, but in all kinds of poultry it will be found the rule that in order to keep the stock up to a high

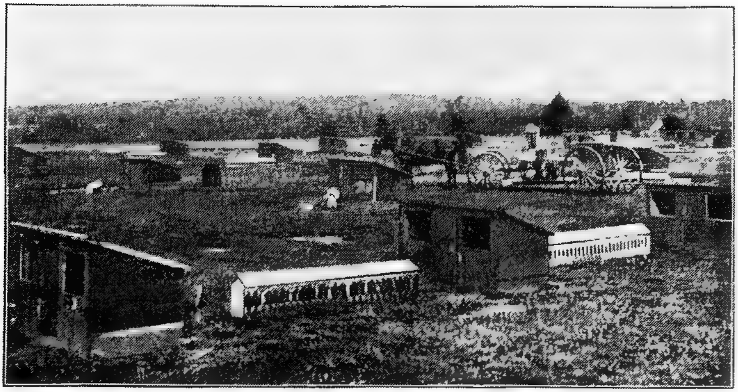

FIG. 298. Growing chickens on range at Pittsfield Poultry Farm. (Photograph from Pittsfield Farm)

standard of development, the growing birds require conditions much more favorable, and more nearly natural, than those which they require when mature.

What constitutes overcrowding. Overcrowding cannot be precisely defined in terms of number of birds and area of coop or brooder, or of yard or land. Indoors it is a question of *air* rather than of area; outdoors, a question of land not polluted by the droppings of poultry, and free from germs of poultry diseases and from poultry parasites which harbor in the soil. In the natural state, and under approximately natural conditions in domestication, all kinds of poultry are hatched and reared in small groups, or broods. The

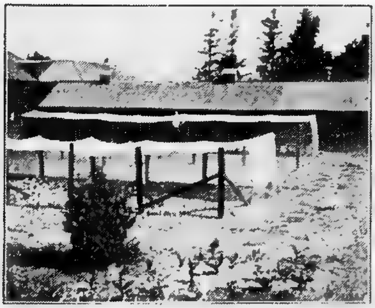

FIG. 299. Cloth shades over brooder-house yards at Cornell University

FIG. 300. Grass range with corn grown at the sides for shade

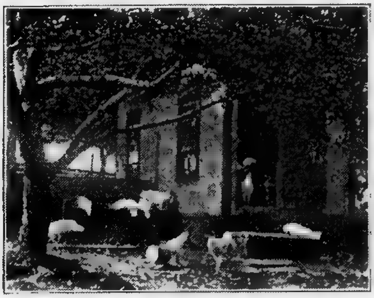

FIG. 301. Chickens in permanent house in old orchard

FIG. 302. Chickens in colony houses in young orchard

FIG. 303. In the field after the corn has been cut

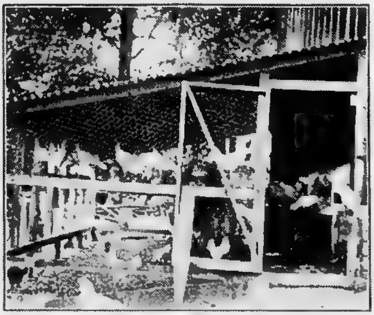

FIG. 304. Roosting quarters at Cornell, open on three sides

SOME FEATURES OF GOOD PRACTICE IN GROWING CHICKENS

(FIGS. 299 and 304 are photographs from New York State Agricultural College at Cornell University) number of young birds in a single natural brood *rarely exceeds ten*, the number in a group of such broods is rarely greater than twenty-five or thirty. The mothers, with their young, forage either independently or in groups of two or three broods. The different broods usually separate at night, if accommodations permit. If several mothers with large broods sit close together, it will usually be found that some of the young soon show the effects of crowding, especially when they are in a small coop or in a corner, and when the circulation of the air is slow, — for the movement of the air is slightly, if at all, influenced by the number of birds at the spot, while the condition of the air depends on the number of birds breathing it. This is equally true as to the air in a brooder. If the mothers are kept separate, or have an opportunity to follow the natural inclination to keep the broods separate at night, there is no trouble from crowding at that time.

FIG. 305. Six-weeks ducklings at Weber Brothers' duck farm. Fruit trees just set out in yards

After the young birds are weaned, they will, if left to themselves, keep well distributed. It is a common practice at that time, however, to combine broods into larger groups before putting them into new quarters; from putting too many birds into small, ill-ventilated coops, and from the tendency of the birds to huddle together when they are moved to new quarters and the natural groups are broken up, this stage of the life of young chickens is especially full of troubles due to overcrowding, aggravated, in many cases, because it comes just at the season when weather conditions make crowding most disastrous.

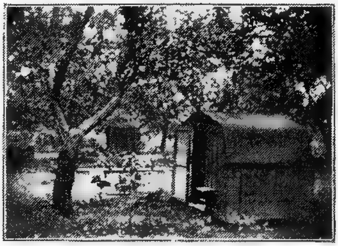

FIG. 306. Chickens in double piano-box house in orchard. (Photograph from J. W. Clark)

In the artificial rearing of poultry larger numbers of young birds are placed together from the first. The primary object is to

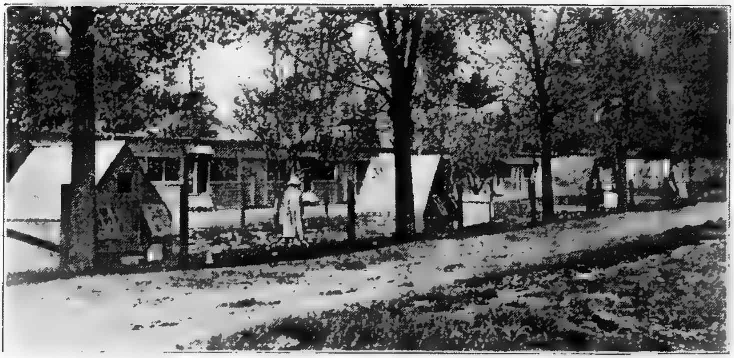

FIG. 307. Intensive methods used when plant was established

FIG. 308. Colony plan adopted after a few years' experience with intensive methods; houses close together, but moved yearly

FIG. 309. Method now in use; colonies well scattered and extensive range

FROM INTENSIVE TO EXTENSIVE METHODS OF GROWING CHICKENS AT CORNELL UNIVERSITY

(Photographs from New York State Agricultural College at Cornell University) economize the cost of equipment and labor by making the groups as large as possible. In a properly heated and ventilated brooder the number of young birds may be much larger than in the natural group, but must still be small compared with the seeming capacity of the compartment. Common experience has taught the necessity of keeping young poultry of all kinds in comparatively small groups, wholly or partly separated, either by partitions or fences or by distance. This is the general practice in the communities where poultry growing is most flourishing.

The poultry farmer in Rhode Island keeps his chickens in flocks of from twenty-five to thirty-five. The grower of winter chickens in eastern Massachusetts

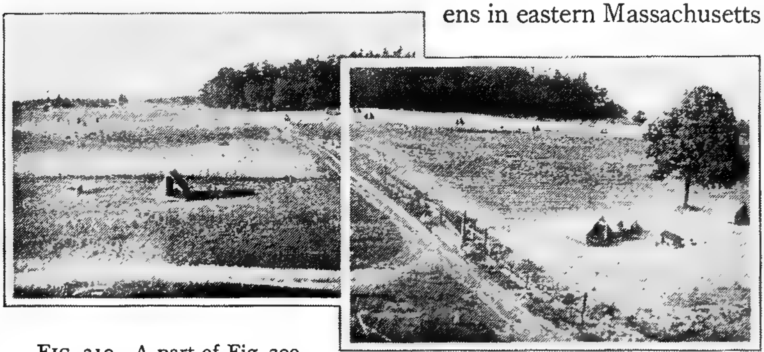

FIG. 310. A part of Fig. 309, showing more plainly how the colonies are distributed

usually keeps them, after weaning, in flocks of fifty. That is the standard, though occasionally from seventy-five to one hundred may be put into a house large enough to accommodate them. In both cases the coops and houses used give small floor space per chicken but are open and well ventilated, allowing an abundant supply of fresh air. In any coop or house the floor is renovated as often as necessary by removing accumulated droppings. If the floor is of earth a part of the floor is removed with the droppings, and a new floor of earth may be put into the house at regular intervals. If the floor is of wood it may be covered with a coating of earth or litter. As long as the droppings in the house or coop remain dry, they do no harm.

Out of doors suitable sanitary conditions are not so easily maintained. It is natural to suppose that if poultry can remain night after night on a suitable floor containing the nightly accumulations of droppings of perhaps a week or two, their outside run need not be very large to give equally good sanitary conditions. Nor need it be if the grower can give the birds the care which will compensate for the lack of the advantages of a range supplying their wants in abundance. This cannot be done when poultry growing is on a considerable scale or on an economic basis. The yard or range must be large enough to furnish green food. A yard that is in grass must be of such size, or so stocked, that the grass will keep growing and be clean. It is not enough that the grass simply maintain itself, tramped down, soiled, and affording no food. In the best practice young chickens are put on grassland which has had no poultry on it during the preceding season. The grass is mowed close when the chickens are put out, and the coops are placed at such intervals that the young chickens will, under ordinary conditions, keep the grass down just enough to make mowing unnecessary. For *goslings* the practice is much the same, except that it is usual to confine them to a limited strip until they have grazed it down, and then to move them. *Ducklings* seem less affected by foul ground than other young poultry, but a run on grass, rye, or other young grain will make a marked difference in the quantity of ground grain consumed, and they will show plainly, both in actions and in condition, the advantage of a change from foul to fresh ground. Young *turkeys*, *peafowl*, *guineas*, and *pheasants* all seem to be even more affected by foul ground than chickens, but it is a question whether, if they were equally docile and contented under restrictions, any difference in this respect could be found.

Overcrowding in most cases unnecessary. The worst cases, both in the city and in the country, are found where the ground available is more than ample to give the poultry favorable conditions, but is not utilized, either from false ideas of economy or from sheer negligence. Young poultry of the smaller kinds, grown in towns or in the suburbs of cities, usually have to be kept in wire-covered runs until large enough to be safe from cats. It is no uncommon thing to see in one of these runs three or four times as many birds as should be in it, and to see the run kept on the same spot for weeks and even months, while all around it there is good grass growing and going to waste. On farms devoted largely to poultry growing it is not unusual to find the young stock grown year after year on the same land, though there is abundance of fresh land available. A poultry grower ought by all means to consider economy in labor, but not at the cost of general deterioration of stock, or of some loss of development on every bird grown in a season. When poultry of any kind, at any age, are kept on land not suitable for them, while better land lies idle or is occupied only by something the poultry would not injure, the methods of managing are radically wrong.

Warmth the first requirement of young poultry. If the young birds are kept warm and comfortable they will keep quiet most of the time for the first few days. If they are with natural mothers it is advisable to keep the mothers on their nests or in a close coop in which they will brood the young almost constantly until the young birds themselves show a strong disposition to forage. After that it is better to confine the mother and give the young liberty, with free access to her until they are strong enough to follow her without tiring. In most kinds of poultry this will be several weeks. Under the usual conditions in domestication, and particularly where large numbers are kept, it is advisable to keep natural mothers confined until the young are weaned. For chickens this will be, in spring and summer, five or six weeks; for ducklings, about three weeks; for goslings with hens, about ten days. The later goslings, hatched by the geese, and the young turkeys and other less domestic kinds of poultry, are usually allowed to run with the adults throughout the season. When birds lay only at the breeding season, nothing is gained by separating parent and young when the young no longer need brooding.

Brooding temperatures. The temperature in natural brooding is the same as for incubation, but it is tempered or reduced by the young bird's keeping partly or wholly from under the mother, and by the mother bird's taking a half-rising posture. The young may remain wholly under the mother at first, but soon begin to sit under her with their heads out, thus getting all the warmth that contact with her body and that of other young will give, and at the same time getting a full supply of fresh air. As they grow (or, in very warm weather, while still small) they may not stay under her at all at night, but still benefit by proximity to the heat of her body. If they become wet or chilled at any time, they resort to the natural brooder and are at once in contact with heat of a temperature which quickly warms and dries them. Except for what are called (perhaps erroneously) low-temperature [1] hens, the temperature in natural brooding, with suitable-sized broods, is never injuriously wrong. The regulation of temperature is automatic and nearly perfect.

FIG. 311. Brooder house at Massachusetts Agricultural College. (Photograph from the college)

Regulation of heat in artificial brooding. The operation of a brooder presents problems similar to the problems of artificial incubation. The general problem is to provide a substitute for the heat of the parent bird. It is economically necessary that this be done at a cost for equipment and labor that will leave a profit on the work. While it is not required that a uniform temperature be as steadily maintained as in incubation, the artificial brooder must be in a measure automatically regulating for temperature, and fresh air must be supplied to the young birds in the hover in much larger quantities than to the eggs in the egg chamber of the incubator. The difficult point is to secure free ventilation while maintaining a sufficiently high temperature. This is commonly made more difficult in practice through the tendency of poultrymen to economize capital, space, and labor by putting into each brooder compartment the largest number of chicks or ducklings that it is considered possible to keep in it. To effect sales, manufacturers often overrate the capacity of a brooder. The capacity of a brooder of fixed size to contain growing birds is obviously

FIG. 312. Brooder house at Goodrich Farm, West Duxbury, Massachusetts (Photograph from Goodrich Farm)

[1] This is one of many points not experimentally determined. The "low-temperature" fowl seems so to the touch. She lacks vitality and may be sick. She may be nervous and irritable, and worry or neglect her young. Her temperature is certainly not so far below normal that it alone would seriously affect the young birds, but as young birds with such mothers do quite regularly show bad effects, it is assumed that this is due to a wrong attitude of the mother toward them, or that such a mother draws vitality from her young instead of conserving theirs.

constantly decreasing, when measured in numbers of birds contained. The capacity of a brooder is often given (correctly for a time) at the number of newly hatched birds that may be kept in it; but the need of reduction of numbers as the birds grow is not always sufficiently emphasized. This form of misrepresentation is sometimes excused on the ground that at the average rate of loss the losses of chicks or ducklings will offset the increase in size of those which remain, but there can be no valid excuse for instructions that are most misleading when the birds are doing best. Experienced growers generally put into individual (heated) brooders rated as having a capacity of from seventy-five to one hundred only about half those numbers, and into the compartments of brooder houses they put the young birds in lots of about one hundred, though for some time each compartment might safely carry two hundred or more. As has been said, under natural conditions all young birds are produced and reared in small groups. Massing them in large numbers creates conditions both unfavorable and dangerous to them. In exceptional cases a large group may thrive, but as a rule the birds do best when kept in lots not many times larger than the natural groups. In general practice, brooders and brooder houses are adapted to this principle.

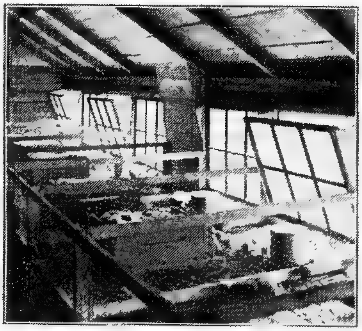
FIG. 313. Fireless, or "cold," brooders at Provincial Poultry-Breeding Station, Edmonton, Alberta. (Photograph from the station)

Methods of artificial brooding. There are three general methods of providing heat without natural mothers: (1) by fireless, or "cold," brooders; (2) by individual brooders, each heated by a lamp or a stove; (3) by a hot-water system arranged to make one heater and system of pipes furnish heat to a series of brooding compartments.

Cold brooders are small boxes, usually with a capacity of from twenty-five to fifty young chickens, in which the birds keep warm through contact and the conservation of the heat from their bodies.

As commonly constructed, the sides are of wood, paper, or metal, with holes for the passage of the birds. The top is composed of one or more "quilts" of lightly padded cheesecloth so adjusted that the center is depressed and the little birds nestle to it instead of crowding into the corners. In a heated room or brooder house, or elsewhere in moderate weather, these brooders may work very well, but birds in them require close attention at first, and they are not adapted to low temperatures. The fireless brooder, as developed to date,[1] is not adapted to regular use on an extended scale. Some of the so-called fireless brooders are used with a hot-water jug or bottle for low temperatures.

Lamp-heated brooders. Lamps are generally used when poultry is grown artificially on a small scale. Lamp brooders are of many different makes, but are nearly all built on the same principle. They consist of a box heated by an outside lamp, the hot air from the lamp being conveyed to the upper part of the interior, and the passages for the chicks being small, to prevent a circulation of air which would make the temperature too low. In some brooders a second compartment, partly heated by the warmer air from the first, is provided. Though mostly on the same general model, brooders of this type vary somewhat in construction, especially in quality of materials, workmanship, and adjustments. With proper attention, most of them will give very satisfactory results. As a rule, the cheaper brooders require closest attention and involve greatest risk of fire. In all lamp brooders the danger from fire is greater than with incubators, first, because of the dust raised by the birds, and next, because the lamp is more exposed. Somewhat different styles of these brooders are made for indoor and for outdoor use, the outdoor style being built to protect the brooding compartment and lamp from the weather. Poultrymen generally prefer to use the indoor style in a small house or under a shed. Kerosene lamps are most used for heat, but gasoline has been found satisfactory. A small system of brooders may be heated from the same reservoir of gasoline. The risk and the labor of caring for many lamps tend to limit the use of individual brooders.

Pipe brooder systems. Hot-water heaters and pipes were used at an early stage of the development of artificial brooding. In the

[1] 1911.

early brooders of this type the pipes were run under a close hover, and the heater used was seldom large enough to maintain the degree of heat required in extreme cold weather. In such a brooder the supply of fresh air under the hover was often inadequate, the temperature was likely to run up with a high outside temperature and almost certain to go down with low outside temperature, and results — as was to be expected — were very uneven. The defects were most serious for the youngest birds but diminished in importance as the birds grew, for then they not only required less heat but contributed the warmth of their bodies to keep up the temperature through a cold spell. To provide for these conditions many houses were built with individual brooders (called nursery brooders) in one end, for the birds up to three or four weeks old, and a pipe brooder system in the other end for the older birds. Methods of reënforcing the heat furnished by the pipes were also tried. In many houses two heaters had been installed to provide for the contingency of accident to the heater in regular use, and in cold weather both heaters were used. Supplementary coils of pipe were also placed on the wall of the house, usually at the north side but sometimes on the south, to keep up the temperature of the house outside the hovers. All these things helped. Eventually experimenters worked out the simple plan of using a heating system of sufficient capacity to maintain the required temperature under open or loosely covered pipes at any season. This is the type of brooder now giving the best results for artificial brooding on a large scale. It is described in detail in the chapter on poultry houses. It is not perfect; even when equipped with the best-known regulators at the heater and with electric regulators on the pipes, it will not run reliably without close attention, but of the many different methods of brooding chicks in large numbers that have been and are being tried this is giving the best results of all those in general use. The real test of an appliance or of a method is its adaptability to ordinary conditions and to a variety of conditions of location and management. Inventors of appliances and promoters of methods and systems may test them under the most favorable conditions, adjusting everything to suit. Under such circumstances good results are often obtained with appliances or by methods which in common use are not found satisfactory.

Temperature in artificial brooding. The best temperature conditions are secured if it is possible for the young birds to come in contact with from 105° to 106° of heat without huddling together, and to have any desired lower degree of heat. They may live and thrive at a lower range of temperatures. With access to the highest temperatures mentioned, they remain mostly where the temperature is lower, but have the extra heat if they need it. It is customary to take the temperature of a brooder at the level of the birds in it, and at that point 95° is considered the right temperature; but if a brooder is so constructed that a chilled chick or duckling can find heat greater than 95° only by contact with others, the birds, when cold, will huddle together. Provided ventilation is sufficient, and the young birds can get to any comfortable lower temperature, it is much safer to have the brooder heat at its source too high than to take the risk of too low temperatures. Whatever style of brooder is used it is essential that the young birds have access both to heat in a well-ventilated place and to fresh air at a moderate degree of heat. In a properly constructed individual brooder these conditions are secured, according to the size and style of the brooder and the age of the birds, by the adjustment of the hover and the ventilation of the compartment in which it is placed, and further (in brooders of more than one compartment) by a downward gradation of temperatures as compartments remove from the source of heat. In the so-called open-pipe system the highest temperatures are secured either by placing a movable hover over the pipes or by filling the floor with earth, sand, or litter to bring the birds nearer the pipes, or by both means. In a compartment five feet wide a complete range of temperatures from 106° or over downward may be had by placing a loose cover (with or without side fringe, according to the temperature of the house) over one half of the pipes, leaving the other half open, the floor being raised or lowered to suit the size of the birds.

Regulation of temperature in brooders. The proper temperature is indicated by the thermometer and by the attitude of the birds. The thermometer gives the absolute temperature at a suitable point, showing whether it is sufficient. The attitude of normal, healthy birds should show whether the extent of the area of highest temperature is sufficient and the ventilation satisfactory. It should also show whether there is a uniform gradation of conditions from the warmest part of the brooder to a point where the heat does not sensibly affect the heat of the apartment. In the old type of pipe brooder, with permanent hovers built over the pipes, and close fringes to retain the heat, the ventilation in the hover was insufficient; the change from inside to outside temperature was too abrupt; there were practically but two conditions (neither perhaps satisfactory) between which the birds must choose. If birds huddle together at a temperature which an accurate thermometer shows is sufficient for normal chicks or ducklings, that is evidence that the birds are not normal,— that either they are constitutionally of low vitality, or that they have been chilled; if birds huddle outside the brooder or at a low temperature, the presumption is that they have not access to a temperature high enough to be attractive. If exposure was short, and the birds are promptly warmed, the huddling should last but a short time, and no serious ill effects should follow; if the tendency to huddle becomes chronic, the behavior of the birds becomes unreliable for regulation of the brooder. If such a lot of birds will not recuperate quickly when separated into groups so small that crowding cannot be especially injurious, and kept at the usual high temperature at the level of the birds in brooding, they may be regarded as injured beyond remedy. Some may live to make marketable poultry, but a profit and loss account kept with such a lot usually shows a loss.

As in incubation, the regulation of temperature, while partly automatic, requires such oversight that wrong conditions may be promptly corrected. The successful growers of large numbers of poultry by artificial methods almost live with their birds while they require special attention. Regulators and electric alarms may be used to relieve them of the necessity of unintermittent watching, but they never leave the place without some one to respond to an alarm, and they make complete rounds of brooders before retiring at night and again the first thing in the morning. To make sure that the birds will not get so far from the heat that they will not find their way back to it when cold, it is usual to keep an individual brooder closed until they become familiar with it; in pipe brooder houses it is customary, for the first few days, to confine them to the space under and near the pipes by means of a board across the compartment, gradually increasing the space before the pipes by removing the board to a greater distance, until, when the birds are thoroughly "hover-broke," it is removed altogether.

Period of artificial brooding. Under the same circumstances and at the same seasons the requirements of the birds are the same, regardless of the source of heat; but, as much of the work by artificial methods is done in the fall, winter, and early spring, the birds are often kept in the brooders much longer than natural mothers would brood them. One of the principal advantages of the artificial brooder is that it has no other function than to brood young birds, so that they may be kept in it as long as they require warmth, while natural mothers (especially early in the season) will often wean their broods and resume laying long before the young cease to need brooding. Winter chickens are kept in brooders up to ten or twelve weeks of age, according to the weather and their development. Ducklings require supplied heat only from three to five weeks, according to the season.

Protection from enemies. Young birds are absolutely defenseless, and, even when constitutionally strong, are physically frail in comparison with most of the creatures with which they come in contact. Allowing them to run with larger poultry, whether of their own kind or another, is a disadvantage. If allowed to run with other stock, considerable numbers may be accidentally killed by being stepped on by horses or cattle, or may be destroyed by hogs. Dogs and cats not trained to let them alone may be very destructive, and rats even more so, while almost every predatory wild animal or bird that haunts inhabited districts is destructive to young poultry. The smaller the birds, the greater the number of enemies they have to fear; the slower their growth, the longer they require watching and protection. Young chickens are hardly safe from persistent, hungry cats until six or eight weeks old, while a young Pekin duck two or three weeks old would not be likely to be molested, and goslings would not be troubled after the first few days. Losses among larger and quicker growing kinds are often equal to or greater than losses among smaller ones, because they roam farther from home and are more exposed to attacks of larger wild animals and birds.

The most effective way of protecting poultry (young or old) is by destroying or driving away their enemies. Protection by confining the birds does not suit either large operations or the most advantageous use of land; it may be necessary for young poultry grown in towns, or even in the country when destructive animals are especially bold or numerous, but in general it should be the object of the poultry keeper to give, to his young poultry at any rate, all the liberty that they need for the most economical management of the stock and the best development of the birds, and this requires the extermination of wild creatures and the restraint of individual domestic animals destructive to poultry.[1] A few of these, if not checked, will make such inroads on the stock that the immediate loss is heavy, and the effect on the plans of the grower is likely to be far more serious.

Protection from parasites. Freedom from lice and worms is also of more importance with young poultry than with adults. Internal parasites (worms) are best prevented by keeping the young birds on fresh ground and away from the general adult flock. Healthy, vigorous young birds will keep down external parasites (lice), if they are given an opportunity to do so. Young chickens, turkeys, etc. which have access to loose earth in gardens or fields should need no treatment for lice. It is a good plan to put hens with broods onto a dry earth floor for the first few days, giving them an opportunity to subdue the parasites at the start. In continuous wet weather, when the soil will not pulverize, or when chickens are cooped on sod, they should be dusted with an insect powder about once a week until three weeks old. After that, under conditions at all suitable, there should be no occasion for the poultry keeper to consider giving

[1] The problem of the relation of the poultry keeper to neighbors who keep dogs and cats which worry or destroy poultry is often a perplexing one. Whatever may be his rights, expediency requires that the poultry keeper be governed in some measure by near-by public opinion. It is in thickly settled places, especially in cities, that this becomes a hard problem. Sometimes the keeping of poultry is an infringement on an ordinance which is overlooked by the authorities so long as no occasion is given for complaint. In such cases there is nothing for the poultryman to do but to securely inclose his young poultry. Where there is no prohibition on poultry, the poultry keeper who confines his birds to his own premises can insist that owners of cats and dogs which molest his poultry shall pay damages and keep the animals off his premises. Even in towns where cats and dogs are numerous, most of them are likely to be inoffensive, and if offenders are known, a poultry keeper within his rights in keeping poultry, if he approaches their owners tactfully, can usually have them restrained without arousing ill feeling between neighbors. He should, however, be sure of his case.

individual treatment for lice. Waterfowl which have access to water in quantities sufficient for bathing or swimming are not likely to be troubled with external parasites. When young ducklings and goslings are brooded with hens and given water only for drinking, they are often troubled with head lice. If the water in the drinking vessel is deep enough to allow the bird to get the head well under water, it will keep the lice off its head and neck in this way; on other parts of the body they are less dangerous, and the bird can get at them with its bill. Young poultry hatched and reared artificially are less afflicted by lice, but it is not well to take it for granted that incubators and brooders are free from them; young birds in brooders will appreciate opportunities to dust themselves, and so make assurance of freedom from the parasites doubly sure.

Growth proves the materials and work of the poultry grower. If the birds grow normally the sum total of factors affecting growth must be approximately right, deficiencies being offset by advantages in other directions, — as faulty conditions by extra attention, slight weakness in stock by very favorable conditions, etc.; if growth is not normal, one factor must be radically wrong or several factors slightly wrong, and the total of deficiencies so great as to have a marked effect on the general result. Normal growth of poultry is continuous and rapid; in the most rapidly growing common kinds of poultry — geese and the larger breeds of ducks — the rate of growth is so great that the fact that the birds are growing fast is self-evident. In chickens and young turkeys growth is not so noticeable, but it is plainly seen by comparing the birds, while small, with younger birds, and, after they are weaned, either with younger birds or with adults.

Rate of growth. This has been determined experimentally only for chickens and ducklings. Though the number of experiments is small, it is probable that, these being apparently average instances, the figures are very near the ordinary averages and may fairly be taken as standards for roughly ascertaining whether the rate of growth is normal.

The rate of growth of chickens of different breeds and types is surprisingly uniform for the first ten or twelve weeks. Differences between individuals of the same stock are more marked than differences in averages for different breeds. Leghorn chicks from medium-sized to large Leghorn stock (males weighing $5\frac{1}{2}$ pounds and upward, females 4 pounds and upward) will often weigh as much at ten or twelve weeks as Brahma chicks from parents of more than double the Leghorn weights. After that, chicks of the larger breeds rapidly outgrow the others, growing much faster and for a longer period. The ordinary young chicken weighs about $1\frac{1}{2}$ ounces (rather less than more) when twenty-four hours old. At three to four weeks it should weigh $\frac{1}{2}$ pound; at six to eight weeks, 1 pound; at nine to eleven weeks, 2 pounds; at three months a chicken of the medium-weight breeds should weigh from $2\frac{1}{2}$ to 3 pounds, the cockerels generally being the heavier birds, though the largest pullets will often outweigh the average cockerels. From this time birds of this class should grow at the rate of about 1 pound a month (a little less for smaller specimens, a little more for larger ones) until from six to eight months old, when they should be full grown and of average weight for specimens of the kind, in fair flesh but not fat.

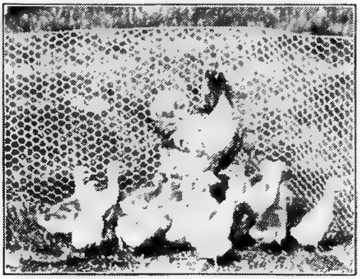

FIG. 314. Goslings three or four days old

FIG. 315. Goslings three weeks old

In the smaller breeds the period of growth is a little shorter, but not so much as would be expected, considering the rapidity of early growth and the size of the birds at maturity. In the larger breeds growth is very rapid. The best-growing specimens in all breeds are usually a little ahead of the others from the start. In Asiatics these specimens often begin, about the ninth or tenth week, to grow

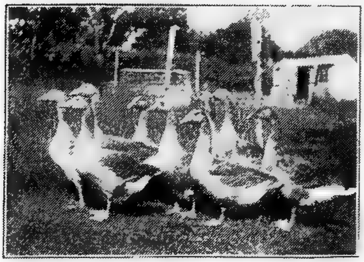

FIG. 316. Goslings nine weeks old

very fast. It is not unusual for large specimens to weigh close to 4 pounds at three months, and to grow at an average rate of over 2 pounds a month for the next four months, putting on an average of over an ounce a day for that period. This, however, is much better than ordinary growth with average stock. For such, $1\frac{1}{2}$ pounds a month would be good growth. Males usually grow both a little faster and a little longer than females.

FIG. 317. White Leghorns, thirteen weeks old

The rate of growth of ducklings is much greater for the first three months than that of chickens. Ordinary Pekin ducklings weigh about 2 ounces when hatched. At three to four weeks they should weigh 1 pound; at six to eight weeks, from 4 to $4\frac{1}{2}$ pounds; at ten weeks, from $5\frac{1}{2}$ to 6 pounds, the largest and fattest ducklings even more.[1] Unlike young chickens, the ducklings that have been well fed are at this stage very fat. Those intended for market are killed at from nine to twelve weeks of age. Those reserved for breeding purposes continue to grow, but more slowly. Usually they lose weight for a while through the loss of their "baby fat." At five to six months of age Pekin ducks, when well meated but not excessively fat, should weigh from 6 to 8 pounds.

FIG. 318. White Wyandottes, fourteen weeks old

The rate of growth of geese is about the same as that of ducks, allowance being made for the original difference in size. The newly hatched gosling is about double the weight of the duckling. At ten weeks the gosling of any of the large breeds or their crosses should weigh from 9 to 12 pounds, and at five or six months should have added about 50 per cent to this weight.

[1] I have weighed goslings that at three months weighed almost nine pounds.

Turkeys grow slowly at first. Though of different conformation, and perhaps looking much larger, the average turkey chick at ten or twelve weeks is often no heavier than a large Brahma cockerel of the same age. The later growth of the turkey is more rapid, birds at eight or ten months often weighing from 15 to 20 pounds.

In general it is with the growth for the first few months that the poultry keeper is most concerned. A large part of the poultry grown is disposed of within three months, and (with some differences in the management of birds for different purposes) conditions and methods that have given normal development up to that time can be relied upon to bring the birds to maturity in good form and in good season. Young poultry that is below normal at three months may be improved by good care and feeding, but will never make first-class stock for any purpose.

Separation of the sexes while growing. Separation of males and females at this stage is necessary only with chickens. The time of separating them varies according to the precocity of the cockerels. In the smaller breeds, like the Leghorn, it is advisable to separate the sexes when the chicks are weaned, for soon after that many of the males become troublesome. In the Wyandottes, Plymouth Rocks, and similar breeds, if the more precocious males are removed as soon as they begin to domineer over the others and among the pullets, the sexes may be left together until they are three, four, or five months old. In the Asiatics the sexes may be kept together until well grown.

Separation according to age and size. Of much more importance than separation according to sex is separation according to size. Especially is this necessary with cockerels intended for exhibition or breeding. The cockerels which at maturity will be best are, as a rule, not the most precocious. The precocious birds domineer over the others, and a cowed bird never develops as he should. The best conditions in this respect are usually obtained when the chicks are given at the start sufficient coop and land room to last until they are well grown, and the culls and inferior birds and the quarrelsome males removed as occasion arises, thus reducing the numbers so that they are never overcrowded. Only an occasional, exceptional lot will then outgrow its quarters, and such cases can be taken care of by removing from each overflowed coop a few of the poorer birds in it, putting the surplus from several lots into new quarters.

Disturbances should be avoided. With all their docility, poultry of all kinds are very sensitive to alarms, to rough treatment, and to change. These things affect the growth of young poultry just as much as they do the laying and breeding qualities of adults. It is especially desirable to avoid frequent separations and new combinations of groups of young birds, with all the confusion incident to such changes. While it is preferable that a brood or lot of young poultry of any kind keep practically the same quarters and range throughout the growing period, that is often impossible. In any case the poultry keeper should try to avoid unnecessary shifts. Where the numbers are adapted to the land available it should be possible to arrange to leave young poultry undisturbed, except for removals as mentioned above, from the time when they are weaned until they go to the fattening coop or into winter quarters, according to the use to be made of them.

CHAPTER XVI

EGG PRODUCTION

Egg production distinguished from reproduction. Egg production is a part of the process of reproduction in poultry performed by the female, without association with the male, and yielding a product immediately useful to man. Hens are generally used for commercial egg production, the few eggs of other kinds of poultry occasionally found in the markets or on tables being, as a rule, the irregular surplus from flocks kept for breeding. An egg that has not been fertilized, or that is deficient in fertility, may be complete for man's use for food, or for any of the manufacturing processes in which eggs are used. Whether those properties which make quality in the egg used as food affect the quality of the chick when the egg is incubated has not been determined. Presumably they do, but no demonstrations have been made which show it. We may profitably use for egg production hens that it is not advisable to use for reproduction. Egg production is in a large measure, though not wholly or regularly, under the control of the poultry keeper, and may be developed to the detriment of the full function of reproduction. Subjects so related cannot be wholly separated for discussion or study, but as far as possible the treatment in this chapter will avoid enlargement upon points more appropriately considered in the chapters on reproduction.

Reproductive organs of the female the source of eggs. The reproductive system of the female consists of the ovaries, attached to the backbone near the middle of the back, and a tube, the oviduct, leading from the ovaries to the vent. There are two ovaries, right and left, but as a rule only one is developed. Singularly, the conspicuous function of the ovary is to develop the yolk, — the part of the egg which contributes nothing to the development of the embryo, but is absorbed just before exclusion and affords nourishment for the first few days. Each yolk is at first a tiny globular granule. After a bird begins to lay, the ovary presents the appearance of a mass of yolks of various sizes from full-grown to as small as can be seen with the naked eye. A magnifying glass will show many still smaller. It is commonly supposed that the number of minute yolks is constitutionally and definitely fixed in each bird, — that a bird cannot lay more than the original number, that it will not lay all these unless kept in proper condition, and that, by skillful management, a bird may be forced to produce in two or three years as many of her predetermined quota of eggs as she would naturally produce in six, eight, or more years. It has been supposed until recently that the original number of ovules in the average hen did not exceed five or six hundred. Observations at the Maine Agricultural Experiment Station showed that the number which could be counted with the naked eye and a common reading glass varied from about fifteen hundred, a number several times greater than the recorded production of the most prolific hens, to more than thirty-six hundred.

When the reproductive organs of the female bird are functionally active, each ovule, as it reaches maturity, is detached and passes into the oviduct. As it passes down the oviduct it is first covered with the white, or albumen, which is deposited in layers, and finally by the lining membranes and the shell.

Laying begins when growth ceases. Normally [1] laying begins at maturity, but occasionally immature birds, especially of the smaller and more prococious breeds, produce a few small eggs. The premature activity of the reproductive organs almost invariably results in stunted growth and the postponement of the beginning of mature, regular laying. Premature laying, though of no advantage, is often considered by the poultry keeper an indication of reproductive vigor

[1] The common difficulty in getting eggs from hens in winter, and the tendency of other kinds of poultry not to lay until toward spring, seems to contradict this. But the number of cases for which the statement holds good is so great as to create the presumption that normally egg production in fowls commences immediately after growth is accomplished. The fact that wild birds wintering in a temperate zone do not produce eggs until the following season does not prove that under favorable conditions they would not. As the subject is developed in this chapter, the reader should note that nearly every factor working against winter egg production from hens works more effectively against the winter production of eggs by wild land birds; while, in addition, the unprotected wild bird is more exposed to its enemies in the fall and early winter than at any other season. What happens in domestication may sometimes be a better index of native tendencies than the phenomena of wild life as they appear to the ordinary casual observer.

and future heavy laying, and so gives him little concern; retarded laying is a matter for serious consideration. Although, as has just been stated, laying begins normally with cessation of growth, normal cases are in a minority. In a majority of cases laying does not begin for some time after the bird is full grown. If the delay is only a few weeks it hardly attracts attention, and may be explained either on the ground that development was only seemingly complete, or that a brief period must elapse after physical growth is completed before the period of regular laying can begin. But when laying is retarded for several months, as it often is, such explanations will not suffice.

Causes of retarded laying. The things which affect growth and those which affect laying after it has begun are the common causes of failure to begin to lay at maturity. Little has been done in the line of scientific investigation of the subject, but ordinary observation indicates some of these causes, and suggests the need of investigation to determine how circumstances affecting the development of the body affect the development of the reproductive organs. From the commonly observed facts some reasonable general inferences may be drawn.

1. *A check to growth at any stage may retard laying at maturity.* Many birds (not only individuals but flocks of all sizes) do begin regular laying promptly upon attaining full bodily development. When the situation in a stock of birds of the same breeding is irregular in this respect, it will usually be found that the birds which lay normally are those which have grown without interruption, and that when growth has been in any way retarded, the beginning of the laying period is retarded. (Apparently, influences unfavorable to the development of the body are still more unfavorable to the development of the reproductive organs.) It is not unusual to find May-hatched pullets laying earlier than their sisters a month older, and equal or superior to the earlier pullets in development at the beginning of egg production. The difference is explained in most cases by unfavorable weather in April and early May.

2. *Any disturbance affecting the habits, nutrition, or comfort of a bird at any previous stage of life may retard laying at maturity.* That such disturbances so affect and check laying when the reproductive organs are functionally active (or beginning to be)

has long been observed. Shifting from place to place and changing diet are common methods of checking egg production in pullets which it is desired to keep from laying in order that they may be in better condition for exhibition or for breeding at a later season. Recent studies of the reproductive organs of hens at the Maine Agricultural Experiment Station show that the development of these organs should be regarded as continuous from the earliest stages of the growth of the bird, and not, as has been the common view, as a part of the general development of the bird until the rest of the organism is complete, and then a special growth of the organs of reproduction. It has often been observed that pullets just beginning or about to begin to lay were more sensitive to disturbances and changes than those that had been laying for some time. From this it has been generally assumed that at the beginning of functional activity the reproductive system of the bird was especially sensitive, and that prior to that time the reproductive organs were not at all sensitive. On this theory the pullets are often handled less carefully in early life than as they approach the age when they should begin to produce eggs. This subject cannot be discussed exhaustively here. So little has it been investigated that knowledge of it is at almost every point deficient. It can only be treated in its most obvious phases and in general terms. Although much relating to it is in doubt, enough is known to show that every condition and circumstance unfavorable to the growth of the body may still more unfavorably affect the development of the organs of reproduction. Every one of the numerous factors unfavorably affecting growth must therefore be regarded as likely to affect the reproductive system more seriously, and to delay its functional activity far beyond the time when growth of the body is complete. This theory explains many cases of retarded egg production which otherwise seem inexplicable. Not all cases of retarded egg production are due to such remote or indirect causes. In many cases direct causes are found sufficient to prevent egg production. But when no direct cause can be found, it may reasonably be presumed that there was a remote cause (or causes) sufficient to produce the results; and when it is known, as it often is, that growth was retarded or interrupted, the cause of that interruption may be considered a sufficient cause for failure of egg production to begin promptly when growth ceased.

Conditions of egg production. Factors in laying may be classed as primary (or essential) and secondary (or accidental).

The prime factor in egg production is activity of the reproductive organs.

Secondary factors are (1) nourishment, (2) regularity, (3) comfort, (4) constitution, (5) exercise, (6) cleanliness, (7) broodiness, — these varying greatly in value, and ranking (as the subsequent discussion of factors will show) about in the order named.

Activity of the reproductive organs may be considered the direct cause of egg production. Without it not an egg is produced, though every other factor is sufficient; when it is present, eggs may be produced though every other factor is inadequate. It may be checked by failure of secondary factors, but as long as it continues, eggs are produced even to exhaustion of the body and of vitality. If the condition of the reproductive organs of the bird could be determined by observation, the poultry keeper might judge, with some approach to accuracy, of the time that must elapse before a nonlaying bird would begin to lay; but these organs are concealed within the body, and the only outward indications of their condition are the development and color of the comb, and sometimes the increased activity of the hen and a "singing" as she bustles about. None of these signs, however, are infallible. The proof of activity of the reproductive organs is given only in eggs. This will appear more clearly as the influences of other factors are discussed.

Nourishment. An ill-nourished bird may produce some eggs, but cannot continue producing regularly for long periods. To lay well the bird must be mature, well-nourished at the outset, physically sound, able to digest much more food than required for its own maintenance, and must be fully supplied with food. With activity of the reproductive organs and these conditions of nourishment a bird may continue to lay, though other conditions are faulty; but no advantage in other conditions can long compensate for deficiency in the more essential. A common fallacy, now generally discarded by students of the subject, makes activity of the reproductive organs dependent for its beginning as well as for continuance upon a surplus of food of proper composition. That this view is erroneous is evident when, with opportunity to eat all that they wish, hens that are not laying eat lightly and keep fat on a light ration, and when, as the hens begin to lay, the amount of food consumed is greatly increased. This is most apparent with old hens that have failed, for a while, to lay under most favorable conditions, though stimulated in every possible way.

Regularity and comfort are so closely associated that they are not readily separated for consideration. The general physical condition of a creature is affected by the regularity or irregularity of its life. Effects of irregularities on particular functions may be still more marked. The reproductive organs seem especially susceptible to such influences. Within limits, the comfort of a creature depends as much upon its condition as upon the conditions of its environment: thus, a debilitated fowl shows that it is uncomfortable on a cool morning, when to robust birds the atmosphere is invigorating and excites greater activity, and a bird that is chilled cannot keep warm at a temperature comfortable for a bird in perfect health. On the other hand, discomfort often causes irregularities: thus, heat which may not prostrate a bird may be debilitating, affecting digestion and egg production; cold which a bird withstands without marked physical discomfort may check laying; moving a bird from one pen to an adjacent pen identical with it, and with all other conditions remaining the same, often checks laying for days and may stop it for a long period. Irregular feeding unfavorably affects egg production, even though the total supply is sufficient and of suitable quality. Disturbances in flocks on account of the presence of a strange person or animal, and unusual movements of the attendant, often have an immediate and marked effect of decreasing egg production. Individual birds vary greatly in susceptibility to such influences, and the difference between small, nervous hens, like the Leghorns and Hamburgs, and large, phlegmatic hens, like the Asiatics, is pronounced. The facts as to the effects on egg production of irregularities of the kinds mentioned are accessible to any one who will keep a record of egg production and of conditions which may affect it; they demonstrate very clearly the importance of regularity in everything which may influence laying. Such regularity, complete at every point, is the exception rather than the rule in the management of laying stock, nearly every one being careless in some particular.

NOTE. The principal irregularities affecting egg production, considered in the order in which they usually occur in the management of pullets, are as follows:

(*a*) *The change from summer to winter quarters.* Under usual conditions it is necessary that such a change should be made. While the ideal way is to start pullets as chicks in the quarters that they are to occupy as layers, the fact that the old stock, or that part of it which is to be renewed, must usually be carried until about the time when the pullets are coming to maturity makes it impossible to do this except in a small percentage of cases. The practical question confronting the poultry keeper at this stage is whether it will be more profitable for him to keep hens that are likely to lay until November, keeping the pullets out in coops that are perhaps overcrowded, or to dispose of the hens (losing the profit on their eggs) and give the pullets every advantage. The prevailing tendency is to keep old hens as long as they lay, or, at any rate, as long as possible and still leave time to renovate the houses and get the pullets in before winter. While this is the common practice, it accounts for a great deal of the poor laying of well-developed pullets in early winter, and experienced poultrymen are generally agreed that the pullets ought to be not only in winter quarters but settled there and beginning to lay when winter sets in. In the latitude of New York this means that pullets so developed as to be likely to lay by November should be in winter quarters by the first of October. If the winter houses have large yards attached, pullets taken to them from a good range may not be much affected by the change. If the yards are small and the pullets are thus taken suddenly from a free life to cramped quarters, a serious check to laying may be the result. Pullets so advanced that they are likely to lay early in October or in September should be put into winter quarters still earlier. Though it cannot be positively asserted, it is probable that after the frame of the bird is grown (though not filled out) it is better to put it into winter quarters than to postpone the change until egg production is (supposed to be) about to begin. The advantages of range for a longer period may be more than offset by the disadvantages of a general disturbance of life at that stage. Apart from effects of changes of quarters, the season is very trying to birds with any predisposition to roupy troubles. The nights are growing chill; cold rains are frequent; the weather is sometimes raw and disagreeable for days at a time.

(*b*) *Change of diet.* If the birds, when on range, have secured much food by foraging, in the winter quarters they must be supplied with things to fill out the ration. It not infrequently happens that weeks elapse before the poultry keeper is giving them a full ration. He is not prepared, or has not time to properly attend to them. Change of diet and inadequate food, with other changes, may easily have more serious effects on laying than are plainly discernible at the time.

(*c*) *Change of ventilation in the house.* Most of the coops used for growing stock are well ventilated. Many of the houses used for adult stock are not. Birds inured to bad ventilation may not be seriously affected by it, but few birds will stand a sudden change from well-ventilated to poorly ventilated sleeping quarters without developing roupy symptoms, and sometimes the most thrifty birds will contract roup in a virulent form under such conditions.[1] While not as general as it was a few years ago, it is still too much the practice to begin, with the first chill and frosty nights, to close poultry houses tight. Under no circumstances should a poultry house be closed, more than it has been during the summer, before water will freeze in it at a few feet from the door. This applies to all kinds of poultry. After such degree of cold is passed, windows and doors may be partially closed for birds with large, tender combs, but except in the coldest sections this is not necessary, as far as the hens are concerned. The open house, for the reasons stated in Chapter IX, usually gives the more uniform temperature conditions and insures greater regularity of life.

Constitution. If pullets are physically and sexually mature, well nourished at the outset and well fed, and if irregularities are avoided, they should, if they begin to lay about the first of October and later, continue to lay steadily, and the rate of production for the individual should be as high then as at any time. To a very great extent the low averages for flocks at this time result from the presence of pullets that are not laying. After a few weeks of laying, differences in constitutional vitality begin to become apparent. Some birds slow up or stop, and perhaps show loss of weight; others continue the same rate of laying without noticeable loss of weight, and perhaps with some gain in weight. Differences due to constitutional vitality are most marked when comparisons can be made between selected lots. Unless birds are very deficient in vitality, the lack of it need not seriously affect the egg yield during the first winter. Good care and an abundance of stimulating food will keep up egg production, though it may shorten the productive life of the bird.

Exercise affects egg production only through its effects on the general health and condition of the bird. Hens will lay and lay well for many months at a stretch with very little exercise, but eventually the lack of exercise will tell. The effects are not in all cases the same. Perhaps the most common development is a gradual softening and weakening of the entire system, most pronounced at first in its effects on the digestive system. Under ordinary feeding hens are likely to lose weight; under very heavy

[1] It is probable that in such cases the germs of roup are present either in the houses or in the birds, which were practically immune under good hygienic conditions. That is a point not easily determined in ordinary instances of this kind.

feeding, with little exercise, they may become very fat while still laying heavily, — a fact that indicates very high digestive power. If the birds remain organically sound, improvement of conditions with respect to exercise is almost immediately followed by the building up of specimens in poor flesh and the reduction of fat in others, and by improvement of egg production if that has fallen off. If there is any organic weakness it is likely to be developed in birds that are out of condition, and may interfere with future production.

Cleanliness, in poultry keeping, is a relative term. It cannot be shown on any broad view of the subject, or on any comparison of instances, that absolute cleanliness, or a condition approximating it, is always an advantage. The accumulations of dirt in poultry coops and houses come chiefly from the droppings of the birds, more or less mixed with earth or sand from the floor, with litter, and sometimes with waste food. While this is dry and odorless it is apparently harmless. If wet, it heats and molds. The molds which form on damp litter are a fertile cause of disease, much more dangerous to some fowls than the pollution of their food and water. The more thorough the ventilation in a house, the better will be the sanitary conditions and the less need of frequent cleaning. The best guides to the degree of cleanliness that should be maintained are the condition of the birds and the keeper's sense of smell. A house should never get so dirty that hens cannot keep their feet, their feathers, and the eggs clean. Any offensive odor in a house suggests need of a search for its cause and the removal of the offensive matter.

Broodiness is most aptly described as a negative factor in egg production. Its characteristic tendency is to limit laying periods and thereby reduce the annual output of a bird.

Duration of laying periods. Broodiness breaks up the laying year into a number of short periods, hence the common idea that eggs are produced in litters and that, having once commenced laying, a hen (or other female bird) will "lay out her litter." While in birds which have the broody character broodiness may tend to develop as production of eggs ceases, in nonbroody birds production is influenced wholly by the other factors mentioned. In the most perfect combination of these factors laying is almost continuous, though the rate of production may vary. Ordinarily a nonbroody hen, having commenced to lay regularly, continues while the combination of factors (most of which are imperfect) is sufficient to maintain production, then stops, and after a period of recuperation, begins again, to continue as long as the factors are able to give the results.

Molting and egg production. In all kinds of poultry except fowls, and in a large proportion of hens, no eggs are laid during the annual molt. Normally the molt begins in early summer and requires about four months for its completion. Most hens will lay more or less during the early stages of the molt, while feathers are dropping fast and new ones are growing slowly, but nearly all stop entirely when the new coat is growing rapidly. As molting checks laying, so laying prolonged into the molting season tends to postpone it. This may be an advantage when the birds are not to be used a second season, but the advantage is not generally so clear in regard to those that are to be kept over. It is a question whether, on the whole, anything is gained by hens laying through the entire molt. In the case of very heavy layers there is no doubt that in many instances the high totals could not be reached if egg production were not almost continuous. In many cases of moderate laying, results indicate that the total output might be greater if the bird did one thing at a time. While always speculating on the phases of this problem, the poultry keeper working for egg production habitually exerts himself to get eggs in the present, and lets the molt and the future laying period come accordingly. Various methods of forcing molting are sometimes recommended. Some of these, notably the plan of starving for a period and then feeding heavily, tend to hasten the shedding of the old coat and the starting of the new, but there is little evidence to show that anything is gained in egg production. Such interference with the course of nature would be expected to unfavorably affect the sensitive organs of reproduction. The usual experience of those who try the experiment is that egg production is stopped, but begins again no sooner than in birds which perhaps lay several months longer and pass through the first stages of the molt more slowly.

Variability of egg yields. *Egg yields are variable both in individual birds and in flocks.* The yields of individuals range from o to over 250 by authentic records. Questionable records give still higher yields. The annual product of an average good layer is about 12 or 13 dozen eggs a year. The usual average for flocks of several hundred and upward ranges from 9 to 12 dozen per hen, 10 dozen being considered a good average yield for flocks of several hundred. High flock averages indicate general uniformity in laying. Low averages under good conditions indicate very unequal laying, and either weak stock, bad conditions, or poor selection of stock.

Selection of stock for laying. Selection of layers is a practically continuous process, beginning with the weeding out of markedly inferior birds as soon as they are large enough for table use, and continued by the regular disposal thereafter of all birds that fail to develop, or that, after having developed and perhaps produced for a period, go so much out of condition that they seem unlikely to become profitable producers again. In selecting laying stock on this principle the standard used is the well-developed, vigorous individual bird. With occasional exceptions, due apparently to ovarian trouble, the best-developed and best-looking[1] pullets in a flock prove to be the best layers. The undeveloped, slow developing, and least attractive birds are usually distinctly inferior to the others, especially in comparisons of yields for long periods. The relative proportions of good, medium, and poor birds selected in this way varies greatly. In well-bred, well-grown stock the proportion of pullets which should be discarded at or before maturity ought not to exceed one in eight or ten, and of the remainder the extra choice and ordinary birds should be about equally divided. After the culling out of the inferior 10 per cent or 12 per cent, the general average production of such a flock of pullets, under good conditions and management, should be good, with the production of the better half of the flock averaging one or two dozen eggs per hen more than that of the poorer half. The better half of the flock should also show the lower mortality and the smaller percentage of birds going out of condition. If the stock is indifferently well bred and has not been well managed, the proportion that are likely to prove profitable

[1] Not necessarily the best looking to a fancier who has been educated to judge by artificial standards, but the birds in the flock which the ordinary person with an appreciation of beauty due to physical development and condition would consider most attractive.

layers may be very small. Special points in selecting layers will be treated in connection with the selection of breeding stock to produce layers. Systems for selecting layers, based usually on physical measurements, are unreliable. The trap nest and individual record are necessary to select the individual producers with certainty, but such methods are too expensive to be profitably used with laying stock. Judicious selection on general appearance will eliminate most of the poor producers. It is usually cheaper to feed any that this method overlooks than to go to the expense of identifying them.

Effect of age on production. Age and egg production are not directly correlated, though they often seem to be. General comparisons of records of pullets with older hens, and of records of the same flock of birds through several years, indicate production at its highest during the first year, and so rapidly diminishing that only a small proportion of hens continue profitable layers after the second year (for the heavier breeds) or third year (for the lighter breeds). Instances of flocks, as well as individuals, furnishing exceptions to the general condition are, however, numerous enough to show that production depends primarily upon constitution and condition, and upon age only as age affects condition through the cumulative effects of unfavorable influences and the natural diminution of vitality. As a rule, only about half the pullets selected for layers at maturity will pass as rigid a test of condition a year later, and not more than one fourth of a third of those reserved for a second winter will pass a third examination. At three years of age, and even older, hens in good condition may be more valuable for egg production than the poorer pullets.

CHAPTER XVII

FINISHING POULTRY FOR THE TABLE

Fattening a finishing process. Poultry in the best condition for laying or breeding is not in the best condition for market and consumption. For poultry of any quality that is at all fit for food there is a market. Inferior poultry will usually sell at its full value as compared with other meats,— often at more than its relative value; but such poultry commands no premium, and yields little profit to the producer. If the amount is small and it has cost him little, he may sell it at small profit, or even at some loss, without appreciating how much less he is realizing on it than he would if the quality were better. When larger quantities are handled, and cost and selling prices are compared, the advantage of growing and finishing poultry to suit the requirements of the best trade cannot escape the poultry keeper's attention.

Fattening improves both appearance and quality. A thin bird is not at all attractive when dressed; the flesh appears shrunken and hard, the bones prominent, the skin thin and more or less shriveled. When cooked, the meat of such a bird is dry and tough unless the bird is quite young. A bird that is muscularly well developed (meaty but not fat) is much more attractive in appearance and much better eating. A fat bird is still better in appearance and better eating. To this point the majority of consumers' tastes agree; beyond it, opinions differ. Only a small proportion of consumers care for very fat poultry, and in America there is practically no demand for such excessively fat poultry as is produced in some parts of Europe.

Common practice as to fattening. By far the greater part of the poultry produced in America is turned off by the producer in an unfinished state. The young birds grown on farms are usually disposed of when they have reached marketable size, or at the end of the season, in whatever condition they happen to be. Turkeys and geese sold for the holiday season are generally given better preparation than at other times, or than other farm poultry get, but even of these, enormous quantities of unfinished birds are put on the market. Of birds, particularly chickens, grown under intensive conditions, the good specimens are usually much better finished than those from the farms; the poorer ones are much inferior,— not only thin but unthrifty or unhealthy looking. As a rule, only those poultry keepers producing especially for the table (and by no means all of these) make any well-directed efforts to put poultry on the market in first-class shape. Among all classes of poultry keepers, however, conditions in this respect are gradually improving.

What has been said so far applies to young poultry. Much of the old poultry marketed is overfat, perhaps best described as accidentally and improperly fattened. A great deal of it is poultry that should have been marketed weeks, months, or even years before, and would have been if the owners had systematically disposed of their birds as they became unprofitable. Such poultry, though fat, is not finished, in the proper sense of the term. The fat on it is usually not well distributed, detracts from rather than adds to the appearance, and is distinctly inferior in flavor to the fat on a freshly finished bird.

Simple methods of fattening. Ordinary fattening is accomplished by modifications of ordinary feeding conditions and methods. As already stated, the mere change of the conditions of feeding by stopping exercise may result in a quite rapid accumulation of fat, though no change is made in the ration. Increase of the proportion of fattening foods in the ration, the birds still taking exercise, also tends to make fat. Increase of fattening foods with restriction on exercise usually causes very rapid fattening, the rate and amount of fattening being governed very largely by the closeness of confinement and the proportion of fat-producing elements in the food, and limited by the capacity of the bird to continue to digest food and to accumulate fat under conditions tending to exhaust vital powers. Finishing in this way is a simple process and (if the birds have been properly grown up to the finishing stage) so effective that there is no excuse for putting thrifty young poultry of any kind on the market in poor condition. All that is necessary is that birds to be marketed should be separated from the others a few weeks before (instead of at) the time when they are to be disposed of, and that in the interval they should be kept more closely confined and fed almost entirely on corn in the form most appropriate to the circumstances and to the kind of poultry to be fattened. The objection to corn as a fattening food in countries where white fat and skin are desired does not apply in this country, where yellow[1] fat and skin are preferred. On the South Shore soft-roaster plants, where most of the chickens grown are destined for market, the practice is (after weaning) to keep a fattening ration before them at all times, yet at the same time to allow them all the range that they want. The ranges used are heavily stocked, but the birds used, being naturally inclined to put on fat, and being full fed, do not go far in search of food. With every opportunity to exercise, they take only enough to keep them in condition, carry at any age more fat than most well-conditioned chickens, and, as they complete their growth, become as fat, without other special treatment, as any American trade requires.

Where the principal thing is to grow good stock birds, and only a part of the poultry is to be finished at one time, the birds to be finished should be penned up for from ten days to four or five weeks, according to their condition and the demand to be met.

Broilers to be killed at from two to two and one half pounds should be taken at about one pound weight (if the chickens have been on range) and put into small yards or indoor pens. They should not be too closely crowded, — one bird to about every 5 feet of yard room or from $2\frac{1}{2}$ to 3 feet of inside room. The feed at first should be the growing ration they have had, all they will eat. Gradually the proportions of corn and meat elements should be increased, until, in the last week before they are to be killed, the most fattening rations mentioned may be given.

Fryers may be handled in the same way, being taken from the range at from one to one and one half pounds below the weight at

[1] Europeans accustomed to (and preferring) white skin and fat in their poultry consider yellow fat strong and not so fine in flavor. Some American writers, assuming that the European taste is more highly cultivated, echo this opinion. American consumers generally prefer the yellow fowls. Custom and prejudice give rise to the preference. Imagination and occasional instances that fit the theory confirm both ideas. It is no more possible for a blindfold person to know whether the chicken that he is eating has yellow or white skin than whether the eggs in his pudding had white or brown shells.

which they are to be killed, and being allowed one week for each half pound of weight to be added. Many birds can be carried much longer in this way, always in marketable condition and steadily gaining in growth; but, as a proportion will usually begin to go off in condition after three or four weeks, it is better not to undertake to carry them in this way too long. In such matters as this the poultry keeper must be governed by conditions as they arise.

Roasters are usually well grown before being finished or fattened. Chickens approaching maturity in good condition may be fattened, as much as required, in two or three weeks' yard feeding of ordinary rations containing half corn; by confining more closely and feeding on corn exclusively, they may be brought to the required degree of finish in a week or ten days. Fattening is hastened by darkening the quarters in which the birds are kept. For a week or ten days, birds of this age being fattened in this way may be kept in rooms from which the light is excluded except for two or three periods of from fifteen to twenty minutes each daily, when it is admitted, that they may see to eat. Under such conditions they put on fat very rapidly.

Fowls of both sexes past profitable use as producers should be sold at once if fat. If in good condition, not fat, they may be finished by close confinement and heavy feeding for a short period, as just described for roasters. If in poor flesh and requiring longer feeding, it is better to treat them for several weeks as described for broilers, and then to finish as above in close confinement.

Ducks to be sold as *green ducks* are handled in general by the same methods as broilers, the fattening periods for these two kinds of poultry corresponding closely. Ducklings (see rations, p. 235) will stand without injury much heavier feeding than any other young poultry. As they grow rapidly, so they fatten easily. Indeed, well-fed ducklings are fat at any time, and with a liberal fattening ration become very fat as the frame stops growing.

Older ducks (both the young birds held until maturity for table use and those no longer required for production) are easily fattened in confinement by heavy feeding — not much different from the usual ration at first and gradually changed until, for about a week before killing, they are fed on the same ration as that used for finishing ducklings. The length of the finishing period must be determined by the condition of the birds at the start and by the rate of increase of fat.

Geese to be sold as green geese are handled in much the same way as green ducks, but as goslings require relatively more bulky green food while growing, the change to the full fattening ration should be made more gradually, and such birds as show signs of breaking down (weakness of legs) should be disposed of at once.

Older geese are easily fattened, either by liberal feeding of whole or cracked corn with grass pasture (good, but not too extended), or by feeding a standard mash once a day and corn once a day. There is less need of very heavy feeding with the older geese than with the green geese. For the latter it is desirable to have the birds finished as soon as possible after the frame is grown, and before the last adolescent molt. The finishing period is therefore short, and rations of the highest efficiency must be used, even at extra risks. For the older birds more time can be taken. As they will keep in good condition on pasture, the keeper who has pasture can extend the finishing period as much as he sees fit, and make the fattening a slow process.

Turkeys, being of a roving disposition (the young especially being likely to fret in confinement), are less easily finished for market than geese. As most flocks of turkeys are handled on farms, the fattening depends much on conditions not under the keeper's control. As the supply of food to be secured by foraging diminishes in the fall, they are tempted to keep nearer home by more liberal feeding there. If the weather is seasonable — that is, rather cool — their appetites are sharpened, and if well fed, they increase rapidly in size and at the same time put on fat. Their condition at the time for killing for the Thanksgiving trade depends much upon the weather during the two months, and especially the few weeks, preceding. Unseasonably warm weather is unfavorable to finishing. Whole corn fed freely two or three times a day is the usual fattening ration, old and young being fed together. Mash, or dough, is sometimes given once a day to hasten the process.

Causes of failures in finishing by ordinary methods. It is usual to attribute poor results to the inefficiency of the ration. They are more likely to be due (1) to the condition of the birds, (2) to conditions unsatisfactory for the process, or (3) to constitutional tendency.

Birds of low vitality and weak digestion are difficult to fatten, as they are to develop in any way. Fattening such birds is, if anything, more difficult than growing them. The explanation of this may be that in the natural course fat is not produced unless every other existing need is supplied. If not demonstrable, it is still a reasonable theory that on a ration supplying all the material for growth that it can use (forcing development at the highest rate of which the organization is capable), a bird of high functional power could store up some fat without expense to growth. Many rapidly growing birds do this even while on range and taking all the exercise that they need. On the other hand, undersized birds are usually poor in flesh as well as small until growth is completed, and are not profitable feeders at any age or for any purpose.

Not only should birds undergoing the finishing process be restricted either by confinement or by circumstances, but particular care should be given to protecting them from alarms, annoyances, and disturbances of all kinds. These may affect a fattening bird more seriously than one growing under more normal conditions, or than a laying hen, because the general effect of the conditions of the finishing process is physically demoralizing to the bird, which becomes more and more sensitive to disturbing influences, as the process continues. Not infrequently poultry being fattened are confined where they are constantly exposed to annoyances. Under such conditions good results are impossible, except, perhaps, with very phlegmatic birds. Constitutional tendency has much to do with fattening. In general, the medium-weight and heavy breeds fatten more readily than the smaller and more active ones, but even in the breeds with a marked tendency to put on fat many individual specimens are difficult to fatten, and sometimes whole stocks with the type and characteristics of such birds will prove very unsatisfactory when subjected to a finishing process.

Special fattening plants using ordinary methods. Goose-fattening farms, developed by poultry buyers for finishing geese raised principally on pasture, are the only special fattening establishments using ordinary methods of finishing. Some of these farms have fattened from ten thousand to fifteen thousand geese a season. The profits are sometimes very large, but the risk of disease in buying birds from many sources, and in using the same land year after year, is so great that this line has proved a most precarious one. Some of the most successful men in it, knowing the risks to which they were continually exposed, have systematically urged the growers from whom they were buying to fatten their own geese, and growers are more and more following this advice, especially when located near good markets.

Fowls, ducks, and (more rarely) turkeys are sometimes fed in considerable numbers by buyers in touch with large live-poultry markets, who take advantage of opportunities to buy cheap and increase the weight of the birds while holding them for a rise. Operations of this kind are rather irregular, and, like most speculative transactions, are often unprofitable.

Special finishing methods. There are two special fattening processes, *crate feeding* and *cramming*. Occasion for special methods comes in part from the neglect or failure of ordinary methods and in part from the demand for poultry fatted more than is possible by ordinary methods. Both processes date from early times and have long been used in Europe. Several efforts to introduce them into America have met with very limited and temporary success. Whatever may be the case in countries where they have been long established, in America the exploitation of such methods turns the attention of the producer to the consideration of the advantage of ordinary methods of fattening, and when these are properly used, there is less material for and less need of special fattening. Again, while these special methods may sometimes give results not to be obtained by ordinary methods, they do not do so regularly. The truest appreciation of their utility is reached by treating them, not as of proved intrinsic worth and as necessary parts of any good general system of poultry culture, but as useful (like all other methods) in proportion to their adaptation to conditions existing at any time and place.

Crate feeding. The process of crate feeding carries the detail of finishing by restriction of exercise and by forced feeding farther than is practicable by ordinary methods, with the birds penned on a floor. The food used is finely ground grains mixed to about the consistency of batter and fed in troughs. The use of such food makes it necessary to keep the birds in small groups, with the food outside of their compartment, and also to keep them on such a floor or bottom that their feet and feathers will be as little soiled as possible by the soft droppings which the use of such food makes, and that the coops may require as little attention as possible. To meet these requirements coops with floors of slats about 2 inches wide and 2 inches apart are used.

Unlike the ordinary methods of finishing, crate feeding cannot properly be considered a modification of methods used prior to the finishing period. It is quite different, both theoretically and in fact. The practice apparently had its origin not with growers of poultry but with poulterers, — middlemen, — who saw an opportunity to make a profit by giving to poultry a better finish than the growers did. Thus, as a rule, the crate-fed birds are abruptly changed from one set of conditions to quite different conditions. Some birds are unfavorably affected by such changes, others are not and may even be stimulated by a change. The birds that are not affected by the change and can stand the forced feeding long enough may be doubled in value in a few weeks at a very low cost for food and labor. A bird that cannot stand the feeding may lose value. Success in crate feeding thus depends first on the feeder's accuracy in judging which birds will stand the process. This a skillful feeder can determine within the first two or three days of crate feeding. The birds not desirable for his purpose can then be disposed of with slight loss, if not with some profit, and his profit on the whole transaction be considerable. With poor judgment in selecting birds for feeding, results may be more unsatisfactory than when ordinary methods of fattening are used. On this continent the practice of crate-feeding has thus far been confined to packing establishments buying in sections where poultry is cheap and not well finished, and to a few poultrymen here and there whose opportunities and aptitude for this line of work enable them to take advantage of the failure of others to finish their product, and of proximity to good markets. The grower estimating the value to him of crate feeding must compare results not with prices for such unfinished birds as are the raw material of the crate feeder, but with results obtained by the simpler method of pen fattening.

Cramming. The process of cramming carries forced feeding to its limit, the birds being closely confined and compelled to swallow food that they do not want. The process is a very ancient one, and seems at first to have consisted in forcing the birds to swallow solid food after their natural appetite led them to discontinue eating. This sort of *hand cramming* is still practiced to some extent in Europe. In *machine cramming* liquid food is forced into the crop of the bird. This method is sometimes used exclusively and sometimes following a period of crate feeding, forcing the process beyond what is possible when the bird is free to take much or little food as it desires. A more uniform product is secured by cramming, though the best crate-fed stock is said to be fully as well finished as that which has been crammed.

As would be expected from the relations of the two processes, cramming is less used everywhere than crate feeding. On this continent the amount of machine feeding done is insignificant. The advantages of special finishing methods are generally overstated by those advocating them. In a large proportion of the cases in which remarkable gains in weight are made when birds are crate or machine fed, much of this gain is *growth* which would be made under any good system of feeding. The best showing for special fattening methods is almost invariably made *with chickens at the stage of most rapid growth* and *with good chickens*. Special finishing methods are not, as is popularly supposed, methods for making good poultry out of really poor poultry. They are used, supplementing the work of the grower, to shorten the time required to finish the birds and to put on an extra finish. It is possible by their use to put much more fat onto birds than by the ordinary methods of fattening, but here there is no object in doing this. So far the most conspicuous result of the exploitation of these methods is to increase the use of the ordinary method of finishing poultry for market.

Caponizing. In America caponizing is extensively practiced only in a few districts where growing large roasting chickens is a specialty. A capon is a castrated cockerel. The effect of the operation is not (as is popularly supposed) to greatly increase growth. On the contrary, for the period during which they are usually kept before marketing, a capon grows no larger than it would if it had not been operated upon. The object is to keep the young males quiet, to keep them soft-meated as long as possible, and to make them easier to fatten. The practice is most common among growers of winter chickens to be held for the early summer trade and marketed at from seven to nine months of age. Most of these are sold not as capons but as roasting chickens, both capons and pullets being so designated. Except for the operation these capons are handled in every way like the pullets grown with them.

Cockerels of Asiatic breeds or of the large general-purpose type are most suitable for capons. The operation is usually performed when the chicks are about six or eight weeks old. It must be done between the time when the testicles become easily visible through the incision made in the side and the time when they begin to be functionally active. After that the loss of blood and the shock to the bird make it inadvisable.

The operation. The testicles of birds, being located internally and attached to the backbone a little below the middle of the back, can be removed only through incisions in the sides. Instruments for caponizing are made by manufacturers of surgical instruments, and sold by them direct and also through poultry-supply dealers. Directions for operating are furnished with instruments. The operation is not particularly difficult for one who has a good eye and a steady hand. While it may be learned by following instructions, few become proficient in it without personal instruction and considerable practice. An expert operator will caponize from forty to sixty birds in an hour. Chicks of suitable size do not seem to suffer from the operation. The wounds heal quickly and often leave no scar visible when the birds are dressed.

Slips are capons which, as they grow, develop to some extent the sexual characters of which it is the object of the operation to deprive them. This is due, presumably, to defective operation, but some good operators declare that with the greatest care they still have many slips. Slips are not sexually potent, but as they become hard-meated and "staggy," they are marketed as soon as their character becomes apparent.

CHAPTER XVIII

PREPARATION OF POULTRY PRODUCTS FOR MARKET

Dressed poultry. The number of steps in the preparation of dressed poultry varies according to the kind of poultry, the choice of methods, and the disposition to be made of it. The full list is (1) fasting, (2) killing, (3) scalding, (4) picking, (5) cooling, (6) shaping, (7) grading, (8) packing.

Fasting. Before being killed, poultry should be fasted (starved by withholding food and water) for from twenty-four to thirty-six hours, that when they are killed, the crop, gizzard, and entrails may be quite empty. This improves the appearance of the carcass. A dressed bird with crop bulging at one side of the breast is not at all attractive looking. Fasting also improves the keeping qualities of the carcass by removing from it offal already in a state of partial decomposition. Poultry to be used at home need not be starved, but unless it is to be cooked immediately after killing, it is better to keep the birds fasting for at least a day beforehand. Packers of poultry, as well as producers who ship their own product, sometimes feed and water shortly before killing, to increase the weight. Apart from the dishonesty of this, it does not always pay in the immediate returns, and always finally works to the disadvantage of those practicing it. In some places, offering poultry for sale with food in the crop is prohibited by law. Poultry dressed in this condition will shrink much more in weight during transportation than poultry that has been properly starved before killing, and the shipper who follows this practice is constantly in difficulty with his customers over short weights. The necessary shrinkage in weight from fasting is very slight, and is more than compensated for by better appearance, better condition, and (usually) by the better price received.

Killing. When dressed poultry is to be sold in the open markets the method of killing is determined by the style of dressing that the market demands. When it is to be used by the producer or sold direct to consumers, the method easiest for the poultryman may be used, provided it is not objectionable to consumers. The common methods of killing are *wringing* the neck, *dislocating* the neck, *cutting off* the head, and *sticking* (with a knife).

Wringing the neck. For birds not too large or too tough, and for one who has the strength and nerve to do it, wringing the neck is the easiest way of killing. The head of the bird is grasped firmly in one hand, and the neck is wrung and the head completely severed from the body in an instant by whirling the bird by the head, the hand of the person rapidly describing a few short circles. This is a common method of killing fowls and chickens for immediate consumption. When done with skill and on suitable birds, it is as humane as any method. When unskillfully done, or tried on birds with strong frames and tough skin, the usual result is strangulation without proper bleeding.

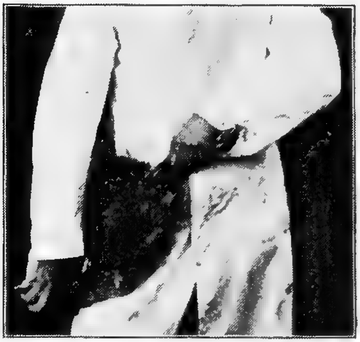

FIG. 319. Killing fowl by dislocating the neck

Dislocating the neck. Dislocating the neck is a method popular in Canada but not used in the United States. The legs and primary wing feathers are held in the left hand (as in cutting off the head), this hand being held near the waist. The head of the bird is grasped between the thumb and forefinger of the right hand, and bent back at a right angle to the neck, while at the same time, by a strong but short pull, the neck is broken close to the skull and the windpipe and arteries severed so that the bird will bleed freely. The skin is not broken, and the blood collects in the neck close to the head and clots there.

Cutting off the head. Cutting off the head is the method of killing most practiced with poultry that is not to be held long after killing, or not sent to markets which want birds with heads on. The bird is held in the left hand by the legs and the primary wing feathers, the wings being drawn back until these feathers can be grasped with the legs in the hand. The head is then laid on a block of wood and severed as close as possible to the juncture of the head and neck with a heavy hatchet or ax; whichever is used should have a straight, sharp edge. For killing a few birds occasionally, any block will do, but if much killing is done, it is best to have a solid chopping block about two feet high, with a smooth top, the surface of which will not be spoiled by the hatchet in a short time. After the head is severed, the bird should still be held in the hand, the neck over the edge of the block, the body held in this position by the flat side of the hatchet until the bird ceases to struggle, when it may be placed on the ground without danger of bruising itself in its struggles. When many birds are killed, it is a good plan to have a pail or other vessels to catch the blood and prevent its being wasted.[1]

Sticking. Sticking is done with a short,[2] sharp knife, the cut being made either in the neck (outside), severing the jugular vein, or in the mouth (inside), piercing the brain. The latter method is preferred, because the cut is concealed. The bird is sometimes stunned by striking the head against a post or by striking with a stick on the head or back before sticking, but this tends to prevent proper bleeding, and is not as commonly practiced as formerly. The details of killing by this method vary considerably, particularly as to the position of the operator and of the bird when the cut is made. These depend upon the method of picking and upon whether each picker kills his own birds or whether one person does all the killing for a gang of pickers.

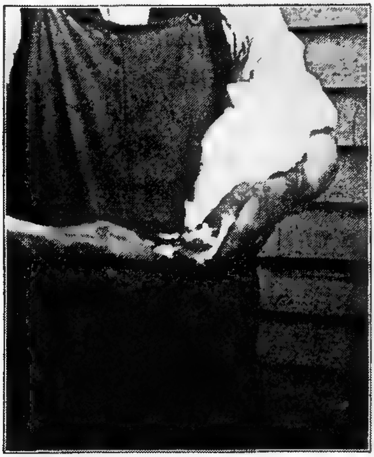

FIG. 320. Sticking fowl held with the hand

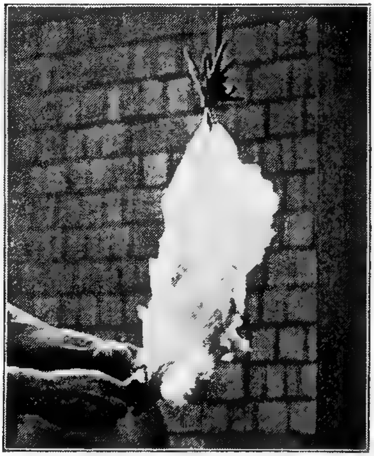

FIG. 321. Sticking fowl suspended by the legs

When each picker kills his own birds, one at a time as he wants them, he usually works sitting down, with a coop of live birds at one side and a box for feathers at the other, and holds the bird between his knees with the head extended from him while making the stick. Sometimes, however, especially when picking large birds not easily stuck in that position, the picker stands up and holds the body of the bird between his arm and his side, with the head extended forward in the left hand in a convenient position for sticking.

When one person does the killing for a number of pickers, as is usual when poultry is scalded, the birds are often suspended in loops, by the feet,

[1] The blood may be fed to poultry either separate or in mash.

[2] Regular poultry-killing knives are short, but some pickers use a common butcher knife.

from a beam, and a hook with a weight attached, inserted in the upper mandible before the stick is made, prevents struggling. This method is also used in what is known as string picking, in which the bird is picked while suspended instead of being placed on a bench or held on the knees of the picker.

Methods of making the stick vary slightly, the object in all cases being the same, — to penetrate the brain and paralyze the bird (causing the feathers to loosen so that they are easily removed), and to secure free bleeding. The method may perhaps be best described as a *stab* to the brain, well back in the roof of the mouth (the thrust cutting crosswise), then a *twist* of the knife to bring it into position, and a *slit* forward the entire length of the roof of the mouth. Skill in sticking depends first on acquiring the knack of it, and then upon practice. Even a good sticker does not always make a good stick. Diagrams are sometimes given to illustrate the cut, but it is to be doubted whether they are of any real assistance, for it is the sense of touch, more than anything else, that regulates the movement of the knife. The sticker knows when he has made his thrust right by a peculiar shiver which the bird gives and which he soon learns to recognize by touch. He presses the knife to the brain until he feels this, then turns it and cuts forward to give the blood free vent, being careful all the while not to cut through to damage the outside of the head and, perhaps, his fingers. When the bird is to be dry picked, the removal of the feathers is begun at once, the object being to have it picked quite clean before bleeding stops. When the bird is to be scalded, bleeding should be finished before scalding is done, or the heat may bring the blood to the skin and coagulate it there, spoiling the appearance of the carcass.

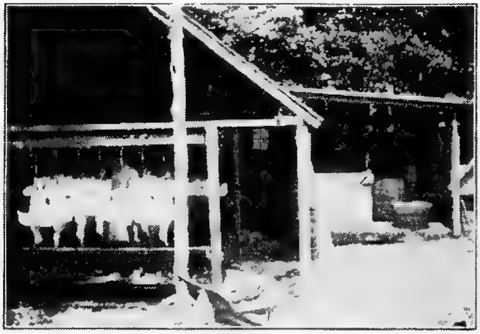

FIG. 322. How ducks are handled when one man kills and scalds

Scalding. This process is used much more extensively and with more satisfactory results than would be inferred from a perusal of most of the special articles and pamphlets on the preparation of poultry for market. It is the easiest way to remove the feathers. When properly done the scalded bird presents none of the defects of poorly scalded poultry, and can be distinguished from the dry-picked bird only by experts. Done carelessly or by one who does not understand it, scalding usually results in spoiling the appearance of every bird put through the process.

How to scald. The first thing in scalding poultry is to have a vessel of water large enough to allow free handling of the birds. The next thing is to maintain the water at the desired temperature as long as required. The temperature of the water should be just below boiling. When a single chicken or a medium-sized fowl is to be scalded, it may be done in a twelve- or sixteen-quart pail, by using enough water, boiling when taken from the stove, to make the pail a little over half full. In pouring or dipping from the kettle or the tank to the pail, the temperature of water at the boiling point will usually be sufficiently reduced by contact with the cooler air as the water passes from vessel to vessel. The bird should be taken by the feet and soused in the water in such a way that the feathers will be rumpled by the movement and the water will penetrate nearly to the skin without reaching it. If the bird is to be dressed with the head on, the head should not be scalded but held in the hand while the scalding is done. It is not as easy to scald in this way as with the head off, but with a little care good work may be done. When scalding is done properly, the effect at the root of the feather is to steam the skin without scalding it. The time required varies with the condition and density of the feathers. A chicken or a molting hen may need only a plunge so rapid that the skin is hardly affected, though the scantiness of plumage allows the water to touch it. A full-feathered fowl, especially an old one, may require several plunges. The effect on the feathers is ascertained by plucking a few from the thigh near the hock joint. If these come easily, there should be no difficulty in removing the others. Only one or two birds can be scalded in the same water in this way, but more may be scalded if boiling water is added. For larger birds a boiler or a tub may be used. Results of scalding in this way are not uniform, however, and if any considerable number are to be scalded, a set-kettle, under which a slow fire can be kept, should be used. This gives a body of water large enough for quick and thorough work in scalding, and after a few trials of the water on the stock with which he is working, an expert will put most of his birds through without a blemish due to poor scalding. If a bird has been well scalded, only the stiff tail and wing feathers need be pulled out. The others will *rub off*, except pinfeathers in birds not in full plumage. If handled immediately after scalding, the feathers are usually a little too hot for the comfort of the picker. They are removed just as easily after they become cool enough to handle, and with little greater difficulty at any time within ten or twelve minutes.

Ducks and geese. Waterfowl are much more difficult to scald than other poultry. Their dense plumage is not so easily penetrated by the water, and the ease with which the feathers on the thigh are removed is not as accurate an index of the general condition. A common practice is to wrap them in burlap (old grain sacks) after scalding, and allow them to steam in the hot, wet feathers for some minutes before beginning to pick. Even then a supplementary scald is sometimes necessary, after a part of the feathers have been removed. In packing establishments *steam* is often used for scalding, giving a dry scald. The steam used is sometimes taken from a pipe or a hose, but direct steaming is said to be more satisfactory. Some of the smaller packing establishments use a method of steaming ducks which may be applied anywhere. On a common round, wide-topped laundry stove is placed a wash boiler with about three or four inches of water in the bottom; in the boiler is a wooden frame which holds the bird in the steam without allowing it to get into the water. The bird is placed in the boiler and steamed for about one and one half minutes on one side, then turned and steamed for about the same length of time on the other side.

In picking ducks and geese powdered rosin is sometimes used to assist in removing the fine down left after the outside feathers are removed. The rosin is rubbed onto the down, which mats, and is then more easily removed.

FIG. 323. First step in lap picking: stripping feathers from breast

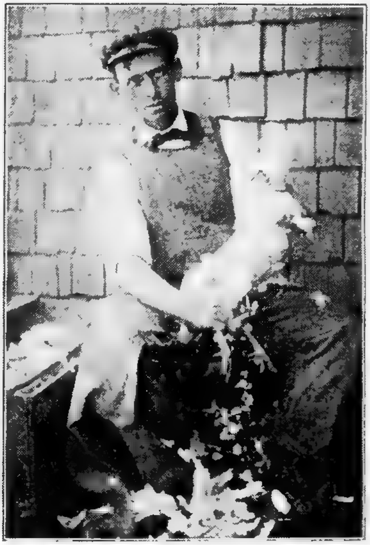

FIG. 324. Second step in lap picking: stripping feathers from thigh

In scald picking the picker usually works standing, with the bird on a table or a bench before him, and rough picks with the *hands* and the *fronts* (not the *tips*) of his thumbs and fingers. Most pickers remove stiff tail and wing feathers first, but some leave them until the last. It makes little difference. The important thing is for the picker to have a systematic way and to pick clean as he goes, except for stubs and pinfeathers, which must be removed one by one.

Dry picking. The removal of the feathers without wetting is the method favored by most eastern markets, and is best adapted to poultry that is to be kept in storage. It may be done at any time after killing. Pigeons and guineas and game birds of all kinds are marketed with the feathers on. In general practice with poultry, however, dry picking is done while the bird is dying, when it has lost consciousness and is insensible to pain, but when the relation between nervous and muscular systems still continues. Good work in dry picking depends first upon the proper sticking of the bird.[1]

NOTE. When the sticking is well done, the feathers come off quite as easily as with good scalding, but with a poor stick they come harder, and an inexpert picker is likely to break the skin and perhaps tear the birds badly. As in scald picking, the picker works as much as possible with his hands, wetting them at intervals to make the feathers stick to them, removing the feathers in handfuls, rubbing them off and unless pinfeathers are very small, taking them with the others. The pinfeathers and stubs that are not taken in this way must be removed one by one. For this (in both methods) the professional picker uses a short knife, either seizing the stub between his thumb and the blade, or shaving it off. Practice, and a certain aptitude for such work, are required to

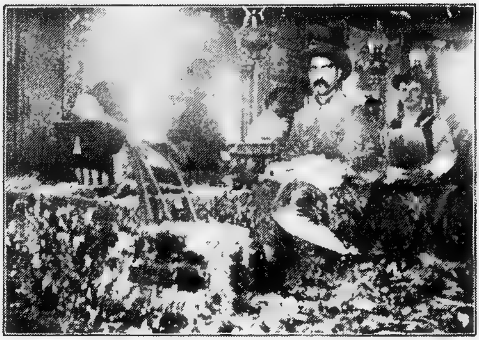

FIG. 325. Gang of poultry pickers dressing geese

[1] The principle upon which this process is based is best explained by reference to a phenomenon which every one with a little experience in handling poultry has had occasion to observe. If in catching a bird one grasps it by the tail, some of the feathers are likely to be pulled out, and if the hold is only on the feathers, the bird will probably escape. If the bird is caught by the thigh, unless the hand quickly closes very tightly on it, a good many feathers may be pulled out just by the action of the closing of the hand on the leg, and by the momentum of the bird. Not infrequently, when caught by the back with so insecure a hold that the person catching it feels that he has hardly more than touched the bird, it loses feathers. Considering how hard these feathers usually are to get out when he wants them removed, the poultry keeper always feels somewhat surprised at the ease with which they come out under these circumstances. There is plainly a direct relation between the mental condition of the bird and the tenacity of the feathers. When the bird is in a state of fright, the feathers loosen, and their loosening may enable the bird to escape. The same effect on the feathers is secured by paralyzing the bird by stunning or by piercing the brain. It is also secured when the bird is killed by dislocating the neck, or by wringing the neck, or by beheading, though in the last two cases the complete severance of the head makes it impossible to direct the flow of blood and begin picking immediately, and so the feathers are relaxed a second time by scalding.

make a good, fast picker. *Aptitude* consists largely in working methodically when removing the feathers, and in picking as clean as possible at every step. As to the division of the work, practice varies largely according to the quality of help to be obtained. Where enough capable pickers can be obtained, each finishes his own bird; where the supply of good pickers is short, the skilled pickers often rough pick the birds and employ less expert persons to remove the stubs and pinfeathers.

Scalding and dry picking compared. After the knack of sticking is acquired, dry picking is often more convenient. Unless the bird is properly killed, it is usually much easier for a novice in picking to get the feathers off by scalding, even if he has to build a fire and wait for the water to heat. In the results of inexpert use of the two methods there is little to choose, but, judging by the comparative scarcity of good scalders, it is much easier to acquire the knack of sticking than to learn to scald right. A poor scalder is apt to disfigure all his birds and, if he has never seen poultry well scalded, to think that it is unavoidable. In dry picking it is not possible to miss seeing the difference in good and poor work, the inexpert picker's great difficulty being to avoid tearing the skin. He can therefore judge his own work better, and with practice is almost sure to become passably expert. Dry-picked poultry is said to keep longer in cold storage than even the best scalded poultry. For use within a few weeks after killing, the advantage of dry picking over good scalding is not apparent. The use of methods, however, is not a matter of choice with the producer who dresses his own poultry. He must follow the custom in his market, and scald pick or dry pick, or perhaps do some of both, according to the disposition to be made of his stock.

Market requirements as to picking. The large eastern city markets and pleasure resorts prefer dry-picked poultry. Inland, western, and southern markets, almost without exception, want the poultry for local consumption scald picked; but at many of these points poultry shipped to eastern markets is dry picked. Customs, however, are not consistently governed by the market preference; conditions affecting shipment and the disposition of the goods may determine the method, and the poultry trade presents some striking anomalies in practice at this point. Thus, while the East prefers dry-picked poultry, a large proportion, perhaps the greater part, of the ducks produced there are scalded. Eastern turkeys are often scalded, while western turkeys for the eastern market are mostly dry picked. Poultry from the states in the Mississippi Valley east of the river is often scalded, even by the packers, for the eastern market; while in the states west of the river the poultry going east is all dry picked. The poultry from points nearest the market, reaching it quickly and likely to be consumed at once, is scalded (that being the cheaper method), while that which takes longer to reach the market and is not so likely to find ready sale, and may have to go into cold storage, is dry picked (that being the method which best insures its keeping).

At bottom it is not so much a question of method as of good work by either method. Good poultry marketed in good condition will bring about the same price scalded or dry picked, when the demand is brisk, but when trade is dull, poultry dressed by the method not favored in a market is hard to move on that market.

Importance of proper cooling. In respect to its effect on quality, cooling is the most important part of the preparation of poultry for food. Enormous quantities of good poultry are damaged or spoiled entirely because not properly cooled when killed. The object of cooling is to remove the animal heat and check decomposition. The sooner the body is cooled, the longer it will keep and the better will be the texture and flavor of the meat. In cold weather, poultry may be cooled in the air (dry cooled). When the temperature is too high for rapid cooling in the air, poultry is cooled first in water of the ordinary temperature at which it comes from the well or hydrant, and then in ice water. Cooling the warm body suddenly in ice water is less effective than beginning with water of a higher temperature. It is supposed that too rapid chilling at the surface diminishes its conductivity and allows the animal heat inside to start decomposition more actively. Whenever it can be done, dry cooling is preferred to cooling in water. When the days are warm and the nights cool it is usual to put poultry into water in barrels, tubs, or tanks as soon as killed, and at night to hang it up or place it on racks to finish cooling. The killing should always be timed so as to give poultry sufficient time to cool before being packed. When it is to be shipped only a few hundred miles or packed in ice, cooling for a night and a part of a day (according to the time of killing) should be enough. If the poultry is to be shipped dry packed for a long distance, it should be more thoroughly cooled. It is of much more importance that poultry should be well cooled before a long shipment than that it should be started on its journey quickly. The condition of the poultry at the start is a more important factor in its keeping than the time in transit. Packers nearly a week from their market cool poultry two or three days before shipping.

Shaping. The operation of shaping is done sometimes as the birds are cooling, sometimes as they are packed. The object is to make the bird appear as plump as possible. The advantage is greatest with poultry in fair condition but not noticeably well meated. In Europe a number of methods of shaping are practiced, some even going so far as to wrap each bird tightly in cloth while cooling. A more common method there, used to some extent in Canada, is to place the birds in a squatting position in V-shaped troughs, with a weight on the back of each bird. A similar but simpler method is used by some packers in the United States, the birds being held in a squatting position on a rack by strips from $1\frac{1}{2}$ to 2 inches high, about 6 or 8 inches apart in front and coming together at the rear, a board the length of the rack serving as a weight for all the birds on it. With good, plump stock there is little occasion for such shaping for American markets. The object of it is evidently deceptive, — to press in the breast and hip bones and give an appearance of greater meatiness than exists. Good stock does not need this treatment for these markets. All that is necessary is to pack in such position that the carcass will present a symmetrical appearance and show for just what it is.

Grading. The proper sorting and grading of dressed poultry is of less importance to the ordinary producer than to the packer, but still it should have his attention. Packers make many grades, according to weight, quality, condition, etc. Producers marketing their own poultry usually make no more than three grades of any one kind of poultry, — *firsts*, *seconds*, and *culls*, — and unless operations have been very unsuccessful, the proportion of seconds and culls should be small.

Firsts are choice, well-finished birds, not damaged in dressing.

Seconds are slightly inferior birds, and firsts slightly damaged in dressing.

Culls are decidedly poor and badly damaged birds.

Whether selling single birds to individual consumers or selling in quantity, the poultry keeper should carefully avoid putting inferior stuff with his better grades. The object of grading is not to pass off all that he has with the highest grade that it can get by, but to assort it in conformity with the general scale of prices and demands of the trade. There is nothing to be gained in money by

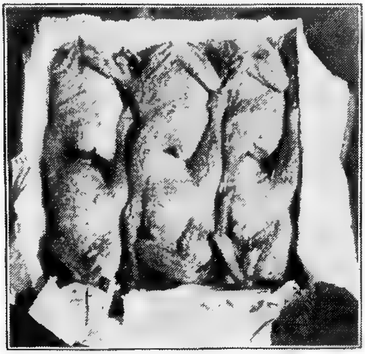

FIG. 326. The side pack, — roasting chickens

grading poultry too high. There is more likely to be a loss, for the inferior birds packed with those of a better grade detract from the appearance of the lot and often reduce the price. In addition to grading each kind of poultry, the shipper should keep different kinds, though of like quality, separate, and as far as practicable should have each package of birds uniform in size. It is much easier to do this now, when small packages are in vogue, than it was when most poultry was packed in barrels and large boxes.

Packing. Two methods of packing are used, — *dry packing* and *ice packing*, the former being employed when weather and distance permit, and the latter when there is danger of poultry spoiling in transit unless iced.

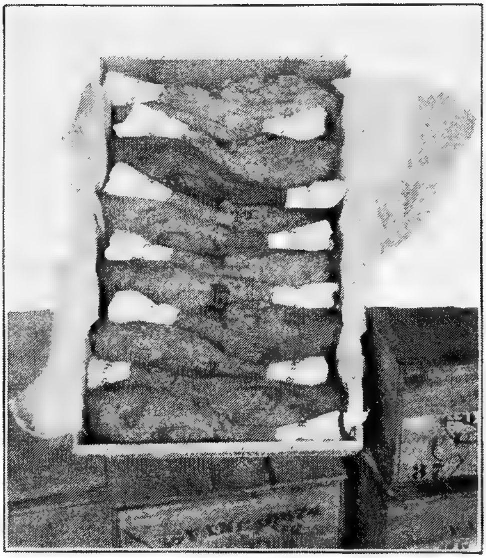

FIG. 327. Style of packing fowls for export. (Photograph from United States Bureau of Chemistry)

Dry-packed poultry is mostly shipped in boxes. For irregular and small shipments any clean second-hand box of convenient size may be used. For regular shipments of choice poultry it is better to use special boxes holding one or two dozen birds, and of dimensions to suit the sizes of the birds. For regular short-distance shipments (by express) of poultry going into immediate consumption it is best to use returnable boxes very substantially built, with covers held in place with bolts and nuts, and with handles on the ends for convenience in lifting. For long-distance shipments and for lots which it may be desired to hold in storage, such light boxes as the poultry packers use are more suitable. Packers making many grades of poultry and assorting carefully as to size use boxes of different dimensions, to fit one or two dozen birds of each size. The producer will usually find it more satisfactory to use a few standard-sized boxes adapted to the sizes of birds of which he ships most, putting fewer large birds, and a large number of small ones, in a box. While the dozen is a convenient numerical division, poultry nearly always is sold by weight[1] and even when the trade prefers one- or two-dozen lots, an occasional package containing less or more than the round number will sell as readily as the rest. Styles of box packing are shown in Figs. 326–328.

STANDARD SIZES OF BOXES

	Inches inside
For 12 broilers, 24 lb. and under per dozen	16 x 15 x 3½
For 12 broilers, 25 to 30 lb. per dozen	17 x 16 x 4
For 12 chickens, 30 to 35 lb. per dozen	18 x 17 x 4
For 12 chickens, 43 to 47 lb. per dozen	21 x 19 x 4¾
For 12 roasters, 48 to 59 lb. per dozen	19 x 16 x 8
For 12 fowl, 54 lb. and upward per dozen	19 x 16 x 8
For 12 ducks, 54 lb. per dozen	19 x 16 x 8
For 12 fowl, 60 lb. per dozen	18 x 17 x 9
For 12 fowl, 38 lb. and under per dozen	14 x 12½ x 7
For 12 chickens, 30 to 40 lb. per dozen	15½ x 14 x 6½
For 12 average turkeys or geese	24 x 19 x 11

Boxes for the smallest birds may be made of ¼-inch stuff for sides, and ½-inch for ends; boxes for birds of medium weight, of ⅜ inch stuff for sides and ⅝ inch for ends; those for heavy-weight birds, of ½ inch stuff for sides and ⅞ inch for ends. If many boxes are needed, it will pay to buy regulation sizes in knockdown bundles, or, if there is a box factory near to have stuff got out to measure there and put it together as wanted. Sometimes empty packing cases of suitable material can be bought so cheap that the poultryman can afford to cut them up and make his own packing boxes at odd times.

[1] There are a few places where birds are sold at so much *apiece*, or so much a dozen, without regard to weight.

There are two principal points to be observed in packing: (1) that the birds be packed solidly, so that they will not shift when the package is handled; (2) that the package, when opened, present an orderly arrangement and show the goods to advantage. The removal of the cover should show either all breasts, all backs, or all sides, and legs, heads, and wings all in the same relative positions.

Ice-packed poultry is usually shipped in large barrels. A layer of clean chipped ice is first placed on the bottom of the barrel,

FIG. 328. Two outside top boxes, standard roaster pack; top center and bottom row, standard broiler pack. (Photograph from the Bureau of Chemistry, United States Department of Agriculture)

then a layer of poultry, packed in a circle with backs up and feet toward the center, the poultry nowhere touching the sides of the barrel; then a layer of ice and another layer of poultry, and so on until the barrel is full to within six inches of the top, when it is filled with larger pieces of ice and covered with bagging. In very warm weather a large chunk of ice put on top (under the bagging) will add to the safety of the shipment. Poultry thoroughly cooled before packing, and properly packed and iced, should be safe for two days' shipment by express or for four or five days in a refrigerator car. Natural ice is better for packing poultry than artificial ice, because it melts faster, and the cold water percolating through the layers of poultry keeps them at a uniformly cool temperature. If the ice melts too slowly, the poultry may arrive at its destination in poorer condition with much ice remaining than if the ice has all melted.

Feathers. Wherever a considerable quantity of poultry is dressed it will pay to save and sell the feathers. The feathers of ducks and geese, if handled and disposed of properly, should pay for the picking. Other feathers are less valuable but still worth taking care of. Stiff and soft feathers, white and colored feathers, and the feathers of each kind of poultry should be kept separate. The feathers from dry-picked stock are usually in better condition than those from scalded stock, but with a little care scalded feathers can be cured so that they will sell well, though not as prime feathers. The wing and tail feathers require no curing; the body feathers should be placed in bins or in a loft and forked over at intervals until the quills are thoroughly dry.

Shipping live poultry. Ventilated coops with solid bottoms and open sides and tops, made of slats or wire netting over a frame, are used for shipping live poultry. Standard coops used by large shippers are made of hardwood strips reënforced with twisted wire, — for fowls, 2×3 feet, 12 inches high; for turkeys, 2×3 feet, 16 inches high. A coop with a 2×3 feet bottom is large enough for a dozen medium-sized fowls, and for from one to two dozen chickens, according to size. Filled with live poultry it makes as large and as heavy a package as can be easily handled by one man. This is the size preferred by commission men and expressmen; but many shippers make a larger coop, with floor from 30 to 36 inches wide by 4 feet long, usually with a partition in the middle. These coops are usually homemade. Poultry is not often shipped in coop lots over distances so great that the birds must be fed and watered in transit. Long-distance shipments are usually made by middlemen either in cars especially fitted for poultry, or with an attendant to feed and water on the journey.

Sorting and grading. Uniformity is as important with live as with dressed poultry. The birds shipped in a coop (or in a compartment of a double coop) should be of the same kind and as nearly as possible of the same age, size, and weight. It is also an advantage to have them of the same color, for, while color is not of such importance in market as in fancy poultry, as far as it contributes to uniformity of appearance it makes a lot more salable, and often brings a little better price. In general it is advisable to have each lot of the same sex, — especially in fowls past broiler size. Grading is less essential when shipping to buyers who dress to sell than when shipping to firms which sell the birds alive. Concerns dressing poultry and buying direct from producers will usually sort mixed lots as they kill and make returns accordingly.

Eggs. The preparation of eggs for market is the simplest of matters. They must be whole, clean, assorted for color and size, and packed in packages of suitable size. As marketed by a producer they should always be fresh. If a poultry keeper wishes, either for experiment or for home use, to preserve eggs, that is solely his own affair. If he undertakes to sell at the same time preserved and fresh eggs, he will soon find that all his eggs are under suspicion and that he has damaged his best trade. The poultry keeper who wants to make a reputation for good eggs, and to get the highest prices, should keep rigidly to the practice of selling only fresh eggs.

Cleaning eggs. If the poultry houses are clean, the nests kept in good condition, and the hens laying eggs with good shells, the proportion of eggs requiring cleaning before being marketed should be small. As far as possible, wetting the shell is to be avoided, for it destroys the "bloom" which is the conspicuous, distinguishing feature of the fresh egg, disappearing with age and handling. If an egg is only slightly soiled it may sometimes be cleaned by rubbing lightly with a dry cloth. If this does not answer, a slightly moistened cloth may remove the dirt. Eggs that are badly soiled should be washed in warm (not hot) water, and dried at once with a soft cloth. The warm water removes the dirt more quickly than cold, and eggs washed in warm water are more easily dried. No soap or other cleansing preparation should be used, — only clean water. If the shell is stained, as sometimes it is, with manure or from being wet in the nest, it is better to keep the egg for home cooking. It is not injured except in appearance, but it is salable only as a "dirty" at about half price.

Sorting eggs for color. Uniformity in the color of the shell is desirable, even though the market has not a color preference. Mixed lots of eggs do not look as well or sell as readily as lots of uniform color. Eggs are classed according to color, as white, gray, and brown.

White eggs are not, as a rule, of a dead-white color, though that is sometimes found; they are nearly always slightly tinted. Eggs that are uniform in color and look white unless closely compared with something whiter may be classed as white.

Gray eggs are eggs that are plainly not white, yet not dark enough to be considered brown. The color of the shell usually tends toward black rather than toward red or brown, but extremely light-brown eggs may be classed as gray.

Brown eggs exhibit a wide range of color, from a light, golden brown to a reddish chocolate. Ordinary brown eggs are light brown. What are known to the trade as dark-brown eggs are mostly medium in the range of shades of brown found in eggs. Very dark-brown eggs are comparatively rare and are not often seen in quantity. Commercially, the darkest-brown eggs are not favored beyond the ordinary dark brown eggs. Where the range of shades is so wide the uniformity of color presented by ordinary white eggs graded with a little care can be secured only by a more discriminating selection than it is usually practicable to make. For all ordinary trade purposes it is enough to make two grades of brown eggs, light and dark (medium), discarding, as not brown, the white or gray eggs sometimes laid by brown-egg stock, and packing the darkest eggs with the medium. An appearance of greater uniformity of color may be secured by a little care in placing the eggs so that those of different shades are not placed at random but arranged according to shade, — not so accurately that the shades blend perfectly, but with care to avoid marked differences in shades of eggs in adjoining compartments.

Grading for size. Grading for size consists principally in discarding from lots designed for ordinary trade all very large and all very small eggs. The compartments of boxes and cases used for packing eggs for market are usually of pasteboard sufficiently elastic to allow the larger eggs to spread the sides of the compartment, the smaller eggs being placed in the adjoining compartments; but eggs that are so long that they project above the filler are almost sure to be broken, because the board between the layers of eggs is less elastic and because, when the lower layer is covered, it is not possible to adapt short eggs in one layer to long ones in the one below. Eggs that are too long for the fillers should not be packed in them. A distinction should, however, be made between a long egg of ordinary width which cannot be placed so that its end will not project from its compartment, and a long, narrow egg which will fit diagonally into the compartment. Of eggs that are too wide for the compartments, as many may be used as can be put in without danger to those in adjacent compartments. Provided the shell is strong, an egg of suitable size need not be discarded for any of the common eccentricities of shape, as corrugated shell or marked departure from the oval form.

In a general way the size of the compartment in the standard egg box and case regulates the size in grading choice eggs. Eggs weighing from twenty-five to twenty-eight ounces to the dozen will fit into the fillers with very few to discard because too large or too small. Eggs weighing more than twenty-eight ounces to the dozen will have a larger proportion of those too large for the fillers. Eggs weighing less than twenty-five ounces to the dozen will contain many so small that when packed the compartments seem only half or two thirds full. Small eggs never show to poorer advantage than when packed in this manner.

Egg cases and boxes. The standard wholesale package for eggs is a light wooden box, or *case*, with two compartments, each holding fifteen dozen eggs, — thirty dozen to the case. Cases of similar construction holding thirty-six dozen are also used, but not so extensively. In general trade the cases are sometimes returnable and sometimes sold with the eggs. Both producers and collectors making regular shipments of strictly fresh eggs often use more substantial cases, always returnable, marked with their own stencil, and such cases are sometimes painted a distinctive color. For shipment by ordinary express, they are safer than the light trade case, though the latter is as good or better for carload lots and for storage.

For retailing eggs in original packages smaller cases are used. Where a consumer uses considerable quantities, but less than a case weekly, — say from fifteen to twenty dozen, — the poultry keeper who supplies him often uses a one-compartment case just half the standard size, for fifteen dozen, and for a larger number makes or has made boxes that will hold just the required number and has the consumer's address as well as his own painted on the boxes. For smaller lots to be shipped by express, smaller boxes are made, holding from two to ten dozen. For eggs to be delivered direct from producer to consumer the cheap pasteboard egg boxes (holding one dozen each) which retail grocers and provision dealers use are commonly used by poultrymen. For those who require large quantities of them manufacturers will print on the boxes special labels or designs, which add to the attractiveness of the package and also advertise the goods. However small the quantity of eggs to be sold, the most satisfactory way to handle them is to pack them in boxes.

CHAPTER XIX

MARKETING POULTRY PRODUCTS

Poultry keepers and middlemen. To dispose of his produce with the largest possible profit to himself is the aim of every poultry keeper. It is commonly assumed that this is best accomplished by dispensing with middlemen and selling direct to the consumer, and that every time a middleman is eliminated from the number concerned in the collection and distribution of eggs and poultry, the producer is benefited. Under some circumstances this may be true; considering the interests of the producer in particular instances, it will often appear that he makes much larger profits by selling direct to consumers than by selling through middlemen. Broader comparisons of results, however, indicate that study of such special instances may be misleading. It has been shown that, in general, a poultry business is limited to what one man can manage with the (usually) very limited help he can rely upon. When a man conducting such a business undertakes to sell direct to consumers, he often finds that it costs him more to sell his produce than it does the middlemen, and that he can make more money by giving all his time to production and selling his products through the ordinary channels, — he, of course, taking every advantage that he can without himself retailing his goods. A poultry keeper whose opportunities or facilities for production are limited may find it to his advantage, and perhaps necessary, to sell his produce direct to consumers, but one who is in a position to extend productive operations to the limit of his ability to handle them will almost invariably make more money by giving as much as possible of his time to production and intrusting the selling of his produce to reliable persons whose specialty is selling. This is a natural division of labor brought about by the conditions of production and distribution and by differences in men. The best producers of poultry are rarely good salesmen. In the most thriving poultry districts producers generally devote themselves to production, selling their produce at wholesale, not even dressing their poultry. As a matter of historical fact the men buying and shipping the poultry of a district are the most important factors in the development of the poultry interests of that district.[1]

Collection and distribution of poultry products. The trade in poultry products proceeds along lines generally parallel to and sometimes coincident with the movement of other provisions.

Eggs. A poultry keeper producing more eggs than his family can consume naturally looks in his vicinity first for an outlet for his surplus. If he is in a community where a considerable proportion of families do not keep poultry, he may easily sell all that he has direct to consumers, perhaps getting a premium for his eggs as strictly fresh. If the eggs are sold at the door, or if the producer can deliver them without devoting an appreciable amount of time especially to it, the cost of delivery need not be considered. The quantity of eggs which can be disposed of to consumers in this way is usually very limited. Larger quantities may be disposed of direct to retailers, or to hotel, restaurant, and soda-fountain trade, at correspondingly high prices and with little expense for delivery, though the trade of this class is not as large as is usually supposed, these places generally using much larger quantities of candled than of strictly fresh eggs.

When a community produces a surplus of eggs, only those poultry keepers producing in such quantities that they can make

[1] This is true both as to the industry at large and as to special branches in limited districts. Poultry packers throughout the West have for years worked systematically to induce and help farmers to improve their poultry. They have made it a practice to select the finest market-type cockerels from the poultry brought to them and to sell these to persons bringing them poor poultry. They have even bought thoroughbred cockerels of good utility types and exchanged with farmers on the basis of prices paid them for ordinary stock. For years some large packing plants made a practice of advertising, a week in advance, the prices that they would pay for poultry, thus insuring the seller against a fall in prices while his stock was en route. On a smaller scale the same thing was done by buyers in the South Shore district of Massachusetts. The buyers there not only distributed good breeding males but in every way endeavored to aid the producers to make a first-class product and to dispose of it to the best advantage, paying at their doors the highest price that they could give for poultry, not the lowest that the producer could be persuaded or forced to take. Under such circumstances the producer could give all his attention to making the product, knowing that as fast as it was ready for market, the buyer would take it off his hands, and his final profits would be much larger than if he had sold to consumers direct.

frequent periodic shipments in case lots can, as a rule, afford to ship their own eggs.[1] In such circumstances it becomes necessary that some should collect and ship the eggs of others. The collector may be himself a producer; this is most likely to be the case in communities within easy shipping distance of a large market. At other points the volume of poultry products to be handled usually determines whether the collector will handle poultry products exclusively or with other lines of produce. If the poultry production of the community is small, the eggs are likely to be taken in bulk at the grocery or general store, packed in cases, and sent either direct to a large receiving center or to an egg and poultry packer at a nearer point. If the community produces enough surplus poultry products to maintain a depot for collecting them, it will have one or more concerns engaged exclusively in buying, preparing, and shipping poultry products, or in handling these with such lines as butter and cheese, — sometimes one, sometimes another line being of first importance. Many creameries handle eggs as well as milk. These various agencies handling eggs sometimes collect and sometimes are simply receivers, that being determined by local custom or by individual interest.

Most of the eggs gathered in this way go into the general market through commission houses in the large cities, but large packing houses also handle enormous quantities. Eggs going to the commission houses are sold direct to large consumers, hotels, restaurants, and bakeries, to retailers, and also to jobbers, who in turn sell to retailers. Thus, between the time when it is laid, on a western or southern farm, and the time when it comes to the table in an eastern city home, an egg may have a history as follows: (1) sold to country store; (2) shipped to nearest egg depot; (3) sent to city commission house; (4) sold to jobber; (5) sold to retailer; (6) bought by consumer; and in going from the farm to the table it may travel several thousand miles, now by wagon, now by rail, and be subjected to many handlings and one or two candlings before it reaches the end of its journey. If it goes into cold storage, or if a glut in one market leads to its being shipped to another, the number of transfers may be still greater.

[1] Exceptions are instances where a small producer can develop a small family trade in a near-by city.

To the producer (and to the consumer also) it often seems that too much of the difference between the first and last selling prices goes to middlemen and transportation companies, but taken by and large the system is adapted to the conditions and is here relatively simple, there more complex, because of the influence of distance and of the facilities for collection, transportation, and distribution on the laws of supply and demand.

As a rule, the movement of supplies from producer to consumer is as direct as conditions permit, and current prices at any point are based on the cost of the general supply at that point. In a community where a surplus of eggs and poultry is produced, the *consumer* gets a considerable part, if not all, of the advantage of nearness to sources of large supply. In or near a community which buys most of its poultry products at a distance, the *producer* should get by far the larger proportion of the last selling price of his product. In either case the situation is exceptional, and the advantage is dependent upon that fact. Where the supply of the near-by product is comparatively small, and supplies from a distance are of uncertain quantity, the average quality of the near-by product will be enough better to make it at nearly all times worth more than all but the finest lots of produce from a distance. In addition there is always, in such communities, a proportion of consumers willing to pay a premium for near-by produce of guaranteed quality, and a much smaller proportion that will pay a very large premium for strictly fresh poultry products, especially for eggs direct from the producer. The poultry keeper located where he can get this trade must figure the expense of catering to it, not in comparison with ordinary market prices, but in comparison with the best wholesale prices that he can get for the same class of goods. As a rule, it will be found that the private trade is more profitable only when it is possible to secure customers buying both eggs and poultry regularly in considerable quantities, and that selling to large retail groceries is the most satisfactory way of disposing of choice eggs in large quantities. There are, however, so many places, particularly pleasure resorts, where a poultry keeper conveniently located can get extra prices for his produce for a long season each year, that before going to this class of stores he should thoroughly canvass his opportunities for selling direct.

Live poultry is assembled for market in almost the same way as eggs. The necessity for promptly forwarding it to the point where it is to be converted into dressed poultry tends to reduce the number of persons handling it in the stages of collection. In distribution, too, there is some difference. Live poultry is retailed almost wholly, and dressed poultry principally, by meat markets, while the grocery stores handle much larger quantities of eggs than the markets. Thus poultry moves in narrower channels of trade than eggs. In districts shipping large quantities of poultry to distant markets, the poultry is likely to be delivered by producers at receiving depots,—often the same to which eggs are taken, though in many places, where the poultry-shipping season is short, the depots do not handle eggs. Elsewhere collections are more likely to be made by carts taking only poultry, or eggs and poultry, according to circumstances.

The greater part of the live poultry is dressed soon after leaving the producer, but large quantities are shipped alive to distributing points and even sold alive to retailers and consumers, for there is a large element of buyers that either want to see their poultry before it is killed, or want it killed in a particular way. In some places it is customary for the consumer to select birds from a coop of live poultry at the butcher's, and have them killed and dressed especially for him, sometimes waiting to take them away with him. Wherever there is a large Jewish population there is great demand for live poultry. Indeed, this demand is the principal factor affecting the live-poultry market. But for Jewish ceremonial requirements the shipping of live poultry farther than the first convenient killing and packing house would probably soon cease.

Dressed poultry is received at poultry depots at some seasons, particularly for Thanksgiving and Christmas trade, but is not collected as live poultry and eggs are. It would be almost impossible to adjust to the visits of the "hen cart" the fasting, killing, and cooling of the poultry of many producers along a route. Poultry dressed by the producer is (or should be) sold in advance, and the preparation and shipping timed so as to have the shipment reach its destination just when wanted.

Relative advantages of selling poultry alive and dressed. In a district where the aggregate production of market poultry is large, but the individual production comparatively small, it will usually be to the advantage of a poultry keeper to sell his poultry alive to persons making a specialty of preparing it for market and selling it, rather than to undertake to dress and market it himself. A poultry keeper anywhere must dress his own poultry for a private trade or for small, irregular orders. But wherever there is poultry enough to run a special killing plant, such a plant, in the hands of persons who will deal fairly with the producers, can dress poultry cheaper and sell it better than the producers can, and make more money for both producer and dealer. A poultry keeper outside of the area tributary to such a plant will usually find it more profitable to dress his own poultry, provided he prepares it properly and has it disposed of before shipment. Otherwise he may get no more for dressed than he would for live poultry. If the poultry arrives in bad condition he may even get less, and besides, he has had the trouble of dressing it. There are times, too, — mostly at Jewish holiday seasons, — when poultry (particularly fowls) may sell for more money alive than dressed. In general, the small producer can dress his poultry to advantage only for private trade and when the quality is choice. Small, odd lots and inferior birds will usually net him more if sold alive to a home buyer than if shipped dressed to a distant market. Selling at home, he rarely fails to get, on the spot, all that the stock is worth, and he has no further risks in connection with it. A great deal of misunderstanding in regard to this point comes from comparisons of prices for unassorted, ordinary, or inferior stock at the producing point with prices of the best stock in a distant retail market. Such comparisons, when fairly made, are serviceable, showing the advantage of producing good poultry and marketing it in first-class condition. As statements of conditions, with the inference that the producer selling his birds alive loses the greater part of the difference between the price that he received and the price that the consumer paid, they are misleading.

Feathers. Buyers of poultry sometimes collect feathers, but in many places there is no local buyer. In that case the best way to dispose of them is to get the addresses of feather buyers from provision-trade papers and communicate with them in regard to prices and instructions for shipping. These houses will buy feathers of all kinds and in any quantity.

Manure. Poultry manure was long salable (at high prices) for tanning purposes, but the use of chemicals for tanning has greatly reduced the demand for it. In some places men still make a business of collecting poultry manure, but at present prices it is worth more for fertilizer, and unless methods are highly intensive, it is more valuable to the poultry keeper for that purpose than for any other. When manure is sold for fertilizing purposes the price depends altogether on the buyer's needs and on his appreciation of its value. Poultrymen who use it on land consider it at least equal in value to the highest-priced commercial fertilizers designed for general use.

Coöperative selling of poultry products. As it relates to poultry, coöperation is in the experimental stage in America. In view of the nature of the industry, the general conditions of trade, and the difficulties in the way of any wide coöperative movement, it must be regarded as highly improbable that much will be accomplished in this direction except as a part of the development of coöperation in marketing farm products of all kinds. The situation with respect to poultry, a crop which, produced everywhere, is being harvested all the year round and yielding quite a variety of products not easily preserved, is unlike the situation in handling fall fruits harvested in a short season and stored for months with slight deterioration, shrinkage, or loss. The most that can be said of the most advanced coöperative movements in selling poultry is that they make some progress. With this it should be said that nearly all coöperative movements in this line everywhere have been subsidized either by actual government grants or through the services, as promoters, of persons compensated not by the producers but by the government or by some organization with educational aims.

A large degree of practical coöperation is attained in some poultry-producing communities, — notably in the South Shore soft-roaster district, where, it should be noted, the crop is sold within a short season. A study of conditions in such a district as this shows plainly that a coöperative selling movement will be most stable when it develops as a part of an industry largely coöperative throughout. In this case there is no formal organization or corporation. The transactions between producers and dealers are on the same basis as in the ordinary course of trade, but the producers, though independent, are all engaged in "making" the same line of goods and in trying to make their product of uniformly high quality; and the middleman, dealing fairly by them, increases his own profits, not by taking from the producer as large a proportion of the price as possible, but by making a fair division of profits and thus encouraging the extension of the industry and enlarging the volume of his own trade.

Uniformity of product is the basis of coöperative selling. Lacking this, no coöperative movement can be self-sustaining. With uniformity of product and a sufficient volume of it, there comes a strong tendency toward practical coöperation in selling, which gives the producer all the advantages that he would gain by a purely coöperative system of disposing of products. Given conditions favorable to such coöperation, the form of the selling system is of less importance than the spirit of the parties interested. The case mentioned was selected as most strikingly typical. Something of the same conditions may be found wherever a particular branch of poultry culture is followed by many persons in a community.

CHAPTER XX

PREVENTION AND TREATMENT OF DISEASE AND VICE

Hygiene and sanitation. Hygiene and sanitation are closely related topics, practically inseparable in a treatise of this kind. Hygiene relates more particularly to health and the preservation of health in creatures; sanitation relates more particularly to the maintenance of healthful conditions of environment. As the principal phases of these topics in their relation to poultry have been discussed incidentally in preceding chapters, we need here introduce only a brief discussion of the common ills and faults of poultry.

The general observance of rules of hygiene and sanitation is of vastly greater importance, both to the poultry keeper individually and in its effect on general conditions in poultry culture, than specific knowledge of the causes, symptoms, and treatments of diseases, for attention to hygienic and sanitary conditions is a general preventive and salutary measure by which we not only ward off disease but remedy most of the diseases which may be profitably treated, and keep stock in the most profitable physical condition. Correct hygiene and sanitation are a part of good practice in poultry keeping. Special consideration and treatment of diseases become necessary only when conditions are wrong or when practice is at fault. Individual treatment is usually not profitable because of the small value of the birds. In general, a knowledge of poultry diseases is directly useful to poultrymen only for the determination and correction of wrong conditions of hygiene and sanitation.

Indications of disease or of a low physical condition are, to those who can apprehend them, unmistakable signs of weakness in the stock, or improper conditions or errors in handling. General symptoms show that there is something wrong. Just what is wrong is not likely to be evident from symptoms except in cases where a symptom is peculiar to a disease or to a small group of similar disorders. When no special symptoms can be detected, the disease can rarely be positively identified, and we have to turn from the observation of symptoms to the investigation of conditions, examine systematically into matters of hygiene and sanitation, mark every wrong condition as a possible cause of trouble, and correct that condition, whether the trouble can be directly connected with it or not.

Causes of disease. The causes of disease are (1) *constitutional* (arising from defects of the organism); (2) *dietetic* (caused by improper food and feeding); (3) *environmental* (due to improper surroundings); (4) *contagious* (communicated by contact). It is not necessary to discuss these exhaustively. Only a few of the more important of each class need be mentioned. Causes of disease are not always clearly referable to one of these classes. A single cause acting independently rarely produces disease, but it may open the way for the operation of other causes. In such a case it may not be clear which is the primary cause, but that point is immaterial.

Constitutional causes of disease. Defects of the organism are of two kinds: *congenital* (or inherited) and *functional* (or spontaneous). A creature may have a constitution generally weak or defective in some respect because one or more of its ancestors had. As a rule, it will not have a sound constitution unless its immediate parents have sound constitutions. No matter how good the constitution may have been originally, it may be impaired, either at some point or as a whole, by accident, or by overworking an organ, or through any external disease-producing cause, and never regain its full tone though the conditions which caused the trouble are removed and a decided improvement follows. In such cases the functional weakness continues as a latent condition favorable to the operation of the causes of disease. The most prevalent constitutional cause of disease is debility, or low vitality, increasing from generation to generation in stocks kept under highly artificial conditions.

Dietetic causes of disease. Poor quality of food, ill-balanced rations, overfeeding, underfeeding, and irregular feeding are the principal dietetic causes of disease. As was shown in discussing the relations of methods of feeding to other factors in the management of poultry, the same ration may be, under some conditions, good, under others, bad; suitable for one bird, not suitable for another; useful for a special purpose or up to a certain point, as in fattening, but dangerous if too long continued. Poisons also are in this class of causes of diseases.

Enviromental causes of disease. Errors in locating poultry houses and yards, faults in construction and regulation of poultry houses, unsanitary conditions in houses and yards, errors in incubation and brooding, disturbances affecting comfort and regularity of life (such as rough treatment by attendants and fright by passing persons or animals), are the common environmental causes of disease in poultry.

Contagious diseases. Epidemics, as a rule, make little trouble among healthy flocks kept under good sanitary conditions. Some of the most virulent (as cholera, fowl typhoid, and bacterial enteritis) sometimes seem to be equally dangerous to all kinds of stock under all conditions, but in view of the general absence of contagious diseases from plants where conditions are good, and of the efficacy of proper attention to hygiene and sanitation in stamping out contagion, it may well be doubted whether even the germs of such contagious diseases are dangerous to poultry that are sound in constitution and living in proper surroundings. When epidemics of roup and enteritis break out, they are usually attributed to contagion, but contagion seems to be effective only when other causes prepare the way for it. Scaly leg and various skin diseases are plainly transmitted in some cases, yet in nearly all affected flocks some individuals are immune.

Symptoms of disease. Indications of disease are *general* (common to many diseases) and *special* (peculiar to certain diseases).

General symptoms of disease are of much more importance to the poultry keeper than are special symptoms, except in cases where the special symptom appears at first or at any early stage and is plainly marked, — as in skin diseases and in some throat and lung troubles. General symptoms are negative rather than positive, indicating lack of health, or of perfect health, rather than the presence of any specific disease. As control of disease depends largely upon detecting it in the first stages and promptly using corrective measures, it is of much more importance that the poultry keeper should have a keen appreciation of the signs of health, and be quick to observe any failing in them, than that he should know the pronounced symptoms of diseases, for in a large proportion of cases a disease cannot be identified by symptoms until it is so far advanced that treatment is useless or unprofitable. The general symptoms most readily marked are weakness and inactivity, a drooping attitude, and a dull color and dull expression of the head. Diarrhea is present in many cases.

Special symptoms plain to ordinary observation are head and foot symptoms, and irregularities in the actions and in the discharges of the birds. When proper allowance is made for paleness associated with inactivity of the organs of reproduction, the color of the comb is a fairly reliable index of health. A yellowish comb indicates biliousness; a pale comb is the sign of an anemic condition, and suggests examination for symptoms of enteritis or tuberculosis, or for lice; a dark comb indicates a plethoric condition, defective circulation, and sometimes congestion, as in bronchitis or pneumonia. Yellow warts on the face and comb occur in chicken pox. Yellowish-white, cheesy lumps about the eyes, nostrils, and corners of the mouth are more likely to indicate roupy catarrh. A watery discharge from the nostrils may be nothing more serious than a common cold. Neglected, such a cold may develop into roup, with thicker discharge and perhaps accumulations of cheesy matter. White or grayish patches inside the mouth, especially when the odor is very offensive, indicate diphtheritic roup. Head symptoms are particularly important, because so many of them have more than local significance. Foot symptoms are direct symptoms of local trouble, such as scaly leg, corns, and bumblefoot. To the lay observer vent discharges are very unreliable symptoms, hardly to be classed as special symptoms for him, though to a veterinary they may be very useful.

General treatment of disease. The practical and profitable way for a poultry keeper to treat disease in his flocks is by general salutary measures; birds too far gone to respond to these are rarely worth saving. Such local troubles as scaly leg, injuries like frostbite, and combs damaged in fighting, may be given attention in the case of individual birds that are particularly valuable, but for the great majority of such cases the best thing to do is to remove the cause — or the bird from the cause — and let nature work recovery. It is possible to cure a large proportion even of very serious cases of sickness in poultry by giving good *nursing* with suitable medicinal treatment, — the nursing being the more important; but it usually costs more than the birds are worth, besides monopolizing time and attention that should be given (then, more than at any other time) to careful consideration of general conditions in the flock, and to the adoption of salutary measures applying to the whole flock. An occasional case of disease has no general significance, but anything resembling an epidemic shows that some of the general causes of disease are operative. Disease on such a scale is the penalty for mistakes, and especially for neglect to keep up the constitutional vitality of the stock and to maintain right hygienic and sanitary conditions. No amount of doctoring, however effective at the time, will give permanent relief. The only advantage that a poultryman has in knowing diseases is that he knows the causes, and is thus able to follow the old medical maxim, "Remove the cause and the effects will cease." It is a matter of common remark among poultrymen that the more one doctors, the more he will have to doctor.

Injuries. Accidents cannot be wholly avoided, but damage from such causes is insignificant. Injuries due to environmental causes must be prevented by dealing with those causes as with causes of disease. One of the most important of these is crooked breastbone in fowls. Thousands of cases of this are developed by allowing young chicks to roost (by day, usually) on narrow-edged boards, on the edges of boxes and barrels, and in like places. This is not the sole cause of crooked breasts, but is a common cause which is easily avoided. Another very common injury is frostbite of combs and wattles. This is best avoided by keeping fowls that are adapted to the climate, but much can be done in the way of prevention by accustoming the birds to low temperature, by giving dry feed only in zero weather, and by giving snow or finely cracked ice instead of water when it is so cold that water freezes quickly. Warm water should not be given.

Internal parasites. Worms are the most troublesome internal parasites of poultry. The *gapeworm* infests the windpipe. It is dangerous only to young chickens. *Tapeworms* and *roundworms* of many varieties infest all kinds of poultry, being found mostly in the intestines and digestive organs. When present in small numbers they do little damage to strong, robust birds, and do not often multiply dangerously when sanitary conditions are good.

When a stock of poultry becomes badly infested with worms, the numbers of the parasites which may simultaneously attack a strong bird may be so great that its strength is of little advantage. In such cases it is advisable to kill off all stock and keep no poultry on the land for several years. Stock from a badly infected flock, if taken to new land, carries the worms with it.

External parasites. Lice are often referred to as enemies against which the poultry keeper must wage unremitting warfare. This view exaggerates the importance of direct personal efforts to keep these parasites in subjection. There are two general classes of lice, — those which live upon the birds and those which only feed upon them, remaining at other times in crevices about the roosts and nests. Neither kind does perceptible damage when present in small numbers, or multiplies too rapidly on adult birds when sanitary conditions are good, when the birds are vigorous, and when ample opportunity is given them to "dust" themselves. Some live on dead skin and feather particles. Very few birds are absolutely free from lice, even when treated regularly with insecticides.

The presence of lice in small numbers on the bodies of poultry is by some authorities considered beneficial. They rarely become seriously detrimental to any strong stock kept under favorable conditions. Treatment for them should be necessary only on incubating poultry, on young birds when very small, and on old ones when confined without opportunity to free themselves from lice. Continued necessity for fighting lice shows plainly that some other condition needs attention. It may be the vitality of the stock; it may be the sanitary conditions; it may be that, once allowed to establish themselves, the lice, though constantly fought, have never been effectively treated (this is the case especially with red mites, which secrete themselves about the roosts). For lice on poultry, dry insecticides (powdered) are used; for lice about roosts, nests, and buildings, liquid insecticides are applied freely to infested places.

Vices. The bad habits of poultry are developed almost wholly in close confinement under unsatisfactory conditions. *Feather eating*, *egg eating*, and various forms of cannibalism common among closely confined poultry are rarely seen among poultry at liberty amid favorable surroundings, and give comparatively little trouble among closely confined birds if the conditions are sanitary and the birds have something to occupy their attention. Feeding in littered floors, supplying dry ground grains in hoppers, and giving cabbages, mangels, and dried meat and fish, all help to prevent vices by giving the birds something to do and to think about. Vices once started spread rapidly. The only effective way to suppress them is by improving the conditions. Sometimes a change of quarters and the removal of the worst offenders will stop a bad habit not too firmly established. The reliable cure is right conditions and (if necessary) special attention to keeping the birds busy until they forget the objectionable practice.

PART III. REPRODUCTION

CHAPTER XXI

TYPES, BREEDS, AND VARIETIES OF FOWLS

Original type of the domestic fowl. The only known wild birds of the same species as the domestic fowl are the little jungle fowls of India and Ceylon. One of these, the *Gallus Bankiva*, is by many considered the ancestor of all the numerous and diverse races of fowls. This view rests more on argument than on evidence, and the argument is far from conclusive. The strongest points in its favor are that the jungle fowls are the only known wild birds of the species, and that the *Gallus Bankiva* closely resembles the domestic Black-Red Game Bantam. There is very little accurate knowledge of the jungle fowls. Considering the difficulty of getting full information in regard to matters more recent than the first domestication of fowls and more ascertainable than the facts as to the modern jungle fowls, the conclusions of naturalists and the rather casual observations of fanciers and others on this point, together with the few far from satisfactory experiments made in India with jungle and domestic fowls and their crosses, carry little weight with the careful student of poultry culture. On either economic or evolutionary grounds it is much more reasonable to assume that the domestic and the jungle fowls are descended from a common ancestor, probably intermediate in size between jungle fowls and ordinary unimproved domestic stock. Unlike the wild ancestors of the duck, goose, and turkey, the little jungle fowl is not economically attractive to man and does not readily adapt itself to domestication or quickly improve in economic qualities under domestic conditions. It seems to be an established fact that, in the countries that they inhabit, the male jungle fowls in freedom breed readily with domestic hens wandering from the villages. The female jungle fowl is naturally less bold in approaching human habitations, and even should connections with domestic cocks occur, the results would not be so readily observed. In captivity jungle fowls of both sexes are shy breeders, the females especially so; but to a poultry breeder familiar with many instances of the effects of changes in location, diet, and habits of life on fertility conclusions on this point drawn from wild birds in captivity and from their immediate descendants have little significance.

Economically the presumption is that with fowls, as with other poultry, the wild type as first brought into domestication was in itself desirable, and that some, perhaps the greater number, of the wild stock were of docile disposition. The desirability of such individuals would quickly lead to their domestication or extermination. The smallest and wildest specimens of the race would escape capture, or perhaps return to wild life to avoid man more carefully than before. Because of their lack of economic value he would refrain from pursuing these, but the larger or more venturesome would be constantly exposed to his attacks. The inevitable results of such conditions in a favorable environment would be the development of a race of fowls less valuable and less adapted to domestication than the original type.

Considering the case from the economic point of view, there is little reason to suppose that primitive man domesticated such a fowl as the jungle fowl of to-day. The antiquity and wide distribution of game types have led some to infer that fowls were first domesticated for the amusement rather than for the use of man, but the domestication of fowls evidently occurred centuries earlier than the earliest authentic records of game fowls. Combining the economic and evolutionist points of view, the theory that the domestic fowls of all varieties, and the jungle fowls as well, are descended from a common ancestor becomes much more plausible than the commonly accepted theory. On this theory, and considering what is known or may be reasonably inferred in regard to the differentiation of types in domestication, the original type may be constructed with sufficient accuracy to afford an initial type from which all the others have been developed. Such a type must be assumed at the outset, and the value of the assumption demonstrated incidentally in the course of the presentation of the histories and descriptions of popular types. Hence it is assumed that *the original type of domestic fowl was a bird of about the size of the partridge or the pheasant; in shape, approaching the game type yet not presenting that type as developed with pit qualities; in color, of the black-red or brown-red type; with small single comb and no superfluous plumage.*

Birds of this type are often seen in mongrel flocks showing no marked traces of the principal improved types. The general shape and size of small mongrels is probably much the same as that of the original stock, though color is more various. Even such breeds as the Leghorns, Hamburgs, and Polish closely resemble this original, except in color and superficial features.

Types of domestic fowls. The number of varieties of fowls is so great, and the development of characters so irregular, that it is not possible to make a simple classification in which the place of each variety is readily assigned. A simple classification requires that the grouping of classes be according to economic characters, which are few in number and relatively stable, rather than according to superficial characters, which are many and constantly changing. Scientific classification must be consistent. A primary classification on a geographical[1] basis is obviously absurd, leading to all sorts of inconsistencies, but regular differences in type in different countries may properly be indicated in secondary divisions. With further subdivision based on superficial characters, a classification fundamentally simple and consistent will include nearly all well-defined types.

This plan of classification gives five distinct general types of fowls, to which may be referred all but two varieties with plumage of abnormal structure, for which a sixth class is made. The basis of the classification being economic, the common economic terms

[1] The classification adopted by the American Poultry Association for the Standard of Perfection is geographic (breeds being classified according to the country in which they originated or from which they were introduced) and patriotic (American breeds being given first), but utterly unscientific and tending to confuse, not to clarify, conceptions of type. In such classification, homogeneity is wholly dependent upon chance. In some cases (as in the American class) the class is homogeneous because, on the principle adopted, incomplete; in others (as the English class) there is no homogeneity. The absurdity of such classification becomes plain when representatives of all breeds and varieties are arranged according to it. This system of arrangement is rarely used a second time at a poultry show.

FIG. 329. Aseel Game cock. (Photograph from Dr. H. P. Clarke, Indianapolis, Indiana)

descriptive of classes of fowls are used for the classes to which they apply. We have, then, the following general types of fowls: (1) game types, (2) laying types, (3) meat types, (4) general-purpose types, (5) deformed types, (6) bantams.

Game types. While, as has been said, it is not probable that fowls were domesticated for the sport of fighting the cocks, it is certain that in domestication the pugnacity and gameness of the cock led to the early development of a fighting type, possessed of great courage, strength, and endurance, of very compact form, close-feathered or short-feathered, with no superfluous appendages. Ancient records of various kinds — hieroglyphics, coins, vases — show the wide distribution of this type. From early times to within a century, cockfighting seems to have been everywhere a popular pastime. In modern times it has been outlawed among civilized and humane peoples. Though not yet wholly suppressed, even in England and America, public sentiment is so strongly against it, the risks of detection are so great, and the penalties are so impartially applied, that even the advocates of the sport recognize that it must

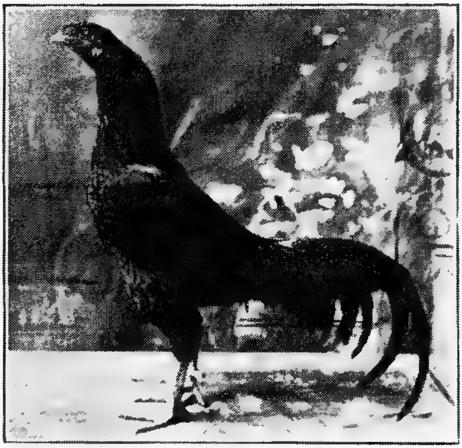

FIG. 330. Old English Game cock. (Photograph from owner, W. F. Liedtke, Meriden, Connecticut)

FIG. 331. Cornish Indian Game hen. Forest City Cornish yards, Shawnee, Oklahoma

soon cease absolutely. Whatever may be said of the humanity and morality of cockfighting, there is no doubt that indirectly the results of breeding for the pit were beneficial to poultry culture, the requirements of the cockpit compelling an attention to strength and vitality too often neglected when qualities not immediately dependent upon them are sought. As would be expected from the attention given to breeding fighting fowls, some most pronounced utility types are plainly derived through modifications of this type. After the prohibition of cockfighting some breeders developed an exaggerated game type for exhibition. The fighting types as developed in different countries vary considerably. Only the two most important, the Aseel and the English Game, need be considered here. These, with the Malay, the Cornish Indian Game, and the modern Exhibition Game constitute the game types of interest to the student of poultry culture.

FIG. 332. Front view of Cornish Indian Game cockerel. Forest City Cornish yards

The Aseel (or Azeel), "the true fighting Game of India," is a small bird very strong in frame and so short of feather that the plumage does not conceal the lines of the form as in birds with longer plumage. It combines, more than any other fowl, great muscular development with strong bone. Aseels are of various colors and have pea combs.

The English Game, by some now called *Thoroughbred Game*, is the type of fighting game familiar nearly everywhere among English-speaking peoples. It is a larger bird than the Aseel (the males sometimes weighing 6 and 7 pounds), has longer plumage, and abundant tail and hackle in the male, and is a more symmetrical bird, more alert, and generally more attractive. This race is of many colors, black-reds[1] and brown-reds being most abundant. Some stocks have been bred to a fixed color pattern, others have

FIG. 333. Three-quarters rear view of bird in Fig. 332

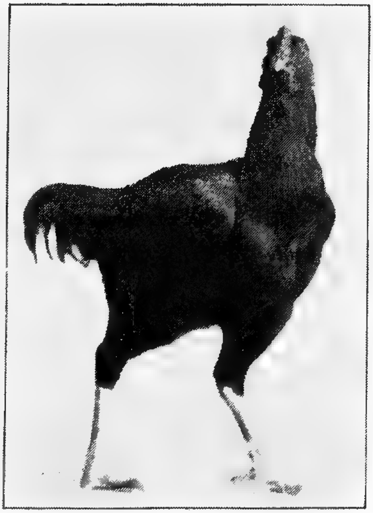

FIG. 334. Three-quarters front view of bird in Fig. 332[2]

not. The comb is small and single. But for the pugnacity of the males, which develops at a surprisingly early age, they make very good fowls for either a farm or family flock, — not as good as special utility breeds but much better than ordinary mongrel stock. The hens are good layers and especially good sitters and mothers, being noted for the courage with which they defend their young. As table fowls they are meaty but rather close-grained and hard.

[1] Short for "black-breasted red," a description applied to the cock of this color type, though as a matter of fact the typically colored male is all black except the neck and back, which are red, and would be more correctly described as "red-backed black."

[2] Photographs for Figs. 331–334 from owner.

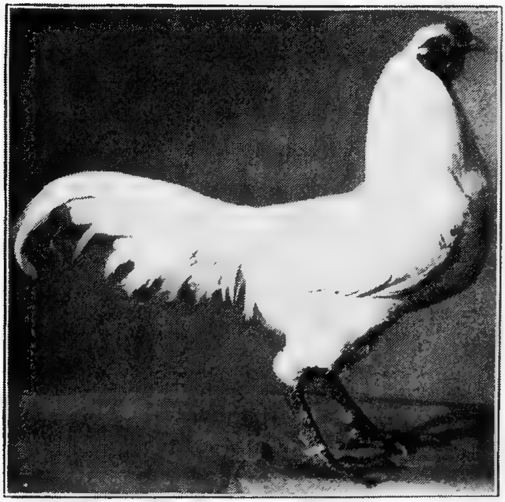

FIG. 335. White Cornish Indian Game cock. (Photograph from owner, Frank Brown, Marblehead, Mass.)

The Cornish Indian Game[1] was produced in England about 1830 to 1840, by crossing the Aseel on the English Game, and (it is supposed) was improved many years later by the introduction of Malay blood. In appearance a giant Aseel, it has little of the fighting quality of that breed. The American Standard weights are cock, 9 pounds; hen, 6½ pounds; cockerel, 7½ pounds; pullet, 5½ pounds. These weights are very commonly exceeded, cocks weighing as high as 11 and 12 pounds. Though of pronounced game type these birds are usually classed as a meat or table breed. The meat is very abundant, especially on breast and legs. They are reputed rather poor layers of small, light-brown eggs. There are three color varieties, *dark*, *white*, and *red-laced*. The dark variety are of

FIG. 336. White Cornish Indian Game hen (Photograph from owner, Frank Brown)

[1] I have retained this name as most appropriate — most suggestive of the relation of this to other types. In England the breed is known simply as the Indian Game. In America it went by that name first but later was called Cornish Indian Game; recently some breeders, hoping to increase the popularity of the breed by eliminating the term "game" from its name, have taken to calling it simply Cornish.

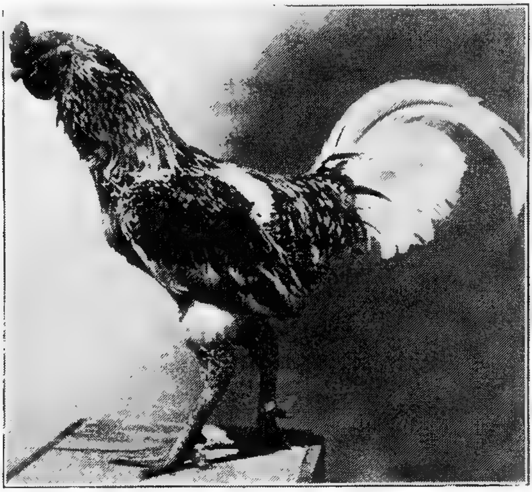

FIG. 337. Red-Laced Cornish Indian Game cock. (Photograph from owner, W. H. Card, Bristol, Connecticut)

the black-red color type, the males black and red in hackle, back, and saddle, and the females a mahogany bay penciled with black. The white variety have all-white plumage. The red-laced have plumage of white ground, edged with dark buff or red. The Indian Game is a mixture of game types from Asia and Europe. The white and the red-laced varieties were made in America.

The Malay Game is entirely of Asiatic origin. Whether the type was developed directly by selection from other Asiatic games, or by mixture with Asiatic types other than game, is not known. It is taller and less compactly built than the Indian Game, suggesting alliance with Cochins and Brahmas of the type first brought to America. American Standard weights are cock, 9 pounds; cockerel, 7 pounds; hen, 7 pounds; pullet, 5 pounds. The full-grown male of standard weight should be 26 inches high; the female, 18 inches. Malays are rarely seen in this country. Their principal interest to the student is in the suggestion of

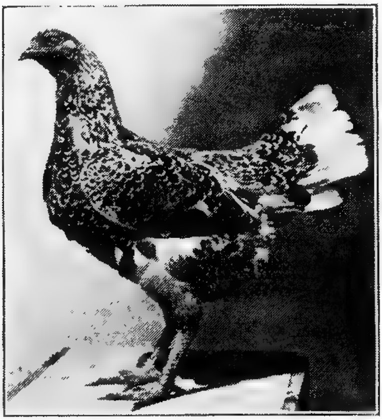

FIG. 338. Red-Laced Cornish Indian Game hen. (Photograph from owner, W. H. Card)

FIG. 339. Red-Laced Cornish Indian Game cockerel. (Photograph from owner, W. H. Card)

connection between the game type and the Brahma and Cochin types. In America they are of the black-red pattern.

The modern Exhibition Game was developed from the English type of pit game, with probably some infusion of Malay blood. The prominent characteristic of this type is the exaggerated length of neck and legs. The standard colors are black-red, brown-red, golden duckwing, silver duckwing, birchen, red pile, white, and black. In common with most other types which have some feature greatly exaggerated, they are at present somewhat out of favor with poultrymen.

Laying types. In Chapter V the term "egg type" was defined, and the Mediterranean, Dutch, and Polish groups were mentioned as illustrations of that type. These breeds are all of the same general conformation and, with a few exceptions, about the same in size. The differences between them are differences in color of plumage and skin, and in development of head appurtenances. Consideration of this type as a whole shows that geographically it is a European type, — of all Europe rather than of any part of it, though superficial characters (as would be expected) have been developed differently by different peoples, and (as will be shown) modifications in the

FIG. 340. Exhibition Game hen owned by W. H. Mudge, Westerly, Rhode Island

direction of a meat type were made in some cases. Of these breeds and their varieties, a brown Leghorn with small single comb comes nearest (and very near) the assumed initial type, and also resembles the black-breasted red game fowl. On this account, and because, also, of the extent to which indications of Leghorn blood now appear in ordinary stock in almost all parts of Europe, some suppose that the Italian, or Leghorn, is the foundation stock of all European races. This is not impossible. It is even highly probable that the Romans introduced their fowls wherever they went in the period of their conquests, and that these introductions sometimes influenced the native stock. But certain general differences in the laying type as it was developed along the Mediterranean, and as developed along a more northerly route westward, are significant, suggesting differences in ideals going much farther back than the Roman conquests. These differences will appear from the descriptions of the European breeds of the laying type. Before describing these, something should be said of their ancestry.

The early laying type. The common native stock in all parts of the world except southeastern Asia seems to have been, from earliest times, of the initial type described, having this type slightly modified, sometimes for the better, by the influence of the game type, or by careful selection for egg or meat qualities, or by good care, and sometimes for the worse by indifferent breeding and neglect, but almost invariably lacking in distinctive characteristics. Of this character, according to accounts, are most of the fowls throughout western Asia, northern Africa, and southeastern Europe to-day, and there is no evidence that they have ever been different.

Laying breeds. Along the Mediterranean Sea the fowls present a general uniformity of type not so noticeable elsewhere on the continent of Europe. The type is not only uniform but is more simple than the other European types to be considered, the more elaborate modifications of superficial characters in some of the Mediterranean breeds familiar to modern poultry keepers having been developed in breeds of Mediterranean derivation in northwestern Europe. As developed in Italy and Spain the so-called Mediterranean fowls were, and still are, very like what would naturally be developed from an initial type (such as has been assumed), under the climatic conditions found there, by people paying little attention to either meat qualities, fighting qualities, or color markings. The most striking peculiarity of these fowls was a large, fleshy single comb, not always present in all individuals of any of the breeds, but often highly developed in specimens of them all.

From Turkey westward through southern Russia, Germany, Holland, Belgium, and France, fowls of the same general body type and simple furnishings were common, but among them there appeared, in large numbers in some localities, and in occasional flocks almost everywhere, two other conspicuous types, — a rose-combed type and a crested type, in both of which were developed more elaborate color patterns than were found among the fowls along the Mediterranean. The sharp differentiation of color patterns and the high development of other features are the work of the modern fancier, but though we have little accurate knowledge of the earlier history of the breeds which he took in their crude form and developed, what we have indicates that the separation of types began very early in the westward movement of the human race, and that interest in the manipulation of form and color in poultry must have been from earliest times, as to-day, more intense in the Teutonic than in other branches of the race. Breeds of this type were early developed in France and England, modified especially for meat production but still unmistakably like the common type. In almost every country of Europe there are breeds of this same body type but unlike in such characters as comb, crest, color, etc. Most of these are hardly known outside of the countries or districts where they are found, and there is little authentic information about their origin and history. In discussing the laying breeds the familiar ones will be considered first, quite fully and in the order of their apparent relation to the primitive type. The unfamiliar ones will be treated very briefly, to show the extent and variety of the class.

The Mediterranean division of the laying type. The Mediterranean group has now two principal subdivisions, the Italian and the Spanish. Just how far characteristic differences between Italian and Spanish types are due to selection and modification in modern times is uncertain, but it seems probable that differences in color of plumage, skin, and feet are race characteristics. As found to-day in their native countries the fowls of Spain are, on the whole, larger than those of Italy. The most significant general difference between them is the color of skin and legs, the Italian fowls having a yellow skin and leg (the Black Leghorn, yellow and black), while the Spanish have white or gray skin with flesh-colored or slate-colored legs. In Spain there seems to have been, for a long time, a decided preference for black plumage, and that is said to preponderate in the native breeds there to-day. In Italy little attention seems to have been given to differentiating color types. Most of the modern varieties of Leghorns have been produced in America and England from Italian foundation stock.

Leghorns, as Italian fowls are called [1] in this country and among English-speaking peoples generally, are said to have been first introduced into America in 1835. Those first brought here attracted little attention. In 1853 another importation was made, and developed some interest in the type. Subsequently a few more lots were brought from Italy, but, so far as known, importations were not numerous, nor was the total number of birds imported large. In the early importations were brown, white, buff, and black specimens, and possibly other colors, but only the brown, white, and black varieties were developed from stock brought in at this period. As introduced from Italy the Leghorns had generally, if not exclusively, single combs, and that type of comb has, from the time of their introduction, been far more popular than the rose comb developed (as is generally supposed) by infusions of Hamburg blood. The ear lobes in the first imported stock were red or partly red.

In size the ordinary Leghorn is small. No standards of weight have been established. Average specimens weigh, at maturity, males, from 4 to 4½ pounds; females, about 3 pounds. The largest individuals in average flocks exceed these weights, and when bred for size the average is easily increased from 1 to 2½ pounds. Occasional specimens weigh more, sometimes equaling in size the average of the middle-weight breeds.

The American Standard type of Leghorn is a finely modeled, graceful, sprightly fowl, with the characteristic large comb, wattles,

[1] Because introduced from the port of Leghorn.

FIG. 341. Single-Comb Brown Leghorn cockerel, Grove Hill poultry yards, Waltham, Massachusetts

and ear lobes of the Mediterranean class, and of size and form appropriate to the style of the bird. The ear lobes are white or creamy white in color. While the body plumage is not as short as that of game fowls, the race is close feathered, with large wings and tails. The shanks and feet are smooth, the number of toes normal,—four on each foot.

The English type of Leghorn is larger than the American, and meatier, approaching the Dorking type, while large Leghorns on the lines of the American type are more like Minorcas in shape. The varieties of Leghorns take their names from the colors of their plumage, the subvarieties from the form of the comb.

Brown Leghorns (single-comb and rose-comb) have the black-red color pattern. The early Brown Leghorns were quite light in color, and were sometimes called red.[1] The American Standard exhibition male has the red very rich in tone, with hackle and saddle feathers cleanly striped with black. Females of like breeding, the natural color mates of such males, are very dark brown, their darkest shades often black or nearly so, and

FIG. 342. Single-Comb Brown Leghorn pullet, Grove Hill poultry yards, Waltham, Massachusetts

[1] As recently as the early nineties I have heard the name "Red Leghorn" applied to ordinary Brown Leghorns.

not to be compared in beauty of color with the exhibition female. The Standard female has a ground color of light brown, with black tail, dark-brown flight feathers, a fine stippling of dark brown on the back and wings, the breast salmon and the hackle orange yellow with black stripe. The male of the same breeding is very much lighter in color than the exhibition male, — a lighter red, usually with less striping in the hackle and saddle, and the black of the breast and body more or less mottled or bronzed with red. In reality the Brown Leghorn has two color varieties, dark and light. The Standard describes the male of the dark and the female of the light variety, and these are shown together in the exhibition pen. They are chosen, not as matching in color, like the exhibition Barred Plymouth Rocks, but as showing the finest color developments in the different sexes. Brown Leghorns are sometimes bred to secure standard specimens of both sexes from the same mating, and when so bred, in time give a third intermediate color variety, specimens of which often closely approximate Standard requirements, though in general they have little chance of winning in competition with birds of the other lines.

FIG. 343. Rose-Comb Brown Leghorn cockerel. (Photograph from owner, W. W. Kulp, Pottstown, Pennsylvania)

Buff Leghorns (single-comb and rose-comb). That among early importations of Leghorns there were more of the yellow, or buff, than of the brown-red shade seems certain, though little interest was taken in them at that time. Buff Leghorns were shown under that name in America in 1867, more than twenty years before the modern Buff Leghorn began to be developed in England, but they made so little impression that the variety soon disappeared, and even the fact of their existence was forgotten until records of their

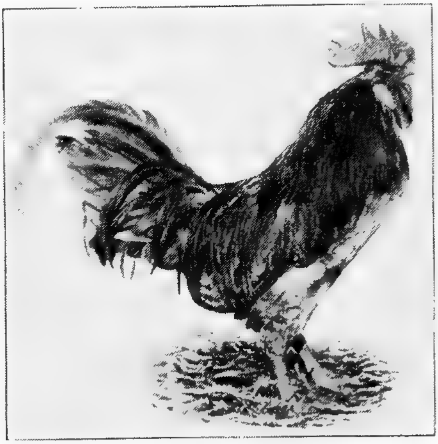

FIG. 344. Single-Comb Buff Leghorn cock (Photograph from owner, H. M. Lamon, Washington, D. C.)

exhibition were found a few years since. About 1888 the modern Buff Leghorn was introduced into England from Denmark, with the color in very crude condition. The Danish stock undoubtedly came originally from Italy, where buff or yellow birds are often seen, but of its history in Denmark little is known. It is said[1] that in England the Buff Cochin was at once effectively used to improve the color. The first birds brought to America were, with few exceptions, far from being of the uniform shade of golden buff required by the Standard. Both white and black were prevalent in wings and tail, and the males

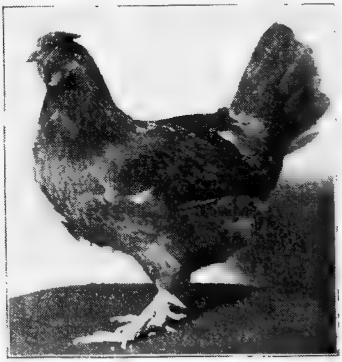

FIG. 345. Rose-Comb Buff Leghorn hen. (Photograph from owner, H. J. Fisk, Falconer, New York)

[1] Though the authority for this is good and in accord with common opinion, my own experience with Buff Leghorns leads me to doubt whether, if Cochins were used, their influence extended to all the stock or was as great as was supposed. The first importations from Denmark to England were made in 1888. The cross with the Cochin was made in that year or in the following year. The first importation to America was made in 1890. In 1893 I bought eggs of this strain, and bred it until 1899. In the seasons of 1894, 1895, and 1896 I reared, in all, about 1500 birds of this variety, and in that number no specimen appeared which at all suggested Cochin ancestry. The birds were unmistakably Leghorns, the variations in shape often suggesting an admixture of Game blood and sometimes of blood of the Sussex type, while the colors suggested combinations of White, Brown, and Pile Leghorns, and Red Sussex. It is hardly credible that undesirable Cochin characteristics could be so completely eliminated in so short a time.

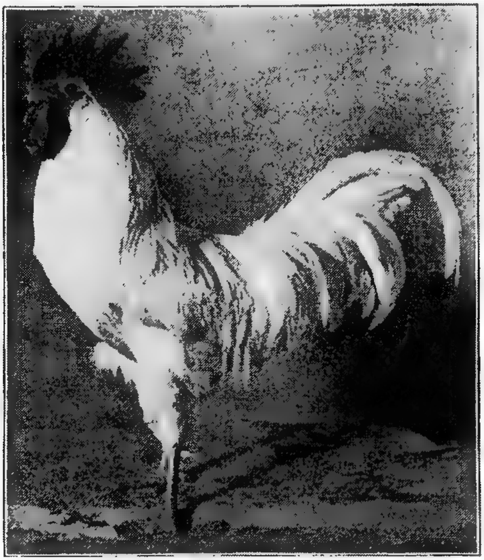

FIG. 346. Single-Comb White Leghorn cock (Photograph by E. J. Hall)

generally had reddish hackles, backs, and saddles. Though reports of exhibitions every year described males quite perfect in color, it was about 1900 before males of a uniform shade of buff were produced. The rose-combed variety was developed in America, apparently by crossing with the Rose-Combed White Leghorn.

White Leghorns (single-comb and rose-comb). The single-combed variety was developed in this country contemporaneously with the brown and black varieties, attracting less attention than the brown at first, but later becoming more popular with specialists in egg production. The color of the plumage is white throughout, — naturally a creamy white, the dazzling white seen in the exhibition room being secured (except in rare cases) only by washing or bleaching the feathers. In its relation to other varieties the White Leghorn represented the last stage in the reduction of the color of the black-red fowl of the initial type, the several intermediate stages being brown, red, buff, white.

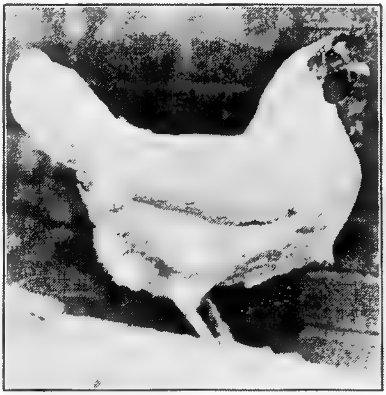

FIG. 347. Single-Comb White Leghorn hen. (Photograph from owner, Harmon Bradshaw, Lebanon, Indiana)

Fig. 348. Single-Comb Black Leghorn pullet, Turtle Point farm, Saratoga, New York. (Photograph from owner)

Black Leghorns (single-comb) have been bred in this country continuously since the early importations, but never extensively. In the dark subvariety of the Brown Leghorn and the Black Leghorn we have the stages of the intensification of color from the original type.

Mottled Leghorns (single-comb), the Anconas, are given in the American Standard exactly the same description for shape as Leghorns. They have distinctive color characteristics only. The plumage is black with each feather tipped with white, giving an even mottling of white on a black ground. According to most authentic accounts the variety came to England from Italy, and thence to America.

Note. The five foregoing are the Italian varieties, in which there is general interest in America and which are commonly seen in our shows. Other varieties of this class are seen only occasionally and in small numbers. Some observations on the relative values of these varieties, and on certain differences between them, are therefore better presented here than at the end of the list. In everything but color the Leghorns as they came from Italy were the same. In the American Standard the descriptions for shape are the same for all. Theoretically, the varieties are identical except in color, but the differentiation of a breed into varieties inevitably tends to further differentiation as the result of individual differences. In addition, introductions of foreign blood usually bring in different elements, and though the purpose of these is to strengthen a variety or breed characteristic, and foreign characters are systematically bred out by fanciers, the use of the fancier's culls, and indifferent selection

Fig. 349. Ancona hen. (Photograph from United States Department of Agriculture)

by less careful breeders, tends to give the variety as a whole more of the foreign qualities than was intended, and to create between varieties differences not in accord with the standards. Of the single-combed varieties, Brown Leghorns have had at various times infusions of blood of the Black-Red Pit Game; White Leghorns, infusions of the blood of the White Minorca; Buff Leghorns, as related, are a recent mixture; the Ancona has had infusions of Minorca blood. That the rose-combed varieties are originally indebted to the Hamburgs for their combs there is little doubt. As a result of these different infusions of blood, rose-combed varieties generally show a little more of the plumpness of the Hamburg and something of its delicacy. Single-Comb Brown Leghorns are more rugged than others, except, perhaps, the blacks. White Leghorns are generally a little larger than the other varieties.[1] White Leghorns and Anconas lay larger eggs than the others. Buff Leghorns were at first very rugged and laid a slightly tinted egg. After their first boom the breeding of this variety was left largely in the hands of a few fanciers. Though these made rapid improvement in color, something was lost in other directions.

Pile Leghorns (single-comb) have a white-red color pattern, the black in the initial type being replaced by white and the red much reduced in strength. The true place of such a combination in a color series is not readily determined. Whether such a combination could be produced directly by elimination of color is not known. The variety was made by combination, — by mating a black-red with a white bird. It is bred only as a novelty.

Duckwing Leghorns (single-comb) are of recent English origin, and are said to have been produced like Pile Leghorns, by crossing Brown and White Leghorns. This is the tolerably well-authenticated statement regarding the stock of the most prominent early fanciers of the variety. According to other versions Pile Game and Silver Gray Dorkings were crossed to produce the Silver Duckwing Leghorn. The Silver Duckwing Leghorn has a black-white color combination, the red of the black-red pattern in the male being absent, leaving white. In the female the light-brown ground becomes white, the dark-brown parts black, while the salmon on the breast remains. In the Golden Duckwings the male is of a black-bay, or buff, color pattern, the (Standard) female so like the female of the silver subvariety that, as a matter of fact, in English Duckwing Leghorns the silver females are shown with both golden and silver males, and the golden females not shown. While the Standard calls for white ground in silver

[1] This is true of general flocks; it is not so noticeable in the showroom.

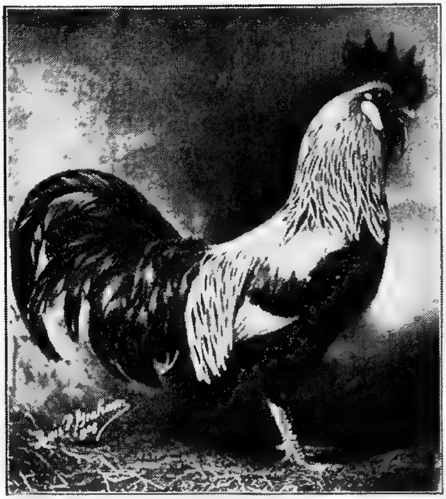

FIG. 350. Silver Duckwing Leghorn cock (Photograph from owner, Thomas Peer, Fairfield, New Jersey)

females, the variety is not well developed, and females are said to be often not distinguishable from Brown Leghorns.

Dominique Leghorns or *Cuckoo Leghorns* (single-comb) have the barred pattern and gray colors of the Barred Plymouth Rock. This color pattern is quite common in Italy. The specimens which are occasionally exhibited in this country are probably made by crosses of White and Black Leghorns, or of White Leghorns with black or barred fowls.

The Spanish section of the Mediterranean class. The Spanish group includes five so-called breeds, — Castilian, Black Spanish, Minorca, Andalusian, and Barbezieux. Of these the first- and last-named are bred only in Spain; the others in their modern form are largely the result of English breeding, though it appears that in one case the development of particular characters was begun on the continent side of the English Channel. As already noted, the conspicuous differences between the Spanish and Italian races are color of skin and legs, and the general Spanish preference for black plumage. While designated as different breeds, these Spanish fowls are properly varieties of one breed.

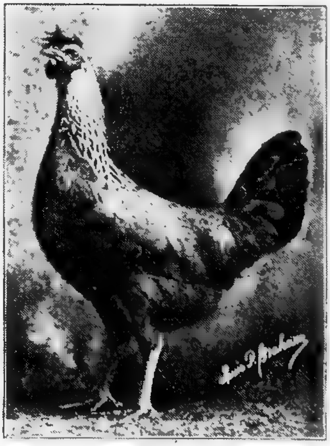

FIG. 351. Silver Duckwing Leghorn pullet. (Photograph from owner, Thomas Peer)

Originally all were single-combed (as they are still in Spain), the rose-combed subvarieties having been made recently in America.

Castilian fowls are in appearance unimproved Minorcas. They are supposed to be the original breed from which the others are derived. According to tradition they were brought to Spain by the Moors at the time of the Moorish invasion. If that could be established, it would indicate a third line of movement of fowls from the starting point across northern Africa. Such traditions, however, are most unreliable, and in a broad survey of the movement and development of these races it appears far more probable that the Spanish races were developed from the Italian. The difference in color of skin and legs is no obstacle to this theory, for yellow-skinned races produce many individuals with white skin, and popular preference for black fowls would lead to the establishment of white or gray skin and dark legs as race characteristics. The Castilian fowl is in size between the Leghorn and the Minorca, with color of skin and shanks like the Minorca, while the comb is more of the Leghorn style, and the ear lobes are white tipped with red. Black is the preferred color, but there are also whites and mixtures (especially the darker shades) of black and white. Castilian fowls, particularly the black, were introduced into England and Holland several centuries ago, and from them came the two varieties next described.

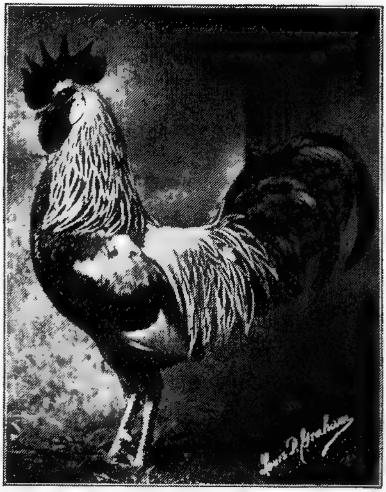

FIG. 352. Silver Duckwing Leghorn cockerel. (Photograph from owner, Thomas Peer)

Minorcas (two color varieties, black and white, single-combed and rose-combed subvarieties of both) were long called Red-faced Spanish. English breeders made the Minorca, as afterwards they made their Leghorns, more on meat-type lines, — made it larger and heavier; and the fanciers breeding for exhibition carried the

FIG. 353. Single-Comb Black Minorca cockerel[1]

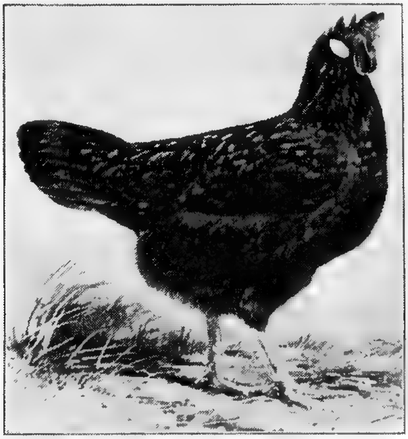

FIG. 354. Single-Comb Black Minorca pullet[1]

development of the comb to such an extent that it became a monstrosity and an impediment. The American Standard calls for a bird of finer type, yet distinctly larger than the Leghorn and with a relatively larger comb. To maintain the size, the following standards of weight were established: single-comb black: cock, 9 pounds; cockerel, 7½ pounds; hen, 7½ pounds; pullet, 6½ pounds; rose-comb black and single-comb white: cock, 8 pounds; cockerel, 6½ pounds; hen, 6½ pounds; pullet, 5½ pounds. Black cock birds over 10 pounds and hens over 8 pounds in weight are frequently produced. In general outlines the Minorca, as distinguished from the Leghorn, is an enlargement of the type, showing more straight lines and angles, because of its greater size. It is generally conceded that Minorca eggs average larger than those of any other race of fowls. Minorcas are quite as prolific as Leghorns. The ordinary Black Minorca stock is distinguishable

[1] Photographs from owner, Dr. Howard Mellor, Spring House, Pennsylvania.

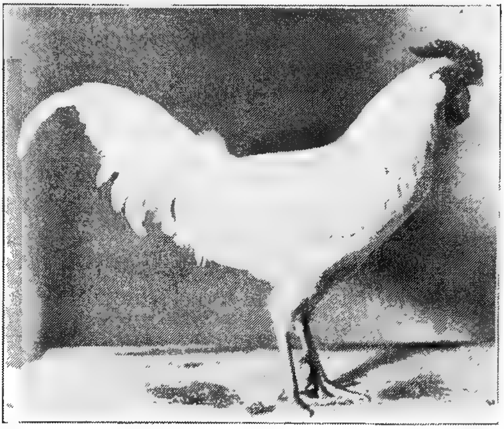

FIG. 355. Rose-Comb White Minorca cockerel (Photograph by Eugene Hall)

from the Black Leghorn only by the color of the skin, and (usually, not always) by its slightly greater size. Much of this stock is mixed Leghorn-Minorca. Instances have been known of breeders advertising Black Leghorns and Black Minorcas and shipping both from the same lot. Comparisons of Leghorns and Minorcas based on presumptive constitutional breed differences are fallacious. Practically there is no difference between them. The Black Minorca has been commonly preferred to the Black Leghorn wherever a black fowl of the laying type was wanted. On the other hand, where a white fowl of this type was wanted, the Leghorn has been given preference, and, as in the case of the black varieties, the White Minorca has been used to give size to the Leghorn.

FIG. 356. Single-Comb White Minorca hen (Photograph from owner, H. J. Teetz, Gloversville, New York)

The typical American Standard Minorca is usually more docile than the Leghorn, less able, because of its excessively large comb, to stand low temperatures, and ordinarily less rugged, though that is largely a matter of the handling of the stock. The rose-combed subvarieties in both Whites and Blacks are usually of slighter build than the single-combed birds. Black and White Hamburgs are supposed [1] to have been used to get the rose combs.

Black Spanish (single-comb), often called White-Faced Black Spanish, have the same weight standards as White Minorcas, and differ from Black Minorcas principally in the head furnishings. The comb and wattles are smaller, more of the Leghorn style. The white face which is the peculiar characteristic of the breed was produced by enormously developing the face and ear lobes, — a less marvelous accomplishment than at first thought appears, for

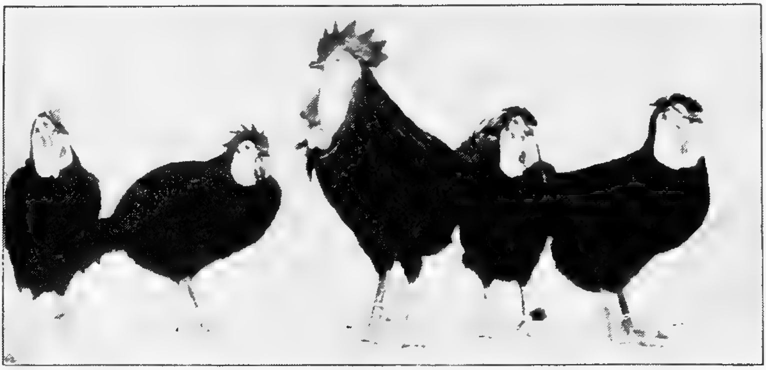

FIG. 357. White-Faced Black Spanish. (Photograph from owner, J. H. Warrington, Cornwall, Ontario)

all fowls with large combs and white ears tend naturally to develop white faces and large ear lobes and wattles. This Spanish variety has been bred in Holland and England for several centuries. The white face is said to have been developed first in Holland, but English fanciers are credited with the extreme development of it. The Black Spanish was introduced into America and became well known before the Leghorns and Minorcas. For a long time it was quite popular, but it always had the reputation of being delicate. The enormous white face was easily injured and was subject

[1] The originator of the Rose-Comb Black Minorca declared that he had developed the rose comb by selection, beginning with single-combed birds with side sprigs. Experienced breeders are decidedly skeptical about this. One remarked to me, "He was foolish if he did, for it would be quicker, easier, and better to cross with Black Hamburg."

to skin diseases, and after the Leghorns and Minorcas became known, the Spanish gradually disappeared.

FIG. 358. Blue Andalusian cock

White-Faced White Spanish came occasionally as sports from the black variety.

Andalusians (single-comb and rose-comb) were first known as the Blue Minorca. The color of the female is a slaty blue laced with darker blue. The color of the male is the same as that of the female on breast and body, with wing flights blue, and the hackle, back, saddle, and tail blue-black. This color is produced sometimes (not regularly) by crossing black and white birds, and in reproduction continuously produces some black and some white, as well as blue, specimens. In size and shape the Andalusian is between the Leghorn and the Minorca. As usually bred it is more of the Leghorn than of the Minorca type. American Standard weights are cock, 6 pounds; cockerel, 5 pounds; hen, 5 pounds; pullet, 4 pounds. The Andalusian has long been known in England, but is a comparatively recent arrival in America. Here it is a favorite with a few, but is not generally popular, because of the uncertainty of color in breeding.

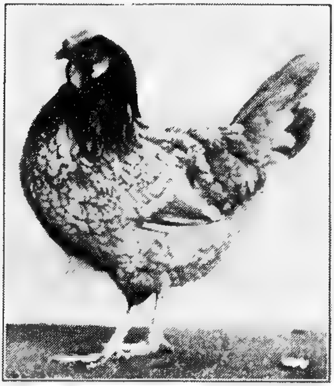

FIG. 359. Blue Andalusian pullet

Other races of the Mediterranean type. Throughout Europe there are many races like the Mediterranean (especially the Leghorn) type in form and size but unlike it in the color of the skin; and though in many cases their resemblance to the Leghorn type is striking, on the whole they seem more closely allied to the Hamburgs and Polish. The breeds which may be considered quite distinctively Italian in origin are the *Magyar* of Hungary and the *Lakenvelder* of Germany. The Magyar is said to more closely resemble the native Italian fowls than do the Leghorns of England. The color varieties of the Magyar are black, red, yellow, white, and speckled. The variety called red is the Brown Leghorn with red ear lobes. The Lakenvelder is a fowl of the Leghorn type, with an ermine color pattern in which the black is more prevalent than in the varieties of the Asiatic and American classes having that pattern. It is a new arrival in America and seems to be growing in popularity.

Mid-European laying types. The modern types of the central European races of fowls, as known in America, have been received principally from England, after having been modified to conform to English ideals. To appreciate fully the relations of the Mediterranean and mid-European types it is necessary to study the latter as they were before being taken in hand by British fanciers. These races may be divided into two general classes, the familiar representatives of the classes being the Hamburgs and the Polish.

The *Hamburg* as developed by fanciers is a rose-combed breed, the shape of the comb being considered a breed character. As first brought to England they had both rose and single combs, as the native stocks on the continent of Europe from which the modern exhibition Hamburgs were originally derived still have. In these stocks, indeed, the single comb is the more common and is regarded as most typical. The color of skin and legs is thus the only general character distinguishing this mid-European type from the Leghorn, and as in this character it is like the Spanish races of the Mediterranean class, it is apparent that the idea of fundamental breed differences between these races has no real foundation.

The *Polish* races present, with body type similar to that of the other races that we have been considering, a very different development of head appurtenances. The comb is split, V-shaped, and very small, and the wattles and ear lobes are of corresponding size. These head embellishments, so conspicuous in the other representatives of the laying type, almost disappear in the Polish. They

FIG. 360. Lakenvelder hen[1]

FIG. 361. Lakenvelder cock[1]

are often almost invisible in the mass of feathers by which they have been largely displaced. On superficial consideration and slight acquaintance with poultry types it seems that in this Polish race,

FIG. 362. Lakenvelder cockerel[1]

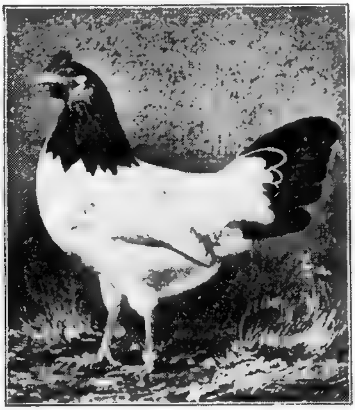

FIG. 363. Lakenvelder pullet[1]

if anywhere, we have a distinctive breed (shape) character, plainly differentiating it from breeds with large combs and wattles and no special development of feathers on the head; but, as in the

[1] Photograph from owner, Ralph C. Greene, Sayville, Long Island.

case of the Hamburg, to find the true relation to fowls of similar body type we must go to kindred and earlier forms. As has been shown, the Hamburg races are allied to the Leghorns on the one side, and on the other side are undoubtedly akin to the crested Polish type. Among the progenitors of the modern Hamburgs crests and feathered legs were not unknown; the Polish of three hundred years ago (as shown by paintings of the time) had crests, beards, and sometimes quite heavily feathered legs. Indications (not sure but none the less significant) point to a movement of ancestors of this type from central Asia by a northerly route through Siberia, Russia, and Poland to Germany, France, England, and America. This will be brought out in the special descriptions. Considering large combs (large flesh or skin developments) and large crests (large feather developments) as racial characters, it should be noted that they are not essentially distinct characters, but different developments of the same part, and that while great development in one direction is not compatible with great development in the other, more moderately developed combs, crests, and beards may be equally prominent features of the same head.

While there are some slight indications that the rose comb may have come directly from the single comb before or shortly after the importation of fowls into southeastern Europe, and that the rose type was preserved by preference in a considerable part of the poultry in a strip between that occupied by the single-combed type on the south and that traversed and in part occupied by the crested type on the north, on a general view of the types and from what can be learned of their development it seems at least as probable that rose combs came occasionally from the mingling of the single-combed and crested types, — not necessarily from a direct cross, but from some combination. For centuries the races have been in contact in central and western Europe. The crested type reached northern Italy and was established in one locality there, but on the whole found little favor along the Mediterranean; but from Germany west the country was a veritable melting pot of the southern and northern races.

Campines. A small, active race of fowls, which has been for centuries the common stock of the Campine country in Belgium, has been given the name of that district. It is thought by some

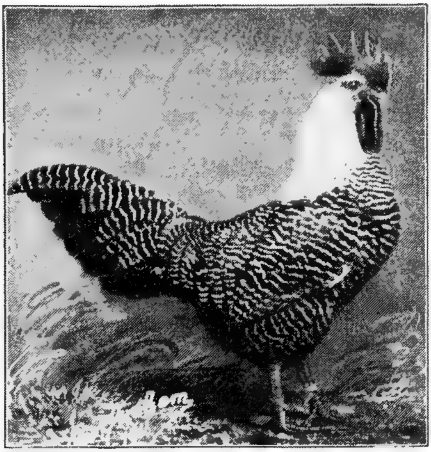

FIG. 364. Silver Campine cockerel, owned by M. R. Jacobus, Ridgefield, New Jersey

that the stock may have come from Turkey, birds of exactly the same description having been observed there by Aldrovandus. Belgian tradition dates the race in Belgium as far back as the early part of the thirteenth century, four hundred years before Aldrovandus. If this tradition is true, it would appear that the race has been bred, in close conformity to the present type, for at least seven hundred years. Campines are about the size of ordinary Leghorns, and are typically single-combed, though it is said that rose combs sometimes occur. Their resemblance to Penciled Hamburgs is so great that a fancier, seeing the birds and not knowing what they were called, would unhesitatingly describe them as Single-Combed Penciled Hamburgs. There are two color varieties, Silver and Golden. In the former both the male and the female are finely barred (or penciled) with black and white, with white hackle. The tail of the male is black with small coverts more or less barred or penciled. The Golden variety has the same pattern as the Silver, with the white replaced by bay. About 1890 they were introduced into England, and shortly after into America, where interest in them proved very short-lived. Though developed more on Leghorn lines and with fixed color pattern, the Campine as first

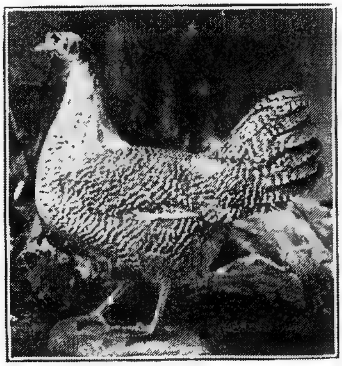

FIG. 365. Silver Campine pullet, owned by M. R. Jacobus. (Photograph by F. L. Sewell)

introduced was in other respects very like the little half-wild mongrels which constituted the mass of American native stock prior to the introduction and development of improved stocks. Within a few years there has been a marked revival of interest in the Silver Campine in America, due to the introduction of stock much larger than that of the early importations. This stock is really an English type of the Campine, bearing the same relation to the Belgian type as the English-type Leghorns and Minorcas do to the lighter-weight American types of those breeds. The color, too, has been slightly changed. The males of the first stock brought to this country had saddle feathers of the same colors as their hackles.

Friesland fowls. In Holland there has existed for centuries a race called Friesland, which is evidently closely allied to the Campine. The leading color varieties are the same, but in addition the Friesland has yellow-penciled (yellow and white), white, black, and cuckoo varieties. Rose-combed fowls of this race were developed as a separate breed with the name "Hollanders," and are believed to have been used for foundation stock in making the penciled varieties of the modern Hamburg.

Hamburgs, as known in England and America, are usually small, rose-combed fowls of the laying type, with gray skin and clean, slate-colored legs. The rose comb on the small laying type is the basis of formation of the group. Although in the American Standard the shape is described in the same terms for the six varieties, — Golden-Spangled, Silver-Spangled, Golden-Penciled, Silver-Penciled, Black, and White, — some of these varieties differ typically in shape, as would be expected in birds of the same general type but different ancestry. The name "Hamburg" was given in England about the middle of the last century to all the then-known rose-combed varieties of fowls of this body type. This name is said to have been selected because Hamburg was the chief port from which fowls of this type were imported. This report of its christening does not accord with commonly accepted English accounts (to be noted shortly) of the origin of the breed, particularly of the Spangled and Black varieties.

Penciled Hamburgs (Golden and Silver) were apparently derived from the same stock as the Campine and Friesland fowls.

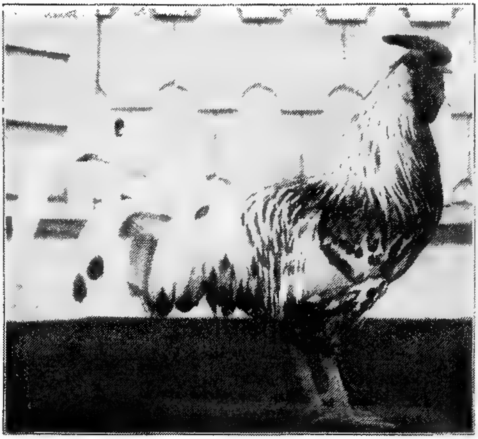

FIG. 366. Silver-Spangled Hamburg cock[1]

As "Dutch Everyday Layers" they were known in England a hundred years ago. Even as late as the middle of the last century they appeared in the London market direct from Holland. They have the same colors as the continental races mentioned, except that the golden variety has a black tail.

Spangled Hamburgs (Golden and Silver). According to some English authorities Hamburgs were a British race of fowls bred in the north of England for centuries. Considering the constant communication between the island and the continent, it may well be that, though bred in England for several hundred years, they were of foreign origin, and the stock perhaps kept up by frequent importations. Certainly a comparison of the color patterns of fowls as developed in different parts of Europe indicates that these varieties must have originated where all the other novel styles of markings did. English breeders and fanciers may be credited with having improved and perfected these markings and also those of the penciled varieties, but it seems altogether improbable that they originated them. In size

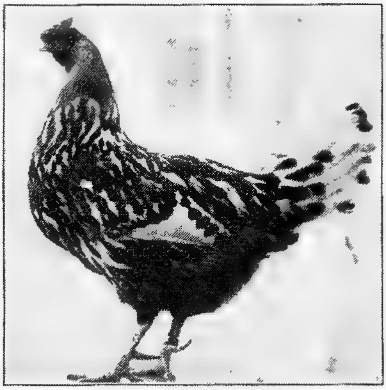

FIG. 367. Silver-Spangled Hamburg hen

[1] Photographs of Silver-Spangled Hamburgs from owner, Dr. J. S. Wolfe, Bloomfield, New Jersey.

the Spangled Hamburgs in America are usually larger than the others; they are also plumper-bodied, suggesting kinship to the Polish. The plumage of the golden variety is a dark bay ground with a black spangle at the tip of each feather, except that the hackle and saddle of the male have a black stripe and the tail is black. The silver variety has black spangles on a white ground throughout.

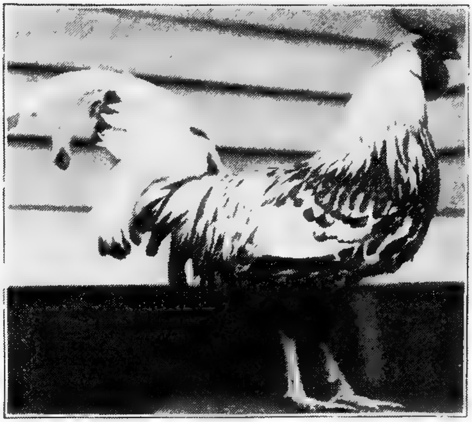

FIG. 368. Silver-Spangled Hamburg cockerel

Black Hamburgs. The Black Hamburg was probably made in England by crossing the Black Game on the Golden-Spangled Hamburg.

White Hamburgs. The White Hamburg is said to have been produced in America by systematic breeding of the lightest-colored Silver-Penciled Hamburgs.

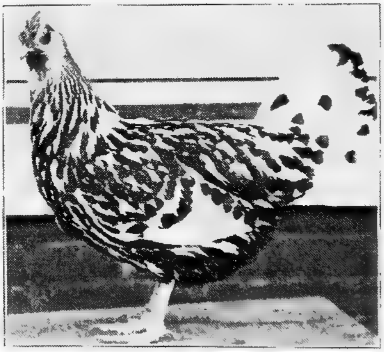

FIG. 369. Silver-Spangled Hamburg pullet

NOTE. Before the Leghorns became known in America, Hamburgs were quite popular, sharing with other known races of the laying type the favor of those who preferred fowls of that type. In disposition they are more nervous than the Leghorn and less easily restrained. In general they have been considered as good layers as Leghorns though producing smaller eggs. The numbers kept now are not sufficient to afford any reliable indications of differences in laying properties in the varieties of Hamburgs, if there are such differences. The spangled varieties, particularly the silver, are very plump and meaty when matured. With a great deal of merit, they are still inferior to the Mediterranean races of their type, and have generally been displaced by them except as they are bred by fanciers for their color and style.

Primitive crested types. An Asiatic laying-type fowl known as the *Siberian Feather-Footed* is found in Russia. Almost nothing is known of its history, except that at present it is a native Siberian race. If, as some suppose, it is a very old race, it becomes doubly interesting as the possible progenitor, or closely related to the progenitor, of the Polish and Hamburgs. It is larger than the ordinary Leghorn (the males weighing about 6 pounds and the females from 4 to $4\frac{1}{2}$ pounds) and has the full form, large wings, and (in the male) flowing tail of the Polish ; it has feathered legs and a small rose comb, behind which is a small crest; it is bearded and in color is generally white or cuckoo.

Pavloff is the name of a Russian race, akin to the foregoing and possibly derived from it, which greatly resembles the Polish. This race is found throughout Russia and in Poland. It has the forked comb and crest of the Polish, and the principal varieties, the Golden and the Silver, have the colors and color pattern of the Spangled Hamburgs. While the two color types mentioned are best established, and are regarded as "pure," there are blacks and blues, regarded as varieties, and a great variety of unestablished color patterns. The race has not been studied as it should be before any positive conclusions as to its relations to other races are drawn, but in it and the foregoing are found (as nowhere else) suggestions of most of the characteristics of native European races of poultry not plainly derivable from Mediterranean and Game stocks.

For a long time after their introduction into England, *Polish* were called Polands or Polanders. The White-Crested Black Polish seem to have come first from Holland ; and, considering what is known of the distribution of the type, it may reasonably be supposed that their present name was the one which they bore on the Continent, and which indicated the country of their supposed origin.[1] Interest in this variety no doubt led to the introduction of others, the general type (as has been shown) having been common on the

[1] Various explanations of the name are given on the theory that the race did not come from Poland. One is that the name was given because of a fancied resemblance between the crest and the cap of the Polish soldier ; another, that "Polish" is a corruption of "polled," and that the intention was to describe them as polled fowls, — an absurd explanation, since the type is quite the reverse of polled, but it has been seriously given times without number.

continent for centuries. Polish are as large as medium-large Leghorns, but are of plumper form and shorter in the leg. In disposition they are quiet and gentle. The crest, when extremely large, obstructs the sight and is in other ways a burden and a nuisance, making it necessary to give the birds special care in wet weather. When moderately developed, it is not detrimental and, to eyes to which the symmetry of the bird as a whole seems more important than the extreme development of this feature, may seem quite as handsome as the larger crest. Like the Hamburgs, Polish were in favor as layers until supplanted by the Leghorns. The American Standard recognizes five color varieties, in three of which there are subvarieties distinguished as bearded or nonbearded.

FIG. 370. White-Crested Black Polish (Photograph from owner, Lionel Lincoln, Jr., Fall River, Massachusetts)

White-Crested Black (nonbearded), fully described as to color by the name.

Golden (bearded and nonbearded), plumage golden bay, each feather laced with black.

Silver (bearded and nonbearded), plumage white, each feather laced with black.

Buff Laced (nonbearded), plumage buff laced with white.

White (bearded and nonbearded).

Polverara is the name of a crested race (allied to Polish) found in the province of Padua, Italy, which is probably an offshoot of the main stock. This race seems to have been somewhat widely known long before the Leghorns attracted notice. The name "Padua" was often applied to Polish fowls and is the general name still given them in western continental Europe.

European meat types. The European market types of fowls might, perhaps, with equal accuracy be called general-purpose types, but so much more attention has been given to perfecting table quality in them than in the familiar races of the general-purpose type that "meat type" seems the more appropriate designation, especially for those varieties made from European stocks without recourse to the Asiatic blood used in making American general-purpose breeds. These European meat types have usually been made by developing the size and meat qualities of the laying types, — in some cases by selection and feeding, oftener by crossing, but nearly always with the shape of the laying type preserved. This is not apparent when the largest, best-meated, and fattest of the meat type are compared with the ordinary specimens of the laying type, but comparison of large birds of the laying type with medium-sized or small ones of the meat type in the same condition of flesh will show that their normal lines are much the same, even though their dimensions differ. "Meat type," however, means more than form carrying abundance of meat. Quality of meat and tendency to fatten readily are fully as important as shape.

FIG. 371. Bearded Silver-Spangled Polish. (Photograph from owner, Lionel Lincoln, Jr.)

English meat types. There are three English meat types. The principal one (and the one most distinctively English) is that of which the Dorking is the favorite, though perhaps not the earlier type. This type is plainly related to the Mediterranean laying type. The others are the Indian Game (already described as a modification of the Game type still retaining pronounced Game character) and the Redcap (a meat type of the Hamburgs). The English have made one or more meat breeds of each of the conspicuous early modifications of the initial type of the domestic fowl, and, as we saw in the case of the Leghorn and Minorca, and shall find in the modern general-purpose type, the English tendency is to develop the meat qualities rather than the laying qualities in fowls.

Sussex fowls (called also Surrey fowls), not so well known as the Dorking, are probably the progenitors of that breed. The antiquity sometimes attributed to the Dorking rests only upon a tradition of little value, and upon the recent finding, in Italy, of fowls with the characteristic fifth toe. The most authentic records (going back only a little over a hundred years) indicate that the Sussex was the earlier type. The Sussex, or Surrey, was developed as a conspicuous type, if not the predominant type, in the counties of Sussex and Surrey, which from very early times supplied a great deal of choice table poultry to the city of London. The type of the breed throughout is exactly what would be expected of Italian fowls bred for centuries for the table. It is larger and better-meated than the English style of Leghorn, is rather short of feather (suggesting occasional Game crosses), has a medium-sized single comb, and is four-toed. The predominating colors are red brown, and yellow or buff. A speckled variety (mottled red, black, and white) and a "Light" Sussex (with the color pattern of the Light Brahma) are also recognized. These are the modern varieties. The Sussex of the middle of the last century are described by writers of that time as of "all colors" and mostly four-toed.

Dorking fowls seem to have developed as a strain or race of the Sussex in the vicinity of the town of Dorking. Compared with the Sussex they present a more highly developed table type, having the fifth toe as a regular feature, and having different color patterns in the modern breed. In the middle of the last century they were of quite as many colors as the Sussex. There are three modern varieties of the Dorking, — the Silver Gray (with the black-white color pattern), the Colored, or "Dark" (a crude and somewhat irregular variation of the black-red combination), and the White. The last-named has a rose comb, is smaller than the others, and lacks much of the characteristic Dorking size, shape, and carriage. Typical specimens are not often seen in America outside of drawings. Red and Cuckoo, or Barred, Dorkings are also occasionally found in England.

FIG. 372. Silver-Gray Dorking cock. (Photograph by Graham)

The typical Dorking presents highly developed flesh qualities and relatively fine bone. The body is long, deep, wide, well rounded, with prominent breast and short neck and legs, making a massive, rather low-set bird. Following are the American Standard weights. Colored: cock, 9 pounds; cockerel, 8 pounds; hen, 7 pounds; pullet, 6 pounds. Silver-Gray: cock, 8 pounds; cockerel, 7 pounds; hen, 6½ pounds; pullet, 5½ pounds. White: cock, 7½ pounds; cockerel, 6½ pounds; hen, 6 pounds; pullet, 5 pounds. In the two first-named varieties the standard weights are often exceeded. Dorkings are generally reputed a rather tender race and indifferent or poor layers. Their good qualities are not duly appreciated because of several features which under some conditions are objectionable. The large comb makes the male especially unable to stand severe cold weather; the fifth toe somewhat impedes the movement of the feet; in America the white skin is a disadvantage.

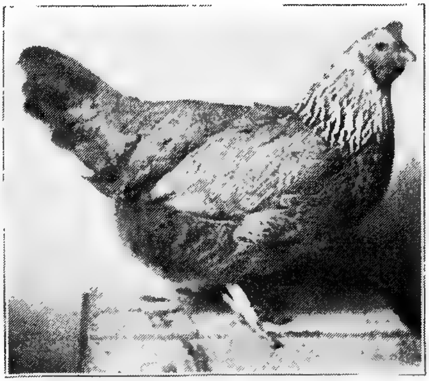

FIG. 373. Silver-Gray Dorking hen. (Photograph by Graham)

Redcaps. The Redcap is a meat type of the Hamburg developed as a once-prevalent type of poultry in Yorkshire and Derbyshire.

It is thought to have been produced by crossing the Golden-Spangled Hamburg and the Black-Red Game. In color it follows the Golden-Spangled Hamburg quite closely. The shape is what would be expected in a larger, coarser type of Hamburg, with greater breast development, due to Game blood. American Standard weights are cock, $7\frac{1}{2}$ pounds; cockerel, 6 pounds; hen, 6 pounds; pullet, 5 pounds. The comb is rose, very large, and gives the name to the breed. The skin is white, the legs slate. The Redcap has long been considered one of the best-laying breeds, equal to the lighter-bodied types in egg production, and in meat qualities superior to them, though not equal to races developed more with a view to table qualities. It is rarely seen in this country.

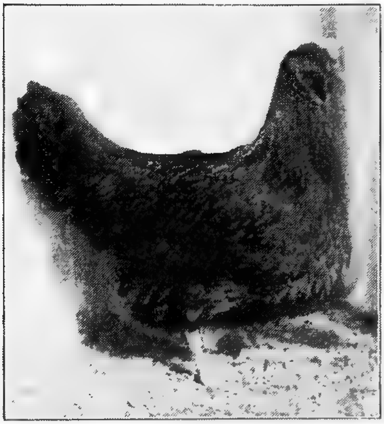

FIG. 374. Colored (or Dark) Dorking hen (Photograph by Graham)

French and Belgian meat types. The market-type fowls of France lack something of the size and substance of such English types as the Dorking and Indian Game. With some modifications of the form of the European laying types, and with occasional traces of the Game type, the class of French table fowls represents fineness of fiber in flesh and special capacity for forcing for market, rather than development of size and quantity of meat. Most of these races have been developed in the districts from which they take their names.

Bresse. In the south of France there has been developed a race called the Bresse, closely resembling the Leghorn but with a remarkable tendency to fatten. It is bred in four color varieties, White, Black, Gray, and Blue.

La Flèche. In this race we have the extreme development of meat properties on a foundation of European laying-type stock as produced in France. With weight approximating that of the Dorking, it is a higher-stationed, more stylish-looking fowl. It is thought to have been produced by a blending of Spanish and Polish blood. The color is black, and the high station suggests the Spanish. The peculiar comb, with two prongs, or horns, suggests a Polish strain. There is a similar race, Du Mans, with rose comb. The two are probably akin, but their relations are not known. The rose comb of the latter indicates a Hamburg cross. As has been shown, the Minorca (Spanish) in England and America has been brought to a large size without special development of table qualities. It may readily be supposed that Spanish stock in France, mingled with Polish and Hamburg, gave in one place the forked-combed La Flèche and in another the rose-combed Du Mans, and that in breeding for market the large size and readiness to put on flesh and fat were developed without recourse to other crosses. American Standard weights for La Flèche are cock, $8\frac{1}{2}$ pounds; cockerel, $7\frac{1}{2}$ pounds; hen, $7\frac{1}{2}$ pounds; pullet, $6\frac{1}{2}$ pounds. It is said that in France the weights often exceed 10 pounds for males and 8 pounds for females. La Flèche fowls are rarely seen in America.

Houdan, *Crèvecœur*, and *Mantes*, are similar races, the first two developed, apparently, from a Polish foundation, the other from the Polish or Houdan by blending with a single-combed type. It has been suggested that the Bresse may have been used for this. The Houdan is in appearance a black-and-white mottled, bearded Polish, with a strain of Dorking blood, giving greater length and massiveness of body and the characteristic fifth toe. The Crèvecœur is a fowl of the same size and type but black in color and without the fifth toe. The Mantes has the mottled plumage of the Houdan, lacks the fifth toe, and has a single comb and no crest. All these so-called breed differences are superficial, — just such differences as variations in ideas of breeders in different localities would be likely to make in a type developed for the same purpose on the same body lines. The Houdan is well known and well distributed in America; the Crèvecœur, rare; the Mantes, unknown. Following are the American Standard weights for these races. Houdans: cock, 7 pounds; cockerel, 6 pounds; hen, 6 pounds; pullet, 5 pounds. Crèvecœurs: cock, 8 pounds; cockerel, 7 pounds; hen, 7 pounds; pullet, 6 pounds. These weights are often exceeded. The Houdan in this country presents considerable differences in size and shape. Some strains are small and light-bodied,

FIG. 375. American type Houdan cockerel. (Photograph from owner, C. E. Petersen, Pembroke, Maine)

others quite as large as Dorkings, but most are of an intermediate type. They are not usually bred with extreme development of crest and beard, yet most exhibition stocks have more of these than is desirable in fowls bred for use. In the Houdan district of France the crests are smaller and the birds better adapted to ordinary conditions. Houdans are as good layers as any breed and make excellent poultry. The color of the skin and legs is against them in this country.

French Cuckoo. A variation of the Friesland-Campine-Hamburg type, developed in Brittany, with the rose comb prevailing in the north and the single comb in the south, is called French Cuckoo. The size and weight of the body are increased and the neck and legs shortened, yet without giving the bird a squat appearance.

Courtes Pattes (Creepers). This is a single-comb black fowl remarkable for delicacy of flesh. In size they approach the Bantams, — the males weighing from 3 to 4 pounds, and the females from $2\frac{1}{2}$ to $3\frac{1}{2}$ pounds. It is thought that they may have been derived from the Bresse.

Braekel. According to the best Belgian authority this is simply the Campine growing to a larger size in the vicinity of Nederbrakel, in

FIG. 376. Houdan pullet. (Photograph from owner, C. E. Petersen)

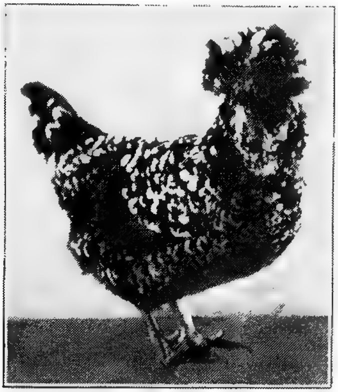

FIG. 377. Houdan hen. (Photograph from owner, C. E. Petersen)

Flanders, the conditions being more favorable there than on the sandy plains of the Campine country. Putting together this view and the apparent kinship of the Friesland and Campine, the Friesland appears as the intermediate (and probably earlier) type, of which the common Campine is a deteriorated and the Braekel an improved offshoot. The Braekel males weigh from 5 to 7 pounds, females from $4\frac{1}{2}$ to 6 pounds. In shape the body approaches the Dorking (as does the body of a Leghorn of like weight). The Braekel greatly resembles the Leghorn in appearance and qualities. It is precocious, a good layer, and indeed so like a large Hamburg or Leghorn that the only warrant for placing it in the meat instead of the laying class is the fact that for a long time it has been bred with special reference to the production of the celebrated *poulets de grains* (corresponding to our broilers). The leading varieties of the Braekel are the Golden and the Silver, the colors and markings of these being the same as for the corresponding varieties of Campines, except that the ground of the Silver Braekel is a creamy white.

FIG. 378. Houdan cock. (Photograph from owner, C. E. Petersen)

Brabant. The Brabant is a large-bodied, fine-boned fowl of the Polish type, occupying about the same position among Belgian

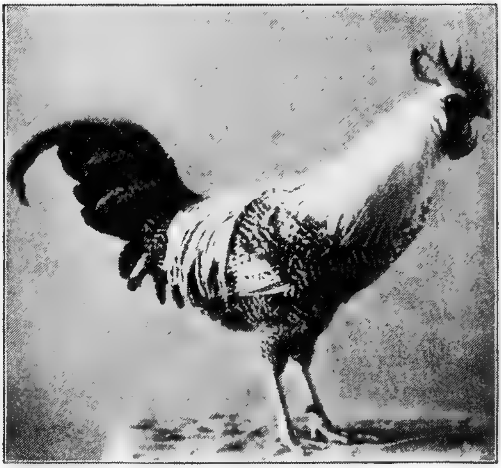

FIG. 379. Silver Braekel cockerel. (Photograph from owner, Thomas Keeler, Waverly, New York)

races as the Houdan and similar breeds in France.

The Asiatic meat type. It has been shown that in south-eastern Asia there was developed a large, coarse type of game fowl — the Malay — which more than a hundred years ago found its way to Britain and was used there later to make the Indian Game. It has also been stated that fowls brought from Asia began to be exploited, about the middle of the last century, by men who claimed to have introduced them from the Orient, and the public became interested in them; but at the same time it was found that there were many such fowls in America, particularly in New England.

FIG. 380. Silver Braekel pullet (Photograph from owner, Thomas Keeler, Waverly, New York)

On the assumption that the Asiatic races, — the Cochin, Brahma, and Langshan, — as now known and bred in America and England, are distinct breeds of different origin, coming from different parts of China and India, there has been, since the public first began to be interested in them, a long series of controversies as to origin, precise dates of importations, correct types, etc. All this has tended to cloud the facts. Having seen how in the European races the differentiation of breeds and varieties has been largely the work of English and American fanciers, the student of the subject can at once see the reasonableness of supposing that precisely the same thing is true of the Asiatic races. The present resemblances between these races indicate very close relationship. Resemblances between earlier types — even types familiar to men still under middle age — confirm this view. An examination of old descriptions and pictures brings the types still closer together. The testimony of early breeders as to the instability of color and comb shows plainly the condition of the stock for some time after the type began to be popular. And, finally, a description of the type as "one of the usual breeds or races raised in the United States" was published in "The American Poultry Book" in 1843, — two years before the first importation of Shanghais from China to England, and three years before the first importation of "Brahmaputras" to the United States. The race, at that time called *Malay*, is thus described: "This is the largest of our breeds. Dampier says that he saw one of this breed so large, that, standing on the floor, it picked up crumbs from the table. They are mostly yellowish or reddish brown. The eggs are large and well-flavored. The flesh of the chicken is not very delicate, and is better adapted to broth than anything else; in the adult it is coarse and stringy. They make large capons, but are considered to be very indifferent layers and not very steady sitters."

This description fits the Yellow Shanghai, the progenitor of the modern Buff Cochin, very much better than it does the Malay Game. Though the Asiatics have the reputation of being most persistent sitters, the broody quality is by no means universal in the race, and there are other descriptions of the early types which agree with this. It is to be noted also that while buff or brown is given as the prevailing tone of color, the description implies a variety of colors, and this is in accord with the statements of other writers a few years later. It is not necessary here to go into an extended analysis of these statements. Together they establish a probability that the Asiatic type, called in America and Europe by a variety of names, was a common fowl over a wide area of Asia, and that the type, though found in parts of India, was probably first developed by the Chinese. What is known of the development of other types of poultry confirms this view. It may seem a comparatively easy matter to settle such a question beyond dispute by a study of the poultry of Asia, but the expense of such investigation is too great for private enterprise.

Compared with the Malay Game type, with which it was sometimes confounded, the early Asiatic was such a fowl as would develop from the same stock or (more easily) from an intermediate type, by general selection for size and constitution. While they had longer plumage than the European races, they had not the excessive development of feather which characterizes the modern Exhibition Cochin and Brahma. The legs and feet were only moderately or scantily feathered,— sometimes quite bare. The combs were sometimes single, sometimes triple (pea combs). There were no striking developments of comb or crest. The colors were much the same as in the Leghorns in Italy,— of the same variety but with yellow or red-brown shades most popular. As in Italy, no effort was made to develop elaborate color patterns. While the colors were various, it appears that by local preference some color varieties had been outlined and somewhat developed; but much of the stock was, so far as color went, in a condition of mongrelism. To Americans and Europeans the feathers on the legs and feet were, after size, the most striking characteristic, and it has been generally assumed that the Chinese made special efforts to develop this character; but as the quantity of foot feathering on the Asiatic type as developed in Asia was no greater than would naturally be correlated with a rather heavy plumage, this type may properly be considered a strictly utility type, especially adapted to cold regions and, because of its greater ruggedness and vitality, growing (under favorable conditions) larger than the European races approaching it in size. While great size was the most conspicuous race character, many specimens described by early American writers were medium or even small in size. In a general way they might be considered the opposites of the European laying race as most typically developed in the Leghorn. They were developed in the opposite direction not only for shape but for color of eggs, laying dark-brown eggs, as did the Malay Game. In flesh qualities they were superior to the Leghorn only in quantity of meat; the quality of the flesh was similar, though the meat of the Asiatics was coarser in fiber.

Divisions of the Asiatic meat type. The modern classification of Asiatic fowls makes three breeds, — Brahma, Cochin, and Langshan,— the order of mention being in accord with the relative popularity of the breeds when the type was most popular. With reference to the (supposed) original type of fowl the Cochin and Langshan are earlier forms, the comb and some other characters of the Brahma indicating Asiatic Game blood which undoubtedly mingled with the other race from time to time.

FIG. 381. Buff Cochin cockerel. (Photograph by Eugene J. Hall, Oak Park, Illinois)

Cochins. Early American and English Cochins comprised four colors of the Asiatic type, and (in at least one of these colors) a variety of shades. The Buff Cochin, developed from the most common and popular color of the Shanghai or Malay, was, until near the close of the last century, bred and shown in all shades of buff, from a lemon-yellow to a brown called cinnamon-buff. In these Buff Cochins were found, as nowhere else among the fowls that came to the notice of early American fanciers, the gradations of color from the black-red of the initial type to white. The Pheasant or Partridge Cochin retained the black-red coloration, with the brown colors of the female arranged in lacings, — a pattern which seems to have been developed in Asia, though not in the perfection in which it is now found in our exhibition stocks of varieties carrying the pattern. At the lower end of the scale of Asiatic colors was the White Cochin; at the upper end, the Black Cochin, commonly called the Java. Of these varieties the Buff was, from the first, most popular, the

FIG. 382. Buff Cochin cock. (Photograph from owners, Tienken and Case, Rochester, Michigan)

Partridge next but far behind, the Black and the White comparatively rare, though before the appearance of the Langshan the Black Cochin (sometimes under that name and sometimes as the Java) seems to have been widely distributed.

In shape the modern Cochin of the exhibition type differs greatly from the early Asiatic type. In this division of the Asiatics the development of feathers on the body and feet has been carried as far as possible, making the birds (the hens especially) appear like big balls of feathers. To heighten this effect the neck and the legs have been somewhat shortened, though not as much as appears, for a part of the apparent shortness of extremities is due to the length, abundance, and loose, fluffy character of the plumage. In the most heavily feathered specimens the shank is completely covered with feathers, on both inner and outer sides. Although the feathers on the body and feet are abundant, the tail and wing feathers are much shortened. The American Standard weights for Cochins are cock, 11 pounds; cockerel, 9 pounds; hen, $8\frac{1}{2}$ pounds; pullet, 7 pounds. These weights are often exceeded.[1] The comb is single; it is small in the females and, preferably, also in the males, though it is not

FIG. 383. Buff Cochin hen. (Photograph from owners, Tienken and Case)

[1] I have had Buff Cochin cocks weigh as high as 14 pounds, and credible reports give 16 and 17 pounds as extreme heavy weights.

unusual to see males with quite large combs. The wattles correspond in size with the comb. The ear lobes are red. The color of the modern Buff Cochin, described as "golden buff," is between the light and the intermediate shades of earlier times. In the eastern United States the tendency of judges has been to favor a very light buff, while farther west and in Canada a richer shade has been preferred. In the male, the Partridge Cochin has the same colors and pattern as the Brown Leghorn, but in the female the ground is a uniform bay or mahogany red (varying in different specimens) penciled with dark brown or black, the object being to secure uniformity of shade and clear, distinct penciling throughout. The main tail feathers are black, the wing primaries dark brown. The black and white varieties need not be described for color.

For utility purposes the exhibition type of Cochin is of little value. For many years after the stock in fanciers' hands had ceased to be suitable for practical poultry keepers, there were here and there throughout the country utility Cochins equal to (and possibly better than) the best of the early importations. It is possible that a few such flocks still remain, but if so they are not known beyond their own neighborhoods.

Black Langshans. Black Asiatic fowls with single combs were introduced to poultrymen as Langshans in the early seventies. They came to England first, from the Langshan district in China. The importer and promoter claimed for them distinct breed characteristics plainly differentiating them from other Asiatic races. High station, great depth of body, erect carriage of head and tail, short plumage, scantily feathered feet, and white or gray skin, with the legs and toes slatish and the soles of the feet a pinkish white, gave enough breed characters, in the ordinary interpretation of that term, to mark the Langshan as a separate breed. As the Langshan began to attract notice, Black Cochins were adapted to Langshan standards, some by introducing the blood of the new race, others by selection toward the adopted Langshan type. In England, between the advocates of the tall, Langshan type and the "Cochiny" type, there has been continuous controversy down to the present time. As a result those who bred away from the Cochin type produced an extremely tall, stilted type, without beauty and with little utility value. In America the race is bred more on the lines of

FIG. 384. Black Langshan cock, owned by Urban Farms, Pine Ridge, Buffalo, New York (Photograph by Schilling)

the Langshans as they first came from the Langshan district. In that district the Black Langshan, though modified in many characters, is plainly a local black variety of the common Asiatic type.

White Langshans are said to have come as sports from the black variety in England. A blue variety of Langshans was made in America by crossing Blacks and Whites, but it has attracted little attention. American Standard weights for Langshans are cock, 10 pounds; cockerel, 8 pounds; hen, 7 pounds; pullet, 6 pounds. Birds from 1 to 2 pounds over these weights are not unusual. In general the Langshan of exhibition type in this country preserves more of the character of the Asiatic type at its best than either the Cochin or the Brahma. Had it not been for the erroneous conception of breed character that demanded the preservation of the color of skin and feet against which people in the United States are prejudiced, the Black Langshan might have become very popular here. It is a hardy fowl and an excellent layer of the darkest

FIG. 385. Black Langshan hen, owned by Urban Farms. (Photograph by Schilling)

FIG. 386. White Langshan cock. (Photograph from owner, Paul P. Ives, Guilford, Connecticut)

of brown eggs. The White Langshan, too, adapted to our requirements, might easily have fitted into the place which the perversion of Brahma type was making vacant, and, for a period at least, might have been of considerable economic importance.

Brahmas. Among the early Asiatic fowls in America were some gray birds. We have seen that in the Cochins the modern fancier retained the black-red color pattern and developed three plain colors, — buff, black, and white. During the period when names were used with little discrimination the gray color types went by various Asiatic names, such as Gray Chittagong, Brahmaputra, Cochin China, etc. As known in America and England for over half a century the Brahma has had two color patterns described as "light" and "dark," these descriptions giving the names "Light Brahma" and "Dark Brahma," by which the varieties are designated. The history of the Light Brahma in this country is given with great circumstantiality as beginning with the finding, by a fancier, of specimens of the breed on a sailing vessel in New York harbor. This is entirely credible but does not prove or even indicate that the

FIG. 387. White Langshan hen. (Photograph from owner, Paul P. Ives)

FIG. 388. Dark Brahma cock. (Photograph from F. W. Rogers, Brockton, Massachusetts)

specimens had fixed breed character. The most that may be inferred from the fact is that several specimens more or less closely approximating this attractive color pattern were found in a lot of fowls on the vessel. Both printed and oral accounts of early breeders of Asiatics agree that the reproduction of color was uncertain and, further, that the type of comb was not fixed. Light and Dark Brahmas came from the same parents, and with them, sometimes, came fowls of other colors. Some of the fowls had single combs, but the pea comb seems to have been most prevalent, and, being a feature which might be used to make differentiation between Cochin and Brahma more pronounced, was adopted as the correct type of comb.

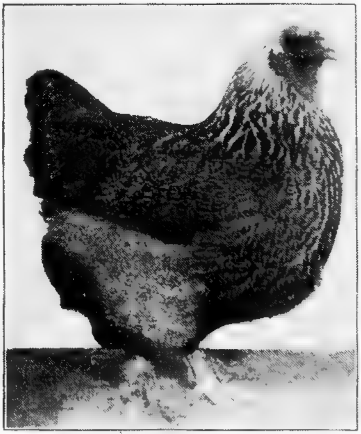

FIG. 389. Dark Brahma hen. (Photograph from F. W. Rogers)

Dark Brahmas. While the Light Brahma was from the first more popular than the Dark, and consequently came to be regarded as the principal variety, it is through the dark variety that it is most plainly connected with the Cochin forms of the type. But for its pea comb the Dark Brahma is a Silver-Penciled Cochin, — a Partridge Cochin changed from

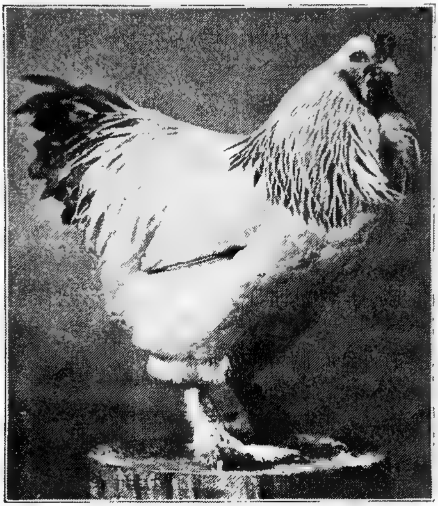

FIG. 390. Light Brahma cockerel. (Photograph from owner, Frank C. Nutter, South Portland, Maine)

the black-red to the black-white type of coloration, and still showing, in all but a few rare specimens, traces of brown or red throughout the plumage. The comb is an immaterial point, for not only were Brahmas at first produced with both pea combs and single combs, but also a pea-combed variety of the Partridge Cochin was recognized in the American Standard as late as 1887. The Dark Brahma of to-day, without the extreme heavy feathering of the Cochin, is bred to the same standards for weight, and is plainly an intermediate between the Cochins and the Light Brahma.

Light Brahma. Without prejudice to other varieties of its general type the Light Brahma may be described as (from the American point of view) the highest development of that type. Exceeding its nearest of kin in size, it is the largest variety of the domestic fowl. Its color pattern is the simplest and at the same time the most striking color combination found on fowls. While its size and general appearance (leaving the comb out of consideration) connect it with the Cochins, it is probable that the comb came from an Aseel

FIG. 391. Light Brahma pullet. (Photograph from owner, Frank C. Nutter)

cross. The color pattern, though long peculiar to the Brahma among American Standard-bred fowls, is one that occurs often in mongrel fowls and must have appeared times without number in the evolution of every race which, for any considerable period, was of various colors. Compared with the color of the Dark Brahma, the color pattern of the Light Brahma represents the almost complete elimination of black from the body plumage, while the tail remains black, the wings black and white (the black or black-and-white flights concealed when the wing is folded), and the hackle retains the black stripe. The early Light Brahmas had not excessive feather development, nor did that feature become seriously detrimental to the variety until about the close of the last century. American Standard weights for Light Brahmas are cock, 12 pounds; cockerel, 10 pounds; hen, $9\frac{1}{2}$ pounds; pullet, 8 pounds. The Standard weights for adults are often exceeded in birds much under a year old.

NOTE. Though not adapted to the general requirements of poultry culture in America, the Asiatic meat type, until spoiled by breeding for extreme feather development, occupied an important position. It was the most satisfactory type for the production of large roasting chickens, and when properly handled, laid as well as any other. It was best suited to northerly latitudes and well-drained soils, and to men with skill and judgment in handling poultry. This class was dependent for popularity upon the fanciers to a much greater extent than the laying and general-purpose classes. As long as the fanciers preserved a useful type, their cull specimens (particularly of the Light Brahma) were much sought by market poultry growers. When the fanciers developed the type beyond utility lines, they lost the market for their culls; the poultry growers who had become dependent on them for stock were unable to procure what they needed, and turned to other breeds. There is still in the country a great deal of Light Brahma stock good for practical purposes, but it is widely scattered. Some effort is being made to bring back the old types of Asiatics. How successful such an effort may be, only time can show.

General-purpose types. While the credit of developing the modern general-purpose type of fowl belongs principally to American poultry keepers, in a sense every effort to improve utility qualities represents progress toward the combination of laying and table qualities. The European meat types, as developed from European laying types, are as good layers as their progenitors, and much better fleshed. The Asiatic meat type, while carrying more meat than most varieties of the European, but generally of inferior quality, were (with good handling) quite as productive of eggs as any other type. But the European fowls as a whole lacked the rugged vitality of the Asiatics, and almost without exception had some superficial feature to which the plainly practical American farmer objected. On the other hand, the Asiatics were not only inclined to coarseness in flesh, but were heavy-boned and much larger than was desirable for general-market or necessary for laying purposes.

Consequently (as stated in Chapter II) acquaintance with the races of poultry as improved in Europe and Asia moved poultry keepers in America to efforts to combine these different types with one another or with native stocks in order to produce medium-sized fowls of plain type, of great vigor, and adapted to a wide range of conditions. While these efforts were greatly stimulated by the exploitation of the Asiatic type, that they began much earlier is evident from the references to the old Hawk-Colored, or Dominique, fowls, and from the fact that at least two breeds (the Bucks County Fowls and the Jersey Blue), formed by combining Asiatic and native blood, had acquired a name and a more than local reputation before the first exhibition in 1849.

Early gray-barred types is the most appropriate general description of the color prototypes of the Barred Plymouth Rock. The color type is a common one, the patterns occurring in all races in which (or at the stage when) plumage colors are various. Fowls of this color pattern went by different names. They were sometimes described as hawk-colored. They were called Dominique, and also by several variations of that name, — Dominick, Dominiker, Dominican. They were called, too, Cuckoo Fowls. In many cases these names were given on account of color, without reference to other points (just as later every barred fowl was called a Plymouth Rock), but it is quite probable that some of them were of a race with other characteristics somewhat fixed. Some early American writers on the Dominique say that it was introduced from France. As the best type shown in illustrations of the period conforms generally to the description of the French Cuckoo, it seems highly probable that that race was the most important factor in fixing the type of the American Dominique, and that the American Dominique is no more American than the Leghorn or the Cochin.

Fig. 392. Dominique cockerel. (Photograph from owner, W. H. Davenport, Coleraine, Massachusetts)

Dominiques, as developed either by amalgamation of early barred types or by preference for the type which became fixed and dominant, were small medium-sized fowls with rose combs. In shape and carriage they resembled Hamburgs and Leghorns, though more substantially built. They were rugged and hardy, good layers, fattened well, and made good table poultry. The males were much lighter in color than Standard Barred Rock males of to-day, more resembling the pullet-bred Barred Rock male. The principal difference between them and the French Cuckoo is the color of the skin.

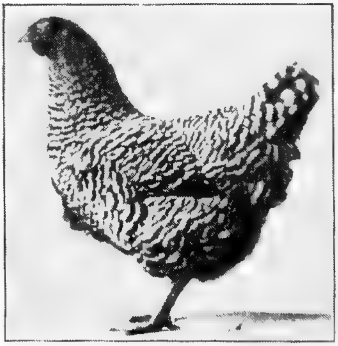

Fig. 393. Dominique hen. (Photograph from owners, Dr. Skerritt and Son, Utica, New York)

This type of Dominique has almost disappeared. With few exceptions, the type now closely approximates the Barred Plymouth Rock in shape as well as in general shade of color. The barring is not so clear as that of the Plymouth Rock, and the birds are smaller, American Standard weights being cock, 8 pounds; cockerel, 7 pounds; hen, 6 pounds; pullet, 5 pounds. Efforts made from time to time to revive the popularity of the Dominique have usually been based on claims of inherent breed qualities superior to those of the Plymouth Rock, but have met with little success. Though rated a hardy fowl in comparison with the

European races to which it properly belonged, the Dominique had not the rugged, vigorous constitution of the Asiatics and of the American types developed by fusion of European and Asiatic races.

Earliest American general-purpose types. If there were no other evidence of the presence of Asiatic fowls in America long before the dates given for their introduction, the existence of at least two well-defined varieties formed by combination of Asiatic stock with native stock of European origin should establish the fact. The Jersey Blue and the Bucks County Fowl, both of this type, had a more than local reputation and were somewhat widely distributed before the sensational exploitation of the Asiatic type. It is possible, too, that the Rhode Island Red type existed at that time, though the breed was scarcely heard of, outside of the locality in which it originated, until nearly half a century later.

Jersey Blues are said to have been made by crossing Black Spanish with Malays or Shanghais. They were of medium size, with single combs, red ear lobes, and the plumage coloration of the Andalusian. After the name became known, it was customary all over the country to call any blue fowl a Jersey Blue, and the name was often given to mongrels from chance matings of black and white fowls.

Bucks County Fowls were developed in Bucks County, Pennsylvania, by crossing Asiatic and native stocks. In everything but color they were of the Barred Plymouth Rock type. The color was buff,— usually a dingy buff,— with some black in the hackle, wings, and tail, and often in other parts of the plumage. Why this variety, widely known by name and as meritorious as the Plymouth Rock, failed to attract more attention is one of the puzzles of the history of varieties of poultry. Considerable flocks of them could be found in places in the eastern states until after the Buff Plymouth Rock became well established. In the making of that variety they were probably used much more extensively than has been admitted. Certainly they offered the best foundation stock, having the Plymouth Rock type and a color so closely approaching buff that they frequently produced specimens of better color than many of the early winners among Buff Rocks. There are probably some stocks of Bucks County Fowls still to be found, but many of the stocks long kept pure have been converted into Buff Plymouth Rocks.

Transient forms of this type were produced in great abundance and in all colors. Among them the type that first bore the name "Plymouth Rock," made from a mixture of Asiatic and Dorking blood, seems to have been for a short period sufficiently popular to be remembered and to make its reputation something of an asset to the promoters of the modern Plymouth Rock. This early Plymouth Rock had the principal general-purpose-class characteristics, but the color pattern seems to have been indeterminate,— a black-red type with no fixed pattern in the female. Many of the birds had five toes, and the legs were of various colors. Considering the popular attitude toward types of fowls, the almost universal practice of crossing (among all poultry keepers except the few breeding for definite superficial features), and the numbers of breeders who were seeking to make a type of general-purpose fowl that would meet the general demand, it is highly probable that specimens closely approximating or presenting the principal characteristics of every one of our modern varieties of this type were produced again and again, and for the most part mingled with the general stock and passed without notice. A few were developed by the breeders who claimed to have discovered them. Occasionally one of these attained some reputation, and perhaps figured in the development of a permanent variety.

Origin of the Barred Plymouth Rock. About 1864 or 1865 (the date is uncertain) Joseph Spalding, of Putnam, Connnecticut, at the instance of John Giles, of Woodstock in the same state, mated a hawk-colored cock with some Black Cochin (then sometimes called Java) hens. The cross produced cockerels mostly like the sire. The pullets were mostly black or nearly black, but a few were marked like the males. Reverend D. A. Upham, of Wilsonville, Connecticut, saw the birds and with some difficulty persuaded Spalding to sell him the best-marked and cleanest-legged cockerel and the two best pullets. From this trio and its progeny Mr. Upham bred for several years. While Spalding and Upham were working with this stock, and before it was introduced to the public, a Mr. Drake, of Stoughton, Massachusetts, had produced birds of the same general type and color by mating hawk-colored females with Asiatic males, either Light Brahma or White Cochin. Both varieties may have been used, but the Drake stock showed pronounced traces of Brahma rather than of Cochin blood.

In March, 1869, Upham exhibited his birds as Barred Plymouth Rocks, at Worcester, Massachusetts, where they made a sensation and entered on a career of popularity so far-reaching that within twenty years it was estimated that they outnumbered all other pure-bred varieties of fowls in the United States. Their popularity had brought out other varieties of the type and greatly stimulated interest in them here, while in England the type, though of a color of skin and legs not favored there, was rapidly displacing the European races, until an English style of the same type was produced in the Orpington.

Early strains of Barred Plymouth Rock. The instant popularity of the Plymouth Rock[1] created a demand for them far beyond what could be supplied from the Spalding, Upham, and Drake stocks. Those who were so fortunate as to secure stock from these earliest originators had, if they used it to advantage, several years the start of others. Many who could not get this stock made crosses to produce the type. Though the facts in such cases would probably not be recorded, no one who knows the ways of poultry breeding can doubt that there were throughout the country many birds of this type (in the rough), and that hundreds of breeders began to mate such specimens as they had or could procure, using blood from the more advanced lines of breeding when it could be obtained. The best of the early strains were the Upham, Drake, Gilman, and Essex,—the latter being an improved Upham strain, developed first in Essex County, Massachusetts, by Mark Pitman, and later by H. B. May at Natick, Massachusetts. This stock, though the best of the early Plymouth Rocks, lacked much of meeting the ideals of fanciers. The stock as it came into May's possession seemed to lack stamina. He tried a Light Brahma cross on some of it, with unsatisfactory results. Then he chanced on a cock described as a grade Game, which he thought promised to give the desired results. This bird (a black-red in color) had yellow legs and a very full breast. The cross proved most satisfactory. In

[1] Until the white variety appeared, the term "barred" was not used. The breed was simply the "Plymouth Rock."

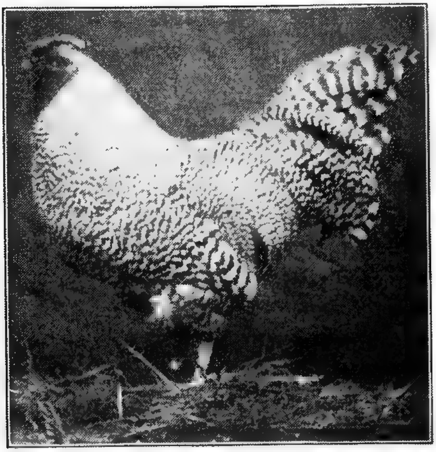

FIG. 394. Dominique cock. (Photograph from owner, A. Q. Carter, Freeport, Maine)

three years the undesirable features that it brought had been bred out, and in the May stock of the original Essex strain had appeared the modern Barred Plymouth Rock. It was in his work with this stock that May devised the double system of mating necessary to produce birds that match in the show pen.

The Barred Plymouth Rock. As bred for exhibition the Barred Plymouth Rock owes most of its merit to the May-Essex strain. The blood has been so widely distributed and so effectively used that, whatever the foundation, practically all Barred Rock stock of first-rate quality presents the character first successfully developed in it. Individual taste in poultry breeders, and individual qualities in the birds they use, tend to slight variations in stocks, but pronounced strain differences have quite disappeared. In color there has been constant improvement. The ideal, from the time when Upham first saw the cross-bred Spalding chickens, was a bluish-gray bird barred evenly all over, — both sexes of the same shade

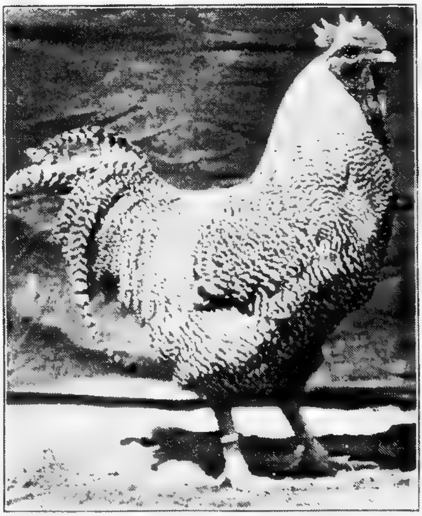

FIG. 395. Barred Plymouth Rock cock. (Photograph from United States Department of Agriculture)

and markings. It was found impossible to produce this with regularity by mating males and females of the desired shade, and in consequence the double-mating system has been used to give this result. There are really two subvarieties of the Exhibition Barred Plymouth Rock, usually described as the *male line* and the *female line* respectively.

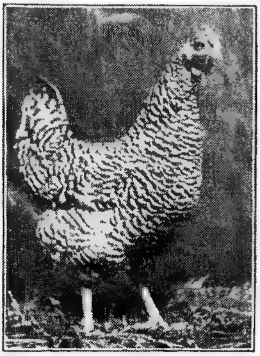

FIG. 396. Dominique hen (Photograph from owner, A. Q. Carter)

The Exhibition male is produced by mating Exhibition males to females of the same line of breeding, these being very much darker and less distinctly barred than the males.

The Exhibition female is produced by mating Exhibition females to males of the same line of breeding, these being much lighter in shade and usually less distinctly barred. The color of the Barred Plymouth Rock is most difficult to describe. It varies in varying lights, and the effect depends much also on the width and regularity of the bars. As now described in the American Standard, the ground is grayish-white, the dark bars stopping short of positive black.

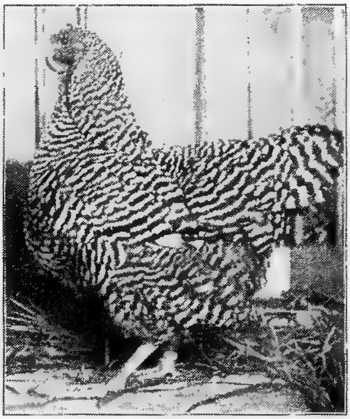

FIG. 397. Barred Plymouth Rock hen (Photograph from United States Department of Agriculture)

White Plymouth Rocks. The credit of introducing the White Plymouth Rock as such to the public is generally conceded to O. F. Frost, of Monmouth, Maine. The Frost stock, considered the best of the early strains, is said to have come, about 1875–1876, as sports from the barred variety. Such sports still sometimes come from matings of Barred Rocks and, according to the common testimony of those who have had and who have bred them, almost invariably reproduce only white

FIG. 398. White Plymouth Rock cock, owned by Urban Farms, Pine Ridge, Buffalo, New York (Photograph by Schilling)

birds when mated together or mated with White Plymouth Rock stock. With sporting still occurring, it is easy to accept the statements of the early breeders of Barred Rocks, who say that white sports were common. From the use of white fowls in matings to produce Barred Plymouth Rocks it may be inferred that white specimens were often produced in considerable numbers by direct transmission of color and by reversion to known ancestors. It is also probable that many white fowls of this type were produced from accidental crosses. It is further quite well established that some were produced with design to make a White Plymouth Rock by breeders who preferred that color. Up to the time of their admission to the American Standard, white fowls of this type went by various names. After that the variations in type were harmonized and strain differences gradually eliminated as in the barred variety. For some time after their introduction the White Rocks were usually considered less vigorous than the others, but if that

FIG. 399. White Plymouth Rock hen (Photograph from owner, C. E. Hodgkins, Northampton, Massachusetts)

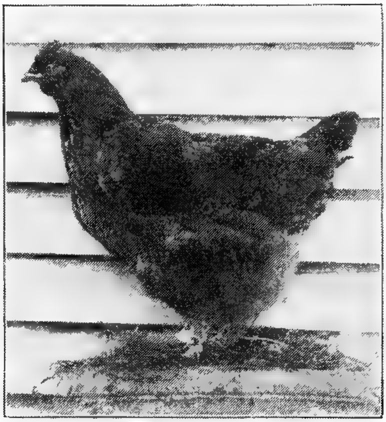

FIG. 400. Buff Plymouth Rock hen (Photograph from owner, J. A. Ashline, Fitchburg, Massachusetts)

difference ever actually existed, it has long since disappeared. The color needs no special description.

Buff Plymouth Rocks. As first shown, Buff Plymouth Rocks were Rhode Island Reds of light shade and with single combs, selected from farm flocks in the district where the Rhode Island Red had become the common fowl. This was in 1890, when Buff Leghorns were being introduced to Americans and the "craze" for buff color was beginning. This Rhode Island Red stock was the foundation for some of the early strains of Buff Rocks, but seems to have had much less influence on the variety as a whole than the crosses of Asiatic and Mediterranean races which were made to produce it directly. The Buff Cochin with White Plymouth Rock or Buff Leghorn gave the best results. White Leghorn and Buff Cochin were also used. To some extent the Bucks County Fowl and the single-combed specimens of the Buff Wyandotte entered into the making of the race. Like the other

FIG. 401. Buff Plymouth Rock cock. (Photograph by Graham)

color types of the Plymouth Rock, it was a type of frequent occurrence, and as soon as a demand for it arose, the work of fixing the type began. With the materials to work with, this process was comparatively short, and within ten years of its first public appearance the color was quite as good as in Buff Cochins.

Partridge Plymouth Rocks, and the two following varieties, may be regarded as originally by-products in the manufacture of Wyandotte varieties of the same color. In most varieties of Wyandottes, and particularly in the early stages of development, single combs have occurred frequently; and the single-combed Wyandotte, though perhaps not of ideal shape, is to all appearances a Plymouth Rock of the color that it carries. The coloration of the Partridge Plymouth Rock is of the black-red pattern, exactly following the description of the Partridge Cochin. Some stocks of this variety were made, at least in part, from Brown Leghorn and Partridge Cochin crosses.

FIG. 402. Partridge Plymouth Rock cockerel (Photograph from owner, S. A. Noftzger, North Manchester, Indiana)

Silver-Penciled Plymouth Rocks came from the same sources as the Wyandotte of the same description. The coloration is of the black-white pattern, following the Dark Brahma style of markings.

Columbian Plymouth Rocks present the Plymouth Rock characteristics with the Light Brahma coloration. While some may have been derived from other sources, the single-combed specimens of the Columbian Wyandotte have been a more than sufficient source of supply.

Javas. As has been stated, the name "Java" was sometimes given to the Black Cochin. With a more discriminating use of names this was applied to large black fowls with small single combs and smooth yellow or yellowish legs. In the early history of the Barred Plymouth Rock many black specimens were produced. These seem to have been the chief source of supply, though doubtless other black fowls were used. The Black Java was the principal variety given this name, but there were also white and mottled (black-and-white) birds of this type, — these being colors likely to occur in reversion and (coming from the Java stock) to be considered as belonging to that breed. None of the varieties of the Java have ever been popular. As varieties of the Plymouth Rock they might have fared better.

FIG. 403. Columbian Plymouth Rock cockerel. (Photograph from owner, S. C. Allen, Orchard Park, New York)

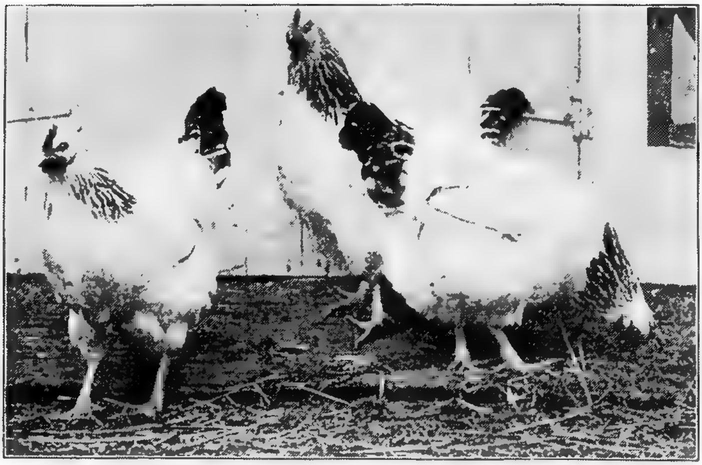

FIG. 404. Columbian Plymouth Rock pullets. (Photograph from owner, S. C. Allen)

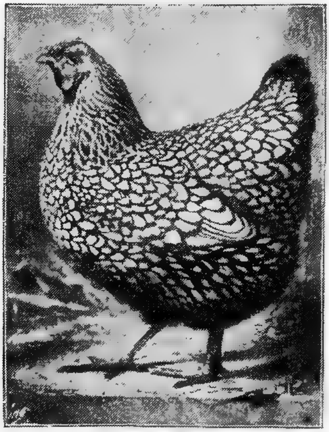

FIG. 405. Silver-Laced Wyandotte hen, owned by J. C. Patterson, Monsey, New York. (Photograph by Schilling)

The Wyandottes. The popularity of the Barred Plymouth Rock led to a search for, and to the development of, another breed even earlier than the development of the white variety of the Plymouth Rock. The ideal of the Barred Plymouth Rock was definitely fixed from the beginning of the history of the breed. Not so, apparently, was the ideal of the first of the Wyandottes, — a name conferred on them in 1883, when they were admitted to the American Standard. Prior to that time fowls of the general-purpose type with rose combs went by a number of names, the most familiar of which was "American Sebright." With this explanation to show the fact, the statement of the development of the breed is simplified by applying the present name to it at all stages.

The Silver-Laced Wyandotte. Accounts of the origin of this variety are very unsatisfactory; the most circumstantial of them credits a Mr. Ray, of Hemlock Lake, New York, with producing, about 1868–1869, from a cross of Silver Sebright Bantam and Yellow Chittagong (or Buff Cochin), fowls which he called Sebright Cochins, which became the foundation stock of this variety. These birds

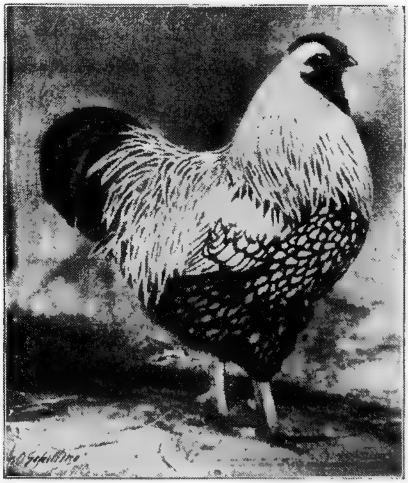

FIG. 406. Silver-Laced Wyandotte cock, owned by J. C. Patterson. (Photograph by Schilling)

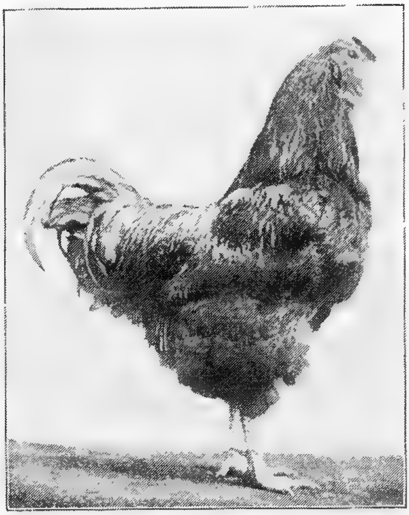

FIG. 407. Golden-Laced Wyandotte cock (Photograph from owners, Wood and Freeman, Fitchburg, Massachusetts)

were not distinctly laced and showed considerable yellow. They had both rose and single combs. On this foundation were used crosses of Silver-Spangled Hamburg and Dark Brahma, and also a black fowl known as a Breda, of supposed Russian origin. This does not strike the student of races of poultry as a likely account. While it is not impossible that poor lacing from a bantam source might be intensified by adding to it spangling, penciling, and black, it is improbable. A more credible though not well-attested account says that a general-purpose type of fowl, with the laced pattern not regularly developed, ranging in

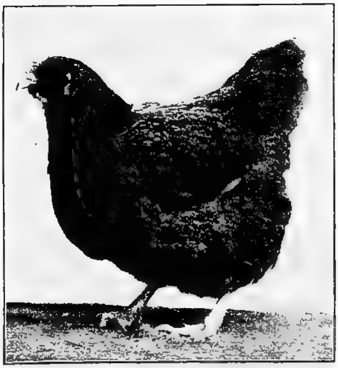

FIG. 408. Golden-Laced Wyandotte hen. (Photograph from owners, Wood and Freeman)

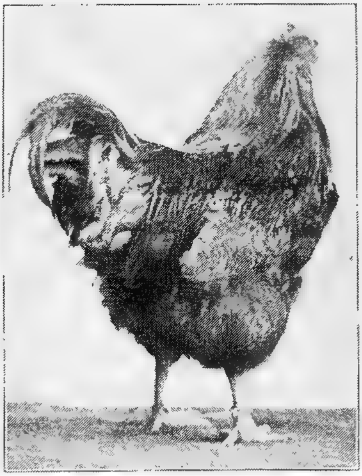

FIG. 409. Three-quarters rear view of Golden-Laced Wyandotte cock in Fig. 407

shade from very light to very dark, and with both rose and single combs, was a common type in one or more communities in the state of New York, and furnished the material from which the Silver Wyandotte was developed, largely by selection. This version carries more probability than the other, even though it offers no explanation of the origin of the color pattern and makes no attempt to show what elements composed the stock. It makes the Silver Wyandotte one of the numerous types early developed in efforts to fix a general-purpose type, making some progress locally on its merits and, after the success of the Barred Rock had stimulated breeders to new efforts, taken up for the development of the ideal of which it was then only a suggestion. The favorite type of the early Silver Wyandottes was much darker than that with which breeders are now familiar. The modern exhibition birds of this variety have the color of the Silver Polish, but with black tails.

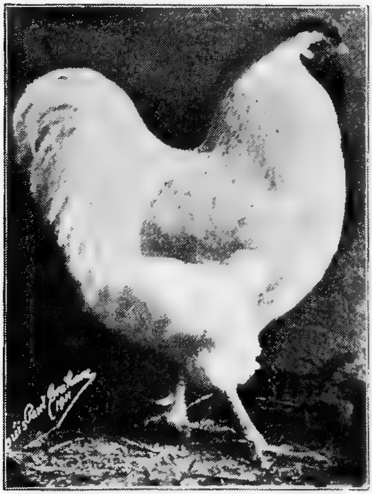

FIG. 410. White Wyandotte cock, owned by J. W. Andrews, Dighton, Massachusetts

The Golden-Laced Wyandotte was produced in Wisconsin by crossing the silver-laced variety with a local breed known as the Winnebago, the origin of which is unknown.[1] The color pattern is the same as in the silver-laced

[1] In "Wyandottes: Silver, Golden, Black, and White," by Joseph Wallace, 1891, Joseph McKeen, of Omro, Wisconsin, is quoted as denying that the Winnebagos had been bred a long time in Wisconsin, and claiming that he originated them. McKeen places the beginning of his work with the Winnebagos "a few years after" 1872 or 1873, and indicates that, at the time he crossed them with the Silver-Laced Wyandottes, they were in a very crude condition. At about the time when McKeen said that he was beginning to make the Winnebagos, the author, then a boy in Galena, Illinois, bought, in the market of that town, two hens called Winnebagos, of a redder ground color than the early Golden Wyandottes, and as well laced as the average Golden Wyandotte of fifteen to twenty years later. No doubt McKeen owed much more to such Winnebagos than he was willing to admit.

FIG. 411. White Wyandotte pullet, owned by A. G. Duston, South Framingham, Massachusetts. (Photograph by Sewell)

variety, with a ground of golden bay instead of white.

White Wyandottes were produced as sports from the lighter specimens of the early silver-laced variety, and also (it may safely be presumed) by every cross that promised a rose-combed white fowl of this general type. In fact, for a long time after the variety was introduced, any rose-combed white fowl with yellow legs that was larger than an ordinary Leghorn was offered, and often passed, as a White Wyandotte. The stock, as introduced in 1885 by Reverend B. M. Briggs, then of Wyandale, New York, was of Silver-Laced Wyandotte origin. The very heavy-bodied, dark-egg strains of some years later bore unmistakable traces of Light Brahma blood. As with other American varieties time and wide distribution of the best stocks has gradually produced great uniformity of type. After the Barred Plymouth Rock, the White Wyandotte became the most popular variety in America; and within ten years of its introduction it was regarded as a dangerous rival of the Barred Plymouth Rock. Had the competition been between the Barred Plymouth Rock and the White Wyandotte alone, the latter would have led in the end, but the White Wyandotte had to divide with the White Plymouth Rock the favor of those who wanted a white fowl of its class.

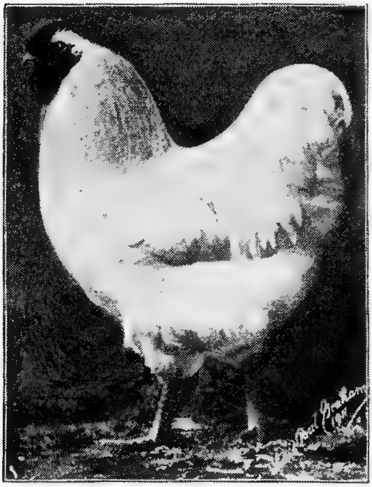

FIG. 412. White Wyandotte cockerel, owned by J. W. Andrews, Dighton, Massachusetts

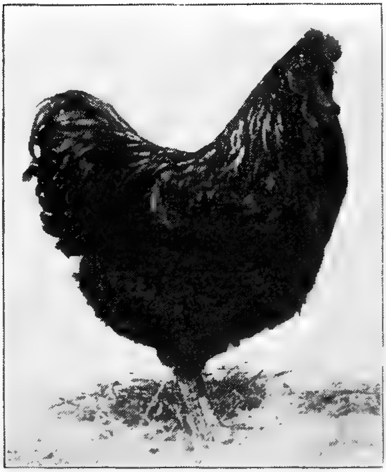

FIG. 413. Black Wyandotte cock. (Photograph from owner. F. S. Chaffee, Rutland, Vermont)

FIG. 415. Buff Wyandotte cockerel (Photograph by E. J. Hall)

The Buff Wyandotte. The history of this variety closely parallels that of the Buff Plymouth Rock. It was first introduced to the public at the same time and place, by the same men, and with stock from the same source, — rose-combed buff birds from the farm flocks of Rhode Island Reds. Elsewhere Buff

FIG. 414. Black Wyandotte hen owned by F. S. Chaffee. (Photograph from owner)

Wyandottes were made from a variety of crosses, one of the best being the cross of Golden Wyandotte and Buff Cochin.

Black Wyandottes. About the time that white specimens from Silver-Laced Wyandottes were being bred together to form a white variety of the breed, the black specimens, which also appeared occasionally, were used by a few breeders to make a black variety. Black Wyandottes have never become popular, but a few fanciers have continued to breed them, and the stock of this variety seen in exhibitions is usually of very good quality.

Partridge (or Golden-Penciled) Wyandottes were made by crosses of Golden Wyandotte and Partridge Cochin, with the further infusion, in one of the principal strains (known as the

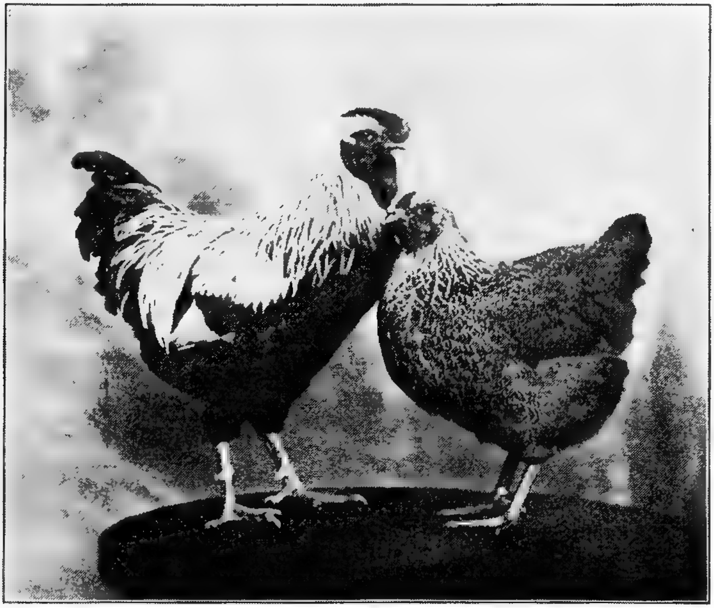

FIG. 416. Silver-Penciled Wyandottes. (Photograph from owner, James S. Wason, Grand Rapids, Michigan)

Brackenbury-Cornell, or Eastern, strain), of Rose-Comb Brown Leghorn and Golden-Penciled Hamburg blood, and in the other (known as the Western strain), of Cornish Indian Game blood. These strains were quite distinct until after the admission of the variety to the American Standard in 1901. Since then they have been mingled, and the modern stock of this variety is practically a blend of these two lines. The coloration in the Silver Penciled Wyandotte is the same as that of the Partridge Cochin.

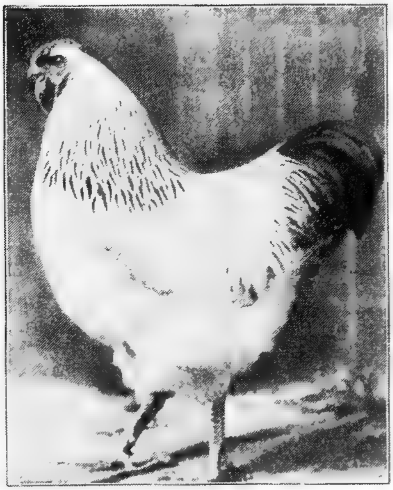

FIG. 417. Columbian Wyandotte cockerel D. Lincoln Orr, Orr's Mills, New York (Photograph by Sewell)

The Silver-Penciled Wyandotte was produced almost simultaneously with the Brackenbury-Cornell strain of the foregoing variety, by the same breeders, and was admitted to the Standard only a year later, in 1902. This variety was made by mating a Dark Brahma hen to a Partridge Wyandotte male, and Dark Brahma and Silver-Penciled Hamburg females to a Silver-Laced Wyandotte male, and by breeding selected specimens from the offspring of these matings. The coloration is the same as of the Dark Brahma.

Columbian Wyandottes were introduced in 1893 by B. M. Briggs (who introduced the White Wyandottes). The name was given in honor of the Columbian Exposition in progress at the time. The color and markings are the same as of the Light Brahma. In the original Briggs stock the color was produced first from a chance mating of a White Wyandotte cock and a Barred Plymouth Rock hen. The variety, when introduced, attracted little attention. A few breeders took it up, and some of them, not satisfied with the color and having little confidence in getting what they desired by selection from the original stock, resorted to other crosses. The White Wyandotte and Light Brahma were used, and

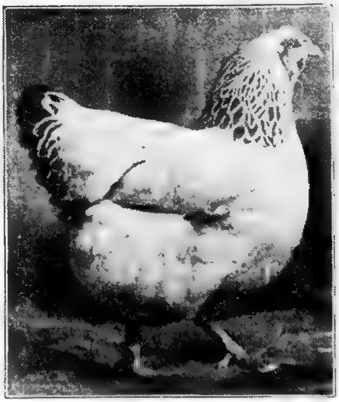

FIG. 418. Columbian Wyandotte pullet, D. Lincoln Orr. (Photograph by Sewell)

also the White Wyandotte and Rose-Combed Rhode Island Red. Both of these crosses gave birds of stronger color than the original. The variety is still[1] in the formative stage, nearly all breeders still either crossing or working out undesirable features introduced by crossing. Though almost unnoticed for about ten years after its

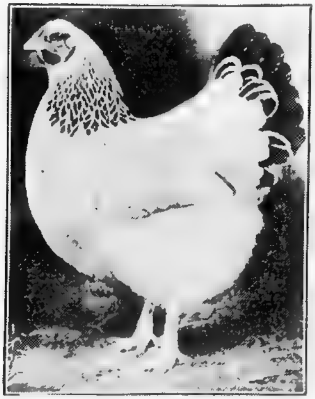

FIG. 419. Columbian Wyandotte hen. Sunny Brook Farm, West Orange, New Jersey[2]

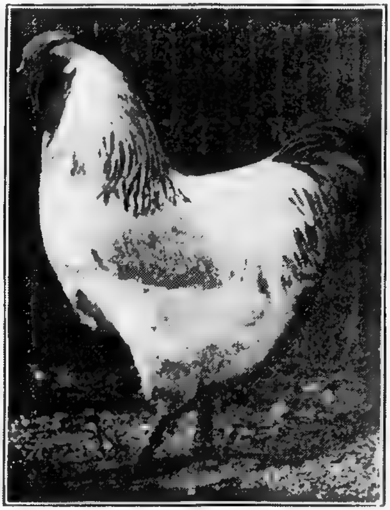

FIG. 420. Columbian Wyandotte cockerel Sunny Brook Farm[2]

FIG. 421. Columbian Wyandotte pullet, Sunny Brook Farm[2]

introduction to the public, when it began to attract attention its popularity increased very rapidly. It is now generally regarded as likely to become one of the most popular varieties of its class.

Rhode Island Reds. About the middle of the last century, by such mixtures of native, European, and Asiatic stock as were then being made all over the eastern

[1] 1911. [2] Photograph by Graham.

United States, the Rhode Island Reds were developed as the common fowls of the poultry-farming district of Rhode Island. Since that time they have developed continuously by absorption

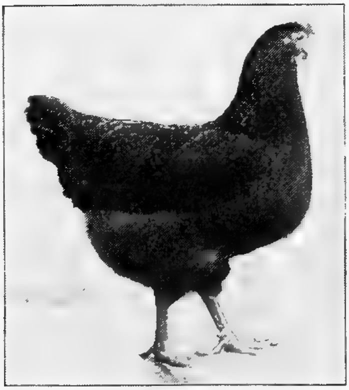

FIG. 422. Single-Combed Rhode Island Red pullet[1]

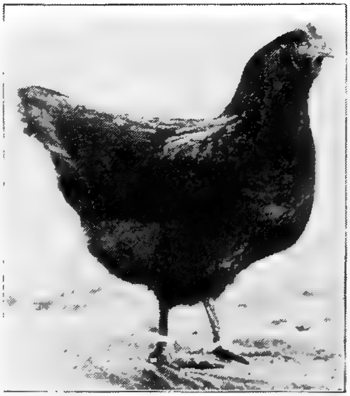

FIG. 423. Single-Combed Rhode Island Red hen

of the blood of almost all races that have attracted notice, the red color and the general-purpose type being preserved through it all. As bred on these farms little attention was given, as a rule, to selection for a particular shade or for uniformity of color, though a few stocks were selected with some care as to such points. In size and shape they varied much more than is usual when any form of selection has long been practiced. As has been said, the first Buff Plymouth Rocks and Buff Wyandottes shown in America were light-colored Rhode Island Reds. In the farm stock single, rose, and pea combs were found, and

FIG. 424. Rose-Combed Rhode Island Red cock

[1] Birds in Figs. 422–427 owned by Lester Tompkins, Concord, Massachusetts. Photographs by Schilling.

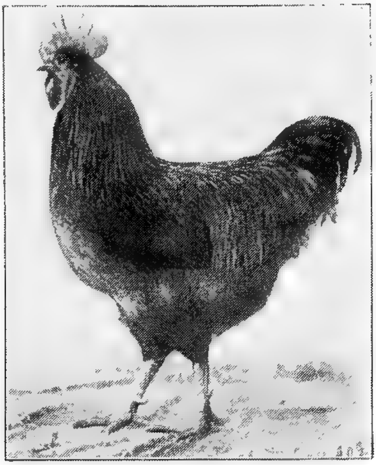

FIG. 425. Single-Combed Rhode Island Red cock

when first taken up by fanciers, they were bred as three varieties. Later the pea-combed variety was dropped. It is said that they were exhibited as Rhode Island Reds at shows in southern Massachusetts about 1879–1880. No classes were provided for them at shows until about twenty years later. They were not shown at New York and Boston until about 1900. For some years they were very uneven in color, ranging from buff to a chocolate brown, with size and shape quite as variable. Gradually the color was developed as a rich, brilliant red with black in the tail and wings and a little black ticking in the hackle of the female; the size and shape also were made more uniform and more in conformity with other American varieties of this class. For some years after it was taken up by fanciers, interest in the Rhode Island Red was mostly confined to southern New England.

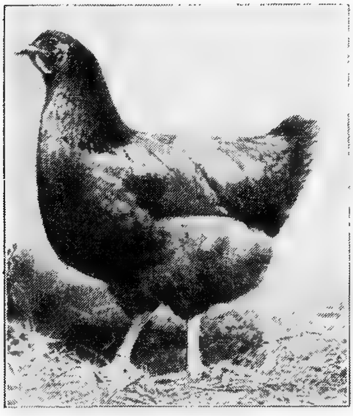

FIG. 426. Rose-Combed Rhode Island Red hen

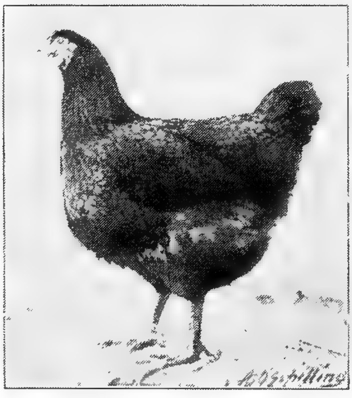

FIG. 427. Rose-Combed Rhode Island Red pullet

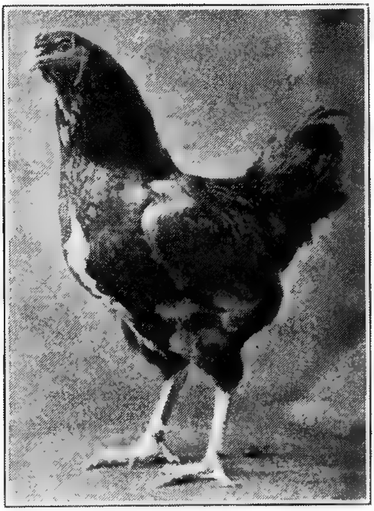

FIG. 428. Buckeye cockerel. (Photograph from owner, Eugene Cowles, Shelbyville, Kentucky)

The intensity of interest there made a wide impression and at present it is well distributed in America.

The Buckeye was first bred in Ohio as a red pea-combed fowl before the Rhode Island Reds were known there. They differed so slightly from pea-combed Rhode Island Reds that when the originator made the acquaintance of the Rhode Island varieties, the name "Buckeye" was discarded. After the Rhode Island Red fanciers decided not to continue breeding a pea-combed variety, the name "Buckeye" was again given to the Ohio stock, and under that name it was admitted to the American Standard, with some changes in description of color and form to give a different breed character.

The Orpingtons. This breed takes its name from the town of Orpington, Kent, England, where it was developed by Mr. William Cook, the avowed object being to produce a breed of the general-purpose type better adapted to English requirements than the Barred Plymouth Rock and the Silver-Laced Wyandotte, both of which were rapidly growing in popularity in that country. The characteristic difference between Orpingtons and the American general-purpose varieties is the color of the skin (gray or white)

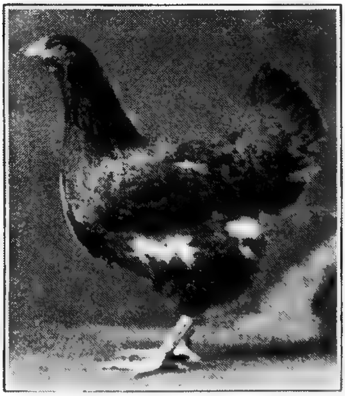

FIG. 429. Buckeye pullet (Photograph from owner, Eugene Cowles)

FIG. 430. Single-Combed Black Orpington cockerel. (Photograph from owner, W. E. Matthews, New London, Connecticut)

and legs (black or flesh color). The typical Orpington is also a heavier-bodied bird, comparing with American birds of the type as do the English Minorcas and Leghorns with American types of those breeds. The color varieties are black, buff, white, variegated (the "Diamond Jubilee"), and spangled. In some varieties there are both rose- and single-combed subvarieties, as indicated in the following descriptions. Thus in the Orpington are combined the general form and both styles of comb found in fowls of the American general-purpose type.

Black Orpingtons (single- and rose-comb). This, the first variety of the Orpington, was said by the originator to have been produced by a series of crosses in which Black Plymouth Rocks, Black Minorcas, and clean-legged Black Langshans were used. English writers familiar with the variety in England assert that it shows Black Cochin blood more conspicuously than anything else, and the appearance of many of the specimens shown in America supports this view. The Cochin type, however, is not the exclusive type in the Black Orpington. Both the Langshan type and the long-bodied Plymouth Rock type are found. Consideration of such facts indicates that, whatever may have been true of the stock of the originator, the single-comb Black Orpington is at present a

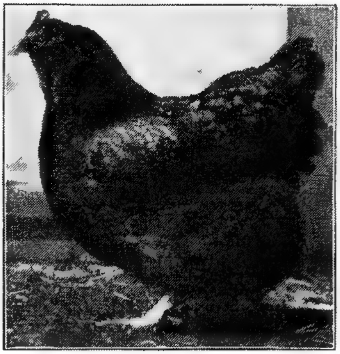

FIG. 431. Single-Combed Black Orpington hen. (Photograph from owner, W. E. Matthews)


FIG. 432. Rose-Combed Black Orpington cockerel, an immature bird[1]

composite of nearly all the earlier varieties of black fowls with single combs. The Rose-Comb Black Orpington is said to have been produced by mating Rose-Comb Black Langshan males with pullets from the Minorca-Black Plymouth Rock cross used for the single-combed subvariety. The black variety was presented to the public in 1886.

Buff Orpingtons (single- and rose-comb). The originator's account of the making of this variety gives the Buff Cochin as the foundation stock, with the Golden-Spangled Hamburg and Dark Dorking as the other components. The prevailing opinion among disinterested English authorities is that the Buff Orpington is, as one writer puts it, "a refined Lincolnshire Buff." The Lincolnshire Buff is a breed developed locally, like the Bucks County Fowl and the Rhode Island Red in America. The Buff Orpington, accordingly, would bear the same relation to it as a Buff Plymouth Rock to a Bucks County Fowl, or an improved Rhode Island Red to the ordinary red fowl of the Little Compton farms. Whatever the facts as to the original stock, here again there is no doubt that when the variety became popular, any buff fowl approximating the type might be passed for a Buff Orpington, and the variety to-day


FIG. 433. Rose-Combed Black Orpington pullet[1]

[1] Photographs from owner, H. C. Faulkner, Marshall, Michigan.

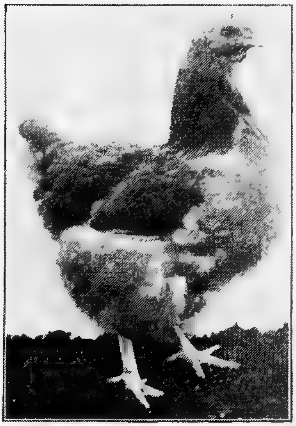

FIG. 434. Single-Combed Buff Orpington pullet [1]

is the result of the blending of all these stocks. This variety was introduced to the public in 1894. To-day it is rated the most popular of English varieties in the colonies, as well as in the mother country.

White Orpingtons (single- and rose-comb). This variety was said by the originator to have resulted from crosses of White Leghorn, Black Hamburg, Single-Comb White Dorking, and Cuckoo Dorking. It was brought out in 1889. The appearance of the White Orpington indicates White Cochin blood as one of its important factors. With the White Dorking this would produce the type more directly and more uniformly than the more complex crosses. As the variety was made just after the White Wyandotte and White Plymouth Rock in this country, these might easily have been used in the making of it. Indeed, with the two styles of comb the White Orpington, like the white varieties of the class in this country, made a place for any smooth-legged fowl, of the color desired, not readily referred to a previously existing breed.

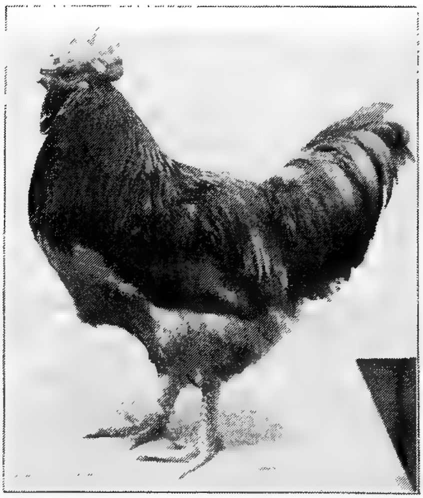

FIG. 435. Single-Combed Buff Orpington cock, a rugged type [2]

Diamond Jubilee Orpingtons (single- and rose-comb) were brought out in 1897, the year of the Diamond

[1] Photograph from owner, Miss H. E. Hooker, South Hadley, Massachusetts.
[2] Photograph from United States Department of Agriculture.

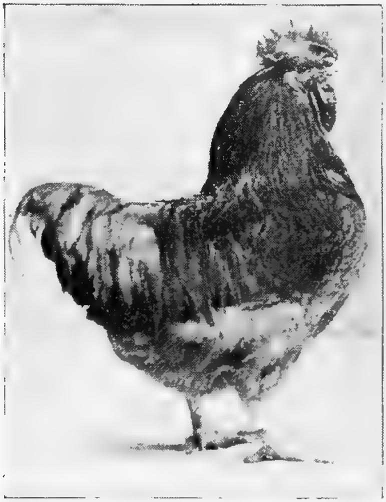

FIG. 436. Single-Combed Buff Orpington cock, a very meaty specimen [1]

Jubilee of Queen Victoria, — hence the name. The variety is said to have been produced in the same way as the Buff Orpington stock of the originator, but with speckled instead of Dark Dorkings. The color is a mixture of black, brown, and white (such as has always occurred occasionally in flocks of mixed colors); this variety was bred with the purpose of securing uniform distribution of the several colors, and a more pleasing effect than a nondescript pattern.

Spangled Orpingtons (single- and rose-comb) are black-and-white mottled fowls said by the originator to have been produced by a mingling of Dark Dorking, Barred Plymouth Rock, and Silver Spangled Hamburg; they are declared by other English authorities to be identical with the Speckled Sussex. Spangled Orpingtons were introduced to the public in 1899.

FIG. 437. Single-Combed Buff Orpington hen

NOTE. These six breeds (the Plymouth Rock, Java, Wyandotte, Rhode Island Red, Buckeye, and Orpington), with some thirty varieties and subvarieties, furnish, in the standard size, weight, and shape of body of each, all gradations between the Leghorn laying type and the Asiatic meat type; in combs, all the principal styles; in colors and color patterns, almost all the distinct types found in other classes of fowls. Taking any one of these varieties, as the different stocks and as the birds in the flocks run, we find in it specimens of most (sometimes all) of the other types, and all the intermediate sizes and forms. Not only so,

[1] Photographs, Figs. 436–439 from owner, J. W. Clark, Cainsville, Ontario.

but in the larger races are often found specimens and strains with the Asiatic body type, and in the smaller races specimens and strains with the body type of the small European races. The standard type in any case is simply the pattern or model selected for the breed. The proportion of any flock approaching it depends on the selection of the breeding stock and the development of the young stock. The ideal shape is preserved only in flocks carefully selected for that character, and so reared that full development is secured. In what are called the practical qualities, — egg production and meat properties, — and in their adaptation to climatic and soil conditions and environment, they are substantially the same. The differences constantly observed between flocks of different breeds, varieties, and subvarieties are no greater than those constantly observed between stocks, flocks, and individuals of the same variety.

Special excellence in any character or combination of characters, secured and made characteristic of a stock or strain by a breeder, may be in a measure transmitted to other stocks, and may persist for a while in his stock under unfavorable conditions, and even reappear in individuals after having been lost for some generations. Certain desirable characters or traits may be very persistent in some lines of blood in any variety; undesirable features may be as persistent in other lines in the same variety. These observations apply to all races of poultry, but apply with particular force in consideration of this class because of the comparatively narrow range of standard weights and shapes. Descriptions of these, omitted from the separate descriptions of breeds and varieties, are here given, and with the weights for this class, weights of varieties of like weights in lighter and heavier classes.

TABLE XXI. AMERICAN STANDARD WEIGHTS OF MEDIUM BREEDS

Type	Breed	Cock	Cockerel	Hen	Pullet
		Pounds	*Pounds*	*Pounds*	*Pounds*
Egg	Andalusian	6	5	5	4
General-purpose	Rhode Island Red	$8\frac{1}{2}$	$7\frac{1}{2}$	$6\frac{1}{2}$	5
	Wyandotte	$8\frac{1}{2}$	$7\frac{1}{2}$	$6\frac{1}{2}$	$5\frac{1}{2}$
	Buckeye	9	8	6	5
	Plymouth Rock	$9\frac{1}{2}$	8	$7\frac{1}{2}$	$6\frac{1}{2}$
	Java	$9\frac{1}{2}$	8	$7\frac{1}{2}$	$6\frac{1}{2}$
	Orpington	10	$8\frac{1}{2}$	8	7
Meat	Langshan	10	8	7	6

A glance at this table shows plainly the difficulty of making sharp distinctions of shape in these breeds. The so-called breed types may be differentiated in verbal and pictorial descriptions, and in occasional specimens, but that in ordinary breeding operations they should be somewhat confused is inevitable. The methods of judging exhibition poultry and the necessities of color breeding tend also to confusion of body types.

FIG. 438. Single-Combed Buff Orpington pullet

Typically the differences in shape of body between these breeds are as follows: The Rhode Island Red, compared with the Wyandotte (which has the same weights, except for the pullet), has a long body, described as "oblong"; the Wyandotte, a chunky, "blocky" body. The Buckeye tends toward the Indian Game rather than the oblong Rhode Island Red shape. Compared with the Wyandotte and Rhode Island Red, the Plymouth Rock is longer-bodied than the Wyandotte and heavier than the Rhode Island Red, with more weight in the rear. The Java is longer and narrower than the Plymouth Rock, the Orpington broader and deeper. To some extent these differences depend upon length of plumage and carriage of the body. As between any breed and one immediately above or below it in the scale of size and weight, little difference in tendencies and adaptations is found. Between breeds at the extremes, considerable differences may be noted. The lighter breeds are usually more active and mature earlier, are less prone to put on fat, and have a longer productive life than the heavier, though the latter, while in suitable condition, are equally good layers. For table use the Rhode Island Reds are commonly rated rather inferior to Plymouth Rocks and Wyandottes, but this is wholly a matter of selection for meat quality. Some stocks of Reds are as good table poultry as any of the other breeds of the class. As first introduced the Orpingtons were probably of higher average table quality than the American breeds because of more careful selection along that line in England; as found now they average with the others. Choice among these varieties is largely a matter of personal preference for a particular color, or for a color adapted to some feature of the location.

FIG. 439. Single-Combed Buff Orpington cockerel

Continental European general-purpose types. The introduction of the heavy Asiatic type had less effect on the poultry of continental Europe than on that of America and England. A few races were locally developed from mixtures of Asiatic with native stocks in the period following the excitement over the Asiatic type, but seem not to have attracted attention of poultry keepers as did the American and English varieties of this class when introduced later. The principal races made on general-purpose lines on the continent are as follows:

The Faverolles were developed in the vicinity of the town of that name in France, from a variety of crosses on the common fowls of the district, which were largely of the ordinary Houdan type. Brahma and Cochin males were largely used, and also Dorkings. Apparently any large male was considered desirable. Faverolles differ from the American general-purpose type in the color of the skin and in retaining various superfluous features, — the beard, the feathers on the legs, and the fifth toe. In their native district all colors are found. As bred by English and American fanciers three varieties are designated: salmon, light, and black. The Salmon Faverolles are really an indeterminate mixture of the black- or brown-red and black-white color patterns. The Light or Ermine Faverolles have the color pattern of the Light Brahma. The weight of males is from $6\frac{1}{2}$ to $8\frac{1}{2}$ pounds, of females, from 5 to 7 pounds. They are reported hardy, very rapid growers, and good layers.

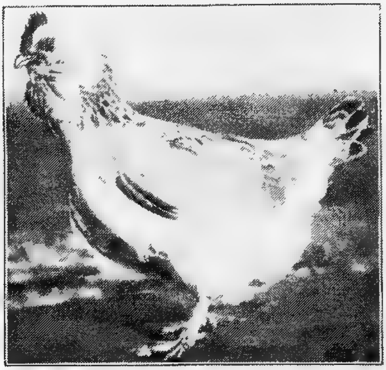

FIG. 440. Salmon Faverolles hen. (Photograph from E. T. Brown)

The Bourbourg, produced by crossing Brahmas on common fowls of the laying type in northern France, has the color of the Light Brahma, the size of the Wyandotte.

The Estaires, produced by Game and Langshan crosses on common fowls of the laying type in northern France, are black in color, with a rather large single comb. They are about the size of the Wyandotte.

The Prat is a variety produced in Spain by crossing Asiatic on native Spanish races. In size it compares with Wyandottes and Plymouth Rocks. The colors are various, brownish and yellowish tints predominating. It is a type similar to the Rhode Island Red, but with comb and tail more resembling the Mediterranean races.

FIG. 441. Red Pile Game Bantam cock [2]

The Malines is a Belgian breed produced by crossing the Antwerp Brahma [1] and fowls of the Campine or Flemish Cuckoo stock. The colors are cuckoo and white, the shape and general appearance much like the early type of Cochin and Brahma or like the Langshan. Weights: males, 9 to $11\frac{1}{2}$ pounds; females, 8 to 10 pounds.

FIG. 442. Golden Duckwing Game Bantam hen [2]

The Huttegem is a mixture of old Belgian with Asiatic races. The colors are various; combs both single and rose; legs feathered; weights: males, 9 to 11 pounds; females, 7 to 9 pounds.

The Breda was produced by crossing Asiatic on native Dutch stock. It is supposed that the breed may have originated from ancient importations of Asiatics, but recent crosses have given it much of its present character. The prevalent colors are cuckoo, black, white, and blue. The comb is rudimentary; feet slightly feathered; weights: males, $6\frac{1}{2}$ to 9 pounds; females, 5 to $7\frac{1}{2}$ pounds.

FIG. 443. Birchen Game Bantam cock [3]

Deformed types. Under this head may be described a few irregular forms.

[1] The Antwerp Brahma is a race of Light Brahmas imported direct from China to the Antwerp Zoölogical Gardens, and there bred pure.

[2] Photograph from A. E. Blunck.

[3] Photograph from Hermitage Bantam Yards, Nashua, New Hampshire.

Rumpless, or tailless fowls. In the true rumpless the spine lacks the normal number of vertebræ, the terminal vertebra is deformed, and the fleshy formation from which the tail feathers grow is wanting. The feathers of the saddle hang down at the rear as at the sides. The colors are various. The deformity is not regularly reproduced, but occurs in some progeny. Many of the rumpless fowls shown in exhibitions are said to be manufactured, the part on which the tail feathers are grown being removed when the bird is very small.

FIG. 444. Rose-Comb Black Bantam hen[1]

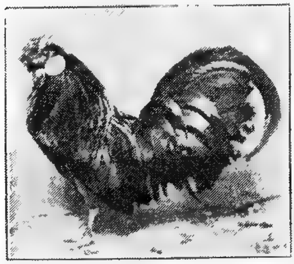

FIG. 445. Rose-Comb Black Bantam cock. (Photograph by Graham)

Frizzles have feathers curved outward at the ends. This freak feature may be established if desired, but few poultrymen are interested in it. The birds are only used as novelties in exhibitions.

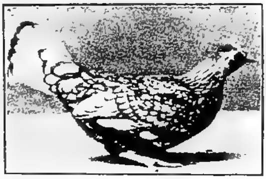

FIG. 446. Silver Sebright Bantam hen[2]

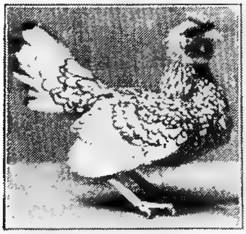

FIG. 447. Silver Sebright Bantam cock[2]

Silkies. In the Silky fowls the web of the feather is hairlike. The plumage is generally white. The skin is "black." They are believed to have originated in China or Japan, where they are said to be abundant.

FIG. 448. Silver Sebright Bantam cockerel[3]

Bantams. Dwarfs come occasionally in all kinds of poultry, and there are references in

[1] Photograph from owner, Grove Hill Poultry Yards, Waltham, Massachusetts.

[2] Photograph from A. E. Blunck.

[3] Photograph from owner, Brook View Farm, Newbury, Massachusetts.

literature to dwarf races of fowls in Europe centuries ago. The name has been supposed to come from the province of Bantam, in Java, whence, it is said, were imported the first bantams to attract attention in England. Neither record nor reliable tradition gives any account of such importation. It was apparently assumed in order to connect dwarf fowls as a class with some place in Asia, at the time when it was fashionable to give Asiatic names to races of fowls. The popular name for a dwarf fowl is (and undoubtedly was long before Asiatic fowls came to Europe) "banty," which probably comes from the Gaelic *banna*, a jot, the smallest portion of anything, and from which were derived the Gaelic *bean*, *bian*, little, small.[1]

FIG. 449. White Polish Bantam cock [2]

FIG. 450. White Polish Bantam hen [2]

Economically bantams are of little importance. As layers they are, as a rule, much inferior to large fowls. Only the largest specimens of the largest varieties are desirable for poultry. Most varieties are rather delicate, especially when young. Common bantams — that is, those of no particular breeding — are kept mostly as children's pets. Standard-bred bantams are kept by fanciers to whom the type appeals and who take pleasure in working out the breeding problems that it presents. Dwarf types of nearly all races of fowls have been produced, and there are a few quite unlike the large types. Singularly, types unpopular in large fowls are very likely to be popular in bantams, while the dwarf types of popular fowls attract comparatively little notice. The

FIG. 451. White Japanese Bantam cock [2]

[1] See Williams's Lexicon Cornu-Brittanicum, a Dictionary of the Gaelic Language of Ancient Cornwall.

[2] Photograph by Graham.

avowed object in every case is to make the bantam, in shape, color, appurtenances, — everything but size, — just like the large breed that it resembles. The exact likeness desired is rarely secured — some students of the types say, never. Usually the head (and appurtenances), wings, and tail of the bantam are larger in proportion than those of the corresponding large fowls, and the carriage is different, particularly in the males, which are the most insolent and pugnacious of birds, often domineering over cocks of the large breeds, and always ready to attack anything. The most common and best-established varieties may be divided into six groups: Common, Game, Rose-Combed, Polish, Asiatic, and Japanese.

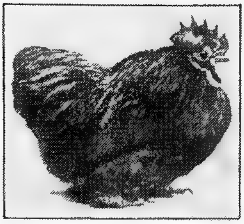

FIG. 452. Black Cochin Bantam cockerel[1]

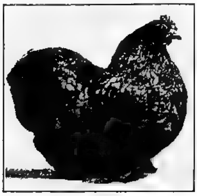

FIG. 453. Black Cochin Bantam pullet[1]

Common bantams are usually the offspring of unions of ordinary Game Bantam males with small mongrel hens. They nearly always show something of the Game style, with various colors. A family so produced may continue for some generations, bred for small size, with little attention to color, or a color type may be fixed without trying to conform to any popular standard. Thousands of such families appear and disappear.

FIG. 454. White Cochin Bantam pullet

FIG. 455. White Cochin Bantam cock

Game Bantams are principally of two kinds. One, which may be called the common Game Bantam, is a miniature of the Pit Game. This is the most common of the established varieties, the black-red type being most abundant. The Exhibition Game Bantam, modeled after the large Exhibition Game, is a great favorite with fanciers

[1] Photograph from owner, Dr. J. N. MacRae, Galt, Ontario.

and a much more attractive bird than the large type, inasmuch as the proportions which in a large bird give the impression of absurd extension of extremities produce much less of that effect in a bird too small to contain, in any part, a suggestion of utility. There are also bantam sizes of the Malay and of the Indian Game.

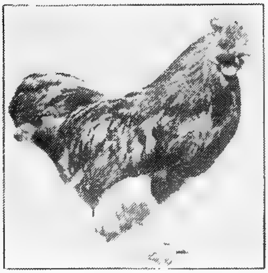

FIG. 456. Buff Cochin Bantam cockerel[1]

Rose-Combed Bantams are of two kinds, — the Hamburg type, to which the description "rose-combed" has been given as a name, and the Sebrights, which take their name from Sir John Sebright, the originator of the type. The Hamburg type is bred in two colors, black and white. The blacks, with their glossy plumage, red rose combs, white ear lobes, and dainty, stylish forms are by many considered the most beautiful of bantams. Sebright Bantams have plumage laced like that of the Silver and Golden Polish, with which the two varieties correspond in color. A peculiarity of the breed is that the males are hen-feathered, that is, lack the flowing hackle, the well-developed tail, and the fine back and saddle feathers which normally distinguish the plumage of the cock.

FIG. 457. Light Brahma Bantam pullet[2]

Polish Bantams need no other description.

Asiatic Bantams present dwarf forms of all the breeds classed as "Asiatics," — Cochins, Brahmas, and Langshans. The Cochin Bantams, first called Pekin Bantams, came originally from China. The others were made in England and America.

Japanese Bantams are of a very different type from those originating on the continent of Asia. They have very short legs, large combs, wings, and tails, and a very erect carriage, bringing the head and tail together. They are bred in various colors, but only the black, white, and black-tailed white are recognized in the Standard of Perfection.

[1] Photograph from owner, Sidney Wells, Newark, Ohio.
[2] Owned by Louis T. C. Loring, Shrewsbury, Mass. Photograph by Graham.

CHAPTER XXII

TURKEYS, PEAFOWLS, GUINEAS, PHEASANTS

Of these four kinds of poultry, including all the gallinaceous domestic birds other than fowls, only the turkey requires special consideration in this connection. No standards for the others have been formulated, though there are varieties in all, and in a general way breeders mate for the preservation of variety characters. This chapter describes turkeys in detail. Notes on the others are appended to it as the most appropriate place for their insertion.

Turkeys. At the discovery of America the turkey, previously unknown to Europeans, was found in Mexico and Peru, both in the wild state and in domestication. The most authentic accounts place its arrival in Spain, England, and France at about 1624. Before the end of that century it was well distributed throughout Europe. Wild turkeys are still found in mountainous and wooded territory in the South and as far north as Pennsylvania. Modern European stocks appear to have been derived mostly from early importations; American stocks usually come from wild stock brought into domestication. While records are scant, it seems quite plain that, from the time of the settlement of the country, the stocks of turkeys in sections where wild turkeys were found have had frequent accessions of wild blood, keeping them nearer the wild color and type; and that when the wild turkey disappeared from a locality, the domestic stock usually became mongrelized, but occasionally was developed as a variety with distinctive color and sometimes with modifications of form. There are not, however, such variations of size and of superficial shape characters in turkeys as are found in the races of domestic fowls, or even in ducks and geese. Of differences which might be made the basis of breed distinctions there are none; color variations are few, and no attempt has been made to manipulate color patterns farther than by selection and improvement of the original. Racial differences are of slight importance, and turkeys are commonly considered as of one breed with a number of color varieties.

The Wild Turkey as frequently seen alive on farms and in poultry exhibitions, and dead with the feathers on in the market, is about the size of the average mongrel turkey found on farms, but more compactly built, higher stationed, and closer feathered, appearing slimmer, though generally heavier than domestic birds of the same

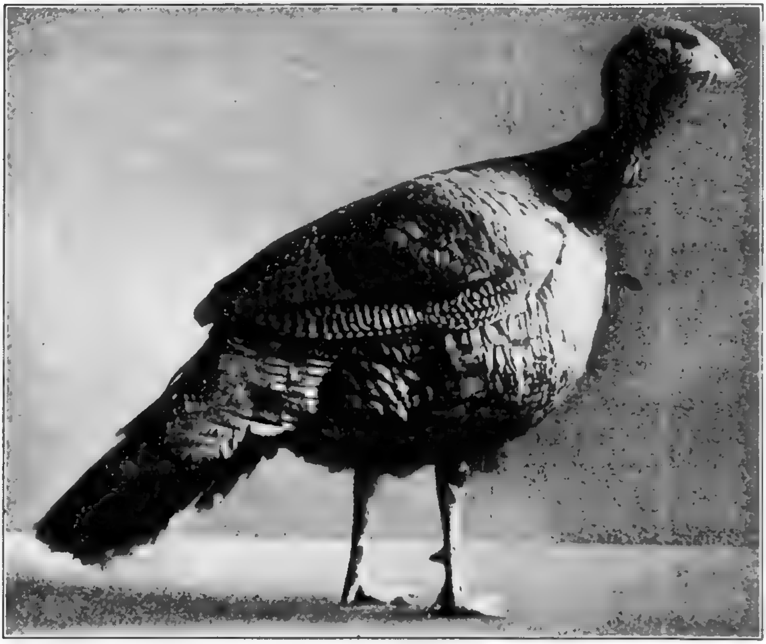

FIG. 458. Bronze Turkey cock. (Photograph by E. J. Hall)

apparent size. In color it is a black-bronze. The skin of the comb, head, and wattle is a darker, more purplish red than in the domestic stock.

The Bronze Turkey is the wild turkey, of the type just described, as it develops in domestication, under highly favorable conditions of life, with selection for the improvement and greater brilliancy of the original color and markings. The type seems to have existed, pure in some specimens but in general more or less mixed with stocks longer under domestication (and often degenerated), for two centuries or more, but not until the modern period in poultry culture did it attract special attention. Since then it has become the leading variety, being extensively kept as a pure race and also everywhere used to grade up inferior stocks. Crosses with wild stock are made at intervals by many breeders of Bronze Turkeys. In color the male and female are alike, except that the color tone of

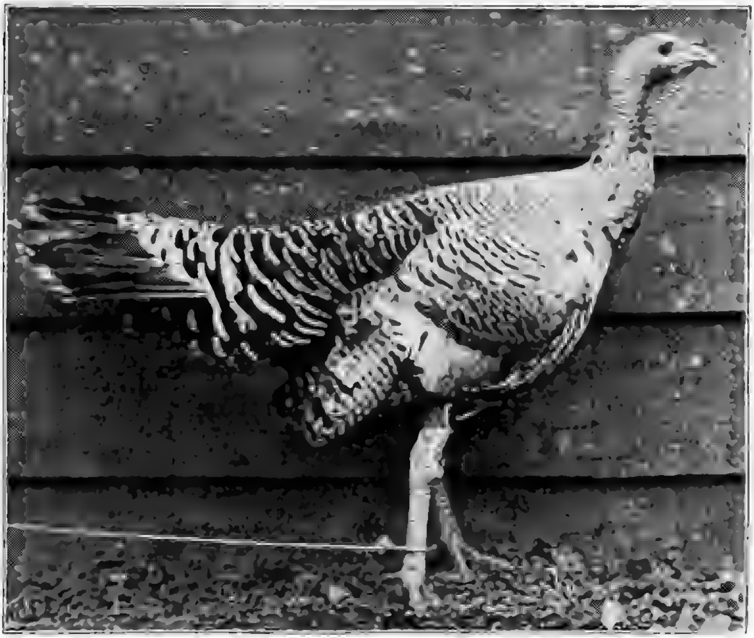

FIG. 459. Bronze Turkey hen. (Photograph by E. J. Hall)

the female is more sober. The soft feathers are dull black or bronze, the wide, nearly straight tips crossed with a wide black band, next to which, at the tip, is a narrower band of white. The different widths of these bands and of the bronze tints in different sections give varying color effects. The long feathers of the wings and tail are barred black, or brown, and white; the tips of the tail feathers are banded like the body plumage.

The Narragansett Turkey is probably most correctly described as a race produced by improvement of stock somewhat degenerated in domestication. It originated and has been bred chiefly in Rhode

Island and Connecticut, taking its name from Narragansett Bay. In this variety the bronze and brown tints are largely eliminated from the soft feathers, but combine with the black in the stiff feathers of the wings and tail, while the colors of the bands at the tips of the feathers are reversed, the wide bands being white and the narrow one at the tip, black. The general effect is gray.

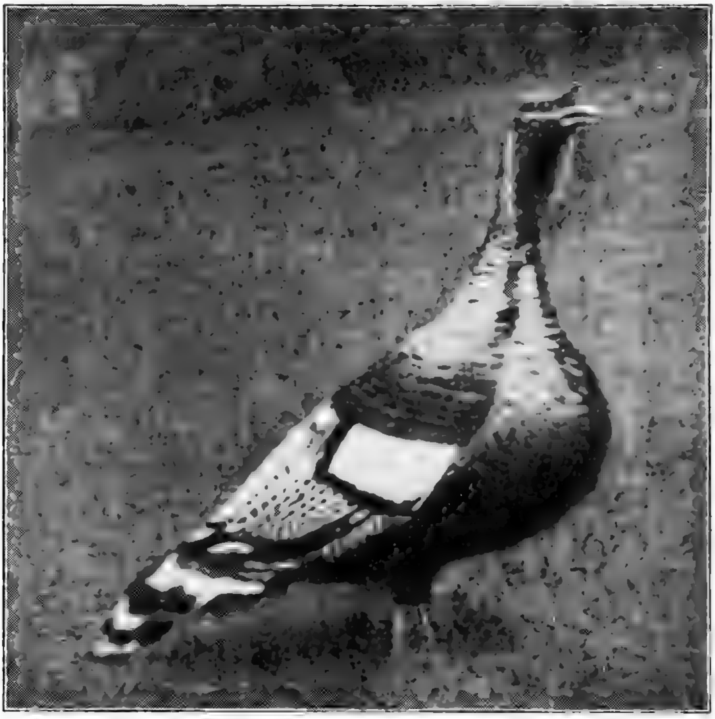

FIG. 460. Narragansett Turkey cock

The Black Turkey. This variety, though found occasionally in America, has been developed principally in Europe. In Spain black is said to be the predominant color. The black turkeys of Normandy still have an excellent reputation. In England the finest specimens of the type were long grown in Norfolk, and in America black turkeys are still sometimes called Norfolk Turkeys, but the English race is said to be nearly extinct. Black color probably occurs often in wild turkeys and, mingling with the bronze, is doubtless a most potent agent in keeping the color darker than that of the domestic bronze selected for lighter, more brilliant color.

The White Turkey. When both white and black varieties of a bird are found, it is usual to consider the white a sport from the black. While such sports may occur, the history of white varieties of fowls shows that they are largely made up of white mongrels which approach the desired type. The white birds derived directly from mixed colors of the same race seem to have come usually from the lightest-colored specimens of the parent stock. Hence, in the case of the white turkey it is more reasonable to suppose that the white turkeys were derived by selection from the same general stock as the blacks, than to assume that they came from the latter as sports, especially as no cases of sporting are recorded.

FIG. 461. White Turkey cock. (Photograph by E. J. Hall)

The name "White Holland" has been given to the white variety of turkey because the color was common in Holland, but it may safely be asserted that the greater part of the white turkeys in America have been derived by selection from flocks in which gray in various shades was the prevailing color. In nearly all such flocks white specimens occasionally appear.

The Slate Turkey corresponds in color to the blue races of fowls and unquestionably comes from a cross of black and white. The color is rare, and it is doubtful whether it should be considered a variety in the proper sense of the term. A few flocks are bred for preservation of this type, but its scarcity and the suddenness of appearances of small exhibits in the shows indicates that most of the stock is cross bred from black and white.

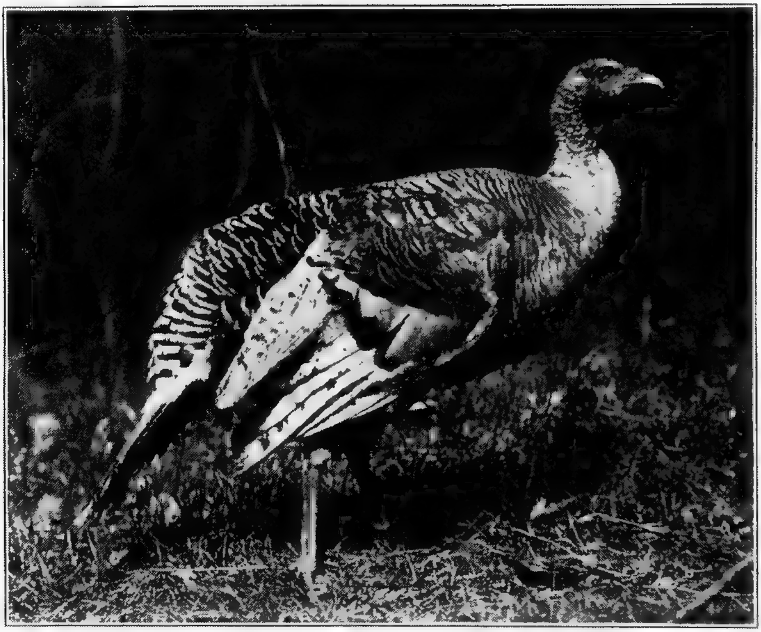

FIG. 462. Bronze Turkey hen. (Photograph from Rhode Island Agricultural Experiment Station)

The Buff or *Red Turkeys* are produced by the elimination of black in the wild or the bronze turkey, the red shades remaining and by selection being made more intense and distributed more widely. Buff birds, as well as gray and buff mixed, appear frequently in mongrel flocks. The red turkeys produced at different times in different places in this country probably came from crosses of such buff turkeys with the bronze, and from personal or local selection of the type. In none of the so-called buff turkeys is the color as uniform

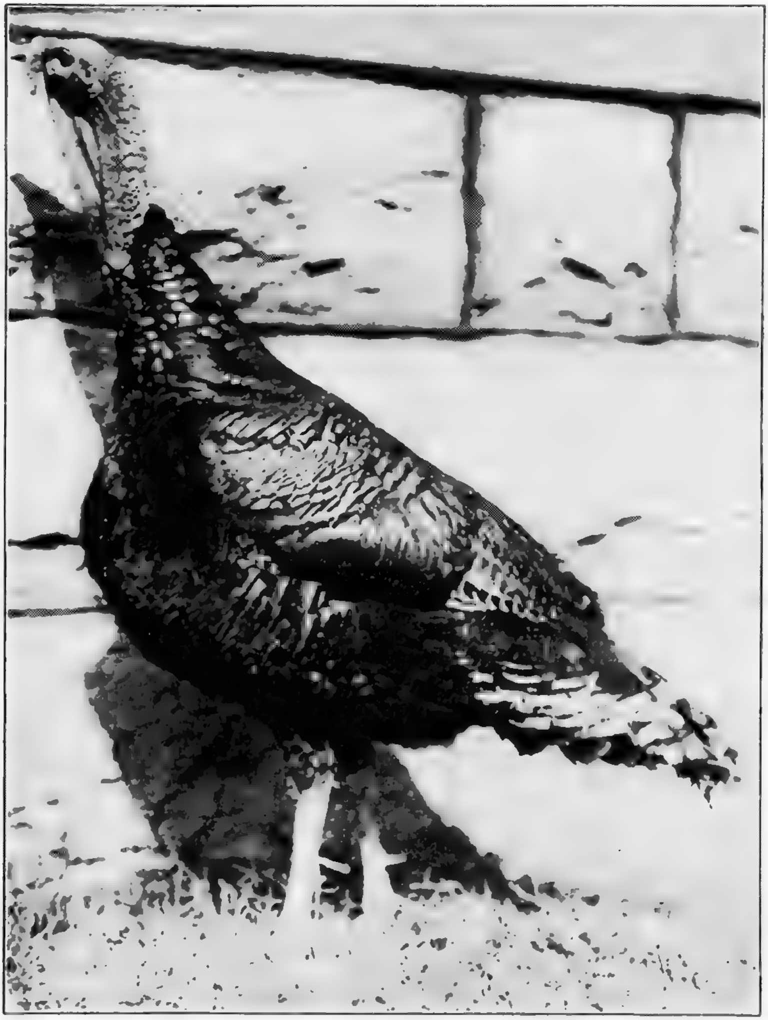

FIG. 463. Bronze Turkey cock: one of the mammoths. (Photograph by E. J. Hall)

as in yellow mongrel fowls. The tail and wings are mostly white, and the buff in other sections patchy and uneven. The variety known as the Bourbon Red Turkey is supposed to have come from a cross of Bronze on mongrel buff stock.

NOTE. The Bronze Turkey is everywhere recognized as altogether the best existing type. Considering its properties collectively, it may well be doubted whether the type can be improved upon. It is a rugged race, growing sometimes to great size but on the average not up to the standards for exhibition weights for other varieties.

TABLE XXII. AMERICAN STANDARD WEIGHTS OF TURKEYS

Variety	Cock		Cockerel	Hen	Pullet
	Adult	Yearling			
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Bronze .	36	33	25	20	15
Narragansett . . .		30	20	18	12
Buff, Slate, and Black . .		27	18	18	12
White .		26	18	18	12

The Bronze, to carry its greater weight, is a heavier-boned turkey than the others. In the largest specimens (usually old males) the meat is likely to be coarse-fibered; in ordinary comparisons of average birds no difference in this quality is noted. For table form, without regard to size, the favorite type of the Narragansett is the finest American type of turkey, closely resembling in shape the Cambridge Bronze of England. The shape of the Narragansett is as obviously due to selection for abundance of breast meat as the vigor and size of the Bronze are to vigorous wild blood and to favorable conditions in domestication. These are practically the only variety differences, other than color, found in turkeys.

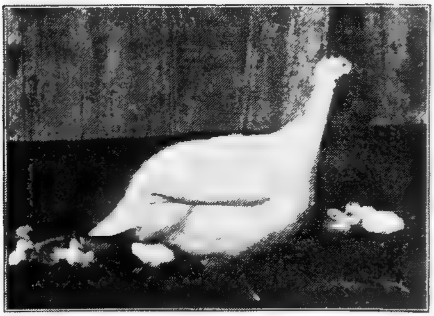

FIG. 464. White Guinea hen with brood

Peafowls. Peafowls are supposed to be natives of Java and Ceylon. They have been domesticated in Asia and Europe since very early times. The most familiar variety is that known as the common peafowl, about as large as a medium-sized turkey, the adult male having gorgeous, iridescent blue-green plumage, the female, grayish brown. A white variety is also frequently seen. These are the only kinds requiring special mention, although several other varieties are found in exhibitions. The male does not get his full adult plumage until the third year.

Guineas. Guinea fowls are natives of Africa. They are supposed to have been brought to America by the Spaniards very soon after the discovery of the New World. The familiar varieties are the common gray, or *Pearl Guinea*, which has bluish-gray plumage with white spots, and the *White Guinea*. Cross-bred birds from these

FIG. 465. Pearl Guinea Fowl at Brook View Farm, Newbury, Massachusetts

two varieties sometimes show part white and part gray with white spots. There is said to be also a white variety with dark spots.

Pheasants. The most familiar variety of pheasant is the *Ringneck*, so called from a white ring about the neck of birds of the variety as they originally came from China. In England the stock has been crossed with other varieties, and in what are known as English Ringnecks and English Pheasants the ring is usually absent and there are other differences due to crossing with other varieties. These are all comparatively plain birds. There are many other varieties, some of which are of strikingly beautiful plumage.

CHAPTER XXIII

TYPES AND BREEDS OF DUCKS

Considered with reference to sources from which stock was obtained, the races of domestic ducks bred for economic purposes are of three distinct types. Taking them as they are, we find but two types. To one of these belong all economic races of European and of Asiatic derivation; to the other, the Muscovy Duck (a native of South America), which, like the turkey, was given a name that suggested eastern Europe as the place of origin. The more common types of ornamental ducks are plainly of the same origin as the large races. They are dwarfed types, or "bantam ducks." The rarer and more brilliantly colored kinds often seen in aviaries are mostly captive wild birds, though some, as the Mandarin, are said to be domesticated in the countries from which they came.

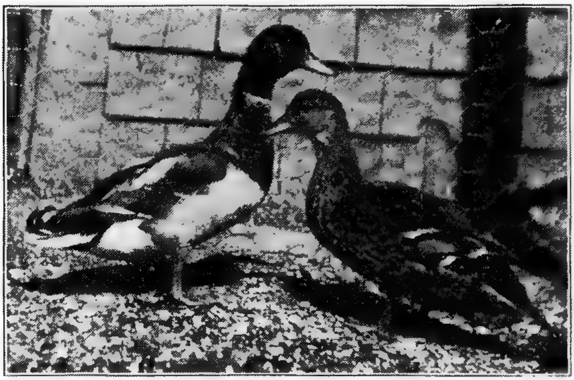

FIG. 466. Domesticated Mallard Ducks. Brook View Farm, Newbury, Massachusetts

The common wild duck. The Mallard, or common wild duck, is generally accepted as the ancestor of all economic races of ducks, with the exception of the Muscovy. Wild specimens are still frequently captured and brought into domestication, and after several generations become so much increased in size that they will pass readily for small specimens of the Rouen Duck, which the Mallard closely resembles in color.

Common domestic ducks. Our common ducks, sometimes called "puddle ducks," are a type analogous to the common fowls previous to the introduction of improved stocks. It is rarely possible to determine satisfactorily whether any particular stock of ducks of this type now seen is of the mongrel stock which has been distributed throughout Europe from very early times or whether it has degenerated from stock improved within the last fifty or sixty years. Twenty-five or thirty years ago most of the common ducks were undoubtedly free from the influence of improved stocks. These ducks were of various colors, about half the size of the Pekin and Rouen, slow of growth, generally inferior as layers, and of but little commercial importance. So far as known, no effort was made to improve them in America; in Europe a number of breeds were developed.

FIG. 467. Rouen Ducks. Brook View Farm, Newbury, Massachusetts

Improved races of ducks. Improved stocks of ducks are of three general types, — the meat type, the laying type, and the ornamental type.

Meat types. As most numerous, of most importance, and also best showing the evolution of types, the table types of ducks are considered first. The races of this type are the Rouen, Aylesbury, Cayuga, Blue Swedish, Blue Termonde, Pekin, and Muscovy.

The Rouen Duck. The Rouen Duck bears much the same relation to the wild Mallard as the Dorking and Houdan fowls to the initial type of fowl. While it is entirely possible that this variety has been developed direct from the Mallard, it is much more probable that it was developed, by long-continued selection for table qualities, from common ducks of the same color, just as the fowls of the European meat type were developed from mongrel fowls. The type was developed especially in the north of France, and takes its name from the city of Rouen.[1] The body color of the male is gray; the back is quite dark, with a greenish coat, or sheen, becoming darker green near the tail; the under parts are very much lighter, the under sides of the wings and some of the feathers under the wings being white; the breast is claret-colored; the head and the upper part of the neck are green, a white ring separating the green from the body and breast colors, which extend to the lower part of the neck; the tail and wings show mixed gray and brown, with some green; the wing when folded shows a rich blue-green bar (called the "ribbon") with narrow white bars on either side. The female has penciled brown plumage, the general color tone of which is strikingly like that of the females in black-red types of fowls, and has the same blue-green and white bars seen on the male. A variety

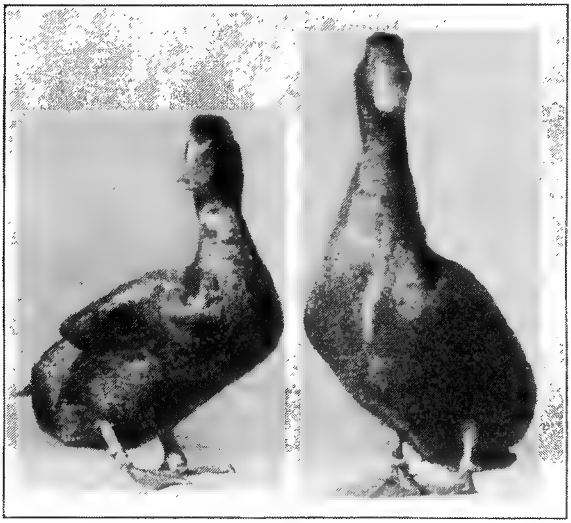

FIG. 468. Cayuga Ducks. (Photograph by E. J. Hall)

[1] This is the view of most of the earlier writers, and considering the nearness of that town to Paris, the great poultry market, and the custom of giving names of towns or districts to poultry for which they became celebrated, there seems no good reason for the efforts of later writers to make the name a corruption of "Rhone" or "roan."

of the Rouen, known as the *Duclair-Rouen*, resembling it in color but having a white neck and breast, is regarded as of the same original stock, unimproved by fancier's selection and not crossed with the Mallard, which was used in the Rouen to give brilliancy of color. The bill of the Rouen is greenish in the male and brown in the female; the legs and feet are orange with a green or brown shade.

The Aylesbury Duck. The Aylesbury Duck takes its name from the vale of Aylesbury in England. The white ducks of that district

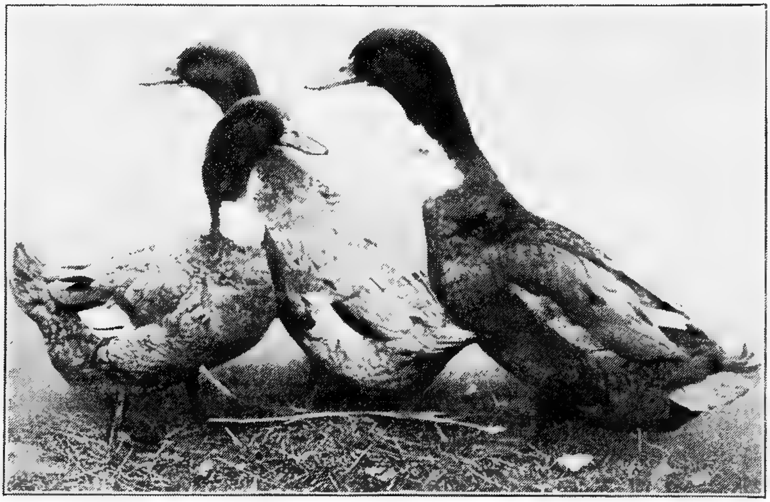

FIG. 469. Blue Swedish Ducks. (Photograph from owner, Sunswick Farm, Plainfield, New Jersey)

were long celebrated for their quality, and in time the name came to be applied generally, in England, to large white ducks. No definite accounts of their origin are given. The natural inference is that this breed was composed of white individuals from various sources. Such a race might have been made by improvement and selection without recourse to crosses with other improved races, but it is believed that both the Rouen and Pekin have been crossed with the Aylesbury to restore vitality lost through indifferent breeding. The plumage is white throughout, the bill flesh-colored, the legs and feet pale orange.

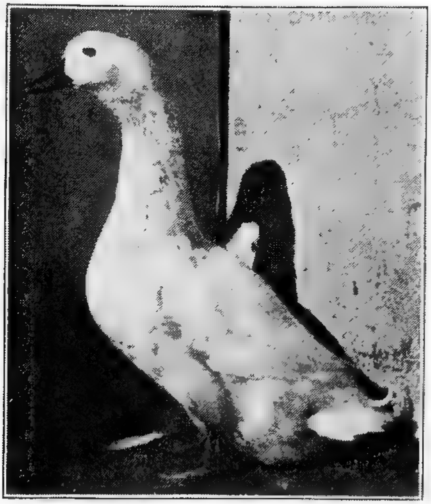

FIG. 470. Pekin drake. White Birch Poultry Farm, Bridgewater, Massachusetts

FIG. 471. Pekin duck. White Birch Poultry Farm, Bridgewater, Massachusetts

The Merchtem Duck. A white Belgian type closely resembling the Aylesbury is called the Merchtem Duck. The Belgian bird is a little smaller and has blue legs and a dark bean on the bill.

The Cayuga Duck. The Cayuga Duck is a large black duck taking its name from Cayuga County in New York, where it appears to have been developed as a local variety about 1850, though it attracted no attention beyond that vicinity until ten or fifteen years later. Stories of its origin attributing the black color to the Black East Indian Duck (also to a black duck from Brazil known as the Buenos Airean) may be regarded as of very doubtful authenticity, except perhaps as to certain stocks. Black ducks are frequently found in all races where the colors are various. The color is one which would naturally occur in the variations of the color of the common wild duck in domestication. There is no warrant for considering this variety as essentially different from other improved races.

The Blue Swedish Duck. In England and America the name "Blue Swedish" is given to blue or slate ducks developed as a color variety. It is said that the color has long been popular in parts of Russia, Scandinavia, and Germany, and that it has been frequently seen in the flocks of Belgium. It occurs occasionally in all stocks of various colors, but not with the depth and uniformity of shade and the peculiar white bib on the neck and the two white flight feathers which have been made standard markings in this variety.

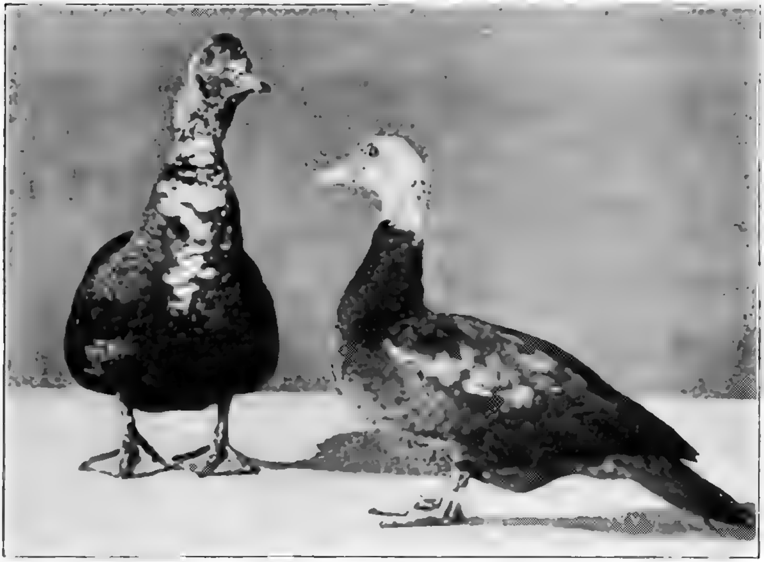

FIG. 472. Colored Muscovy Ducks. (Photograph by E. J. Hall)

The Blue Termonde Duck. The Blue Termonde is a race recently developed as an established type in Belgium. It is a very large duck, similar in color and evidently near kin to the Blue Swedish, but with the white throat an irregular feature.

The Pekin Duck. Brought to England from Pekin, China, in 1874, and to America in the next year, the Pekin Duck had an even more marked influence on duck culture in this country than the Asiatic type of fowl had on the improvement of fowls. Like the Asiatic fowls, the Pekin Duck was of large size and extremely hardy. It is the common duck of China. Its origin is probably similar to that of the early European races, ancestral lines meeting not in any domesticated stock but remotely somewhere in the evolution of the wild duck. As nothing is known of other varieties of ducks in China, the Pekin is here usually considered a white breed. The history of other races indicates that it is probably the white variety of a race which, when first domesticated, broke up into various colors. From the extent to which it has displaced other races in America and some parts of Europe, it is easy to suppose that if in China there early arose a popular preference for white ducks, this color long ago became dominant or exclusive.

FIG. 473. White Muscovy Ducks. (Photograph from owner, Brook View Farm, Newbury, Massachusetts)

The Muscovy Duck. The Muscovy Duck is a native of South America, introduced to Europeans, as is supposed, sometime in the seventeenth century. The name is a corruption of "musk duck." This duck is in several respects very different from the common wild duck and the races derived from it, and is sometimes described as a distinct species. Many authorities have declared that when crossed with other ducks the offspring are sterile. It seems, however, to be well-established that the bybirds will breed freely with either parent race, if not so readily among themselves. The most conspicuous peculiarity of this race is that the head and face are partly bare, as in the normal fowl, the skin being a brilliant red, roughly caruncluated and having a protuberance above the beak corresponding to the comb in fowls. There is a tuft of feathers on the head which can be raised or depressed at will.[1] Another conspicuous feature is the difference in the size of the sexes, the males being commonly much larger than the females. The Muscovy Duck has greater power of flight than other domestic ducks, and frequently perches on branches or elevated places. The color of the wild race is black with some white on the head. In domestication black, black and white, blue, and white are found. The American Standard varieties are the *colored* (black and white) and the *white*.

TABLE XXIII. AMERICAN STANDARD WEIGHTS OF DUCKS

Variety	Adult drake	Young drake	Adult duck	Young duck
	Pounds	*Pounds*	*Pounds*	*Pounds*
Pekin	8	7	7	6
Aylesbury	9	8	8	7
Rouen	9	8	8	7
Cayuga	8	7	7	6
Blue Swedish	8	6½	7	5½
Muscovy	10	8	7	6

NOTE. The improved races of ducks are all rapid growers, and of large size compared with the common duck. For special duck plants the Pekin is the only duck now considered in America. Its color, hardiness, fecundity, and docile disposition make it far superior to any of the others for the conditions of production on a large scale and for the requirements of the market. Prior to the advent of the Pekin, the White Muscovy and the Aylesbury Duck were used by growers producing for the New York market. The Aylesbury in this country has never been a favorite. At different times, duck growers have tried the experiment of crossing the Aylesbury and Pekin, but have invariably discarded the results, considering the produce inferior to the Pekin. In England the modern Aylesbury has some Pekin blood, but how much it is impossible to say. Aylesbury breeders declare that there is very little. Others assert that the modern Aylesbury is practically nothing else than a

[1] This is true as to the feathers on the heads of fowls, ducks, and geese, but when there are only a few very small, short feathers on the head, they simply appear rough when elevated. I have frequently observed Pekin Ducks with the feathers on the head elevated so that it appeared deformed. In some the action, or attitude, was so constant that it was practically a deformity; in others it was only occasional.

Pekin with white skin and pale bill. The experience of American breeders with Aylesbury crosses cannot be taken as conclusively showing racial differences, for similar results might have followed the importation of Pekins of European stock. It is generally admitted that the Pekin Duck has reached its highest development in this country.[1] Of other races of this class the Rouen ranks first, and is considered by many actually much superior in meat quality to the Pekin, especially when full grown. At that stage it is said to dress more easily than the white duck. The black (Cayuga) and blue (Swedish) ducks have their admirers, but make little progress in popular favor. The breeding of races of this class other than the Pekin is largely in the hands of fanciers. The shape of all these ducks (except the Muscovy) is much the same (the body long, broad, and deep, the breast full and prominent, the keel well developed), especially in old birds.

FIG. 474. Indian Runner drake (old), White Birch Poultry Farm, Bridgewater, Massachusetts

In the Muscovy there is greater breadth, with less depth of body and little keel. The chief shape difference in ducks of this general type is the carriage of the body, and this difference, it should be observed, is artificial, the typical carriage being designated largely for the purpose of maintaining a semblance of breed difference in varieties which in practical breeding tend to become alike. The carriage of body in American Standard exhibition ducks of this type is Rouen, Aylesbury, Cayuga, Muscovy, and Blue Swedish, nearly horizontal; Pekin, a little elevated in front. The elevated carriage of the Pekin is more characteristic of the male than of the female, and tends to disappear with increase of weight. The typical carriage as shown in model illustrations is usually the extreme pose of the bird in an attitude which emphasizes the desired feature. In every point of shape (including size), variations in individuals and stocks are constantly found to be much greater than the differences between representatives of the breed type. As layers the Pekins are rated much superior to other large races, the Muscovy at the foot of the list.

[1] In 1907 Mr. S. Sato, of Tokyo, Japan, visited this country to investigate methods of poultry culture and to buy poultry — among other kinds, Pekin Ducks. I learned from him at that time that the white ducks of China were so much inferior to the American Pekins that they were not considered desirable to improve the stock in Japan. According to Mr. Sato, not only this race of ducks but all Chinese fowls came to Japan by way of America.

Laying-type ducks. The egg-type duck is a type developed in Belgium, Holland, and northern France as a common, very hardy duck; it makes rapid growth, especially the first five or six weeks, and is meaty, though small in comparison with those just described; it is an early layer and very prolific. On the continent these ducks are of all colors. There seems little doubt that they have furnished the foundation stock for the Blue Swedish, the Buff, and the Indian Runner ducks. They still afford material for new varieties.

The Indian Runner Duck. In England and America the Indian Runner Duck was introduced to the public as a native of India, but in view of the positive testimony[1] on that point it can hardly be doubted that it is simply an improved color type of the ducks from that part of the Continent directly opposite the south of England. The peculiar erect carriage is like that of the closely allied domestic Penguin duck. Those who attribute this character to a wild ancestral race are evidently not aware that the "wild penguin duck" of early poultry writers and some naturalists was a fiction. In England the continental stock was sometimes crossed with common English ducks. American Standard weights for this variety are drake, $4\frac{1}{2}$ pounds; duck, 4 pounds. The body is long and narrow, the breast well developed. The standard color is fawn (preferred) or gray and white, in a peculiar pattern, the dark color occurring in patches on the crown and cheeks, and on the back, breast, and fore part of the body like a jacket. As layers they surpass

FIG. 475. Indian Runner drake and duck (young). (Photograph from owner, Clayton I. Bullard, White Pine, Tennessee)

[1] M. Louis Vander Snickt, of Belgium, in *Chasse et Pêche*, in 1900, stated very emphatically that the Indian Runner Duck was identical with the ducks of the same type common in the Netherlands. Against such authority, stories of importations from India (coupled with the information that in their alleged native land the race is very rare) carry little weight.

all other ducks known in America, though the average is far below the large yields which are frequently reported (two hundred eggs or more per bird per year). They are used to some extent for broiler ducks, dressing very plump and meaty at from $2\frac{1}{2}$ to 3 pounds each at six weeks of age.

Common ornamental ducks. Ornamental ducks include the Crested White Duck and three varieties of small ducks which are all of the same type, though classed in the Standard of Perfection as two breeds, of which one has two varieties.

The Crested White Duck. As usually found, the Crested White Duck is a medium-sized duck, though the American Standard weights make it the same weight as the Pekin. They are bred only as curiosities. Although white is the only color recognized as standard, other colors occur. The type seems to have been developed in common European ducks centuries ago.

Call Ducks. Gray and White Call Ducks and Black East India Ducks are of substantially the same size and type. The Gray Call Duck closely resembles the wild Mallard, and the coloration fixed by fanciers is the same as that of the Rouen. The White Call Duck is of the same derivation, and though given another breed name, the Black East India Duck is plainly of the same stock.

CHAPTER XXIV

GEESE AND SWANS

Domestic geese in America are mostly of European derivation, but there are also races from Asia, and the American wild goose is quite extensively bred in confinement in some districts, and in such places is largely used to cross with domesticated races. European and Asiatic types are supposed to be from different wild types, but from the fact that they interbreed freely it is assumed that these must have been varieties of the same species. While some races of geese are quite regularly better layers than others, and occasionally an individual gives large egg production, laying qualities have not been sufficiently developed in any race to justify its description as a laying type. Geese are kept in domestication usually for their flesh, but occasionally for ornament. The most appropriate classification, therefore, is to make two divisions, *economic* and *ornamental*.

Economic races of geese. The most important races of geese are the European races. The influence of other blood on stocks in the country at large is practically negligible. Our common geese came with the early settlers from Europe. Our popular improved races are bred as received in later days from the parts of Europe where they were developed.

The common geese. The greater part of our stocks of geese apparently still retain the type and characteristics of the geese common in Europe since long before the beginnings of history. The graylag goose is the wild variety from which it is supposed that the common domestic stock is derived. Except where selection for white has been made, gray and mixed gray and white are the prevailing colors. While inferior in size to the largest improved races, the common geese are large enough, when bred and grown well, to answer ordinary market requirements, and are extremely hardy.

The Roman Goose. The Roman Goose is supposed to be the oldest of the improved varieties. Although the Italians gave little attention to color in fowls, it appears that from very early times white was a preferred color, and is to-day the prevailing color of geese in those parts of Italy where geese are grown. A black- and- white or gray variety is also found in parts of Italy. Roman. Geese are said to be precocious and prolific layers, from sixty to one hundred ten eggs from October to June being given as the recorded production

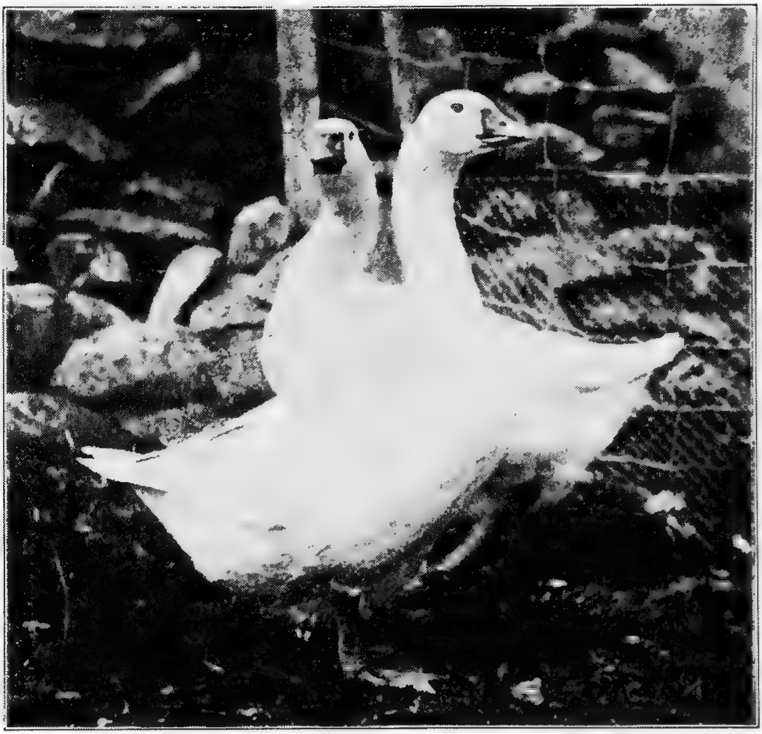

FIG. 476. Emden Geese

of individuals. In size and general appearance they closely resemble our common geese. As a variety they are little known outside of Italy, but some authorities believe that the race has been an important factor in the development of common stocks throughout southern Europe.

The Pomeranian Goose. The Pomeranian Goose (also called the Saddleback Goose) is a common variety, apparently an improvement of ordinary stock, found throughout Germany and southeastern Europe. In size it is intermediate between our common geese and the heavier improved European varieties. The color of the goose is usually white; of the gander, white with gray head, neck, back, and wings. While not known (under this name) in America, the variety is of special interest as the probable progenitor of

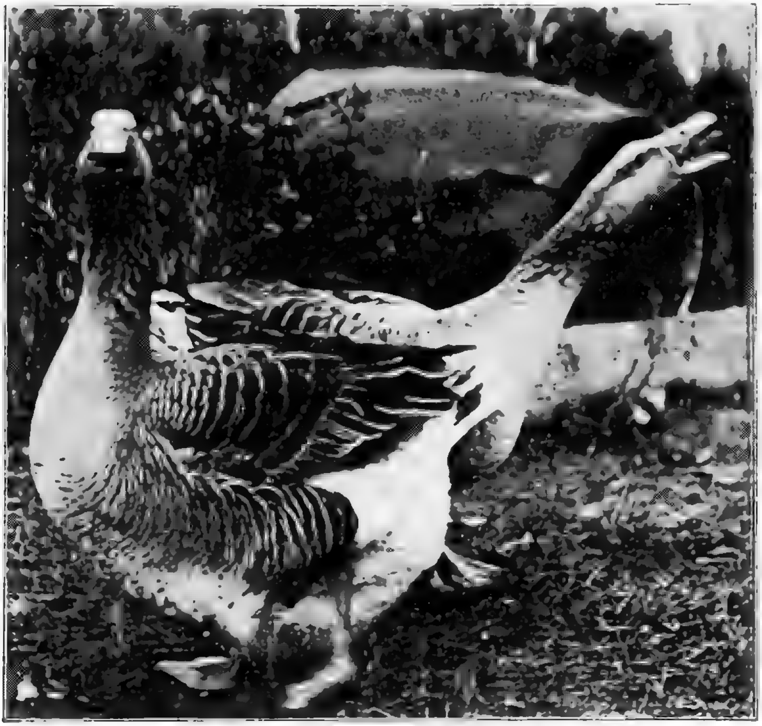

FIG. 477. Toulouse Geese

both the Emden and the Toulouse. As the goose has been more of a favorite in communities settled by German-speaking races than elsewhere in the United States, it is entirely probable that some of this stock has from time to time been brought here and merged with our common stock.

The Emden Goose. The first of highly improved European stocks of geese to reach America was an Emden. The importation by James Sisson of Rhode Island in 1826 is better authenticated than the claim that a Colonel Jaques of Massachusetts had imported some in 1821, though that claim may be correct. It is even quite possible, as the account of the introduction of Asiatic fowls shows, that occasional importations were made earlier. At first the Emdens were generally called here Bremen geese, Bremen being the port from which the first importation on record came. In England they were called Emden, importations to that country coming, as is supposed, from the port of Emden. The Emden Goose is described sufficiently for identification anywhere as a large white goose. The size is easily developed from the Pomeranian

FIG. 478. Captive Wild Geese used as decoys at shooting stand of C. M. Bryant, East Weymouth, Massachusetts. (Photograph from C. M. Bryant)

by selection or by crossing. According to the descriptions of early Emden geese in this country, those first imported were not invariably white, but often showed some gray.

The Toulouse Goose. The Toulouse Goose takes its name from the city of Toulouse, the capital of a department in southern France noted for its geese. It was brought to England probably about 1835–1845, and to this country from England many years later. It is not mentioned by Cocke (1843), and references to it in the decade following 1850 plainly show that the writers were dependent on English authors for their descriptions. It is probable that the variety became known here either in the latter part of that decade or early in the following decade. Like the Emden, it is sufficiently described for identification by a general description of size and color. A very large, massive gray goose can hardly fail to be a Toulouse, or a grade bird not distinguishable from the pure or standard-bred type of the breed.

Asiatic types of geese. The Asiatic types of geese include three varieties, two of which are classed as *China Geese*, and the third as

FIG. 479. White China Geese. (Photograph from owner, Charles McClave, New London, Ohio)

the *African Goose*. References to these by early American writers leave no doubt that the type was quite well known through scattered specimens before 1840. It is quite reasonable to suppose that from an early period in the trade with the Orient, Asiatic races of geese, like the Chinese fowls, were brought in at intervals by vessels trading with China. The striking peculiarity of this type is the knob, or protuberance, developed on the head at the juncture with the

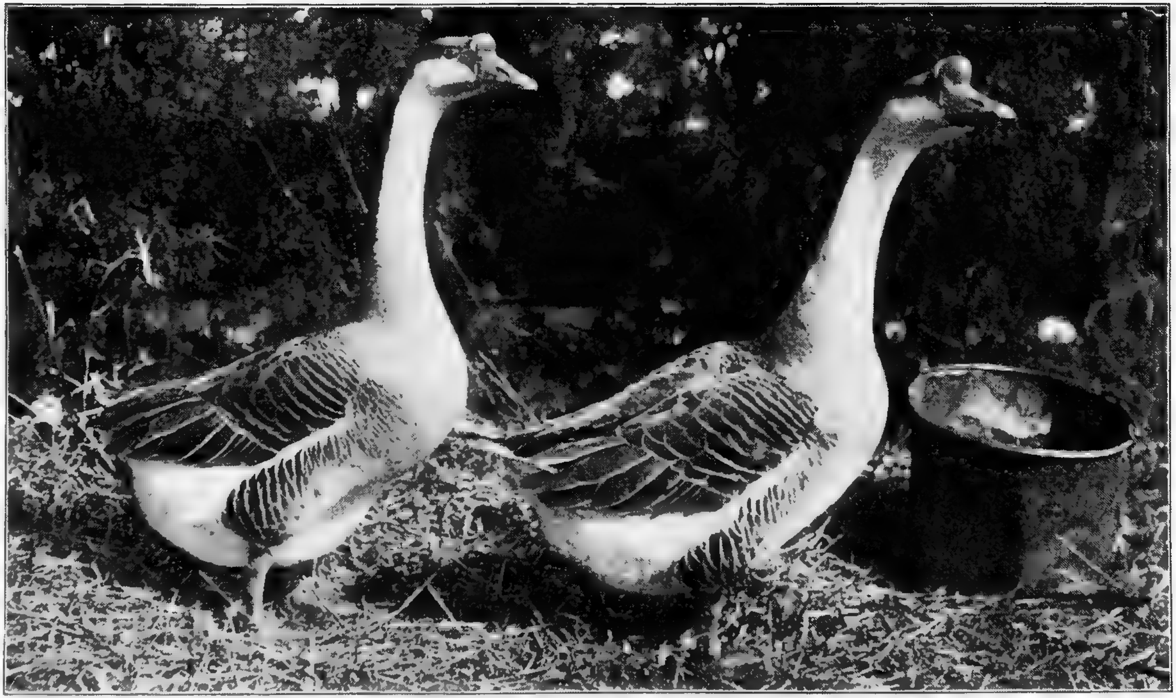

FIG. 480. Brown China Geese. (Photograph from owner, Charles McClave, New London, Ohio)

Fig. 481. African Geese. (Photograph from owner, Charles McClave, New London, Ohio)

upper mandible. The shape is also different from that of the European races. In profile the body has a more oblong appearance; the carriage is more erect; the neck is long and slender, making, in the smaller varieties, a more graceful type. In color, too, there is a characteristic difference, the colored variety having a distinctly brown shade not found in domestic races of European ancestry. Notwithstanding these differences the Asiatic and European races interbreed freely and produce fertile offspring. A possible link connecting two types is found in the Russian geese, in which nobby protuberances develop on the heads of old birds, and which sometimes show, in their clay color, traces of the brown shade of the dark Asiatics.

The China Goose.[1] There are two Standard varieties of the China Goose, the *Brown* and the *White*. A general description of shape has been given above. The size is about the same as that of the common goose. In color the *Brown China* is a brownish gray, darkest on the head and back; the *White China* is pure white.

The African Goose. As now known, the African Goose is in appearance a large Brown China, with the brown shade eliminated (in Standard exhibition specimens) from the plumage. Of the origin of this variety nothing definite is known. The confusion of names and the lack of definiteness in descriptions of early writers make it impossible, in many cases, to determine whether the geese they describe as "Chinese" and "African" are the same as the geese now known by those names. Early descriptions of the African Goose, however, attribute to it brown color (like the Brown China) and great size (unlike the Brown China), making it quite plain that the present distinction in color is one of the common tricks of breed making. The type is one not found in Africa, and considering the Chinese custom of developing size in practical poultry, it is much more reasonable to suppose that the China Goose in America is a refined, and the African Goose an enlarged, development of an intermediate size. Whether either type is of purely Asiatic blood may well be doubted. In the flocks of the African Goose usually seen, indications of mixtures with Toulouse or common

[1] The China Geese are sometimes classed as ornamental, but though not popular, their undoubted adaptability to economic uses makes it proper to recognize them in this class.

stock are often evident. The relation to the Brown China, too, is often manifest. No doubt continuous and somewhat irregular crossing has had much to do with these appearances, but it would be quite absurd to suppose that only recent crosses have influenced the development of these varieties.

The American Wild Goose. While not, strictly speaking, a domestic race, the Wild Goose, also called Canadian Goose, is a factor of some importance in commercial goose culture. Along the North Atlantic coast considerable numbers are bred in captivity, the young being sold to hunters of wild geese for decoys. Where so bred they are largely used for crossing with domesticated races. The progeny of the cross is sterile, showing that this is a different species. The weight is about the same as the common goose, though the wild bird, because of its more compact form and shorter plumage, appears smaller. The color of the body is gray, the head and neck black, the cheeks having white marks; some brown color appears in the flight feathers of the wings.

TABLE XXIV. AMERICAN STANDARD WEIGHTS OF GEESE

Variety	Adult Gander	Young Gander	Adult Goose	Young Goose
	Pounds	*Pounds*	*Pounds*	*Pounds*
Wild	12	10	10	8
China	12	10	10	8
African	20	16	18	14
Emden	20	18	18	16
Toulouse	20	18	18	15

These are ordinary, average weights. A considerable proportion of stock of the heavier varieties is below the Standard weight for exhibition specimens, but many specimens are above these weights. Emden and Toulouse geese 5 pounds above Standard weights are not rare in America. In England these varieties are grown still larger, Emdens weighing 30 pounds for males and 28 pounds for females; Toulouse, 28 pounds for males and 26 for females. As a rule, only the Emden and Toulouse varieties are approved by goose growers wishing to breed a large variety pure. Both are used extensively for grading up common stock. As they run in America, where the Toulouse is far more popular, the Toulouse is larger than the Emden and many of the latter are poor layers. The African is also used to some extent for grading, but the difference in type makes it less desirable. On the other hand, the cross of the

Wild Goose and the African produces a mongrel of more attractive appearance than the cross of the Wild Goose on European varieties. The Toulouse is a nonsitter; the other varieties are all sitters. As layers the Chinese Geese are rated highest, producing usually from forty to fifty eggs a season. The Toulouse come next, then the Africans, with the Emdens last.

Ornamental geese. Only two varieties of ornamental geese are seen in America, and those rarely. The *Sebastopol Goose*, also called Danubian, is a white goose about the size of the common goose (usually a little smaller), with red bill and legs and long, slender, slightly curling feathers on the back and wings. The *Egyptian Goose* is a small goose said to be found throughout the continent of Africa, probably a distinct species. Though recognized and described in the Standard of Perfection, specimens are seen here only in collections. It is variegated in color, and is chiefly interesting to the student of poultry types from the fact that, of all the geese with which poultrymen come in contact, it is the only kind which shows the variety and brilliancy of color found in the natural types of our domestic fowls and ducks.

Swans. The White Swan is the only familiar variety of its species, the Black Swan being rarely seen. Each is presumed to be free from other color. The rarity of the birds and their large size and ugly disposition when handled make it impracticable to apply in their breeding the methods used for common kinds of poultry. While ornamental, they are of little interest to the fancier.

CHAPTER XXV

PHENOMENA AND PRINCIPLES OF BREEDING

Kinds of reproduction. In the simplest forms of animal life reproduction is by self-division, the separating parts being (normally) equally developed. As the scale of life ascends and organisms become larger and more complex, division into equal parts becomes detrimental or impossible, and the organism at maturity reproduces by a series of divisions, at each of which there is thrown off from the parent body a part such as that body itself was at an earlier stage of development. Still higher in the scale, with life and its functions growing more complex, reproduction takes place only when the elementary bodies from two mature bodies unite at (or very near) the time of separation from the parent organisms. With the evolution of the sexual from the asexual method of reproduction we are not here concerned. Such facts as the fundamental similarity of the forms of reproduction and the necessity of the higher organisms for diverse parentage, which gave rise to sex, are elementary in the study of the principles of breeding.

Likeness in asexual reproduction. In the self-division of simple animal forms the maxim of the breeder "Like produces like" is, according to our observation, exactly applicable. The organism resolves itself into like and equal parts. In forms a little higher up, the organism resolves itself into parts unequal in size and development, the larger and more advanced part producing a succession of smaller parts without change in itself, then dying, the others (such as survive) growing to maturity and producing and perishing in the same manner.

Relations of body and germ. The higher we go in the scale of life, and the more complex the structure of the animal becomes, the greater the difference, both in size and appearance, between the fully developed organism and the part which separates from it in reproduction, until in creatures which reproduce sexually the germs are (as compared with the body) very minute and of the most simple elementary form and structure. The germs of creatures differing greatly in every character by which we distinguish them are so nearly alike in size and appearance that, out of association with or proximity to the parent form, their identification is difficult and ordinarily impossible. Virtually, the germ retains its primitive form and structure up to the point of separation from the body, no matter what may be the development of the body. But however little the germ, at separation, may show the character of the body from which it came, under proper conditions it develops into a body of the same kind, — never by any possibility into a body of another kind. Like still produces like, but in the higher organism the likeness of the part called the germ to the part called the body becomes apparent only with development.

In the simpler organic forms, where self-division results in the production of like parts, no question is raised as to the possession, by each of these parts at the time of separation, of every characteristic of the other. In the higher animal forms, and particularly in domestic animals and birds, differences between a parent organism and the germs it has produced, as observed at advanced or mature stages of the development of these germs, cause questioning as to how far the germ partakes of the character of the body at the time of separation from it. That the tiny germ carries in it power to develop an individual having the general characteristics of the parent form and race is undeniable, — the evidence is everywhere. How far the germ contains power to reproduce, in the individual developing from it, modifications peculiar to the parent form, is the disputed question. Reasoning from analogy with the simpler animal forms, the presumption is that the germ carries in it power to produce (under suitable conditions) an organism identical with the parent body *at the time of separation.*

However scientists, in their endeavor to demonstrate laws of heredity by exact comparisons of limited numbers in consecutive generations, may disagree as to the transmission of acquired characters, the whole practice of live-stock breeders is based on the theory that from the germ may be developed a creature in every way like the parent form at the time of self-division, and results of breeding in general demonstrate that the theory is correct. To the practical breeder the idea that acquired characters (more correctly, quality or grade of character) cannot be transmitted is absurd. On the other hand his experience teaches him that they are not regularly and uniformly transmitted, even under the most uniform and favorable conditions, and that differences in forms compared at maturity are due in part to environment and conditions affecting the creature during its independent development, and in part to modifying tendencies or to factors brought over or inherited from the parent organism. The nature of these will appear as the phases of inheritance are presented.

Beginning of variation. In the simpler forms of animal life, variation through the influence of environment is plainly a cause of individual differences. Such differences are evidently acquired and as evidently transmitted, for, once separated, the parts may become in a measure unlike through difference of environment. One may die by accident or through lack of nourishment; another, more favorably placed than before, may grow larger than the parent organism and in self-division produce creatures superior to what it was at the beginning of its independent existence. Between such extremes there is a range of possibilities of development, and always, as long as the parts are equal at division, we can hardly conceive of one possessing at its origin a characteristic that the other has not. In the higher animal forms, with the germ developing during a long period independently of the parent body, it is obvious that, since environment may influence growth, there is opportunity for much greater modification of the organism during the period of development, and that, the more highly developed and specialized the organism, and the greater its possibilities of somatic variation, the more detrimental to the species it would be to have individual variations fully and uniformly transmitted. Every slight variation would start development in a new direction and there would be no stability in animal forms.

Sex the natural regulator of variation. As long as an organism reproduces independently, by simple self-division or by division and combination of its own elements, its characters will be reproduced in its offspring, and its tendencies intensified in each succeeding generation developed under favorable conditions. While simplicity of structure prevents wide variations, this is no detriment and may be an advantage to the species. But as the structure becomes more elaborate, with specialized parts, each of which has a number of different qualities, the possibilities of variation increase, and with the tendency to vary one of its principal inherent characters, variation and specialization unchecked might lead to mongrelism and to the destruction of an established balance of characters, as it has in many cases in domestication. Nature checks variation and extreme specialization by making the creature no longer capable of independent propagation, — making reproduction contingent upon the combination, at the same stage of existence, of germs from two different individuals. The orderly arrangement of natural processes requires that an individual shall always contribute, in reproduction, an elementary germ of the same character. Hence nature divides individuals, of each species requiring this regulation, into two kinds, with differences dependent upon or related to the sexual functions. A right appreciation of this use of sex is of importance to all breeders of live stock, but more to poultry breeders than to others, because in most kinds of poultry secondary sexual characters are more marked and made more important in breeding, and because in the practical work of the poultry breeder the sexes are of more equal value than in horses, cattle, sheep, and swine.

Likeness in sexual reproduction. Observation of numbers of offspring of the same parents shows that the parental characters do not combine in the same way in all. When a sufficient number of cases is considered, it is apparent that any character of either parent may appear unchanged, but that in general all characters blend, though not always uniformly. This lack of uniformity, objectionable to the breeder because he is seeking to secure uniformity, often seems to him irregular and eccentric. On the contrary, it is regular,— due to individual variation and to the impossibility of offspring being exactly like unlike parents. The likeness which the breeder desires is obtained, in individuals of each generation, only when the parents are so nearly alike, both in appearance and in breeding, that the range of variation in inherited characters is narrow, and, consequently, differences due to individual variation are slight. Briefly stated, *The general problem of the breeder is to find like ancestors for all (or as many as possible) of the individuals of a race produced in each generation.*

This problem is easy if his standard considers few characters, becoming increasingly difficult as the number of characters considered is increased, and the breeder's ideals of quality in stock advance. The problem of the breeder who works to a standard is essentially the same, whether that standard be, as yet, imperfectly conceived in his own mind, or elaborated, agreed upon, and established by an organization of breeders,— whether the variety is as yet unformed or has been brought to close conformity with a high standard; but in the first case he may sometimes use parents quite unlike (in external appearance) the offspring that he hopes to secure by a combination of their differing characters, and in the other, if he uses a parent that is markedly unlike the desired type in the offspring, it is in the hope of securing either the direct inheritance of some quality in it, or a blending of some of its characters with those of the stock on which it is bred. The development and condition of such a variety as the Barred Plymouth Rock afford illustrations of all kinds of combinations to secure, in a variety of poultry, likeness to a desired type. The early strains were formed (1) by a number of different crosses of parents quite unlike; (2) by selection of such of those cross-bred offspring as most nearly approached that type; (3) in a particular strain, by the late introduction of blood of a race radically unlike[1] those used in any of the original crosses, but very like the (supposed) original type of fowl; (4) by a general distribution and mingling of this strain with others; and, finally, (5) by the device of a double system of mating to provide for each sex of the Exhibition type just the kind of parents required to produce it.

The sexes equal in respect to the transmission of characters. Though consideration of particular cases often indicates differences in the influences of the sexes in the transmission of characters,

[1] The Black-Red Game has been much used by breeders of recently made varieties to restore vigor and stamina where they have deteriorated through neglect of those qualities in the keen pursuit of special features of desired types. A favorite theory with many of the older breeders was that the Black-Red Game, by reason of its close relation to the original type and through centuries of careful breeding for shape and stamina, could give to the newer races stamina and stability of type which would remain even when the superficial Game characters and the color had been bred out. The theory is not altogether fanciful, though it may not be demonstrable.

such differences are individual, irrespective of sex.[1] This becomes apparent whenever a sufficient number of cases is considered. How the line is drawn between asexual and sexual reproduction is not known. From the fact that in asexual reproduction the germ carries the possibility of development of every parental character, the logical inference is that a germ from any individual will always carry possibilities of development of every character of that individual. Wide observations of the phenomena of breeding as exhibited in any race indicate that this inference is correct. Many poultry breeders will declare that the female has most influence on shape and size, the male on color and superficial characters. Observation supports the assertion that the female influences size (and shape, which is largely dependent on development) more than the male, but this influence is exerted *after transmission* through the special relation of the female to the embryo, and the opinion is based mostly on comparisons of the offspring of different females by the same male. As between two females, the one well developed and vigorous, the other undersized and lacking vitality, the offspring by the same sire will (conditions after the embryonic stage being equal) invariably show marked difference in development, due first to difference in transmission, but also to difference in nourishment during the embryonic stage. When characters not so materially affected by the vitality of the dam are compared, none can be found on which sex has any special influence in transmission.

Prepotency. Observation of the common phenomena of breeding shows that individuals vary in capacity to transmit characters. Ordinarily, the average of the progeny, even of parents carefully selected for quality according to the standard used, is distinctly lower than the average of the parents,— though in the work of a skillful breeder the average quality of the progeny in each generation tends steadily higher than the average quality of the preceding generation as a whole. But there are frequently found individuals with unusual capacity for impressing upon their progeny high quality

[1] This observation, of course, does not directly apply to what is called sex-limited inheritance, where the sexes differ regularly as to the form in which they inherit a particular character or characters. Yet in the last analysis it does apply to such cases, as is seen when a male inherits the male form of a character from the maternal line, or the female the female form of a character from the male line of ancestry.

or rare combination of quality in their racial, family, or individual characters. This peculiar capacity in reproduction is termed *prepotency* and individuals possessing it are said to be *prepotent.*

As commonly used, the term "prepotency" relates only to capacity to transmit desired characters. It is not a character or quality in the ordinary sense of those terms. It is more appropriately described as a condition of a particular individual in which it reproduces, with extraordinary accuracy, its racial type or its particular type, according as the condition affects or is affected by the common laws of inheritance. Prepotency is not a definite condition or quality, but is always relative to average or ordinary potency. An individual which in the early stages of the development of a stock appears prepotent might at a later stage rank low in breeding potency. It has no marks distinguishing it in the individual; consequently its occurrence seems erratic. Because of the absence of distinguishing marks in the individual, the bird which shows externally the highest excellence in desired characters is always preferred for breeding, and so undoubtedly many prepotent individuals are never given an opportunity to show that quality.[1] Because only desirable transmissions

[1] One of the most remarkable cases of prepotency was related to me by Mr. H. C. Rollins, of Woodville, Massachusetts, for many years one of the foremost breeders of Light Brahmas. In making up his Brahmas one winter, he had one cockerel reserved for breeding on his general appearance, but discarded him as not of sufficient merit to be used in a mating from which eggs for hatching were to be sold at high prices. When females had been selected to mate with the other males, there were some eight or ten left over, — birds of general high quality but not considered quite good enough for the regular matings. Naturally this surplus stock was all put in one house. It was not considered a pen mated for breeding. Not having eggs enough from the regular matings to give all he wanted for his own hatching after supplying his customers, Mr. Rollins used eggs from this pen and found them very fertile. Then, running short of eggs for his orders, he used eggs from the same pen to fill some orders for old customers in cases where he knew them and thought they would rather take the chances of these eggs than have their order returned, and where, if results were not satisfactory, he could adjust the matter easily. As his own chickens developed, he found the chicks from the mating of discarded birds a remarkably uniform and superior lot, the average being above the best of other matings. Reports from customers who had eggs from this mating were to the same effect. This case, it should be noted, was in the experience of a man who has no superior as a breeder, and in stock bred in line by him for over a quarter of a century. That the prepotent quality was in the male bird was evident, for the females, while of the same stock, were not all bred alike, nor as like in appearance as in regular matings. They were simply the remnants of the several lines of females used in the matings of an extensive breeder.

are considered in estimating prepotency, and because only a small proportion of poultry breeders carefully pedigree their stock on the female side (so that the quality of prepotency in the females used is not always discovered), the manifestations of breeding capacity to which that term is applied are undoubtedly but a very small part of the possible manifestations of unusual capacity for the transmission of characters.

Prepotency and selection. Ordinary cumulative results of selection and prepotency should not be confounded. Ordinarily progress in breeding to a type is slow,—inch by inch, as it were. Let a prepotent individual appear, and its power be discovered, and in a single generation a breeder may make more progress through this one individual than in a long term of years preceding. Within another generation he may have raised the average quality of his stock to very near the average of the progeny of the prepotent individual. Within a very few years the distribution of this stock may have made marked improvement in the general stock of the variety. This is most noticeable in the early stages of the development of varieties, when quality of characters is low or mediocre as measured by the approved standard, and individual differences are most marked.[1] A variety as represented at leading shows (where the best specimens always come) may show no special merit or advance for years. Then an exhibitor will appear with a remarkable string of birds. Immediately his stock is in great demand, and the next year's exhibits will show in the stocks of many breeders similar improvement due to infusions of the blood of the improved stock, or to direct purchases of it. Progress by ordinary selection is always slow — hardly perceptible in the averages of consecutive generations. Progress by the use of prepotent individuals is immediately conspicuous.

Transmission of prepotency. To what extent prepotency is transmitted it is difficult to determine. Direct investigations of this point

[1] The Barred Plymouth Rock again affords an illustration, and in a leading stock of that variety. About twenty years ago, H. B. May, after a visit to the farm of A. C. Hawkins, said in conversation with another breeder: "Hawkins's stock has been going back; it is n't as good as it was a few years ago; but he 's got one cock there that can put him up in front again. I don't know whether he knows it or not, but I think he does." That cock was Royal Blue. He was both a phenomenal bird and a phenomenal sire and gave his name to the Hawkins stock.

have as yet afforded no positive conclusions. The consensus of opinion of breeders, based on general observation, is that prepotency is transmitted, but it requires very careful analysis of the results of breeding the progeny of prepotent individuals to show how far such results are unusual in the sense that the results of breeding from the prepotent individual were, and how far they should be considered normal after the prepotent individual had raised the average of its family or race.

Present and latent characters. "Dominance" and "recessiveness" are terms used to describe the behavior of extreme, or plainly distinct, grades of characters in sexual reproduction. While each of the two germs which in this form of reproduction unite to form a new organism brings to the new organism possibilities of developing any character of the body which produced it, it is manifestly impossible that the new organism should develop with characters in the aggregate equal to the sum of the characters of both parents. It must be, as has been stated, a composite, in which the characters of the parents blend, and usually blend very irregularly, presenting all grades of blending between different forms of a character (as of color or comb), or a variety of different combinations of characters.

Alternate inheritance, reversion, and atavism. If organisms reproducing sexually could transmit to their offspring only such developments or modifications of characters as could be produced direct from characters as developed in them, a character which had once disappeared could not reappear, except as it might come from some new combination. But it is found in practice that characters disappearing in one generation often reappear in the next or, less numerously, in later generations. The most familiar illustration of such reappearance in characters of poultry is the perpetually recurring single comb in rose-combed varieties. Similar "faults" occur frequently in other characters in all varieties of poultry, cropping out sometimes most unexpectedly in stock in which they have been scrupulously avoided by the breeder for many generations when making up his matings. The biologist, observing the phenomena of reproduction in a short series of generations, and breeding to secure full manifestation of the laws of inheritance, deals impartially with characters. If a character can come back, he gives it every opportunity to do so. He considers the character *recessive*,— tending to recede in the race if not interfered with; that is the natural status of such characters. The breeder, who works as far as possible with predominant characters, considers a character which has once disappeared and may reappear, *latent*. As a rule, his only interest in it is to prevent, as far as possible, its reappearance. The reappearance of latent characters after a lapse of one generation is called *alternate inheritance*. The reappearance of characters after a lapse of two or more generations, but still traceable to comparatively near ancestors, is called *reversion*. The appearance of a character not belonging to the race as it exists, or to its known ancestors, but presumed to be derived from a very remote ancestor, is called *atavism*.

From the occurrence of the phenomena of alternate inheritance, reversion, and atavism we conclude that the germ contains possibilities of development of any character of any ancestor, however remote; by the regularly diminishing frequency of the occurrence of a recessive character, as the number of generations of ancestors free from it increases, we conclude that, once eliminated from a single individual, a family, strain, or variety, practically free from that character, may be produced in three or four generations.

Laws of heredity. A general law of inheritance may be based on the rate of increase of a dominant character in a race, or on the decreasing reappearance of a recessive character. The law as worked out by Galton, from the investigation of inheritance in human beings, is generally accepted by poultry breeders as a correct expression of the general behavior of characters of poultry in reproduction, and as showing approximately the percentage in each generation of birds which show a selected character common to all observed ancestors, or a rejected character absent in all observed ancestors.

Galton's law. An individual inherits from each of its two parents of the first generation, $\frac{1}{4}$ of its total characters; from each of its four parents of the second generation, $\frac{1}{16}$; from each of its eight parents of the third generation, $\frac{1}{64}$; from each of its sixteen parents of the fourth generation, $\frac{1}{256}$; from each of its thirty-two parents of the fifth generation, $\frac{1}{1024}$, and so on.

Applied to a single character appearing in an individual but not present in other members of the race, this means that one fourth of the direct progeny of that individual would be likely to inherit that character. If, then, two of the offspring possessing the character were bred together, the chances of its appearance in their offspring would be one fourth from each parent and one sixteenth from the grandparent. Nine in every sixteen of the second generation would inherit the character. As by constant selection the number of ancestors which had the character is increased, and the proportion of ancestors which did not have it is steadily reduced and its influence rapidly diminished, only a few generations are required to reach the stage of fixity of the character in the race where the influence of ancestors unlike in respect to it becomes a negligible factor.

Galton's law is not a law or rule of practice in poultry breeding. The attitude of the practical poultry breeder toward it should not be misunderstood; it cannot be said that he uses it. As a formal statement based on scientific investigation it has been especially serviceable to those giving instruction in the principles of breeding, to prove the general rule of selection, to demonstrate the stability and practical purity of new breeds and varieties, and to show the need of close breeding to fix and hold desired combinations of characters.

Mendel's law. Of more importance than Galton's statement were the discoveries of Mendel in regard to the behavior of unlike characters in transmission. When first published by Mendel, these attracted no attention. Mendel's account of his work was rediscovered about 1900, and has since profoundly influenced the course of investigation of the subject of heredity. Unfortunately many scientists who took up this work with enthusiasm failed to note some serious faults in Mendel's treatment of his results and in his enunciation of principles based upon them, and consequently, though a considerable amount of this work has been done with poultry, it has not yet yielded results of such value to poultry breeders as at first seemed likely to follow scientific investigation in this field.

Mendel, experimenting mostly with the sweet pea, observed[1] (1) that in the offspring of certain crosses a certain character of a parent form might disappear; (2) that when these offspring were

[1] For a fuller statement of Mendel's law see Davenport's "Principles of Breeding."

bred together and also with the parent forms the behavior of this latent character and of the corresponding dominant character seemed to follow a definite law, there being approximately fixed ratios of frequency of occurrence of such contrasted characters in each possible combination of parent forms; (3) that certain individuals in which a latent or recessive character reappeared in this generation were pure as to that character, while a like number presenting the dominant character were pure as to that character, and a number equal to these two classes combined had the dominant character but would not certainly produce offspring having it; (4) that in breeding from this last class there would be regularly produced the same proportions of pure dominants, pure recessives, and individuals in which the visible character did not correspond with the germ character.

It is plain that, if this was a correct interpretation of his results, Mendel had discovered and formulated a law of great importance to practical breeders. But Mendel's own interpretation of his results was faulty in these respects: (1) attributes which were properly grades of characters he regarded as "opposite" and "mutually exclusive" characters, and (2) he did not discriminate carefully in the examination and description of his results. The modern disciples of Mendel have generally persisted in these errors, and are only now beginning to avoid them and to present their results so that practical breeders will give them serious attention. Furthermore, in nearly all Mendelian discussion it has been assumed that Mendel's law related especially to cross-breeding, and that its principal practical application would be to the making of new breeds and varieties, while poultry breeders as a class are most interested in perfecting established races, and discourage the multiplication of varieties. To be of direct use to the mass of poultry breeders the facts of Mendelism must be demonstrated with pure-bred poultry and the laws stated for direct application in the breeding of pure races. In all the confusion on this subject it seems clear that the behavior of characters in transmission is less eccentric than has been supposed, and that it may be possible to devise systems of breeding and of record keeping which will enable breeders to identify those individuals which breed true as to desired characters, and to eliminate more certainly and rapidly from their flocks those specimens in whose progeny undesirable latent characters would appear. Incidentally, the methods of studying breeding problems which Mendelism has introduced are likely to lead to important discoveries in relation to other phenomena of breeding.

Correlation of characters. If we have, to begin with, such an individual as we desire, and the work is not obstructed by failure of the individual of the desired type to breed, or by adverse prepotency of individuals mated with it, it is easy to fix or to eliminate any single character, and this can be done in a very few generations; but in breeding to fix, maintain, or produce a type, it is necessary to consider many characters at the same time. If each character, in its various expressions, were absolutely independent of every other character, the making and maintaining of types approximating fixed standards would be a hopeless task. The characters of an individual, being parts of an organism, are often necessarily similar in certain manifestations, either throughout or in closely related groups. The welfare of the individual depends to a great extent upon the adaptation of its parts to each other and to its conditions and mode of life. So there are established, in any race or family bred on any principle of selection, certain apparent correlations of parts occurring so regularly that, when considered only where they occur, they appear to indicate an essential unity, making the group of characters act as one. Thus, the body, legs, neck, and head of a bird have as a rule a similarity (differing outlines considered) of proportions; a bird with long body is likely to have a long neck, head, and legs; a bird with very short, strong bill and broad skull is likely to be short and heavily built throughout. That these correlations are not essential is seen when we find in such a variety as the Exhibition Game fowl an increase in length of neck and legs quite out of proportion to the increase in length of body, and in creeper varieties the size (including length) of body maintained, while the length of neck is slightly, and the length of legs greatly, reduced. Again there is a natural, general tendency to correlation in structural character of bones, muscles, and skin. If size and muscle are developed, making a large, heavy body, the tendency is to coarseness throughout, — coarse bone, coarse-fibered flesh, and coarse, thick skin. But on examination of a number of birds of this general type it will be found that there is not close correlation, while when fowls of different types and breeding but of like weights are compared, great differences are found in weight of bone and in texture of flesh and skin. In short, while the tendency to correlation which constitutes physical symmetry is marked, the fact that it is variable and easily broken up indicates that such characters are not necessarily correlated.

Correlation of external characters with constitution and function. A distinction must be made between the normal state of a character and transient, abnormal expressions of it. To one observant of the attitudes and actions of animals and birds under a variety of circumstances, the general attitude and carriage of body and limbs, the movements, the expression of the eye, etc. indicate immediately whether the creature is in normal health or not, and in a healthy creature afford means of estimating its vitality. There is plainly a correlation in such things, but not of the kind under consideration. It is merely the expression of the general condition of the creature. By correlation of external and internal characters is meant such particular relation between a certain external, plainly visible character and a certain functional character, or a certain quality which cannot be determined by ordinary inspection of the creature in life, that the external character serves as an index of the value of the other.

The most familiar cases of supposed correlation of external and internal characters in poultry relate to the laying capacity in fowls. The size of the comb has long been popularly considered a reliable index of relative laying capacity. To a less extent popularly, but more widely among poultrymen, a certain shape of body is regarded as the egg type, invariably found in great layers. Like all fallacies, these have a slight foundation in fact. That the condition of the comb of a hen varies according to the activity or inactivity of the reproductive organs is so evident that no one who has the care of fowls can fail to see it. Normally the comb of a hen is larger when she is laying than when she is not, and brighter in color; [1] the comb of a pullet does not develop until she is about to lay; the growth of the comb of a cockerel corresponds with the

[1] The fully developed, bright-red comb is not an infallible sign that the hen is laying. Many hens with diseased ovaries, and some that never lay, have well-developed combs. In a healthy hen, however, there is regularly a difference in the appearance of the comb when she is laying and when she is not.

development of the reproductive organs. When a hen is not laying, the comb becomes smaller and loses its bright-red color. If a sufficient number of cases is considered, a comparison of egg production of hens with large and hens with small combs will always show that the size of the comb is not correlated with laying capacity. Neither as between varieties or breeds, nor between individuals in a variety, does the size of the comb indicate laying capacity. Many uncommonly good producers have very small combs.

The shape of the comb and the size and shape of the wattles sometimes appear to be correlated with reproductive capacity in both cocks and hens. Many instances are noted of fowls with poorly developed combs and wattles that are lacking in vitality. Males of this kind are often marked as poor breeders. In these cases the failure to develop is not peculiar to the comb and wattles. The body is not well developed, and in the males the lack of development of the male plumage is noticeable.

The alleged egg type in hens is a long-bodied bird, appearing wedge-shaped, with the broad part of the wedge at her rear when she is viewed either in profile or from above. The type description is borrowed from the favorite description of the dairy type of cow. It applies with varying accuracy to most hens when laying heavily, but the records of experiment stations which have investigated this point confirm the view of careful observers among poultrymen that there is no correlation between shape of body and laying capacity.

Quite a long list might be made of supposed correlations of external features with internal characters or qualities. A few will show the general character of all. White birds of all kinds are popularly considered weaker in constitution than others, but not the slightest foundation for the idea can be found in a general comparison. A red eye is considered by many as an indication of reproductive vigor, but, except as heightened color of the eye gives a brighter, bolder, expression and reflects good physical condition, it would be hard to show foundation for the idea. People who prefer a special color of skin often aver that there is a correlation between color of skin and quality and flavor of flesh. Some justification for this view may be found in the fact that the meat types of western Europe, with white or gray skin, are of better average table quality than the fowls of America, where yellow-skinned poultry is generally preferred. It is not the color of the skin, but selection for quality, that makes the difference. The European breeders give careful attention to meat quality; in America very little attention has been given to the development of fine quality in table fowls.

Tradition, prejudice, and superficial observation are the principal sources of ideas of correlation of external and internal characters in poultry. In a general way the development and condition of external characters indicate the development and condition of all characters. Correlation of development is general rather than special. The substantial characters of a species are necessarily closely correlated. In a state of nature the superficial characters are also closely correlated, but in domestication natural groups may be broken up and new combinations formed, and after a few generations the combination as a whole tends to reproduce with only slight modifications.

CHAPTER XXVI

APPLICATION OF THE PRINCIPLES OF POULTRY BREEDING

The work of the breeder consists in intelligent direction of the natural laws of reproduction for certain definite purposes. His object is not (as is so often erroneously supposed) to secure the perpetuation of natural types, or of the types of domestic live stock which would develop under any given conditions if he did not interfere. If such were his objects, all that would be necessary would be to destroy individuals presenting marked variations from the common type and to allow others to mate according to chance and inclination. The breeder's part in the development of domestic races is to bring order out of the chaos of variation called mongrelism. From a practically unlimited stock of types he selects the few found most serviceable, or which seem to him most beautiful, fixes these types and tries to persuade others to use and preserve them. What nature would do in any particular case interests him either not at all or only as it gives him an insight into the properties of the living matter with which he works. While the standards to which he breeds are practically fixed, in successful individual work in breeding the results are always progressive. If the first independent efforts of a breeder show improvement in good stock, that is usually due to chance and is likely to be lost in the next trial. It is when the poultry breeder finds, year after year, better quality in his good birds and a larger proportion of birds of high quality, that he knows that he is applying principles correctly.

While it is not to be expected that the independent work of a novice in breeding stock of any type will give at first a high grade of results, there is no need of the rapid regression from type, and deterioration of quality, usually shown in the work of the novice beginning with good poultry. With very rare exceptions novices in poultry breeding begin their work with two wrong ideas firmly fixed in their minds. They suppose that absolute purity of blood gives uniformity in results, and that the great evil they have to guard against in breeding is loss of vitality and of " practical qualities " through breeding from birds near akin.

The history of the development of races shows very plainly that the development and preservation of artificial types depends upon systematic, continuous selection. The fact that self-division is the first form of reproduction, and that self-fertilization is the law in both the vegetable and the animal kingdom until a high stage of development through variation is reached and sex becomes necessary as a check on variation, shows that inbreeding is not in itself detrimental. The breeder who accepts these two facts at the beginning of his work is in a position with reference to it which no one who fails to apprehend them ever reaches. It would be hard to find a successful poultry breeder who did not date the beginning of his success from the time when he came to appreciate the fact that any breed or variety in his hands became what he made it, and that outbreeding tended always to disintegration of well-established types. The effective use of principles of breeding as deduced from phenomena of reproduction depends on the application of principles without prejudice.

Adaptability of poultry breeding. In poultry breeding, and particularly in the breeding of fowls, we find the one line of animal breeding open to every one who has the use of a little land. The ordinary farmer cannot be an independent breeder of horses or cattle; the number of animals he can produce and mature on his farm is not large enough to give him either the necessary experience or a proper selection of breeding stock. With sheep and hogs the ordinary farmer may, if he is so inclined, do something in the way of special breeding. With poultry the resident on a village lot may do in a few years more actual work in breeding than most growers of other domestic live stock can do in a lifetime. The relatively small individual value of ordinarily good breeders, and the rapid rate of increase in poultry, make it possible for a breeder to secure a few good individuals by a very small investment, and to build up a large stock in a short time.

Length of life and breeding value. The short life of most kinds of poultry is a disadvantage to the breeder, in that the full measure of the breeding value of an individual may not be found until its usefulness as a breeder is nearly over. The value of a stallion or a mare, or of a bull or a cow, as a breeder may be demonstrated long before the animal has reached its prime. Then many years of life remain in which the breeder may use a few selected individuals year after year. But except in the larger and less productive kinds of poultry, the breeder must make a large proportion of new matings every year. The numbers produced by even large stock breeders are less than those produced by the average small poultry breeder. The poultry breeder usually has an abundance of material for selection, and if he attends to it year by year, may make much more rapid progress in any desired direction than the breeder of cattle and horses. On the other hand, inattention to selection of breeders for a year is almost certain to put him back two or three years, while two or three years' relaxation of vigilance in efforts to maintain or develop a type will usually make it necessary for him to begin all over again. A breeder of horses or cattle might neglect special attention to breeding for several years, and yet, if he retained a part of his stock, take the work up again about where he left it, and with the same individuals. In a like period of time a neglected stock of fowls or ducks would include a very small proportion of individuals of known breeding. The breeder of poultry has to give practically constant attention to the selection of breeders.

Relative value of male and female. If in polygamous creatures the females produce normally but one or two young at a birth and breed but once a year, the apparent breeding value of a male, bred to any given number of females, is equal to that of all the females, for he has a one-half influence on the progeny of all, while the hereditary influence of each female is limited to her own progeny. Then whatever of peculiar merit an individual in any generation may take from its dam is limited to that individual. Its sire and dam may reproduce its like, one or a few each year. When it arrives at maturity, it may reproduce its special merit in its offspring,—if a male it may reproduce its type in a considerable number; if a female, in a very limited number each year. Under such conditions a male of great individual merit or prepotency is much more valuable than a female. As the number of young produced by the female increases, her practical value in reproduction of type as compared with that of the male increases; for while the male may still influence a very much larger number of offspring, the female may produce enough offspring in a season to enable a breeder to produce in the next season hundreds or even thousands of young from matings of her offspring. As between a male and female of equal breeding value, polygamous mating constitutes a handicap of one generation on the female. This, where a generation matures in less than a year, is a very slight difference. An experienced and skillful poultry breeder places as high a value on the female in his breeding operations as on the male, though commercially the male is more valuable because a purchaser may realize more quickly on his investment.

Selection. In nature the established type of a species or a variety is the type that is best adapted to its environment. Such types develop as a result of *natural selection*, defined by Darwin as "the survival of the fittest." In improved domestic races types are arbitrarily determined by man in accordance with his needs or his tastes, and are secured and maintained by allowing only individuals of the desired types to propagate their kind. Such types are called *artificial types* (breeds) and the system of selection by which they are made and preserved is called *artificial selection*.

Superficially, artificial and natural selection often seem to proceed on radically different principles, and so are by many regarded as essentially antagonistic. The impression is very general that artificial selection is *unnatural*, — at variance with nature. This is true only when by artificial selection the development or suppression of a character is carried to the point where the result becomes detrimental to the race. In domestication natural selection becomes in a measure inoperative, and the natural type varies and multiplies indefinitely. Artificial, or intelligent, selection then becomes necessary for the isolation and development of a limited number of the types arising. In the wild state conditions make it impossible for many special types of a species to develop in the same territory. In domestication, man may develop, by the control and separation of individuals, as many types as he wishes. As long as selection does not unduly disturb the natural equilibrium of characters, artificial selection is not unnatural; and in so far as, without injury to others, it develops special characters beyond what is possible under natural conditions, it is better than natural selection. The difference between the common type of a wild race and the finest type of the same race in domestication is a measure of the difference, in its value to man, of natural and artificial selection.

Poultry standards. The continuance and distribution of a specific type or variety in domestication depend upon the agreement of breeders on a standard for that type. In the development of a breed or variety in any locality an unwritten standard is gradually evolved, and the breeders are loosely governed by that standard. When a variety is widely distributed and competitive exhibitions bring together stock from many localities, a written standard becomes necessary. Unwritten standards, as a rule, relate only to the most conspicuous features of a type, and allow great variation in details. Written standards undertake to establish size and weight and to describe every visible character. They are usually mere outlines, and often seem vague to those not familiar with the varieties described and with the popular types. Even when descriptions are supplemented by pictorial illustrations, a written standard is quite inadequate as a description of a variety. In studying a standard the novice must use as illustrations live birds of known values as commonly measured by that standard. The standard of a breed or variety describes the assumed perfect type of every character of that variety. Such a standard is ideal, in that the model form of each and every character is not often found in any one bird.[1] The ordinary view of standards makes such a standard (in theory) the ideal toward which all breeders are striving. Actually, considering the relations of a standard to its variety at different periods of the history of the variety, and the inevitable differences in interpretation of its provisions, a written standard only indicates general directions and bounds, and the exact type in style at any time can be learned only by observation of the type that wins most prizes at leading shows.

The term "standard" is technically (but not discriminatingly) used in this country with specific reference to varieties described in

[1] The technical fiction is that the perfect bird cannot be produced. While the proportion to the whole number is small, many birds are produced which only hypercritical judgment can find fault with.

the "American Standard of Perfection"[1] published by the American Poultry Association. Stock bred for any definite purpose or to fix or maintain any character or combination of characters is, properly speaking, standard bred. The Standard of Perfection is a handbook for judges and exhibitors rather than a complete guide for breeders; for, although the breeder's object is to produce birds of the descriptions the Standard calls for, in all varieties many birds of great value as breeders are found which the Standard disqualifies for exhibition, while in every variety in which double matings are used the exhibition type is regularly produced from matings of Standard birds of one sex with non-Standard birds of the opposite sex.

Relative value of characters in selection. When fowls are bred for eggs, without special attention to increase of egg production, there are only two essential points to be considered, — *vitality* (vigor, good constitution, and development) and *size*, and in respect to the latter point, all that is necessary is that the fowls shall be large enough to lay eggs of the average size that the market demands. All other points may be disregarded. In breeding for the table, shape also must be considered, making vitality, size, and shape the essential points. In breeding for exhibition, carriage, color, comb, crest, and other superficial features become of importance. In applying standards in accordance with the original and rational intent of the written standard, superficial characters are not given valuations which make it possible for a bird inferior in substantial characters to win by superiority in superficial characters, and especially not by exaggeration of valuation of a single character. The common effect of the use of written, accurate standards is to bring a variety quickly to a high state of development in superficial characters. After this stage has been reached and the birds (with the usual slight individual variations) are actually of very uniform quality (on a fair interpretation of the terms describing the various

[1] In a general way the practice of the American Poultry Association has been to give recognition to breeds or varieties at an advanced stage of development whenever a considerable number of persons showed interest in the matter, but it has frequently happened that breeds that were quite popular were refused recognition, while others in which few were interested have been admitted. Recognition in the Standard of Perfection usually implies that considerable progress has been made in fixing the type. The fact that a breed or variety is not in the Standard tells nothing as to its quality.

sections), the tendency is to make the decision of relative merits turn on a few special features, to overvalue such features, and so, by corresponding undervaluation of other features, to develop a few favored characters at the expense of the rest. Many illustrations of this kind might be given. There is hardly a variety in the Standard that has not at some time suffered through such partiality for some character. The most marked cases are those in which the variety has lost popularity through the development of a feature which finally became detrimental; but the evil is by no means confined to such. The craze for dead-white plumage for a time made the white varieties conspicuous for lack of shape and vitality. The craze for barring "to the skin" leads breeders of Barred Plymouth Rocks to some neglect of shape and size. In Leghorns and Polish the head points have been rated as high as thirty per cent of the value of the specimen, with the result, in case of the Leghorn, of so reducing size and neglecting shape of body that the breed seemed at one time in danger of losing standing with the public. In breeding birds for exhibition the breeder is forced to follow prevailing fads. Doing so does not necessarily compel neglect of other characters, but as the fad develops it becomes more and more difficult to find and produce specimens good in the favored section and also in other sections.

Systems of selection. In selecting his breeding stock a poultry breeder uses two principles, or systems, of selection, applying sometimes one, sometimes the other; thus the common method of selection is by irregular alternation of these systems. Selection by a complex standard may be (1) *progressive* (or particular), considering certain characters or groups of characters always in the same order, and rejecting from subsequent consideration all individuals failing to meet requirements at any stage of selection, and (2) *simultaneous* (or collective), in which an effort is made to consider all the more important characters collectively, balancing faults in some against merits in others. It is not practicable to apply the progressive principle to a great many characters, one by one. By a division of characters into natural groups, with separate consideration of each group and of the principal characters, and collective consideration of all but the more important characters in a group, a simple and effective working system of selection is developed.

Division of characters for this purpose gives three classes, which may be designated as (1) essential, (2) substantial, and (3) superficial.

Essential characters. Whatever the purpose for which poultry are bred, they should have (*a*) good constitution, (*b*) size appropriate to minimum requirements, and (*c*) individual symmetry. Lacking constitutional vigor, a bird is not likely to produce offspring equal to itself in other respects. The difference may not be perceptible in comparing consecutive generations, but a comparison of stock bred for several generations with care to preserve vitality, and stock in which this point has been neglected for a similar period, rarely fails to show marked deterioration in the latter. Constitution not only affects the quality of other characters but the numbers produced, the losses of stock, and so (indirectly) the methods of practice. In size the birds selected as breeders must always be large enough to produce offspring that will meet the ordinary requirements of the purpose for which the stock is bred. Stock bred for egg production must be large enough to lay eggs marketable at prices for average receipts; stock bred for market must be large enough to produce poultry that will meet at least the minimum ordinary demand. So with stock bred to sell for breeding or laying purposes, — if the stock is vigorous and has the size required for the ordinary production of eggs and market poultry, it is salable, though deficient in many other respects; but if it lacks constitution and ordinary size, it cannot, as a rule, be profitably grown for any purpose. Individual symmetry means a symmetrical development of the individual without regard to any particular standard; there may be symmetry of parts without correspondence with any special established type. Individual symmetry implies absence of deformity.

Substantial characters. Size as related to special uses or standards, and distinctive shape and color, are substantial characters. If a particular size of market poultry is to be produced, the birds used for breeders must be of appropriate size. In breeding birds, of any established race, to be sold for exhibition or breeding purposes, the breeders selected must closely approximate the standards of weight for their breed or variety. They should also have the distinctive shape and symmetry of the breed or variety, both as to body and as to the general size and shape of other parts in which characters are distinctive. Color, too, is a substantial character in so far as it may have an influence on profits with poultry of no particular color type, or may qualify a specimen as of some particular color type. In breeding for market the breeder, as a rule, avoids black and dark-colored birds, especially if they are to be dressed and sold before maturity. In breeding to color standards (even without close attention to the finer points of color) a line must be drawn between color faults which may be tolerated and those which ought to condemn a bird for breeding purposes.

Superficial characters. The fine points of color and of shape, particularly of shape as not affecting any useful quality, are superficial characters. It is the superficial points which make the differences between those individual specimens of a race that are worth consideration for exhibition or breeding purposes, — which give to the specimen *finish* and proportionately increasing money value, provided these superficial characters are found with the desired essential and substantial characters. Remarkable finish in color or in some other conspicuous feature is often found on birds of poor shape, or distinctly inferior in size, or lacking in constitution. Such birds are not usually salable at high prices, but the breeder is strongly tempted to use them, in the hope of getting a proportion of offspring with their excellence and without their faults. An experienced breeder who knows his stock thoroughly, who relies on other matings for most of his stock, and who uses such birds only in special matings may sometimes succeed in doing this. A novice rarely gets the desired results, and if (as is too often the case) the use of such a bird for breeding affects a large part of the produce of a season, he may lose more than he could possibly gain if the bird bred up to his expectations; for a bird of this kind rarely impresses its good quality on any considerable proportion of its offspring.

Progressive selection, with the elimination, at each step, of all individuals which fail in the requirements under consideration, prevents the development of stocks strong in some fancy points but lacking in essential and substantial characters. The more rigid the selection, the smaller becomes the number of birds that will pass it. As a matter of business policy the breeder must so regulate his selection of available stock that he can make the most profitable use of it as a whole, but to establish himself firmly as a breeder he must make the best possible use of the relatively small proportion of each year's produce in which he finds combined a high degree of excellence in many characters.

Collective selection and compensation in breeding. Progressive selection can apply in practice to only a few of the more important characters. It is in effect selection for the elimination of faults which the breeder regards as intolerable. When birds with such faults have been eliminated, what remain will always show considerable variation, and this will be most marked in superficial characters. Continued careful breeding reduces differences, but since at the same time it develops the breeder's critical faculty and his ability to distinguish slight differences, the proportion of what he considers good breeders in his stock may not be materially changed. There is usually a tendency, partly in the stock and partly in the breeder's selection, to develop a stock in the direction of its strongest points. The most effective checks on this are the written standard, competition, and the difficulty of selling specimens which are decidedly weak in any superficial character.

Having eliminated the most unlike individuals by progressive selection, the breeder proceeds to make appropriate matings of those he has reserved by collective consideration not simply of the points of the individual but of the points of a pair, male and female. His object is to secure in the sexes, as far as possible, likeness to the type to be produced (sexual differences of color, etc. duly considered), and when the bird of one sex varies from the typical in any character, to secure in the other sex the opposite variation in that character, nearly all variations in well-bred birds being slight when compared with variations in specimens from parents markedly unlike. This balancing of opposite tendencies in variation is of little use, as a rule, when the characters considered represent wide variations, for the result of the union of such characters is likely to give many intermediate grades of blending of characters and only a very few of any desired grade. The mating of individuals differing widely in any character is good practice only when the desired character cannot be secured by breeding together like individuals. The object of the compensation method in mating is not to enable the breeder to use for breeding purposes as large a proportion of his stock as possible, but to enable him to equalize the tendencies to variation in the individuals nearest the type. A skilled breeder never uses, in his regular matings of an established variety, birds varying conspicuously from the type which produces the standard type. Experience shows that, when the object is to produce uniformity of type and high average merit, the most reliable breeders are those individuals with the fewest faults. The "good all-round bird" is almost invariably more valuable as a breeder than the bird conspicuous for special excellence of one character or a few characters.

Inbreeding and line breeding. Inbreeding refers to matings of individuals that are near akin. Line breeding is applied to various plans designed to conserve blood and race character without inbreeding. Theoretically, plans of breeding may be, and have been, worked out which would give the breeder, for use at frequent intervals, individuals bred in the same way from the same origin, — the same blood separated by several generations. Possibly the specifications could be carried out in practice, but the work is too complicated and the results are too uncertain, and experience in close breeding soon shows the breeder that it is not necessary to resort to such methods to avoid inbreeding.

The most common form of line breeding is to maintain a male line intact, though occasional or even regular changes are made in the female line. Such line breeding gives better results than when breeding lines are crossed and recrossed irregularly. If the head of the line was an exceptional bird, and his male descendants used for breeding in each generation resemble him very closely, the type cannot fail to be strongly impressed on the stock, though females of somewhat different breeding are occasionally used. In most cases, when results of line breeding are conspicuously and regularly good, the breeder practices close breeding to a much greater extent than he thinks it wise to admit to a public with a prejudice against it.

Close breeding. The term "close breeding" describes the practice of the best poultry breeders more comprehensively than the more familiar terms "line breeding" and "inbreeding." Close breeding is necessary to secure such likeness in parents that similar uniformity may be produced in their offspring. Since an individual inherits, on the average, only one half of its characters from its immediate parents, 6.25 per cent from each of four grandparents, 1.50 per cent from each of eight great-grandparents, and .39 per cent from each of sixteen great-great-grandparents, it is plain that if a breeder undertakes (as most breeders do at the outset) to avoid consanguineous matings, he will always have in the ancestry of each generation of stock so many chances for reversion and recombinations of latent characters that his stock will never reach a high grade of excellence in many qualities.

In selecting like parents for any generation the breeder usually finds that the birds most like in appearance (and generally in performance as well) are of near kin, — that is, they are like in ancestry as well as in appearance. The advantage of mating like birds of like ancestry is so plain, and has been demonstrated so often in practice, that it is universally recognized. But there is a popular belief that close breeding (in-and-in-breeding), while of advantage to the fancier, is almost immediately destructive of vitality and of practical qualities, and quickly leads to sterility. This fallacy is less prevalent than it has been, and would soon disappear from among poultrymen if breeders did not, as a matter of policy, say as little as possible about this part of their breeding practice.[1]

The rule of good practice. *Mate the best (for the object in view) individuals available, disregarding relationship*, is the general practice of skillful breeders. It makes close breeding the usual practice, and at the same time leads to the introduction of new blood in small flocks every few generations, and in large stocks at less frequent intervals. As long as a breeder's matings within the blood lines of his own stock are giving him such breeding birds as he wants, there is no object in his going outside for new blood, but when he finds another breeder producing birds better than his

[1] The poultry breeder's ordinary and low-priced stock is bought mostly by novices who insist on having stock not akin. A large breeder making many matings can furnish birds mated for breeding that are not near kin. The purchaser would usually get good results from a mating of this kind. But in a great many cases, so fearful is he of the dangers of inbreeding, and so distrustful of the breeder, that he buys from two different breeders at the same time and changes the males, or if he has some stock of his own, mates some of his females to the male purchased and one of his males to the females. An expert breeder who knew all the stock might do this with a specific object and get the results sought, but one who has no reason for a mating except to avoid inbreeding seldom gets good results from such changes.

in any respect, unless he can make the same improvement in his own stock, he must have some of that breeder's stock. Usually he buys stock as the easiest and surest way to get what he wants. A breeder who is working on a large scale, making ten, fifteen, twenty, or more matings of a single variety every season, can, with a little care, avoid mating birds of near kin, yet keep within the same general blood lines. Such breeders, as a rule, consider the point of relationship only as it may affect the behavior of characters in transmission. Without exception these breeders are ready buyers of birds that they think may prove useful in their breeding. The small breeder, unless he has stock of high quality, and breeds very closely, is forced to go outside often, not for new blood but for better quality.

The danger of introducing new blood. In any well-bred stock the danger of deterioration through the introduction of new blood is very much more real than any danger of deterioration through lack of new blood in stock bred with due attention to essential and substantial characters. While the point is not one easily demonstrated, there is reason to suppose that a mingling of blood lines long separated tends to bring out latent ancestral characters (more especially, the most troublesome faults of a variety). Hence, before making extensive use of a bird of different stock or of unknown breeding, an experienced breeder tries it in special matings, to find out how it will "nick" with his stock. A breeder may try a bird in this way a number of times with different mates without getting the results he wants. Small breeders, even after a good deal of experience, are too prone to take chances on a new bird that has taken their fancy in their general matings, often with the result that faults requiring years of careful breeding to eliminate crop out all through the progeny. The experienced breeder never relies on a new bird until he has tested it, and never lets a bird of proved breeding value go unless he has a better one for its place.

Age and breeding quality. In those kinds of poultry which get their full growth within a year, it is commonly observed that the birds, if matured by the beginning of the breeding season, are more reliable breeders the first season than afterwards, producing more young, though the quality may be somewhat inferior to what the same birds produce in their second and third breeding seasons. In the larger kinds, as geese and turkeys, the yearling males in particular lack development and the two- and three-year-old males are usually in every way much better breeders. With regard to fowls and ducks — especially the former — many instances of great breeding vigor after the first year show that the common failure is due to conditions and management. Males are overworked during the breeding season and not given proper care after it. While old cocks are usually much less fertile in winter than cockerels, if in equally good condition they are as serviceable when spring approaches and will get larger and more uniform chickens. In general this is true also as to pullets and hens. It is largely a question of condition. The older the bird grows, the more difficult it is to keep it in good breeding condition. Few fowls and ducks are as good breeders the third year as the second, fewer still are good after the third year; yet occasionally four- and five-year-old birds of both sexes will breed as well and the hens lay as well as young stock, and there are authentic instances of fowls breeding well at seven and eight years of age.

Ratio of females to males. In ordinary breeding, with quantity the first consideration, it is usual to make the mating ratio as wide as possible, mating with each male the largest number of females that can be kept with him and a satisfactory percentage of fertile eggs secured. This number varies greatly for individuals of the same variety, and also in averages for males of different classes of fowls and of different kinds of poultry. In fowls it varies notably, also, with conditions of mating. When one male is penned for the season with the same lot of females, the usual practice is to mate with a male of the small breeds, from ten to fifteen hens; with a male of the medium-sized breeds, from eight to twelve hens; with a male of the largest breeds, from six to ten hens. These are about the numbers used by fanciers and breeders who select and breed closely for general matings. In special matings the breeder mates with each male such females as closely match, in appearance and breeding, the one selected as the best mate for that male. In mating as carefully as this a breeder rarely finds more than three or four females for a pen, and frequently finds only one. To get full service from the male in such cases, he may either alternate him in two small matings (the second of which is made up of females judged less desirable as mates for him but likely to produce some good birds) or mate him with females of several slightly different types and keep the eggs separate by trap-nesting the hens. When it is inconvenient to keep hens in as small flocks as ten or fifteen, many poultry keepers keep from twenty-five to thirty-five hens in a flock and use two males, alternating them at regular intervals.

When hens in large flocks are used to produce eggs for hatching, the proportion of males used is much smaller than for separate matings. With medium-sized fowls six males to one hundred females is generally considered sufficient. Good results have been reported from flocks of Asiatics with the same proportion of males. With large flocks of Leghorns the same proportion is used by many breeders, but others use a smaller proportion of males, some as low as three to one hundred hens.[1]

In ducks the usual mating ratio is one male to five females until warm weather (May or June); after that, one male to eight or ten females. As the males are not quarrelsome, and interfere with each other very little, breeding flocks may be of any desired number. Average flocks contain from thirty to forty breeders. In turkeys one male is mated with any number of females up to fifteen or twenty, the usual number being ten or twelve. All other kinds of poultry either pair or mate in small families.

Period of fertility. Fertile eggs are often obtained, on the second day after the introduction of a male, from hens previously kept in celibacy, but usually fertility from a new mating is low for a week or two, especially in cold weather. Experiments have shown that hens may continue to lay fertile eggs for nearly three weeks after separation from the male, and that the fertility is likely to be as good for a week or ten days after the removal of a male as it was while he was present. In turkeys the influence of an impregnation is said to continue for a very much longer period, but this view seems to rest on a small number of instances not very well authenticated. Accurate observation is difficult, and the roving

[1] I cannot say positively that fertility runs better in the large flocks with the wider mating ratio, but reports from breeders indicate to me that it does. The fact of the very regular difference in mating ratio for separate matings and miscellaneous matings indicates more efficient service of the males under such conditions.

habit of the turkey makes it quite possible for females and males from different flocks to mate without the knowledge of the keeper. There is no authentic instance of the influence of impregnation continuing as long as three weeks in fowls. When birds of different varieties that have been running together are separated and mated each with its own kind, no effects of previous matings are likely to appear after a week or ten days.[1] The usual rule is not to use the eggs for hatching until two weeks after separation.

Regulation of sex. It would be a decided advantage to many poultry keepers to be able to control sex, but there is no known method of either controlling or influencing the proportions of the sexes. Usually they are produced in nearly equal numbers, even in small broods. Occasionally one sex will greatly predominate in a brood, in a small stock, or in the offspring of a particular mating. Current reports sometimes indicate a general preponderance of one sex in a particular season, in which case every one with a theory on the control of sex can easily find instances which seem to confirm it. When the preponderance of one sex is quite general, it suggests that some general condition may influence sex. If so, any general control of sex by the breeder is plainly impossible. On such scant and crude observations as have been made on this point, the only instances of regularity in predominance of numbers of one sex are found in particular matings or in individual birds.[2] In none of these cases did the tendency to produce one sex appear to be transmitted. It is possible that the occurrence of a large excess of one sex was purely accidental.

[1] It does not seem to me necessary to say more on the subjects of contamination and telegony than is said above, except to add that in a considerable experience with different kinds of poultry I have never seen a trace of contamination from eggs set two weeks after separation from a male of another variety, and that, although ever since 1897 I have made it a point to take up every case of mental impression reported to me, in not a single instance has a person reporting such cases been willing to answer questions or to have the case investigated.

[2] The most remarkable cases I have known or heard of were the following: In the early nineties I had a Houdan male that for two seasons mated in four different matings, — once with Houdan hens, once with Light Brahmas, once with Barred Plymouth Rocks, and once with Brown Leghorns, — produced regularly about five pullets in every six chickens. Mr. A. C. Smith informed me that the celebrated Barred Plymouth Rock male Rally produced the sexes regularly in about the same ratio, five females in six chicks, — a quality in his case decidedly objectionable, the daughters of an Exhibition Barred Rock male being useful only for breeding.

Mating systems. Whenever Standard specimens of both sexes can be produced regularly from a mating of a Standard male and a Standard female, the practice is to mate in that way. This is called the *single-mating system*. When the Standard requirements for males and females of a variety are such that the desired type of male and female cannot be regularly produced from a mating of a Standard male and female, two distinct lines, or sub-varieties, are developed, one to produce Standard males and one to produce Standard females. This is called the *double-mating system*. Whether or not the necessity for double matings shows inconsistency in the Standard depends upon the points of view. From the practical poultryman's point of view it does; from the fancier's point of view it does not. The occasion for double matings arises principally because of sexual differences in plumage color, which the fancier in some cases would intensify and in others would remove. In either case he can produce what he considers the finest type in one sex only at the sacrifice of his favorite color in the other. The particular reasons for special mating will appear in the discussions of matings of such varieties as the Barred Plymouth Rock and the Brown Leghorn. Here it need only be said, with reference to the general question of the system to be used, that in all varieties for which the double-mating system is commonly used, a breeder who adopts the single-mating system cannot compete, in the production of high-quality stock, with those who use the other system. *Intermediate matings* (so called) are sometimes used, in which a male about medium between the two types of males used in the distinct lines is mated with females of both types. That method may give satisfaction when a breeder works only for his own pleasure, or when competition is not too strong.

Details of Matings

In general a character common to a number of breeds or varieties behaves the same way wherever found. Its behavior sometimes varies because of different ancestral influences, but on the whole the rules for mating which apply to a character or a combination of characters in one variety will apply to all similar characters and combinations. Hence, in a general consideration of details of mating poultry the subject may be greatly simplified by considering similar types in groups. The special details of mating are principally color details. In consideration of shape points the application of the rule requires only knowledge of the type to be produced; in substantial points of shape "like closely produces like." But in color and some superficial points sex differences and tendencies must be considered. In poultry other than fowls the color varieties are few. In fowls the duplication of color types (varieties) in breeds (shape varieties) is so general that discussion of color matings can be reduced to a few heads. In the treatment of details fowls will be considered first, and the order of consideration of objects and characters will be (1) egg production, (2) meat production, (3) superficial characters.

Mating fowls for egg production. In common practice mating for egg production deals only with a few essential characters. Whatever the type or variety, when eggs are the special object the male should be an active, vigorous bird, and one that grew quickly and matured a little earlier than the average for males of his race. He should be of at least average size or, in a variety having a standard for weight, should closely approximate that weight. The hens should be selected for the same points, except that, as each hen influences only a small proportion of the offspring, and the mating ratio is usually made as wide as possible, it is not so necessary to give special attention to the point of early maturity in individual cases. If the mating is made, as it should be, before February, any pullets that are then well developed and laying may be used with reasonable assurance that the proportion of slower-maturing birds is not large enough to materially affect the general result, provided the male is not one that developed slowly. The matter of size is more important in selecting breeders to produce layers than in selecting layers. Slightly undersized hens often lay as well, or better, than larger hens, and lay as large eggs. A male a little under size may give offspring not notably smaller than those of a somewhat larger male, but the continued use of breeders of less than average size for their kind quickly reduces the average size of the stock. Even with care to use only birds not below medium size, the proportion of smaller stock is usually larger than desirable. Many poultry keepers who are indifferent to this point in mating offset their error by careful selection of the eggs set, taking only such as are of good size, form, and color. When only a small proportion of the eggs are to be set, this may be the more convenient and economical way to select; but since the hens of medium size, or larger, are usually the hens that lay the kind of eggs selected, it is better, when the object is to get as large a proportion of selected eggs as possible, to exclude small birds from the matings.

Breeding for improvement in egg production. The practice in mating just described, with good management in growing and handling the stock, will bring the egg production from poor-laying flocks to a good annual average, with occasional production in a part of a stock or for a season much above the average. These occasional instances of great production stimulate interest in the question of bringing the common average production of a stock up to the high marks, and the results from the best producers proportionately higher. Many breeders have tried to develop heavy-laying strains from known great producers. Results have sometimes seemed encouraging in a few individuals, but there are no authentic records of extraordinary laying characteristics continued in a stock, or even in selected specimens, for more than a very short term of years. More careful experiments on an extensive scale have been carried on for many years at the Maine Experiment Station, with similar results.[1] The present line of experiment at this station seeks to determine how far egg production may be improved by breeding from prepotent heavy layers. As far as increase in possibilities of egg production in the individual is concerned, the whole question seems to depend on whether or not the number of ovules produced by a bird is congenitally fixed in the individual, variable in individuals, and generally so small that the supply might be exhausted within the average productive life of a hen, that is, within three or four years. It has been commonly assumed that the possibilities of production in the ordinary unimproved hen were small and were increased by selection. It has been supposed that ordinarily a hen having laid a few hundred eggs would permanently cease because of the exhaustion of the supply of ovules. The observations of Raymond Pearl and Frank M. Surface on the numbers of visible ovules indicate that there is always present a greater supply of elementary eggs than any hen is capable of developing. Here, as everywhere, nature is prodigal with the elements of life. With the number of elementary eggs in an ordinary hen five or six times as great as the total of eggs laid by the average hen kept until three years old, it is plain that the practical problem in breeding for increase in egg production is to produce stock with the substance, constitution, and functional vigor required for the combined strains of heavy egg production and reproduction. As a rule, it is found that

FIG. 482. Dark Brahma cockerel with extraordinary breast development. (Photograph from owner, F. W. Rogers, Brockton, Mass.)

[1] Actually the first line of experiment at this station showed a decrease in egg production, but the results are not strictly comparable to the results of experiments of individuals, because the individual breeder discards all apparently inferior specimens, while at this station close selection of breeders was not followed by close selection of pullets for layers, except in one or two instances for special observation.

as breeders the greatest producers are inferior to average good producers. Hens producing two hundred eggs in a year are not as likely to produce daughters that are extraordinary layers as are hens that have performed more moderately. The great laying individuals come generally from moderate layers of strong constitution. Extreme heavy laying saps vitality and tends to sterility.

In the light of the commonly observed facts as to the increase of individual egg production, the extraordinary layer appears as the culmination of the development of the tendency and capacity to develop eggs. In general, what may be

FIG. 483. Silver-Gray Dorking cock, ideal table shape. (Photograph from owner, Arthur C. Major, Ditton, Langley, Bucks, England)

regarded as the supreme effort in egg production leaves the individual without reserve force for reproduction. A rare individual with vitality enough for both may prove a good producer of heavy-laying stock. Such an individual, of great prepotency, might be bred, with striking results in high egg production, for a generation or two, but the steady drain of egg production, and its ordinary effect on reproduction, tends always to abrupt cessations of progress in this direction.

Influence of the male on production of eggs. If the supply of elementary eggs is always ample the only influence of the male to be considered is his influence on those characters which affect the capacity to develop eggs. It has

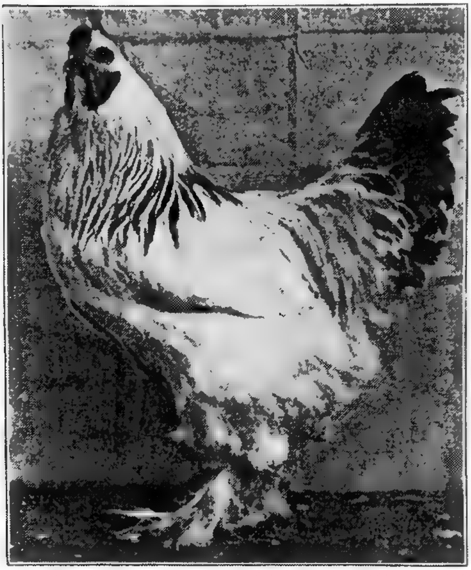

FIG. 484. Light Brahma cock[1]

repeatedly been found by breeders who had made marked increase in egg production by simple selection and good care, and by close breeding for a term of years, that when they went outside of their stock for new blood, the introduction of males of different breeding was immediately followed by a sharp decline in egg production. This fact has been one of the strong arguments in favor of the theory that the number of elementary eggs was relatively small and was progressively increased by individual variation and selection. Such results are often attributed to the use of males not of heavy-laying strains. Within heavy-laying stocks the lack of uniformity in results of breeding shows that the sons of heavy-laying hens reproduce that quality in the same manner as the daughters. Some males do unquestionably have a strong influence on the laying capacity of their daughters, but it seems to be due to transmission of the characters that give capacity to develop eggs.

Mating for table poultry. In the development of poultry for food purposes, more than in any other line of poultry breeding, the conditions of production tend constantly toward an undesirable modification of form and

FIG. 485. Light Brahma hen[1]

[1] These birds won prizes for best-shaped Light Brahmas at the Boston Show when this variety was one of the big classes there. They are birds of a good utility type.

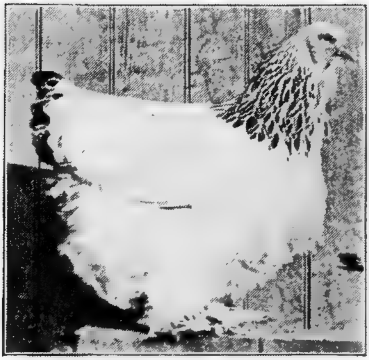

FIG. 486. A "cochiny" Light Brahma hen, not a utility type

reduction of vitality. The development of a meat-type fowl that will grow quickly, fatten readily, and still produce, at the season when eggs are most difficult to secure, an abundance of eggs that will hatch a high percentage of vigorous chickens, is the most difficult line of work with poultry. A flying bird has enormous development of the breast, that is, of the muscles which move the wings; the proportion of meat elsewhere is very small. Terrestrial birds in the natural state have the muscles of the wings and legs more equally developed, but in every case the relative development of muscles of the anterior and posterior sets of limbs, with their adaptations to different methods of locomotion, depends upon the habits of the bird and the amount of use of each. When birds are domesticated and the flying habit discouraged, the inevitable result is a reduction of the muscles of the

FIG. 487. Long-bodied Barred Plymouth Rock pullet[1]

FIG. 488. Barred Plymouth Rock cock,[1] good utility type

[1] Owned by Grove Hill Poultry Yards, Waltham, Massachusetts. Photograph by Schilling.

FIG. 489. Partridge Cochin cock. (Photograph by Graham)

wings and an enlargement of the muscles of the legs; and the larger the bird, the more marked is the difference in development of the wing and leg muscles. In flying birds the meat of the legs and that of the breast (or wing muscles) are of almost the same color. In most domestic land birds the meat of the fore part of the body is light (or " white "), that of the hind part, dark. In waterfowl, not so far removed from the flying habit, the meat of the different parts is much the same in color, but with a tendency to lighter color in the anterior portions. Difference in color of muscles of different sets of organs of locomotion in domestic poultry is plainly due to difference in development and use. Through disuse the muscles of the wings, which are the most highly developed muscles of the normal bird, lose color, become soft, and finally diminish in size. But it is this meat which most people prefer; hence it becomes necessary for the breeder of table poultry to give particular attention to the development of the white meat, that is, to keep up the quantity of development in this character when its natural tendency is to diminish. This he can do only by the most rigid selection of breeding birds well developed in this section, and by different methods of handling the birds to be developed

FIG. 490. Partridge Cochin hen. (Photograph by Graham)

FIG. 491. White Cochin hen. (Photograph by Graham)

for breeding purposes and those to be used for food as soon as they have reached the desired stage of development. Stock to be developed for breeding purposes must be allowed and even encouraged[1] to use the wings enough to counteract the tendency to atrophy through disuse.[2] The tendency to fatten, most desirable in stock bred for the table, is directly opposed to the continued production of eggs. A degree of fatness may be maintained with great prolificacy and breeding power, but the general tendency of breeding from birds that fatten readily is to reduce egg production and fertility. Unavoidable and troublesome as such conditions are, the difficulties they present may be overcome by selecting as breeders individuals which show, with the fullest development of form, considerable activity, and by properly differentiating between methods of managing breeding stock and stock not to be used for that purpose.

FIG. 492. White Plymouth Rock cock, owned by Elm Poultry Yards, Hartford, Connecticut

[1] In such heavy breeds as the Brahma and Cochin, the difficulty that some of the birds have in flying to ordinary roosts two feet or so from the ground leads some breeders to discard roosts and bed the birds on the floor. Invariably the stock of such breeders will, after some years, become conspicuously deficient in breast. A fowl that, when in health, cannot fly to a roost two feet from the floor ought never to be considered for breeding table poultry.

[2] This does not necessarily mean that the bird should have the opportunity or develop the ability to fly high. By flapping the wings, by using them in running, and by low, short flights, a bird may give its wing muscles enough exercise to maintain development.

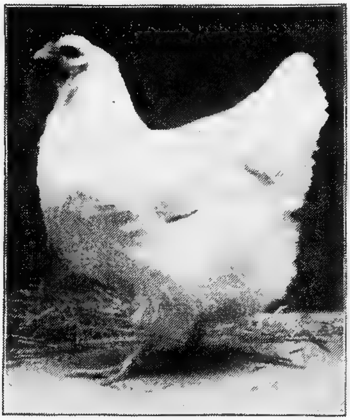

FIG. 493. White Orpington hen. (Photograph from United States Department of Agriculture)

What the breeder of table poultry aims to secure in his stock is full form, quick growth, and a fattening tendency strong enough to make the birds fatten readily under favoring conditions, yet not so strong as to be troublesome under the usual conditions given to laying and breeding stock. As a rule, that part of an individual's lifetime in which the desired balance of qualities can be maintained is short as compared with the normal productive life of its kind. So we find that generally types that make good poultry are the profitable layers and breeders for only one, or at most two, seasons; but occasional individuals are found which, in this and other points to be considered by the breeder of table poultry, are much better than the average. A bird of table-bred stock of any kind of poultry that will keep in good laying and breeding condition for two, three, or more years is of great value for breeding this class of stock, not only because it gives its progeny something of the general-purpose character but because it produces more, and more vigorous, offspring, and is a serviceable breeder for several seasons.

In most stocks and breeds used especially for table poultry the tendency to fatten is strong enough to make any vigorous birds take on fat readily when put up for fattening. In developing a table type from an egg type, fattening tendency must be given special consideration, but in improving existing meat types a degree of recessiveness in that character is to be preferred.

FIG. 494. White Orpington cock. (Photograph by Graham)

Shape in table poultry. In breeding for the table, shape must be considered on a different basis from that used in breeding to a special breed shape. The shape distinctions between

FIG. 495. White Plymouth Rock hen (Photograph from owner, Rockandotte Farm, Southboro, Massachusetts)

breeds nearly the same in size are arbitrary. It is no advantage to a Plymouth Rock to have a body a very little longer than that of a typical Wyandotte, or to weigh a little heavier; but the heavier fowl furnishes more meat (if the proportion of bone, offal, and edible meat are the same), and (other proportions being approximately the same) the longer-bodied fowl furnishes more of the preferred white meat than the other. This last is true as to all poultry; if a breeder, whatever kind or variety he is working with, wants to get the largest possible proportion of white meat, he must give particular attention to length of body, not because length is more important than the other dimensions, but because the lack of it gives an impression of plumpness and meatiness that is often misleading.[1] If Standard type is not to be considered, the longer the body can be made without unduly lengthening legs and neck, or making the bird unsymmetrical, the better. When Standard requirements as to shape must be observed, the body should be as long as may be without departing from the approved type; that is, in selecting breeding birds, the breeder of table poultry of a Standard variety should always keep away from the short-backed and short-bodied types of that variety.

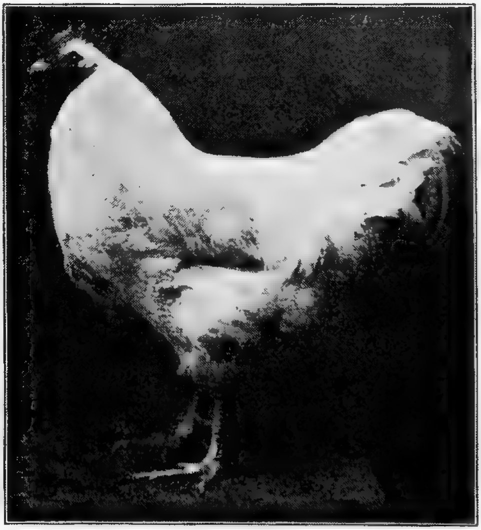

FIG. 496. White Plymouth Rock cock. (Photograph from Rockandotte Farm)

[1] In the open market this is an advantage to the short bird; for a regular trade where the buyer practically relies upon the seller to give him satisfactory goods, the long-bodied bird, if properly filled out, is better.

FIG. 497. White Wyandotte cock. (Photograph from owner, Rockandotte Farm)

With all the length of body that the bird can stand, or the Standard will permit, the breeder should select for breadth and depth of body, and fullness of breast. The Dorking shape is as nearly an ideal table shape as any breed shape, the combination of length, depth, and breadth of frame, and fullness of muscular development being, in the finest types of the breed, as near perfection as can be imagined.[1] This shape may be closely approximated in a number of other breeds without altogether losing the types of those breeds. This is most apparent when the bodies of females are compared. A Plymouth Rock hen of good length, breadth, and depth of body, and exceptionally good breast development for the breed, will be a very good Dorking shape; but because it stands a little higher on the legs, with a shorter tail and smaller comb, the impression of the whole type is different. Heavy-weight Leghorns tend toward the Dorking type; Houdans and Faverolles show it very strongly. Even in the Asiatics the nearer we can get to the Dorking model body without losing the carriage and station which have been developed in the Asiatic class, the better table fowl we get.

FIG. 498. White Wyandotte hen (Photograph from owner, Rockandotte Farm)

[1] With ideal table shape it might be supposed that the Dorking would be more popular in America. I have long thought that it would have been but for a reputation for delicacy of constitution (which it did not deserve), and for its large comb and superfluous toes. Such superfluous developments of appendages have always been objectionable to the mass of American poultrymen. Add to these objections the fact that the skin of the typical Dorking is not yellow, and the superficial faults more than overbalance, in the popular mind, the substantial merits.

In selecting birds for breeding, the poultry breeder should judge shape by touch as well as by the eye. He should handle the birds, lifting them with the keel across his palm so that his fingers on one side and thumb on the other give him at once the measure of development of meat on the body. With a little practice the sense of touch becomes much more reliable for this than the eye. The bird that, when balanced on his hand, fills it and spreads it until it is well opened, will hardly fail to be well meated all over.

FIG. 499. Young White Wyandotte cockerel. (Photograph from owner, A. G. Duston, South Framingham, Massachusetts)

Quality of meat depends primarily on fineness of fiber, secondarily on conditions under which the bird is grown. Coarse-fibered meat may be soft if the bird is so grown as to keep it soft, but a bird of fine fiber grown under similar conditions will be far superior. Identification of this quality in the living bird can be made with sufficient accuracy by observation of the texture of comb and wattles, and of the general structure of head and feet. If these appear strong without coarseness, the structure of the muscular fiber will usually be fine.

In *ducks*, *geese*, and *turkeys* there is usually ample length of body, and the common faults are lack of breadth and depth of body, and, in the waterfowl,

FIG. 500. Pekin Ducks at Connecticut Agricultural College. (Photograph from the college)

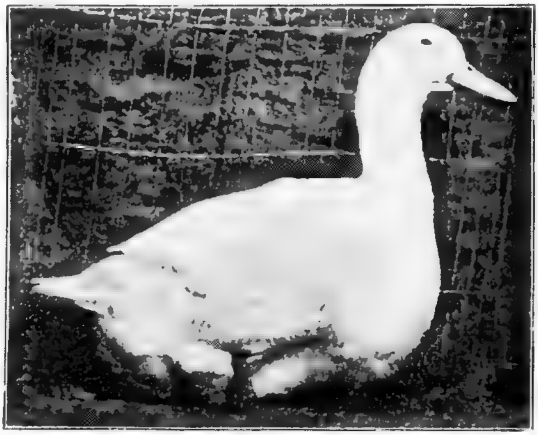

FIG. 501. Aylesbury duck. (Photograph from E. T. Brown)

lack of fullness of breast. The best development of the table type in both ducks and geese is secured by developing the keel as it is typically in Standard specimens of the Rouen and Aylesbury ducks and of Toulouse and Emden geese. The typical exhibition Pekin duck is not so well developed in this respect as the others mentioned, but many market duck growers have stocks of Pekins in which this feature is fully developed. In turkeys of the best table form the breast is more conspicuously developed than in any other poultry; this is in accord with the flying powers of the bird.

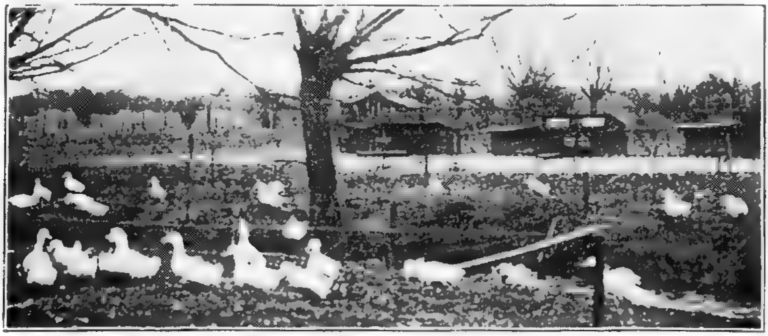

FIG. 502. Aylesbury ducks at College Poultry Farm, Reading, England. (Photograph from E. T. Brown)[1]

The shape and carriage of the head, neck, legs, and tail are of importance in selecting for the table only in so far as they are correlated with and indicate faults in shape of body, or lack of vigor. The well-developed body, if designed only for the table, is not much the worse for that purpose if the legs are a little

[1] Note that, with the exception of the second duck from the right in Fig. 502, the Aylesburys do not show the type seen in Fig. 501 but are more like the Pekins in Fig. 500.

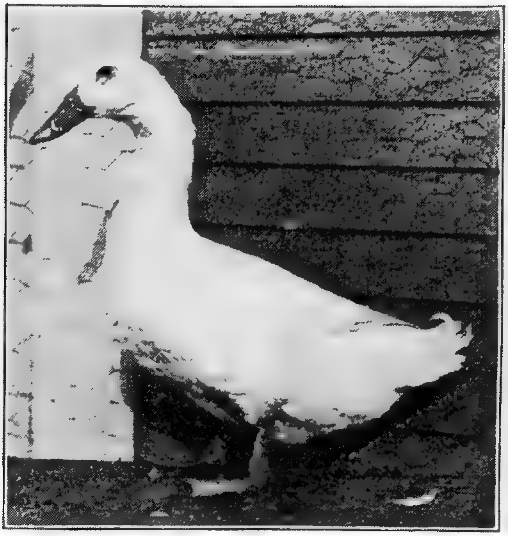

FIG. 503. Pekin drake four months old, weighing nine pounds, owned by H. B. Robinson, Reading, Massachusetts

FIG. 504. Pekin duck, owned by H. B. Robinson

weak or a little too long to look well, if the back is a little crooked and the tail carried too high or too low to look well, or carried awry, or if the head and neck appear a little too fine; but if the bird is to be used for breeding, all such faults should be carefully avoided. The color of the plumage in table poultry is of importance only as it affects ease of dressing, and here it is of most importance when stock is to be marketed while immature.

Selection for shape points in mating standard poultry. In selecting for exhibition Standard shape the type as a whole must be considered. This requires particular attention to the head and its appurtenances, and to the neck, tail, and legs; for it is these parts and their adjustment to the body that chiefly distinguish different breeds of the same general type or class. A bird that carries both head and tail high will appear shorter, one that carries head and tail low longer, than it is, because the carriage of the head and tail makes a difference in the apparent length of the back. In market poultry this is not a material point, for in selecting for breeders the length of keel, as ascertained

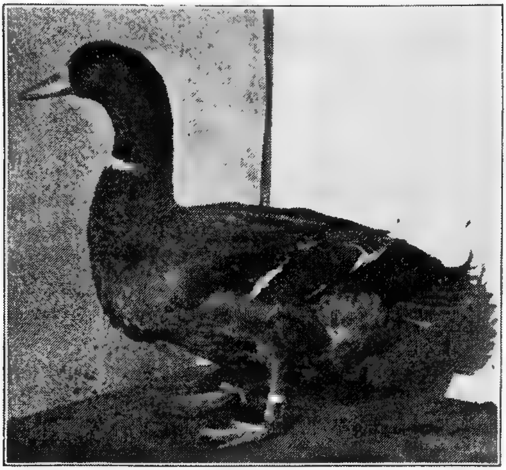

FIG. 505. Rouen drake, owned by White Birch Poultry Farm, Bridgewater, Massachusetts

by touch, is a better test of length in the body of the breeding bird than the length of the bird as it appears to the eye, and when the bird is dressed, the true length is apparent; but in judging exhibition stock, considered section by section, the back is judged as it appears, and a bird of this character may be penalized in several sections for a fault which strictly belongs to one or two. A slight difference in length of leg will make a marked difference in the station and style of the bird. In nearly all breeds of fowls American fanciers want the leg (shank and thigh) long enough to show the hock and something of the outline of the thigh when the bird is seen in profile. The only clean-legged breeds in which a leg with shank appearing to come right out of the body is at all favored are the Dorkings and Orpingtons. In all others the thigh should show, and for most of them this provision is a part of the unwritten standard, for only in the Wyandotte and Game descriptions is this point mentioned in the "American Standard of Perfection."

FIG. 506. Rouen duck, owned by White Birch Poultry Farm

The shape of the wings seldom requires special consideration, except in case of deformity of the first joint, causing, when slight, inability to properly fold the wing. When the defect is more serious the wing may hang badly and some of the feathers be badly twisted. The worst cases are so conspicuous that they attract attention at once. The others are often overlooked because, if noticed, it is supposed that the failure to tuck the wing is due to fright from handling, or that, in the case of cocks, the disarrangement of the flights is due to a slight slip of the wing in flirting, which will soon be readjusted. This fault is very common also in ducks and geese. The breeder should make sure that every bird selected for breeding has perfect wings and can carry them properly. Failure to do so need not always lead to rejection of the bird, but it calls for special care in mating. If two birds with this fault are bred together, the result is likely to be a lot of offspring with deformed wings.

FIG. 507. White-Crested Black Polish hen, owned by William McNeil, London, Ontario

The shape of the head appurtenances — comb, wattles, ear lobes, crest, and beard — demands careful attention, for excellence in these points is essential in exhibition stock, and even if a breeder is not breeding for show or sale, and makes substantial qualities of first importance, there is no need of breeding birds good in other respects but with heads for which he has constantly to apologize. Birds selected for breeders should have these characters of average good quality for their type, and serious defects in them should be admitted only when a bird is so good in other respects that it is policy to breed it even with the expectation of discarding a considerable part of its progeny for its fault. As a rule, there are no irregularities in mating to meet Standard requirements in these features. The breeder mates birds having the character, in both sexes, as near as may be to what he wants. An exception is in mating to produce the male and female types of comb in large single-combed

FIG. 508. White-Crested Black Polish hen. (Photograph from owner, Charles L. Seely, Afton, New York)[1]

[1] Figs. 507 and 509 show a very pretty, dainty type of Polish, as bred strictly for fancy. The photographs were taken by the author in 1901 or 1902. Figs. 508 and 510 show a larger, more rugged type bred by a farmer who is a Polish fancier. This is the style now favored by breeders.

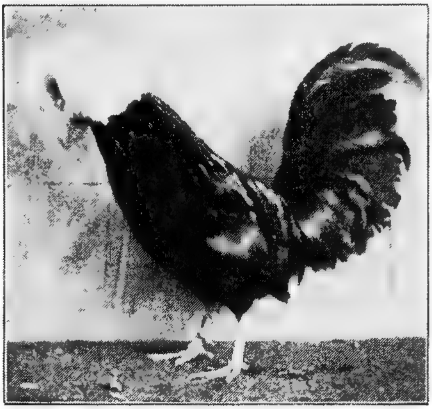

FIG. 509. White-Crested Black Polish cock, owned by William McNeil

fowls. The comb of the male, however large, is required to stand straight; the comb of the female must always droop to one side. To get the strong, straight comb of the Exhibition male, females with combs that droop slightly or not at all must be used; to get the drooping comb of the Exhibition female, males with weak combs tending to lop, or droop, must be bred with females with the required type of comb. In a variety like the Brown Leghorn, in which a double-mating system is used for color, the requirements for producing the desired accompanying type of comb are simple. All that is necessary is to breed the females of the male line with small, rather straight combs, and the males of the female line with large combs with a tendency to droop. In varieties in which special color matings are not required, the breeder usually breeds from males with combs as thin as will stand straight, and use with them some females with thin, drooping combs and some with smaller, thicker combs standing straight or nearly straight.

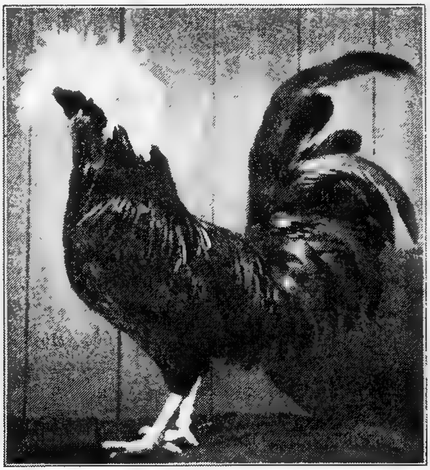

FIG. 510. White-Crested Black Polish cock (Photograph from owner, Charles L. Seely)

COLOR MATINGS OF POULTRY

Mating black-red fowls. Of fowls with the colors and general color pattern of the original type there are many varieties, — Black-Red and Brown-Red Games of the English, Exhibition, and Bantam types, Black-Red Malays and Malay Bantams, Brown Leghorns, Cornish Indian Games, Partridge Cochins, Partridge Cochin Bantams, Partridge Plymouth Rocks, Partridge Wyandottes, and Redcaps. In all of

FIG. 511. Stylish Single-Combed Brown Leghorn cockerel[1]

these the male is roughly described as having a black breast, body, and tail, with a red back, and the female as brown. When details of color are examined the males are found to vary in the shade of red, the narrow red feathers of neck, hackle, and saddle being sometimes striped with black, and the red and black in the wings being regularly distributed, the longest flight feathers nearly black, and red or brown appearing usually in a distinct line along the outer edge of the narrower outer web of each flight feather, or in irregular and less distinct patches in the broader inner web. In the secondaries the black is found regularly on the inner web, not quite covering it; the red, on the outer web and quill, and extending a little way on the inner web. The wing coverts are black, the wing bows red. In the darker varieties, as the Cornish Indian Game and the Redcap, the black tends strongly to encroach on the red areas. In the lighter varieties, as in the pullet-breeding Brown Leghorn males, the red tends strongly to encroach on the black. The object of the fancier is to keep the different colors distributed as exactly as possible in accordance with the Standard specifications.

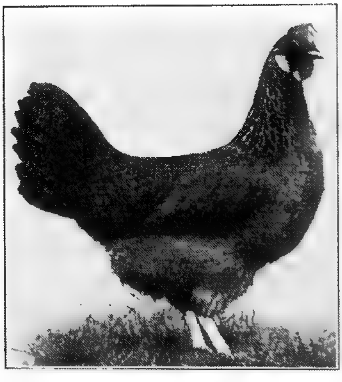

FIG. 512. Stylish Single-Combed Brown Leghorn Pullet[1]

In the females of the black-red color type are found two styles of distribution of color. On the Brown Leghorn there is no regular pattern, but the dark brown appears as a fine, even stippling on the back and wings (except where there is black in the male), while the breast is a redder brown and the under part of the body an ashy brown. In females of the other varieties the Standard calls for a light brown or bay

[1] Owned by Grove Hill Poultry Yards, Waltham, Massachusetts. Photograph by Schilling.

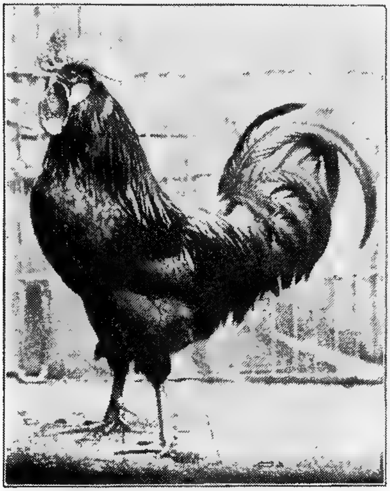

FIG. 513. Single-Combed Brown Leghorn cock, very full breast [1]

ground all over, and on this ground two or three pencilings of darker brown on each feather, except where feathers are black in wings and tail, and in the hackle where the feathers are striped with black.

These Standard color requirements for the different sexes are in a measure incompatible. There is a natural difference in the coloration of the sexes. The tendency in the male is toward greater intensity of color and the occurrence of the more brilliant color in the distinctive male plumage; the tendency in the female is toward a duller tone and a more uniform distribution of colors. But in bisexual reproduction these tendencies in a measure counteract each other, as the breeder of fowls of this color type finds when he tries to produce, from females in which the colors are distributed, males with colors distinctly separated, and from males in which he has segregated the colors in different sections, females in which the colors are distributed through all sections. His difficulties are increased when, as in the penciled varieties, he tries to secure a general separation by sections of color in the male, and in the female the same distribution of color in nearly all sections, with separation of the colors in a distinct pattern in each feather.

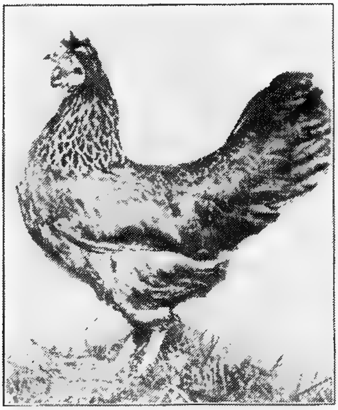

FIG. 514. Single-Combed Brown Leghorn hen [1]

Very early in the development of colors in black-red types fanciers discovered that the production of males and females of the desired colors from matings of Standard specimens was uncertain; that the male with solid black breast, mated with the female of correct shade and type, was likely to produce (through cross heredity in direct transmission, and the blending of colors)

[1] Owned by Grove Hill Poultry Yards, Waltham, Massachusetts. Photograph by Schilling.

males with the black of the breast and body more or less marked or tinged with red, and females with a superabundance of black. It was found that for the regular production of males with colors distinctly separated, females in which the tendency was strong must be used, and for the regular production of females with the colors distributed uniformly as to sections, and separated on feathers, males in which that tendency was strong must be used. It was found also that the external indications (the indications in the plumage itself) of color-breeding tendencies were usually plain. A Brown Leghorn or Partridge Cochin male showing traces of brown all through the black of his breast and body was likely to breed, when mated with a Standard-colored female of his kind, pullets of the correct shade and markings; mated with darker females, he might produce some males with black breast and body and some females of his own type and tendency, but results were too often disappointing. Similarly, the finest males of the approved color type were found to reproduce that type best when mated with females with the same tendency to black body color.

FIG. 516. Single-Combed Brown Leghorn hen [1]

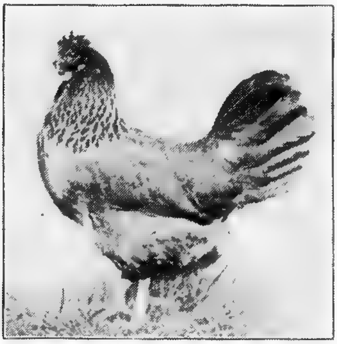

FIG. 515. Single-Combed Brown Leghorn hen [1]

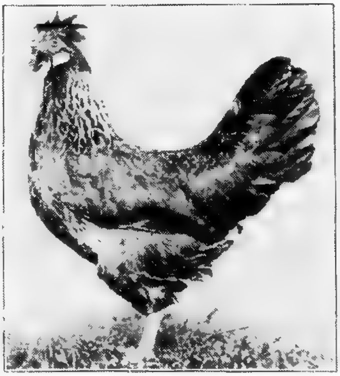

FIG. 517. Single-Combed Brown Leghorn hen [1]

[1] Owned by Grove Hill Poultry Yards, Waltham, Massachusetts. Photographs by Schilling. The bird in Fig. 516 is the daughter of the one in Fig. 514; that in Fig. 515 is the granddaughter of the one in Fig. 516. The bird in Fig. 517 is in the same line of breeding, — a very large hen, weighing 6½ pounds, yet of good shape and style.

It was especially observed in breeding the Partridge Cochin, in which the Standard requires very distinct pencilings in all sections in the female, that while these pencilings could not be produced typically in the male, and the red appeared only as a defect on the black of the breast and body, the son of a well-penciled female, when mated with females of Standard type, would usually produce daughters similarly well penciled. On the other hand, from a female with poor penciling (colors distributed but pattern not arranged) a male might be produced (to all appearances like the other) which, mated with the same females, would give daughters distinctly inferior in penciling. Similar observations were made in regard to the production of the desired type of males. The sexes having the same colors in different patterns, the color of a male indicated only the general shade or tone of color of his daughters, the color of a female only the general color tone of her sons; and unless the breeder knew the details of color of the sire of a female or the dam of a male, he could form no idea of what their influence would be on the markings of their offspring of the opposite sex. Thus it was demonstrated empirically in the experience of many breeders, most of whom were not versed in the science of evolution, that, in breeding poultry in which the sexes differ in color, the most important thing to know about a bird is the color of its parents.

FIG. 518. Model head of Single-Combed Leghorn male (Brown Leghorn)[1]

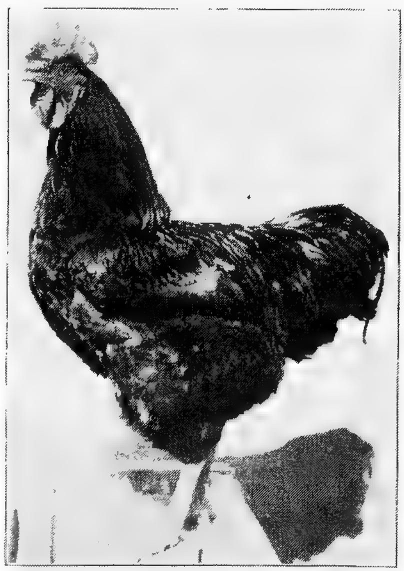

FIG. 519. Partridge Plymouth Rock cockerel. (Photograph from owner, Frank T. Chambers, Bristol, Pennsylvania)

For a long time the common practice in mating Partridge Cochins and Brown Leghorns, which were the black-red varieties most popular with fanciers, was to make intermediate matings, using a male with a slight tendency to a mixture of red in black sections with both dark and light females in the same pen. This sometimes gives good birds of both sexes, — occasionally a large proportion of them; but it is, at best, a makeshift method of getting results, and the breeder

[1] Photograph from Grove Hill Poultry Yards.

FIG. 520. Partridge Wyandotte cock. (Photograph by Graham)

who practices it cannot long compete with one of equal skill who breeds two distinct lines. It is a significant fact that special mating for the sexes, though not made a regular system until after it had been adopted for another pattern, was worked out first with fowls of the colors of the natural species, and as a result of the fancier's efforts to develop in each sex the sexual color tendency.

Mating modified black-red color types. We have seen that the black-red color type, the same in pattern in the males of many varieties, is modified in the females of all these varieties; that it may be changed in the females without changing in the males; that the males will regularly transmit in their female offspring the pattern peculiar to females of their own race; and that the influence of the female coloration on the male coloration may be very strong, developing a tendency to distribution of red throughout the black, as in the female. By further separation of the colors on each feather in the female plumage the several pencilings may be combined either in a single broad penciling, or "lacing," following the edge of the feather, as in the Golden-Laced Wyandotte, or in a spot, or "spangle," near the tip of the feather, as in the Golden-Spangled Hamburg, or in transverse bars crossing the feather, as in the Golden-Penciled Hamburg. With these types of female coloration may be developed male types with the female markings in all black sections, the red sections remaining as before, as in the Golden-Laced Wyandotte, or changed to give on the special male feathers a distribution corresponding to that in the general plumage, as in the Golden Polish, or with the black in all

FIG. 521. Partridge Wyandotte hen (Photograph by Graham)

sections largely replaced by red, as in the Golden-Penciled Hamburg, which has the breast of the male (of the ground color of the female without pencilings), has black fluff, and has the sides of the body between the breast and the fluff penciled as in the general plumage of the female.

These modifications, especially in the first two instances cited, are in the direction of making a distinct pattern common to the male and female of the black-red color type. Theoretically it should be possible to secure some modification of this type, making male and female identical in color, which would result in regularly giving typical males and females from matings of standard specimens. Many breeders of Laced Wyandottes assert that this will be the result, if breeders will not undertake to secure open centers and narrow lacing in both sexes too rapidly, and will patiently mate birds with medium centers and lacing until the pattern is well established in both sexes. This view seems sound, but not many breeders are willing to wait when they can occasionally get phenomenal specimens by special matings. Though there is no regular double-mating system in these modified types, the principle applies wherever the color tendencies in the sexes differ.

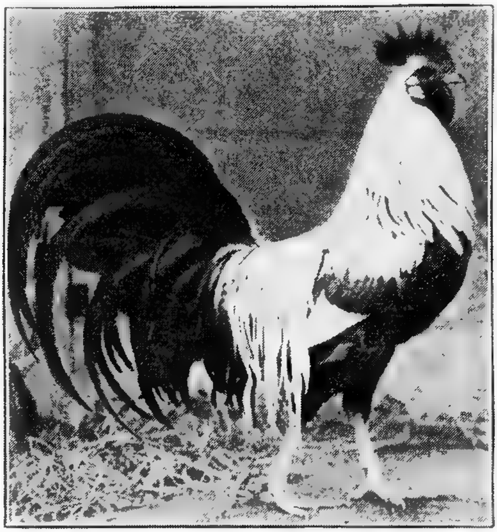

FIG. 522. Long-Tailed Japanese Phœnix cockerel, owned by Urban Farms, Buffalo, New York. (Photograph by Schilling)

Mating red and buff-color types. The red and buff varieties are derived from the black-red type by the blending and reduction of the black and red. There is practically no limit to the number of shades produced by combinations of their colors. Not only are there all gradations of the mixture in the general color tone of the plumage of birds of these color types, but there is always some variation of shade (and often a great deal of it) in the different sections, in different feathers, and (in less degree) on the same feather. Of the many possible shades in this class of colors only three are recognized as Standard: golden buff, in all buff varieties; red, in the Rhode Island Red; and dark red, in the Buckeye. While the description thus rigidly limits buff fowls to one and red fowls to two shades, it is absolutely impossible to secure uniformity in

FIG. 523. Silver-Penciled Plymouth Rock cock. (Photograph by Graham)

FIG. 524. Silver-Penciled Plymouth Rock hen. (Photograph by Graham)

varieties and flocks, and difficult to get it in individuals. The rigidity of the Standard only serves to unify the ideals of breeders, and to prevent the breaking up of varieties into subvarieties, as when Buff Cochins were bred in three color subvarieties.

While commonly classed by fanciers with black and white as a "solid color,"[1] and handicapped with them in sweepstakes competitions, buff and red shades are the most uncertain of all in transmission and the most unstable in the individual. With both red and black present in considerable amounts, there is a constant tendency for these pigments to separate and arrange themselves as in the black-red type. The black tends to go to the wing and tail feathers, the red to the feathers of the hackle and the back. Hardly more than one bird in a thousand in any variety will meet the Standard requirement for uniformity of surface color and hold that color until and through the first adult molt. For this reason an old buff or red bird that is sound in color is even more valuable as a breeder (compared with a similar young bird) than an old bird of other color types.

The general rule in mating buff and red birds is to use birds of both sexes as near the Standard shade of color as possible and uniform in color. The second specification is as important as the first. A bird that is uniform but a little lighter or darker than desirable may not show as well among birds of the stylish shade as one that, with the

[1] Strictly the term describes the pattern rather than the quality of the color.

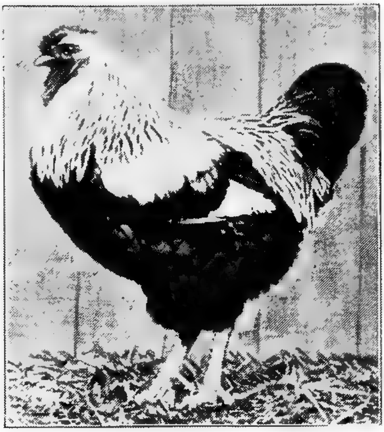

FIG. 525. Silver-Penciled Wyandotte cockerel, a nice type [1]

desired shade in some sections, runs a little off in others, but it is likely to give more satisfactory results in breeding. The tendency to a uniform distribution of colors is more valuable in a breeding bird than the correct shade of color prevailing in most sections but lost in one or two. Systematic breeding from the birds nearest the desired shade of color, offsetting weakness in color in one sex by strength in the other, and applying the compensation principle section by section, when necessary, will keep a stock of buff or red birds very close to the Standard color.

As stated in the description of the breeds, the Buff Wyandottes, Plymouth Rocks, and Rhode Island Reds were at one time of nearly the same color. The first Buff Leghorns were mostly weak in color, with a great deal of white and some black. At the time when the buff craze came on in the early nineties, the popular shade for Buff Cochins in the East was a very light buff, in the West a rather dark buff. This difference continues, but in less degree. The very light birds favored in Eastern shows when the Buff Leghorn boom was at its height were so reduced in buff pigment that the color began to break up and show traces of white throughout the plumage. When this stage was reached it was necessary to "feed" the stock some dark color by using dark birds in some matings. The feeding process often caused such lack of uniformity that the breeder's stock was not found in the showrooms again for one or two seasons.

FIG. 526. Silver-Penciled Wyandotte pullet. Good bird with poor head [1]

In the darker shades of buff, fluctuations still continue, but as long as the color is strong enough to keep out the white, a variation of a few shades is immaterial. In red fowls the tendency has been constantly to a darker shade, many breeders going beyond red in Rhode Island Reds and getting a large proportion of brown specimens. With

[1] Photograph from owner, James S. Wason, Grand Rapids, Michigan.

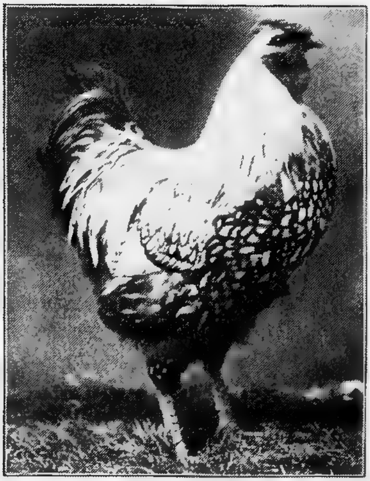

FIG. 527. Silver Laced Wyandotte cockerel. This bird and the one in Fig. 528 are full brothers. The bird in Fig. 528, with the best-laced breast, fails in saddle

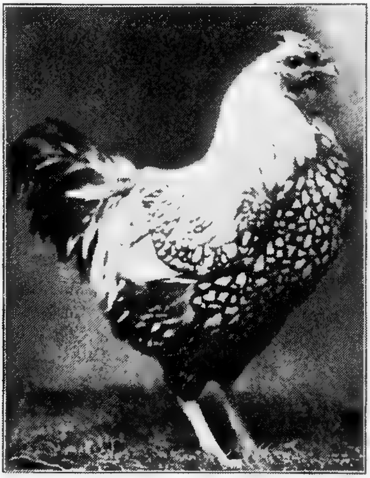

FIG. 528. Silver-Laced Wyandotte cockerel. (Photograph from owner, John C Jodrey, Danvers, Massachusetts)

[1] Photograph from owners, Wood and Freeman, Fitchburg, Massachusetts.

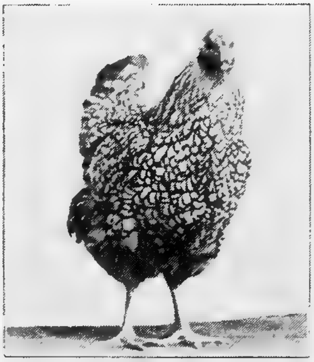

FIG. 529. Front view of Silver-Laced Wyandotte pullet [1]

FIG. 530. Side view of bird in Fig. 529

FIG. 531. Three-quarters rear view of bird in Fig. 529

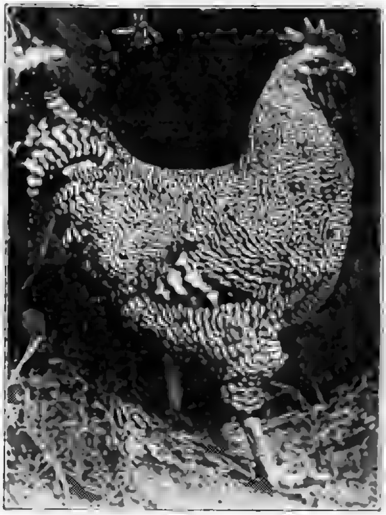

FIG. 532. Exhibition Barred Plymouth Rock cockerel[1]

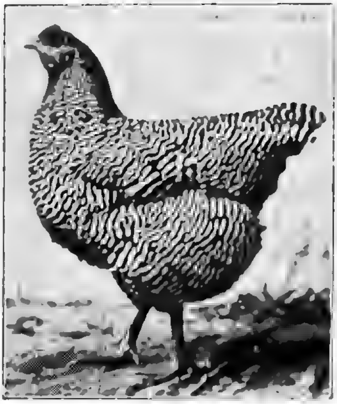

FIG. 534. Barred Plymouth Rock pullet of the Exhibition male line. Remarkably well-defined barring for a "cockerel-bred" female. This pullet and the male in Fig. 532 make a model mating for Standard males[1]

FIG. 533. Exhibition Barred Plymouth Rock pullet. This pullet and the male in Fig. 535 make a model mating for Standard females. Many of the males from such a mating will be much lighter in color than the sire[1]

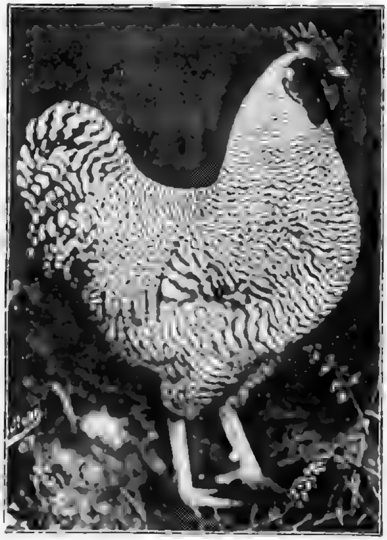

FIG. 535. Barred Plymouth Rock cockerel of the Exhibition female line[1]

[1] Owned by Grove Hill Poultry Yards, Waltham, Massachusetts. Photograph by Schilling.

the idea that the blending of extremes will produce a mean, many have mated these dark brown specimens to light buff or salmon birds. The usual result is a mottling of the shades in the progeny. A light or dark bird may be used to tone up or down in the progeny the color of a bird a few shades lighter or darker than itself, but extreme matings always produce variegation.

While standards for red fowls require or allow considerable black, the breeder should always work away from black and endeavor to secure rich red throughout, for the development of fanciers' ideals and of standards is always in the direction of uniformity of color in a variety which has no pronounced pattern in the plumage.

FIG. 536. Typical American Dominique cock (Photograph from owner, A. Q. Carter, Freeport, Maine)

Mating black-white color types. The black-white color types present the same phenomena as the black-red, with the red replaced by white. Though red is considered a strong positive color, and white merely absence of color, the colors behave in just the same way in the Dark Brahma as in the Partridge Cochin, in the Silver-Laced as in the Golden-Laced Wyandotte, in the Silver-Penciled as in the Golden-Penciled Hamburg. In mating any of the varieties with these color combinations the breeder who finds it difficult to get good specimens of both sexes from the same mating must carefully study his type, his individual birds, their ancestry and their progeny, and determine how far it is necessary to cater to sex tendencies by special matings to produce what standards require.

Mating the gray, or blue, barred pattern. Barring in all sections of both sexes is in appearance one of the simplest of color patterns. "Common looking" is a phrase often applied to the finest Barred Plymouth Rocks by people who do not know how difficult it is to produce fine finish in this pattern, and do not appreciate the results. The pattern seems to have been comparatively crude in all varieties in which it was found, until the keen competition of Barred Plymouth Rock breeders brought it to a high state of perfection. The fancier's attitude toward sexual differences in color in this variety is just the opposite of his attitude toward such differences in pronounced black-red color types. In the Brown Leghorn and varieties similar in color he cultivates the sexual tendency to differences in color; in the Barred Plymouth Rock he cultivates the opposing race tendency to similarity in color and markings. The result is secured in both cases by the application of the same principle of special mating, — breeding not the Standard-colored bird of either sex to a mate of the other sex of the same shade of color, but the male to a female of the color and breeding of his dam, and the female to a male of the color and breeding of her sire. There is, however, this difference in the cases compared: when sexual differences in color are exaggerated by a standard, the application of the principle keeps apart the lines of breeding, or subvarieties. When a standard seeks to make the sex color types identical, the application of the principle of special matings tends first to fix the types and finally to fuse the lines. Allusion was made to this in the paragraph relating to modified black-red types. Nowhere is the evidence of progress toward fusion of sex varieties as marked as in the evolution of the Barred Plymouth Rock. From within a few years after they were established, the two lines have been steadily converging. The dark females with indistinct barring, once used in the male line, and the nearly white males with just a suggestion of barring, once used in the female line, are rarely seen now. Crosses of the two lines are occasionally

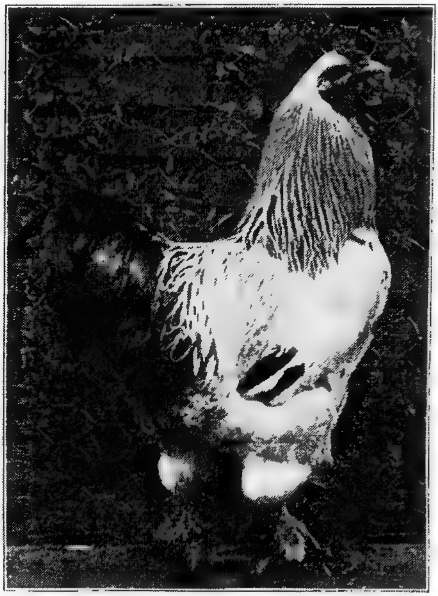

FIG. 537. Light Brahma cockerel, owned by H. B. Robinson, Reading, Massachusetts

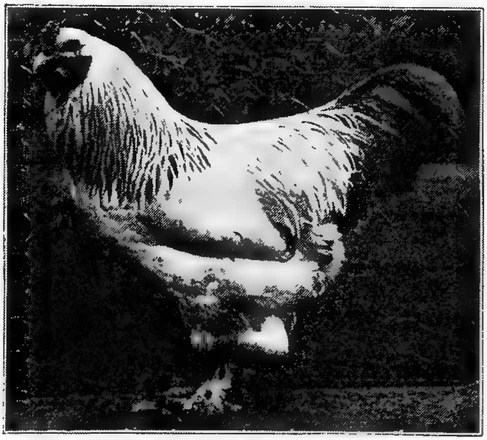

FIG. 538. Same as Fig. 537. Note how the pose changes the apparent shape

made by skillful breeders with good results. The barring is becoming narrower and more distinct, and the general color tone darker. It seems plain that a time will come when the two lines of the Barred Rock will be one, but how soon no one can say. At the present stage of their development they are satisfactorily fused only by breeders of great skill, thoroughly familiar with the breeding of both lines of stock used, and by them only occasionally. Nor is the result at this stage to start a new line on the single-mating system; it simply starts a new family on one of the old lines.

While the Standard specifies that bars shall be straight across the feather, uniform in width, distinct, and free from any brownish or greenish tinge, such perfection of color and pattern appears in only a small proportion of specimens. The bars on many birds still tend to the crescentic form once prevalent even in well-bred stock. A common fault in barring is the breaking of the bar as it crosses the shaft of the feather, the part in each web being straight but not matching at the quill. In the flight feathers of the wings good clear barring is comparatively rare, the bars presenting more of the uneven appearance described as "marbled." The brown and green tinges in the dark bars, often seen in both males and females, give the surface color a muddy, dirty look. Both are likely to be most conspicuous on the backs of males but appear in all sections. All these faults should be carefully avoided in selecting breeders. A pair free from them is worth more to the breeder than any number of birds in which they are prevalent. Feathers wholly or partly black are found in varying numbers in nearly all barred fowls. Unless they are large or conspicuously abundant, a good bird should not be discarded for them. It is practically impossible to breed them out entirely.

FIG. 539. Showing remarkable wing of Columbian Wyandotte pullet in Fig. 421[1]

The color of the beak and shanks in the Barred Plymouth Rock male is usually of the yellow demanded by the Standard. In the Standard female a perfectly clean yellow beak and leg is rare. The Standard allows a little dark stripe on the beak. Nearly all pullets show some dark spots on the shanks after they begin to lay, if not earlier. The females of the male line have quite darkly shaded beaks and legs.

Mating the ermine[2] color type. White with black points — that is, black on neck, wings, and tail — is the color of the Light Brahma, Columbian

[1] Photograph from owner, Sunny Brook Farm, West Orange, New Jersey.

[2] A variety called the Erminette, white with black spots in the plumage, the converse of the Houdan, was at one time bred in America, and there may still be some in existence. As long as the Light Brahma was the only distinct variety bred white with black points, the term "light," describing the bird as light in color

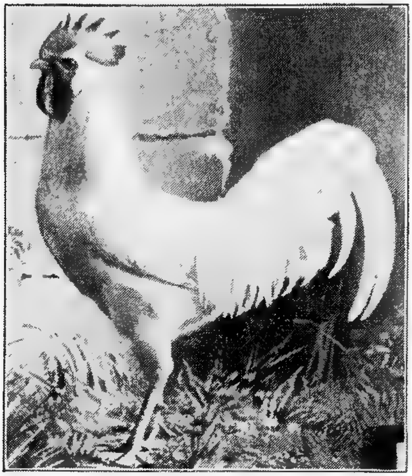

FIG. 540. Model Single-Combed White Leghorn cockerel[1]

Wyandotte, Columbian Plymouth Rock, and, in more crude form, of the less popular Lakenvelder. This color pattern appears as the elimination of black from the surface of the body plumage of a silver-laced or silver-penciled type, leaving the bird white with black in the wing flights and tail and a black stripe in the hackle. As has been stated, the Light and Dark varieties of the Brahma were not clearly differentiated when brought from China. The early Light Brahmas showed a great deal of black or gray on the back, breast, and body. For many years the ideal of Light Brahma breeders was a white fowl with neck-hackle cleanly striped with black; tail black, tail coverts black with clean edge or lacing of white; wing black or nearly black in the flights, with one web black in the secondaries, but no black showing when the wing is folded. A little black ticking in the saddle near the tail was tolerated in an Exhibition male and considered desirable in a male for breeding. Recently, a darker type of Light Brahma has sometimes been given preference. In this type males have very heavy striping in the hackle, and have the striping in the saddle extending well up to the cape, making the back almost the same as in Dark Brahma and Silver Wyandotte males. This corresponds with the popular type of Columbian Wyandotte. Whether this type will

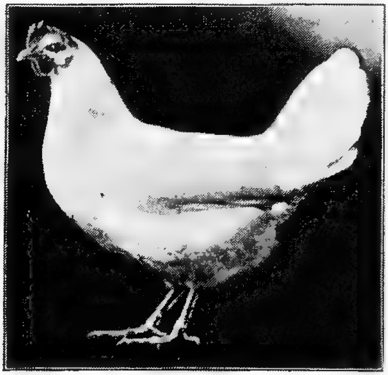

FIG. 541. Model Single-Combed White Leghorn pullet[1]

but not white, was adequate. With the appearance of Wyandottes and Plymouth Rocks of the same color type, "light" no longer answers for a general description of the color, while the name "Columbian" has no appropriateness whatever. Every other variety of these breeds having a name descriptive of its color, the appropriate names for these are Ermine Wyandotte and Ermine Plymouth Rock.

[1] Photograph from owner, Harmon Bradshaw, Lebanon, Indiana.

FIG. 542. Single-Combed White Leghorn cockerel

continue popular is uncertain. Extensive black striping in white backs cannot be secured without more black than is desirable in other white sections. The general tendency in the development of color patterns in fowls is to clean color in sections where there is no definite pattern. For these reasons it is most probable that there will be a gradual return to the older type. The Columbian Wyandottes, during the decade after their introduction, in which they were bred by only a few breeders, were very poor in color, the white brassy, and the black very weak. After they became popular, crosses with both Light Brahmas and Silver-Penciled Wyandottes were made to strengthen the black color. The variety was largely in the hands of breeders not familiar with the behavior of the colors in the pattern. Most of them were insistent for black wings (flights) and for strong striping in the hackle and saddles of males,—points which cannot be regularly obtained without bringing out a great deal of black elsewhere, particularly in the backs of the females, where it appears as mossiness.

FIG. 543. Head of Rose-Combed White Leghorn cockerel[1]

FIG. 544. Rose-Combed White Leghorn pullet[1]

The most reliable method of mating this color pattern to secure clean white surface and strong black points is to use males with a white edging on the lower web of each flight, with clean,

[1] Photograph from owner, Turtle Point Farm, Saratoga, New York.

FIG. 545. Single-Combed White Leghorn cock [1]

sharply defined striping in the hackle, a little ticking (but not pronounced striping) in the saddle, tail coverts with clean white lacings, the surface black in every section jet black, and the surface white a clean white; the females should not be quite so strong in color. Females with black or nearly black wings will usually show poor striping in the hackle, the black stripe too wide (breaking the white edge at the tip of the feather), and the white margin flecked with black (smutty). It is better to select both males and females first for good striping in the hackle, and not reject for white in the flights unless it is excessive. In general there is a degree of correlation in black sections (a weak wing accompanying weakness of color in the main tail feathers and in the hackle), but this is not regular.

FIG. 546. Single-Combed White Leghorn cockerel, extra good breast [1]

To produce the now fashionable darker type, without white in the upper webs of flight feathers and with strong striping in the saddles of the males, selection must be made for these points, with (at present) some sacrifice in cleanness of surface white. Whether it is possible ultimately to produce the color pattern with striping on the backs of males and clean white surface on the backs of females is debatable — and doubtful. Such specifications

[1] Photograph from owner, Elm Poultry Yards, Hartford, Connecticut.

FIG. 547. White Langshan cock[1]

FIG. 548. White Langshan hen. This hen and the cock in Fig. 547 are shown in different positions on page 301. Good type, except back is a trifle short. In the male it should form a U not a V[1]

FIG. 549. Black Langshan pullet This bird and the cockerel in Fig. 550 are in type intermediate between that shown on page 390 and the English Exhibition type[1]

FIG. 550. Black Langshan cockerel[1]

[1] Photograph from owner, Paul P. Ives, Guilford, Connecticut.

are inconsistent. If followed, they lead to a double-mating system and to the development of male and female lines as subvarieties.

Mating white fowls. The novice usually assumes that white birds must be easy to breed, for (as he supposes) they have no color. The fancier of white fowls soon finds that it is as difficult to produce an absolutely white bird as to produce a party-colored bird perfect in all sections, and particularly difficult to produce the combination, now required by the American Standard, of dead-white plumage and yellow legs, beak, and skin. Most of the birds of this description seen in the shows are washed to remove from the feathers the oil which gives them a creamy tint, and some are bleached to remove the more objectionable brassiness prevalent in new white varieties and in carelessly bred stock. "White" as a description of a color of poultry is always relative; birds that have positive white where they are white, and no trace whatever of other color, are not known to poultrymen. In the colored varieties of poultry we find everywhere the principal effects due to varying intensities and combinations of black and red. In the whitest fowls traces of one or another of these colors are always present,[1] sometimes toning the white throughout, sometimes appearing as splashes or ticks of red or black. It has long been observed by fanciers that the whitest birds are most likely to have black ticking in the web of the feathers (sometimes a great deal of it), while those free from black ticking are likely to be creamy, that is, have a trace of red. Apparently, the small residue of color left after the elimination of color has been carried as far as possible will be, as a rule, of one color or the other, — red or black, not both; and apparently, a residue of red tends to distribute itself throughout the plumage and a residue of black to appear in specks or

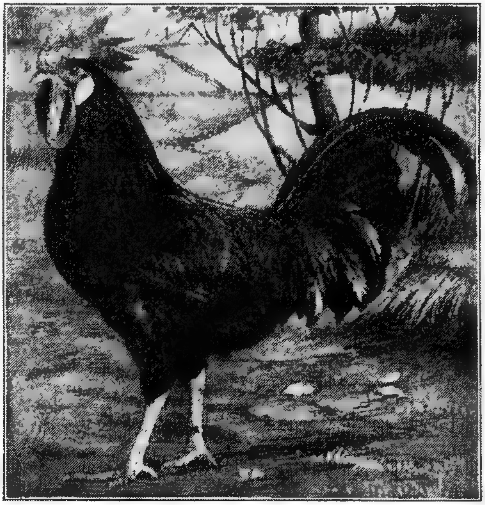

FIG. 551. Single-Combed Black Minorca cock. (Photograph from owner, Arthur Trethaway, Wilkes-Barre, Pennsylvania)

[1] To the novice not trained to consider colors in poultry critically, such statements always seem absurd. He supposes that he has seen hundreds or thousands of domesticated fowls that are absolutely white. His awakening comes when he exhibits a bird that he supposes is white.

FIG. 552. Rose-Combed Black Minorca cock[1]

ticking. This is the case where the color is reduced to the minimum. With more color present, splotches of red, and red feathers, as well as black, will appear.

In considering color, in white birds it is necessary to distinguish between the creaminess due to superabundance of oil (fat) in the growing feather, and the creaminess due to the distribution of red. The former tends to disappear as the feathers mature, and may be removed by washing; the latter cannot be removed without damage to the feather. It appears as creaminess when little red is present; as the red increases, it becomes straw-colored, and the bird is said to be "brassy." Brassiness is always most pronounced on males and in the sections which are red in black-red fowls. Usually it is of a distinctly yellow cast, rather glossy, and appears to be on the surface rather than in the substance of the feather; but sometimes it is dull and seems to permeate the web where it appears, and in such cases it is likely to be found in both sexes and in all sections. Sometimes the red appears as a faint bricky (in some lights, rosy) tint in the white, probably due to the combination of minute particles of red and black.

FIG. 553. Rose-Combed Black Minorca hen[1]

The faults of white plumage are always plain in stock not bred with care to eliminate them, and

[1] Photograph from owner, G. A. Clark, Seymour, Indiana.

FIG. 554. Rose-Combed Black Minorca cockerel. Undeveloped form of Fig. 552 [1]

are never wholly absent in the best-bred stock. When serious, they cannot be got rid of by any quick method. In stock in which brassiness is bad no improvement of consequence can be made by mating with good white stock. Because brassiness may not appear in females, a breeder often supposes that it does not exist in them, and uses them with white males. Almost invariably the result is brassy males in the offspring. It is just as necessary to know that the sire of an apparently very white hen was free from brassiness as to know the breeding of the sire of a black-red female. In White Plymouth Rock males close inspection often shows a suggestion of black barring, especially in the hackle, and sometimes the tips of hackle feathers are plainly tipped with gray. The whitest plumage is secured only by long-continued selection of the whitest birds. In the present state of development of white breeds no one who breeds for exhibition can afford to waste time with birds in which brassiness is conspicuous. Those who breed white poultry for utility purposes need not be so careful, but males that are badly brassy should never be used.

Mating black fowls. It is as rare for a black fowl to be dead black as it is for a white fowl to be pure white. Ordinary black fowls are a rusty black or a brown black, usually with white appearing as gray in various parts of the plumage, oftenest in the wing flights, in the concealed tail feathers, and in the undercolor. Even in good black fowls red is usually present, either visible or

FIG. 555. Rose-Combed Black Minorca pullet. Undeveloped form of Fig. 553 [1]

[1] Photograph from owner, G. A. Clark, Seymour, Indiana.

FIG. 556. Single-Combed Rhode Island Red cock. (Photograph from owner, Frank D. Read, Bridgewater, Massachusetts)

latent, and the black is never absolutely free from white.[1]

Black stock that has not been very carefully bred for color is usually a brown black. Breeding from the blackest of such brown-black birds develops the Standard jet black with the green surface, sheen, and brown casts eliminated. After this stage of development has been reached it becomes necessary to check the intensification of black by breeding with a Standard bird of one sex a mate of the other in which the black is dull yet free from pronounced rustiness. If two jet-black birds are mated, further intensification of the black seems to bring it to disintegration, and brings out purple barring, which is a most objectionable character. The occurrence of white

FIG. 557. Single-Combed Rhode Island Red pullet

FIG. 558. Single-Combed Rhode Island Red hen[2]

[1] Some of the most careful breeders and expert exhibitors of black fowls say that white can always be found in a black fowl if the examination is thorough. A breeder of Black Leghorns and judge of many black varieties, who had had over twenty years' experience with them, once told me that no matter how carefully a black fowl was examined for white, and faulty feathers removed, he could always go back and find another.

[2] Photograph from owner, Frank D. Read.

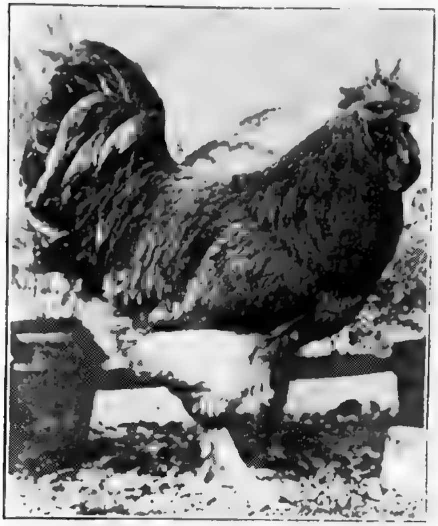

FIG. 559. Single-Combed Buff Orpington cock (Photograph from owner, Miss Henrietta E. Hooker, South Hadley, Massachusetts)

FIG. 560. Single Combed Buff Orpington hen. (Photograph from owner, Miss H. E. Hooker.) This female and the male in Fig. 559 show a type halfway between the Plymouth Rock and the Cochin

FIG. 561. Buff Cochin pullet

FIG. 562. Stylish Single-Combed Buff Leghorn cock [1]

[1] Owned by Thomas Peer, Fairfield, New Jersey. Photograph by Graham.

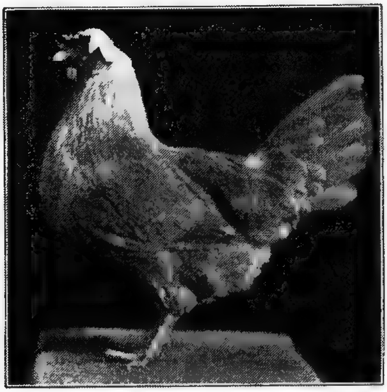

FIG. 563. Single-Combed Buff Leghorn hen; a nice specimen[1]

in black fowls and in black plumage in all fowls is often due to poor condition when the plumage is growing, — a point to be considered with due allowance when birds are being selected for breeders. The fault is most conspicuous and most serious when it appears in the flight feathers of the wings. If found here in considerable amount in birds of a stock which has been quite free from it, the presumption is always that the bird was a little out of condition (perhaps lousy) when the feathers were growing, and that, if in good condition at the breeding season, it is likely to produce offspring that under good growing conditions will be as free from the fault as its ancestry. A breeder working with stock that he does not know may, for once, give to a bird with too much white the benefit of the doubt. Then if the fault seems racial, he should secure birds free from it to breed with his stock, or perhaps get altogether new stock.

Undercolor. In all the preceding discussions of selection for color, surface color only has been considered. Undercolor, the color of that part of the soft feathers which does not show as they lie in natural position, is of nearly equal importance. Defective undercolor is a much more serious matter in a breeding bird than in an exhibition bird, though even in the latter it is a serious fault. Standard specifications as to undercolor are in many instances lacking, and rarely give the breeder a clue to the weak places in undercolor.

FIG. 564. Single-Combed Buff Leghorn cock[1]

In all *black-red* types the prevailing tone of the undercolor is slate, that is, there is white distributed quite evenly through the undercolor that does not appear (or is desired not to appear) on the surface.

[1] Photograph from owner, Monmouth Poultry Farm, Freneau, New Jersey.

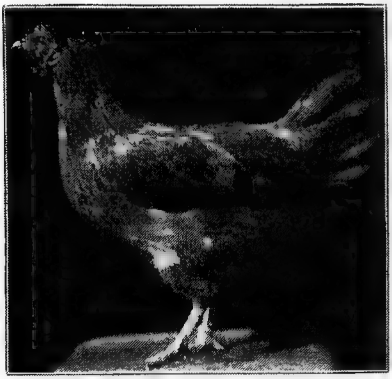

FIG. 565. Single-Combed Buff Leghorn pullet, very sound color[1]

This white often appears as white at the base of the feathers next the skin all over the bird. The amount of white may be small or it may be considerable. There are two places on the fowl where this white tends especially to crop out, the tendency being particularly strong in the male, — at the base of the tail and on the back of the neck, in the hackle. In poorly bred males of this color type white at the base of the tail is conspicuous and may extend for some distance on the main tail feathers. It is hard to eliminate entirely even in well-bred birds. It is more noticeable in Games and Brown Leghorns than in Cochins, Wyandottes, and Plymouth Rocks, because the tail is larger and the saddle feathers are less profuse. The white in the neck, unless very bad, does not show on the surface. If present, it may be found by parting the feathers of the hackle, or cape. Sometimes it is there for one third or one half the length of the feathers when no sign of it is seen on the surface.

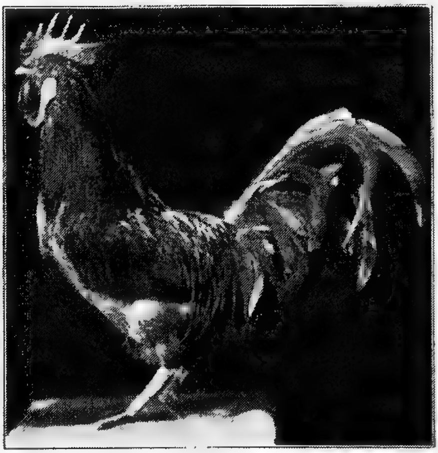

FIG. 566. Single-Combed Buff Leghorn cockerel; shy, and would not pose to show style[1]

In the individual bird such defects, if not conspicuous on the surface, are not of great importance, but as they occur in most pronounced form in the males, and a female showing them slightly or not at all may be the daughter of a male in which they were very bad, unless the breeder is sure of his females it is doubly necessary that he should avoid breeding from males with such faults.

In the *modified black-red* types the tendency is to lighter undercolor. As long as white does not break out, some diminution of the intensity of the slate color is not objectionable.

[1] Photograph from owner, Monmouth Poultry Farm, Freneau, New Jersey.

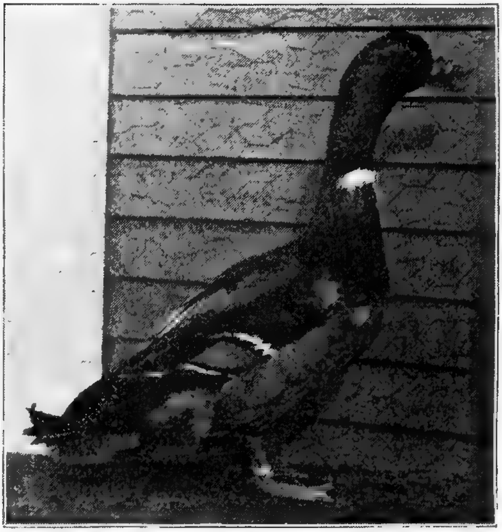

FIG. 567. Young Rouen drake, owned by Howard B. Robinson, Reading, Massachusetts

In the *dark-red* types, with black in the wings and tail, the undercolor is usually red with more or less slate, the slate, when present, appearing as a bar next the surface. If black points are required or allowed, a moderate amount of slate in undercolor is not objectionable, but care must be taken to avoid repeated matings of birds with much slate, for the tendency of such matings is to bring out black specks, and sometimes indistinct pencilings, on the surface.

In *buff* birds, and in *red* birds in which it is desired to reduce the black as much as possible, slate in undercolor should be scrupulously avoided, and selection made for undercolor as near the surface color as possible. The strongest buff and red undercolor is always a little lighter than the surface color, but strong surface color is often found with weak undercolor. In these colors, if surface and undercolor are very nearly the same shade and the former somewhat faded and mottled by exposure, a bird may appear to have good undercolor and poor surface, and in such cases the undercolor may afford a better index of the breeding character of the bird than the

FIG. 568. Old Rouen duck, owned by Howard B. Robinson, Reading, Massachusetts

FIG. 569. Black Sumatra Game cock. (Photograph by Graham)

surface color. Buff and red varieties are especially prone to white in the hackles of the males, and the breeder of these varieties should always look for it there.

In the *black-white* type and its modifications, and to a less extent in black varieties, the white faults in undercolor appear. In most black varieties the undercolor is a very dark slate, but is sometimes a dull, or brown, black. In the black-white or gray color types white is necessarily somewhat prevalent in undercolor, but with so much white in the surface its presence is often overlooked until neglect of it leads to weakening of the surface color. The breeder has always to guard against the troublesome white in the hackle and at the base of the tail. Where white and black are mixed, he detects it in the weakening of black. If he fails to notice that the black stripe in a hackle is broken across with white just under the surface, he soon finds chickens developing with weak striping on the surface. If he overlooks a little white at the base of the main tail feathers and sickles, he soon finds white extending farther out on these feathers.

FIG. 570. Black Sumatra Game hen (Photograph by Graham)

In the *ermine* types, as in the red with black points, a light slate undercolor, or a slate bar just under the surface, is favored by many breeders; and, as a rule, more or less black is found in the undercolor of birds of this type which have good black points.

In *gray-barred* fowls strong, clear barring on the surface is preserved only by careful selection for barring in undercolor. It is not necessary that the barring in undercolor be as clear and the dark color as strong as in the surface color. Some breeders of Barred Plymouth Rocks tried for a while to develop it that way, but as the natural tendency is to darker color on the surface than in undercolor, the result was to increase the black in the surface color and make the birds too dark. Strong barring in undercolor is still a fad with many breeders. Others require only that the bars be quite distinct for the greater part of the length of the feather, and apparent, though not sharply defined, down to the skin. If barring in undercolor is neglected in selecting breeders, surface bars soon become indistinct, and white appears in considerable amounts in the tail and neck.

In *white* fowls the undercolor is often the most reliable index of the quality of surface color. Exposure to rain and sun may burn or stain the surface of a good white bird so that it will look like a poor one. If the bird is *white*, the undercolor, and especially the quills, will be free from yellow in ripe plumage.

In a very literal sense, undercolor in all birds with strong color is reserve color. Unless intensified by mating and mixture with a color as strong as or stronger than itself, the tendency in all plumage colors is to grow weaker. There is also a tendency for color, if present, to come to the surface. If all the color is at the surface, as it is in some buff and gray birds, a very slight loss of color will cause marked deterioration in surface color.

Color selection of Rouen Ducks. The Rouen Duck is the only variety of poultry, other than fowls, requiring special discussion of color. In all others single Standard matings are the rule. In the Rouen Duck, as in the black-red color type in fowls, the colors of the wild bird are intensified in domestication, and sex differences in color are developed. Were the variety bred more extensively for exhibition, the double-mating system would probably be used regularly. As it is, it is used to some extent, and when special separate matings are not used to produce exhibition birds of the different sexes, intermediate matings are used.

The American Standard Rouen drake is a light-colored Rouen drake, the Standard Rouen duck a dark-colored Rouen duck. The Standard duck is quite similar to the Partridge Cochin hen in color and pattern, not so rich in color or so well and uniformly marked, but still strongly suggestive of this Cochin variety. The drake which matches this duck in breeding is very dark and without the white ring around the neck so conspicuous in the exhibition drake. The duck which in breeding matches the Standard drake is very much lighter in color than the Standard duck, indistinctly penciled, and has a white ring indicated around the neck. When only one pen is bred it is usual to mate a medium male with females of both types. This gives a proportion of good Standard birds of both sexes, but not so many as when typical drakes are used in separate matings.

PART IV. THE POULTRY FANCY

CHAPTER XXVII

POULTRY EXHIBITIONS

Primary poultry exhibitions. The beginnings of poultry exhibitions are to be found in England and Scotland in little gatherings of poultry fanciers in taverns, and in America in small exhibits of poultry at agricultural fairs. It is altogether probable that in all countries where any degree of attention has been given to the development of special types, the bringing of fowls to semisocial evening gatherings of persons interested in them has been for centuries an irregular custom, but we have definite information only of those in Britain, in which some of the veteran American fanciers of British birth took part. In America—so far as is known—this type of informal private show was not developed until after public exhibitions became somewhat general. Since then it has been an occasional feature in meetings of local poultry associations. Exhibits of poultry were made at agricultural fairs in Massachusetts at least two years before the first special poultry exhibition at Boston in 1849. It is quite possible that poultry was shown at earlier fairs both in Massachusetts and other eastern states.

The early informal evening exhibits brought together some of the fancy fowls of a locality. The early exhibits at the fairs were more in the practical line, representing the best poultry found on farms. At these early agricultural poultry exhibits the exhibitor was expected to furnish a written statement describing his stock and giving an itemized list of his expenses for and receipts from his poultry for a year preceding. Both the poultry and the report were considered in awarding premiums, or bounties, as they were then called, from the fact that the prize money was paid by the state.[1]

[1] The Commonwealth of Massachusetts still pays an average of about $4000 a year in poultry prizes at agricultural fairs.

At first, prizes were given to common barnyard, or dunghill, fowls, and to poultry of other kinds, not as individuals but as flocks, or, in some cases, as representatives of flocks. In one of the earliest reports, a farmer who exhibited a few turkeys for no particular merit was awarded a bounty because the birds represented a flock of eighty. Classification was made for popular varieties, but if entries were not made in these classes, the poultry committee of an agricultural society, in its discretion, awarded bounties to exhibitors whose exhibit represented real effort to develop poultry culture as a farm interest. The practical phase of poultry exhibits at agricultural fairs soon disappeared, and they became, for the most part, poorly patronized displays of thoroughbred stock of very ordinary or very poor quality. This continued to be the general condition for many years. When, after a time, efforts were made to improve poultry departments at fairs, development was naturally (through imitation) along the lines of the fancier's shows.

Modern poultry exhibitions. The modern poultry exhibition combines sporting, commercial, and educational features, with commercial interests on the whole most potent, sporting interests tending to decrease, and the educational influence tending to increase. The dominance of commercial interests is most noticeable in the larger shows; in small local shows the sporting and educational features may be prominent and the commercial tendencies hardly apparent or entirely absent. As shows increase in size, the commercial aspects develop, partly of necessity — for expenses increase amazingly — and partly because the growing importance of the show gives commercial value to prizes won there, and so induces commercial breeders to exhibit, as well as fanciers. The larger and more important the show, the greater the commercial value of a prize won there. So competition at the great shows, and especially in the leading popular classes, tends more and more to become a contest of commercial breeders for the lion's share of the trade in eggs for hatching and in stock for exhibition or for breeding. In such competition the amateur fancier has little chance to win more than an occasional prize, for with the commercial breeder, who is a professional fancier, to win is necessary. He cannot afford to let prizes go to others if by any legitimate method he can secure them for himself, nor can he afford to be satisfied with a part of the more important prizes in the class in which he competes, if by any means he can secure them all. The advertising value of the five first prizes on a variety at a New York show is worth probably twice as much as the advertising value of four of the five first prizes, and many times the advertising value of one prize in a class. One first prize may mean a chance bird; the winning will attract little attention. The winning of five first prizes on one variety indicates clear superiority over competitors and gives a breeder who advertises them sufficiently the cream of the trade in his variety for the year.

Educational aspects of exhibitions. The educational value of a great poultry show is much greater than that of smaller shows, but the number of those who can actually appreciate the great show is relatively small, and as big shows are now conducted, a visitor's appreciation of the exhibits depends on his personal knowledge of poultry and, to a considerable extent also, upon acquaintance with the exhibitors, with their stock, and with their previous records. The novice in the poultry fancy in a large show has usually been left to his own devices; though poultry is especially adapted to demonstration, no provision has been made for his entertainment or instruction. The crowds and the show as a complete spectacle may interest him, but he is likely to be very much at a loss to know what it is all about, and few persons not able to form an intelligent opinion of their own about the exhibits and the merits of the awards care to stay long at a poultry show where there is no one to guide and instruct them. Thus the actual educational value of the great show is closely limited to its value to experts. To an expert poultryman one large show is worth scores of small shows, giving him in a few days a much more accurate idea of conditions and progress in various directions than could be obtained in weeks of traveling among the breeders and manufacturers or among the small shows.

That the neglect of novices among poultrymen, and of the public at the large shows, is a fault which should be remedied is generally admitted, but it is hard to change the customs of exhibitions of this character, and the general opinion of those who have given some study to the subject is that the reformation of the large show will come only when various plans for improving poultry exhibitions have been worked out in the smaller shows. For that reason the treatment of the subject here will consider first the small show such as may be held by a small group of poultrymen in any town or by the poultry students at an agricultural college, describing methods of promoting and managing such shows and suggesting ways of increasing their educational value.

A poultry show primarily a competition of poultry breeders. A breeder of one or many varieties of poultry may make a display of a number of specimens of each, but with the element of competition lacking, such a display will attract much less attention than a competitive exhibition containing fewer specimens and inferior quality. The individual breeder's display may make a very attractive and important feature of a show, but no matter how large or how good it may be, it does not constitute a show as the term is commonly understood and used. The individual breeder's display represents his own judgment of his own stock, or at most the judgment of an expert in his employ. In competition the relative merits of the birds are decided by disinterested parties according to common standards. A judge is supposed to judge the birds without knowing, or, if he knows, without considering, to whom they belong, but the object of competition is always to determine the relative skill of breeders as shown in the quality of their products.

Competition in live poultry necessarily in standard stock and its products. Only things of the same kind can be compared. Competition in living birds is on a basis of values measured mostly by the eye. The table properties of a live bird are partly but not fully indicated by its weight, condition, and shape, with feathers on. The insufficiency of judgment for these qualities while birds are living is so clear to every one that, though classes are sometimes provided for live market poultry at shows, neither exhibitors nor the public take much interest in them. Competition in poultry products — eggs and dressed poultry — also resolves itself into a competition in the products of similar varieties of poultry, because differences in size and color of eggs and carcasses make it necessary to classify them accordingly, and because continuous production of eggs or poultry of a given description requires the maintenance of a flock of such uniformity as can be best secured by careful breeding to a particular type. While it is true that in the general market handlers and consumers pay no attention to breed and variety differences, and also that these differences are largely superficial, close competition in eggs and dressed poultry inevitably leads producers to give more attention to uniformity at all points, and, as competitive exhibitors, to insist on classification by breeds and sometimes by varieties. The exhibits of poultry at poultry shows are almost exclusively of live fancy poultry, and this will probably always be the case in the great majority of shows, for the conditions of exhibiting poultry to be judged on appearance and poultry produce to be judged on actual selling value are different, and the possible values of winnings on exhibits of eggs and dressed poultry are comparatively small. In the development of shows the fancy comes first.

An elementary poultry show. A few competing exhibits and a judge to examine them and make the awards constitute an elementary show. The cost of a judge's services renders it practically necessary that the number of exhibits be large enough to make it worth while to engage a judge. At the seasons (fall and winter) when most shows are held, suitable shelter must be provided for the exhibits brought together. Usually a public hall or a conveniently located vacant storeroom is hired. The expenses for a judge and a hall are the principal items of necessary outlay in holding a small local show. A small amount is required for printing. If a judge can be obtained near by, and if the show is limited, as it should be, to two or, at most, three days, a little show may be held at a total outlay of from twenty-five to thirty dollars. When a judge must be brought from some distance, the cost of judging is much higher, and the average small two-or-three-day show costs from fifty to one hundred dollars for judging, rent, and incidental expenses, all the work connected with it being done, as a rule, by the officers without compensation.

Financing a show. The small amount of money needed for the preliminary work of a show is usually provided by dues of members of an association, or advanced by persons interested. The regular receipts come from two sources, — entry fees for exhibits and admission fees of visitors. In a rough division of the business features of the show it is usually calculated that the entry fees for exhibits will pay the judge and the regular premiums, and that, with fair attendance, the door receipts will pay the rent and incidental expenses. On this basis most small shows can make a very low entry fee, especially if they give ribbons instead of regular cash prizes. On a show of several hundred birds, with exhibitors furnishing their own coops, a fee of ten or fifteen cents a bird will often pay for the judge and for feed for the birds during the show. In these small shows the entry fee is rarely placed higher than twenty-five cents per single bird, and one dollar per pen of five birds (a male and four females). In nearly all shows the payment of regular prizes is contingent on the number of entries in the class being sufficient to make the entry fees pay the prize money and other expenses which the entry fee should cover. If this is not done, shrewd exhibitors can enter just enough birds in many classes to take the prize money, and the show will lose on every such class. When a show association furnishes coops, the entry fee must be high enough to cover the cost of cooping.

A very small charge for admission usually brings in enough money to pay the rent and the incidental expenses of a small show. At ten or fifteen cents each, several hundred visitors may give as much as is needed, or so near it that the promoters are satisfied. Outside of large cities twenty-five cents is the maximum charge for adults, with ten or fifteen cents for children. On such a modest scale of arrangements and prices a local poultry show is on the same basis as any other local entertainment, and, wherever it is possible to get together some two hundred birds that will pass as representatives of established varieties of poultry, may be made instructive to exhibitors and entertaining to visitors. The profit cannot be large, nor can the loss. This type of show is especially adapted to places where breeders are mostly novices, but may be used to advantage by breeders of considerable experience. A show in a small place is much more likely to be permanent if run on a small scale than if the management undertakes to attract entries from abroad and build up a big show.

The work of running a show. Usually two or three persons do all the work connected with a small poultry show. Even for a small show the amount of work to be done is much greater than is usually supposed. For a small local show soliciting only local exhibits the promoters have to do a great deal of personal work, — beginning weeks or months in advance, — persuading poultry keepers to exhibit, advising them in regard to selection and preparation of exhibits, etc. The motives which induce men (and occasionally women) to do this are various. Some do it out of interest in the development of poultry culture, some for such prominence as it may give them, some because they like such work. As the work is out of all proportion to the rewards, the poultrymen benefited usually accept the service without question as to the motives. Those who, without previous experience, undertake to make a poultry show should understand that if they go into it they must give it a great deal of time and thought, especially during the first few years. Some one (usually the secretary) supervises everything and personally sees that details are looked after, though some of the work may be done by others. One of the most important points in the management of any show, large or small, is that it shall have a single head.

General quality of exhibits. In localities where no shows have been held the quality of exhibits is usually rather poor. The breeders of pure-bred stock in such places have, as a rule, very imperfect ideas of what constitutes quality in their stock. Those who feel most sure of their knowledge of requirements, if they have not exhibited elsewhere, are often most rudely undeceived when their birds are judged. The greater number of poultry keepers who might exhibit, however, are reluctant to do so, feeling that their stock is not good enough. The most effective appeal that can be made to such persons to exhibit is the educational appeal, — the invitation to bring their stock to be passed upon by an expert, and to learn just how good it is and what they must do to make it better according to existing standards. Provided there is not too great disparity of quality in competing exhibits, so that the owners of the poorer stock are entirely out of the running, just as much enthusiasm and interest may be developed in a competition with ordinary good birds as in classes of greatly superior quality, because the competitors generally are in the same (novice) class.

Judges. Judges for initial small shows should be men of considerable experience and good reputation. It is a mistake to take an unknown and inexperienced judge, for the services of a judge are chiefly valuable to exhibitors as a means of instruction, and that judge is worth most who has the widest experience and can discuss and practically demonstrate each variety as he judges it. In shows so large that the judges engaged must be free from interruption if they are to get their work done on time, it is often necessary to exclude exhibitors from the hall or from those parts of it where judging is going on, but in shows of the class under consideration exhibitors should be given every facility to see the judging of their exhibits and to learn the judge's reasons for placing birds as he does, for in this is the greatest educational value of the show for them.

Methods of judging. The method of judging small shows is usually by the score card. This method makes specific estimate of values, and so is more satisfactory to novices than the comparison method, and more useful for instruction where many points are considered. These methods will be explained in the following chapter. Exhibitors at shows of this kind should insist that the judge be as severe on faults in their fowls as he would be at a higher-class show. Some judges always score high at small shows, cutting faults very lightly when judging, and so give exhibitors false ideas of the value of their birds.

Classification. The classification of poultry in exhibitions should be the same, regardless of the size and importance of the show and of the quality of the exhibits. By wrong classification the greater part of the possible educational value of a show may be lost to exhibitors, and the exhibits may be misrepresented in reports of awards. Different kinds of birds are not strictly comparable; neither are birds of the same variety but of different sexes and ages. Young birds must be favored in weight and some points of development, old birds in color (which has a tendency to fade with age) and in all points where age brings deterioration. The common classification for fowls makes five classes for each variety, — four classes for single birds (cock, cockerel, hen, and pullet) and one class for exhibition pens, a pen being composed of five specimens, a male matched according to Standard requirements with four females. The single-bird classes are also called the "open classes." In ducks, geese, and turkeys the same classification is used, the old and young of each sex competing separately. In turkeys, and occasionally in geese, two classes for old birds (particularly males) are made, two-year-old birds competing separately and all over two years classing as "aged" birds. In the single classes each bird is judged on its individual merits in comparison with competitors in the same class.

In pens the birds are judged collectively, a disqualification on one bird throwing the whole pen out of competition. It is required that the females match as closely as possible. The four females are usually considered as representing half the value of the pen. A bad practice, common in small shows, is to consider the best male and the four best females of an exhibitor his "exhibition pen" and award prizes on these, the pen being selected from the scores after judging, and existing as a pen only on the score card. This practice entirely loses sight of the object of giving prizes for pens of matched birds, which is to put a high premium on uniformity and stimulate breeders to work for it at every point.

In general, competition in pens has been between birds of any age. Wherever this is the case, it tends to exclude old cocks from pen competitions, because a well-developed cockerel can, as a rule, win over a superior cock by virtue of better condition. Many of the finest old hens are also excluded for the same reason. The tendency of the competition of birds of all ages in the same class in pens is to bring into the exhibition-pen classes the most matured young birds and those adults which show least signs of age, such a combination having an advantage, in condition and uniformity of appearance, over better birds either more or less mature in appearance. On this account some shows are now making separate pen classes for old and young birds. Another feature at some shows is special classes for pens mated for breeding in varieties in which special matings are used. While custom decrees that fowls shall be shown only singly or in pens, it would be good policy in many small shows to provide classes for specially mated pairs or trios as well as of specially mated pens, or instead of the pens if the exhibitor also has birds in the open and regular pen classes. The stock and judgment of the exhibitor are shown and the principle of mating illustrated as well with one female as with four.

Arrangement of classes in the showroom. The order of the arrangement of classes usually follows the order of descriptions in the Standard, or places the classes systematically according to type. The latter is the practice at New York and Boston, and at a number of the leading shows. The Standard arrangement is more generally used, not because it is better but because it is natural for inexperienced managers to adopt that order of arrangement, and

TABLE XXV. NUMBERS OF POULTRY EXHIBITED IN THE PRINCIPAL CLASSES AND IN CLASSES OF SPECIAL INTEREST AT THE MADISON SQUARE GARDEN SHOW, NEW YORK CITY, FOR TWENTY YEARS, 1891–1910

VARIETY	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910
Light Brahma	220	212	197	205	179	148	134	70	106	174	143	132	136	97	120	83	66	50	84	64
Dark Brahma	23	33	16	30	27	17	34	25	39	19	7	31	13	27	6	11		4	23	25
Buff Cochin	147	108	171	137	134	137	86	49	66	43	44	51	45	62	12	33	20	6	4	26
Partridge Cochin	24	38	47	62	88	42	40	33	39	11	53	41	12	48	20	25	26	13	13	46
Black Cochin	18	25	30	50	62	43	17	12	25	28	8	15	14			8	2	7	5	5
White Cochin	20	51	40	43	45	54	28	19	48	23	38	57	26	22	32	18	26	13	16	13
Black Langshan	110	144	131	120	69	70	103	73	65	67	33	28	25	39	29	24	36	23	33	47
White Langshan	18	81	22	11	8	5					19	16	9	14	1	2	10	2	7	2
American Dominique	13	19	18	6	1	6					18	6					2	11	27	16
Barred Plymouth Rock	145	154	159	177	166	199	139	178	145	212	144	228	240	205	265	474	283	404	336	254
White Plymouth Rock	78	74	80	40	83	40	40	36	85	71	136	105	78	113	126	270	313	252	169	125
Buff Plymouth Rock		13	15	33	32	47	46	55	100	111	119	81	79	98	98	130	78	99	91	117
Partridge Plymouth Rock															10	26	27	36	36	49
Silver-Penciled Plymouth Rock																54	24	45	38	9
Columbian Plymouth Rock																	5	10	20	31
Silver-Laced Wyandotte	71	56	58	80	56	74	36	26	20	32	33	34	28	61	36	69	47	63	39	44
Golden-Laced Wyandotte	73	57	26	67	53	40	38	53	25	50	42	23	29	13	27	49	27	71	27	36
White Wyandotte	81	36	51	38	56	42	75	74	78	168	172	130	174	232	483	340	288	269	261	206
Black Wyandotte	14	12	2				7	2	2	8	13	11	6	16	19	26	14	16	17	28
Buff Wyandotte		12	26	44	23	26	39	60	63	43	78	56	48	117	45	35	88	31	37	78
Partridge Wyandotte							10	5	6		57	28	41	102	77	142	83	53	64	56
Silver-Penciled Wyandotte							5				9	1	22	38	42	35	22	28	14	12
Columbian Wyandotte													16	16	41	115	154	132	135	123
Single-Comb Rhode Island Red		61[1]							2	6	16	34	20	31	23	99	150	111	135	100
Rose-Comb Rhode Island Red									5	21	32	36	50	68	87	111	88	112	116	95

[1] Comb not described.

	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910
Buckeye																	5		13	2
Colored Dorking	16	9	9	8	8	6	11	5	3	4	6	2	4	4	4	7	5	4	5	2
Silver-Gray Dorking	30	14	17	17	38	20	36	13	14	14	4	26	8	39	16	17	22	23	22	28
White Dorking	23	7	4	3	4	2	2	2		2	12		3	2	2	2		4	2	
Single-Comb Buff Orpington						4			17	41	24	43	64	105	173	207	161	108	178	176
Rose-Comb Buff Orpington													4	7	16	25	18	10	14	12
Single-Comb Black Orpington													27	52	100	90	133	160	144	134
Rose-Comb Black Orpington									4				21	8	11	11	10	6	19	8
Single-Comb White Orpington													10	20	57	73	81	83	70	154
Rose-Comb White Orpington																10	5	6	5	10
Single-Comb Brown Leghorn	93	45	83	155	87	69	114	52	82	60	71	90	87	82	53	163	85	104	66	42
Rose-Comb Brown Leghorn	24	39	16	19	26	21	34	34	23	21	7	32	30	34	56	72	73	50	31	55
Single-Comb White Leghorn	54	11	58	65	92	45	86	75	57	88	71	108	154	214	164	264	191	206	114	216
Rose-Comb White Leghorn	25	9	20	13	18	12	20	26	23	25	30	41	38	33	26	50	37	26	18	13
Single-Comb Black Leghorn	15	10	5	21											22	46	33	27	5	8
Single-Comb Duckwing Leghorn				5	21						8					30	23	24	11	9
Single-Comb Buff Leghorn	5	70	5	80	44	41	107	76	43	63	78	39	112	75	53	80	64	67	88	117
Rose-Comb Buff Leghorn	3							3		11	8	8	4	6	5	6			13	2
Blue Andalusian	18	11	7	7	23	34	19	16	30	20	23	3	11	25	22	18	12	20	41	30
Ancona														7	6	4		21	16	53
Campine					2														17	16
Lakenvelder														6	12	14	9	17	21	22
Single-Comb Black Minorca	32	49	61	20	75	60	48	105	109	83	82	51	89	79	111	120	127	94	52	90
Rose-Comb Black Minorca								28	35	19	3	8	9	8	14	39	26	64	46	58
Single-Comb White Minorca	12	12	8	12	10			11	11	3	19	34	7	17	18	18	22	9	13	39
Rose-Comb White Minorca									4					1		5	13		1	5
White-Faced Black Spanish	20	6	12	25	20	6	17	11	9		5	3		10		1	2	7	3	17
White-Crested Black Polish	28		23	19	10	13	11	4	2	11	23	20	13	18	21	49	16	22	34	46
Bearded Golden Polish	11	2	4	8	6	8	4	2		4	4		1	2		4	1			
Bearded Silver Polish	10	3	4	10	6	8	6	2		4	6			2			1	1	1	2

TABLE XXV (CONTINUED)

VARIETY	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910
Bearded White Polish	6	1		6	6	7	3	2	2	4	2		7	2						
Nonbearded Golden Polish	18			8	6	8	7	4	2	4	2		2	2	8	13	9		5	
Nonbearded Silver Polish	3				2			2			2			1		2			5	1
Nonbearded White Polish	14			8	6	8	6		2	4	11			2		4	5		13	
Buff-Laced Polish	12		3	8	6	8	10	4	4	4	5			2		5	10	9	2	2
Red Caps	31	9	1	2		7			2		5								5	
Golden-Spangled Hamburg	12	3		13	23	9	10	22	4	7	9	3	4	8	4	5	4	4		2
Silver-Spangled Hamburg	27	26	12	18	19	11	15	25	24	22	19	28	39	44	29	26	15	30	18	37
Golden-Penciled Hamburg	29	26	19	27	25	15	14	16	17	17	7	4	3	6	4	5	8	4	6	6
Silver-Penciled Hamburg	18	10	13	13	22	10	11	12	7	6	4	2	2	6	4	6	4	4	5	7
White Hamburg	7				6	4								3					2	2
Black Hamburg	16	2	1	11	24	8	20	21	7	5	8	2	5	8	5	4	5	4		9
Houdan	37	12	29	37	30	24	15	18	29	42	21	41	10	19	39	31	17	32	56	47
Crevecœur	3	8		6	2	2	2	2	2	2	2	4	4	4	2	2	2	2		
La Fleche	11	7		11	5	4	2	2	4	4	3		4	2	2	2	2	4	4	2
Faverolles															32	25	16	33	4	4
Exhibition Game	105	20	52	138	108	43	51	100	78	70	49	65	82	47	22	42	30	13		4
Pit Game	24	35	58	29	61	51	31	29	29	33	58	98	64	60	73	92	50	70	50	111
Malay	6																			
Aseel		9	8		3														2	
Cornish Indian Game	93	143	64	67	30	23	40	53	81	48	55	53	47	18	49	65	45	46	23	38
White Indian Game		15		12	3	17	8	14	17	11	18	27	4	9	4	9	25	24	28	25
Exhibition Game Bantam	103	109	68	173	153	118	139	136	141	153	123	147	182	160	159	138	155	156	119	72
Golden Sebright Bantam	30	26	19	23	28	29	35	52	39	17	54	14	52	8	38	39	21	20	19	30
Silver Sebright Bantam	22	39	11	15	30	27	41	40	39	21	27	17	12	7	34	31	21	20	12	27
Rose-Comb Black Bantam	41	18	28	28	24	21	36	22	18	25	16	36	61	10	16	35	24	39	43	24
Rose-Comb White Bantam	7	4	4	2	6	3	15	8	9	9	9	10	10	3		2	19	7	5	4
Light Brahma Bantam									30	25	14	21	26	37	36	52	24	23	15	26

	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910
Dark Brahma Bantam									1	1			2	12	4	10	4		3	7
Buff Cochin Bantam	33	50	36	41	45	42	34	51	40	34	32	42	50	69	31	56	40	97	45	35
Partridge Cochin Bantam		3	4						8	9	5		3	15	27	18	9	7	12	
White Cochin Bantam	15	17	8	11	20	18	47	41	12	26	17	15	26	23	20	26	21	26	22	19
Black Cochin Bantam	4	4	13	16	13	24	37	31	24	17	13	14	29	36	17	42	21	29	27	43
Japanese Bantam	17	6		10	24	17	22	33	24	29	32	20	27	33	29	37	38	91	30	28
Polish Bantam	10	7	3	7	16	13	16		9	9	8	1	5	3	9	10	15	11	10	12
Bronze Turkey	10	8	15	18	19	23	19	19	31	51	37	36	24	26	23	8	44	48	45	39
White Holland Turkey	10	8	4	10	6	10	10	4	2	18	19	18	9	7	3	2	16	23	18	9
Buff Turkey																	2			
Slate Turkey			2								4	8			2	2	4	8		1
Pekin Duck	36	10	42	24	45	40	27	16	60	18	25	38	11	24	53	45	57	49	55	21
Aylesbury Duck	10	4								2		2	2	2	4	2	5	2	2	2
Rouen Duck	4	6	10	2	8	11	10	13	12	5	19	23	28	30	22	22	40	44	58	45
Cayuga Duck	10	4	6			5	4	2	2		3	2	8	9	7	6		4	9	7
Grey Call Duck	2	2	10		1										5					2
White Call Duck	6		4		1											1				2
Crested White Duck	8		2																6	2
Colored Muscovy Duck	12	10	10	4	4	6		8	4	10	2	13	5	9	8	10	20	7	11	11
White Muscovy Duck	10	4	6	4																
Indian Runner Duck									4	10	13	6		4		2	9	11	28	55
Blue Swedish Duck												16	16	6	5				3	
Toulouse Goose	12	6	8	4	8	8	8	4	18	4	8	8	11	8	17	7	18	19	31	18
Emden Goose	6	8	8	4	10			2	8	2	6		6	6	6	6	10	6	15	18
African Goose					2						3	2	2				2			
Brown China Goose	4	4	6		2						1	6					4	2		4
White China Goose		2	2	2	2												2	2	2	6
Wild Goose		12	6					4		4		2								

once adopted at a show it is likely to be continued there. The arrangement at the leading shows is generally correct, though in some of the less important classes the system is not observed.[1] It is usual to number the single entries of all varieties consecutively, with the pens of all varieties following in the same order. All shows accept non-Standard as well as Standard varieties and make classes for them as soon as the breeders offer entries enough to warrant it. Unclassified exhibits usually compete with one another in what is called the "Any Other Variety," or "A. O. V.," class. In this case birds are not actually judged in competition, but prizes are awarded to the most meritorious birds in the class.[2] Exhibition pens are usually placed in the best location in the hall, with wide aisles between the rows of coops, because they attract the attention of sight-seeing visitors more than do the birds in the open classes.

Sweepstakes prizes. Prizes for which different varieties compete are not now as generally offered as was the custom some years ago. To the inexperienced manager they seem a good thing. The experienced manager has learned that there is nothing connected with the showing of poultry so certain to cause disputes and hard feeling among exhibitors, and to make trouble for him, as a sweepstakes prize. Persons offering liberal special prizes often wish to make them sweepstakes prizes. It is much better to give the prizes on a single variety or breed, or to divide them into smaller prizes to be offered in that way.

Special exhibits. Noncompetitive displays in extra large separate coops are most attractive to the general public. The advertising value of such displays to the exhibitor is so great that, as a matter of business policy, the management of a show usually gives the preference, in renting display coops, to exhibitors making large entries in competitive classes. At small shows where there

[1] The order of arrangement at the Madison Square Garden (New York) show is most interesting, because it has furnished the general plan for the arrangement of first-class shows, has carried out its plan more consistently than any other, has been scientific in the general arrangement of types, and, in placing the varieties of the different breeds, has kept them in the chronological order of their introduction to the public.

[2] It is worth noting in this connection that the attitude of the shows toward the multiplication of breeds and varieties is just the opposite of that of the American Poultry Association. The shows encourage the making of new varieties and give the promoters every facility for exploiting them.

is room to spare, exhibitors are still often allowed to place in "sale classes" any stock they choose, and sell from these for immediate delivery; but as shows increase in number of entries, this leads to many abuses, and furnishes opportunities for evasions of the necessary rule that exhibits must not be removed until the close of the show. If authorized to do so and given a fixed price, show associations usually undertake to sell exhibits on commission for exhibitors not in attendance. An exhibitor giving a price on a bird entered thereby authorizes the association to sell the bird at that price, and according to custom the association is obliged to sell the bird at the catalogue price to the first person who claims it and pays the money down.

Balancing exhibits. Balancing the exhibits of poultry to add to the general attractiveness of the show is a matter to which the experienced show manager gives a great deal of attention, often going so far as to offer liberal rebates on entry fees to exhibitors who will send varied exhibits of rare specimens of good quality. The manager of a small show has no inducements to give to the professional exhibitors of the rare and odd varieties that interest the general public more than the classes in which competition is keen, but he ought to make special efforts to get entries (if only one or two specimens) from breeders of all varieties and all kinds of poultry in which there is little interest. In the absence of better quality any specimen that will pass for a representative of an established variety helps to fill out and balance a poultry show.

Practical exhibits. Dressed-poultry and egg competitions interest the ordinary visitor to a poultry show more than the live birds, because every one feels that he is something of a judge of merit in food products. Exhibits of this class are much harder to get than exhibits of fancy live poultry, not only because poultry shows are mostly held at the season least favorable for making displays of this kind, but because most of the exhibitors are not especially interested in these lines, and because winning prizes on eggs and dressed poultry at a poultry show does not give an exhibitor such advantage over other producers as does winning prizes on Standard-bred birds. No competitive dressed-poultry and egg exhibits of any importance have ever been made in America, except in a few cases where state and provincial governments have given liberal prizes and no entry fees have been charged. With a little effort directed especially in that direction egg competitions among exhibitors of live poultry might be developed in any small show. Something, too, may be done with dressed poultry through coöperation with poultrymen dressing considerable quantities of it, or with nonproducing local dealers. In either case the exhibits would come in as noncompetitive displays, on practically the same footing as displays of incubators, brooders, and poultry supplies. Under existing conditions this seems the best way to treat this class of produce in most small shows.

Combination shows. Combining exhibits of other stock with poultry shows to attract larger attendance is the rule in all large shows and many small ones. Pigeons, pet stock, cats, and sometimes dogs are exhibited with poultry. A cat department will attract more people who would not otherwise attend the show than any of the others mentioned. Pigeons and pet stock are usually a loss to the management, but the departments are maintained to add to the variety, on the same principle that exhibits of nonpopular kinds of poultry are specially solicited. There is a growing feeling in regard to all these side shows that, with popular development of the exhibition possibilities of poultry, they might well be dispensed with.

Mercantile exhibits. Displays of poultry supplies have become a very important feature in all the larger poultry shows, are often found in small shows, and are everywhere one of the most popular features of a show. Incubators hatching and little chicks or ducklings in brooders interest all classes of visitors, and an extended array of poultry appliances and supplies will hold the attention of many poultry keepers long after they have tired of looking at the birds. These displays are usually made by local dealers, and by inventors of appliances who wish to exploit a particular article.

Suggestions for improving appearance of regular displays. The most marked feature of poultry shows is sameness in the method of displaying exhibits. The breaking up of the display of an exhibitor to bring together specimens which are to compete in the same class makes impossible any general effort to beautify the displays by appropriate setting or decoration, or to give any special character to an exhibit. A few exhibitors decorate their coops, especially coops of birds winning important prizes after the awards are up, but most of the coops are bare except for the entry number, a ribbon if the bird has won a place, and perhaps the card of the owner. The rule prohibiting distinctive marks on coops ought everywhere to be abolished. If this were done, and a uniform style of combination shipping and exhibition coop adopted (in standard sizes appropriate for the various sizes of birds and classes), and exhibitors required to furnish their own coops and allowed to decorate them as they saw fit, the regular competitive exhibits at shows would soon become more attractive; for much can be done, in the way of showing off birds, by the very simple device of painting the back and sides of coops in shades which contrast effectively with the colors of the birds.[1] At most small shows, exhibitors furnish their own coops, and such shows might well inaugurate the practice of using a standard style of individual coop and making efforts to display each variety separately. This method of cooping would also make it practicable to carry out a suggestion often made by exhibitors that, after judging, the birds in a class be arranged in order of merit, thus enabling every one to make direct comparisons.

Ring judging, a common practice in live-stock shows and in the pigeon departments of poultry shows, may easily be made an attractive feature of judging in small shows, though conditions in the larger shows often prohibit it. In this form of judging, the competing specimens are displayed and judged by classes, on a large table before the audience, each specimen being in charge of its owner or attendant. The practice has been used in a few poultry shows with satisfactory results.

Suggestions for special displays. A statement of a few of the special poultry displays that have proved very attractive to visitors will indicate something of the possibilities of development of this line of attractions.

An exhibitor showed a Barred Plymouth Rock cock and hen with over a hundred chicks hatched from her eggs in the preceding season.

[1] This would not be the only advantage of the exhibitor owning his own coops and using them at all shows, large as well as small. There would be no handling of the birds in transferring from the shipping to the exhibition coop and back again at the close of the show, and less opportunity for birds to get lost. The responsibility of keeping his coops clean and sanitary would rest with the exhibitor, and he would not, as now, run the risk of having his birds placed in exhibition coops that have been occupied by diseased specimens from other flocks.

People came in crowds to see the sight. It was a drawing card for the show, the best of advertising for the exhibitor, and an instructive exhibit. A much smaller family than this could be used as a feature.

Persons crossing varieties of poultry often get some very interesting results. Exhibits of crossbred birds presenting striking characteristics (either of uniformity or of dissimilarity) always attract attention, especially if the parents are exhibited with them.

Breeders of established varieties often experiment with them, trying to modify the type as to a single character. In nearly all breeds heavyweight strains are made occasionally, and are always of interest to many persons. New color patterns and new types of comb in breeds are often developed by breeders, and are always of passing interest as exhibits, though they may not take with the public. Many such modifications have been worked out again and again by different breeders in different localities.

Competitions for children may be very effectively used, both to add to the interest of a show and to increase the interest in poultry in the community.

Models of appliances in use by local poultrymen, particularly of homemade appliances devised by them, could be made an interesting feature in small shows.

Collections of such poultry literature as breeders' catalogues, supply catalogues, poultry journals, Experiment Station and United States government bulletins are easily made, and when well arranged, add materially to the interest and attractiveness of the show. Good collections of poultry books can often be made by combining the poultry libraries of local poultrymen. Anything that would be of interest in a poultryman's yard or home will be of interest in a show. Working up such accessory exhibits usually takes more time than those looking after the competitive exhibits can give. For that reason it ought to be in the hands of a special committee or of an assistant secretary.

Institutes at poultry shows. Lectures may be made an attractive feature at small shows. Indeed, they are very much better adapted to small shows than to large ones, where the crowds, the confusion, and the din make it hard for speakers to talk, except to small groups. Many of the poultry judges are very acceptable lecturers on both practical and fancy topics. In some states it is possible for the managers of a poultry exhibition, by coöperating with a local agricultural society or by direct application to the state department of agriculture, to arrange for lectures to be given at the show under the auspices of the agricultural department, in which case speakers furnished by the department are paid by the state. If an association has to provide speakers for its institute, it can often get a very acceptable lecture, talk, or paper from some of its members, or from persons in near-by towns, at very moderate cost. Institute work should be a feature of every show where conditions admit, and every effort should be made to use local poultry keepers in this line of work, if only for five-minute talks.

College poultry exhibitions. Poultry exhibitions at agricultural colleges and schools call for special mention. It is not generally practicable to make them competitive in the same sense as the ordinary exhibition. The show is made for the students, the object being to bring together a larger collection and a greater variety of poultry than could be maintained for practice at the college or school plant, and to give the students practice both in judging and in the management of a poultry show. Shows of this class are rarely so located that they can be made an attraction to the sight-seeing public, but as they are not under expense for hall rent, that is not a serious matter. The logical development of these shows is along the line of closer correlation with the work of graduates of the poultry courses. The poultry show of one year should be made up, in part, of the exhibits of students in previous years, and exhibits of results of their work with poultry, with full reports on conditions and methods of production, should be required of students seeking the fullest recognition of accomplishment that the institution can give. While college shows are for the most part insignificant at present, it is very plain that if they are so developed that even a small proportion of the students of each class retain their interest in the college exhibition after leaving the institution, they will ultimately become large affairs, controlled by the technically educated poultry keepers of the state, and of great educational importance. In the agricultural college and school, more than anywhere else, the conditions favor continuity and permanence of exhibitions and the full development of the educational possibilities of the poultry show.

CHAPTER XXVIII

FITTING AND EXHIBITING POULTRY

Selecting specimens for exhibition. The selection and the preparation of poultry for exhibition are practically simultaneous processes. Special attention to the condition of the bird usually follows its tentative selection as one of those to be exhibited, but final selection depends on whether the specimen will be in show condition at the required time or can be kept in such condition if it reaches that stage of development too early for the show at which the owner wishes to exhibit it. A novice in showing poultry usually begins to select and prepare his birds for exhibition a few days, or at most a few weeks, before he intends to exhibit them. Almost invariably he finds then many faults of condition — as lack of weight, dead and broken feathers, scaly legs, etc. — which might have been corrected had they been taken in time, but which now make it inadvisable to show the birds. One of the most important points in working up a new local show is to direct the attention of prospective amateur exhibitors to this matter in time. This can only be done effectively by going to their yards and looking over their stock with them.

An expert exhibitor is selecting and preparing his exhibition birds from the time they are hatched. He notes certain birds as suitable for exhibition as young birds, and certain others as not qualified to compete as young birds but likely to be in good exhibition form as old birds. As nearly all birds fade somewhat with age, in cases where strength of color is a fault in the young bird the natural fading with age may make the bird of the Standard color in its second or third year, and so give it a great advantage over birds of the same age which were of the Standard color when young. Thus females of the ermine type, with so much black in the backs that as pullets they would be disqualified if exhibited, often molt this out and make the finest exhibition hens. Such birds, when they come free from disqualifications late in life, are peculiarly valuable for exhibition purposes, for a bird of undoubted age which does not require the customary allowance for deterioration due to age deprives all competitors of the benefit of such allowance. The same thing is true in regard to the condition and development of young birds. Whenever a bird that is unmistakably young, but as well developed as an old bird, appears in a class of average young birds, they lose (in competition with it) the benefits of the usual allowances for immaturity.

In large measure, success in exhibiting poultry depends upon having specimens just right for the shows at which they are to be exhibited. Inexperienced exhibitors often inadvertently get the benefit of this without actually appreciating it. The seasoned exhibitor plans for it. He has learned that the plumage of a bird is at its best for only a very brief period after completing its growth; that pullets begin to go off in condition after laying; that both young and old birds may fail to properly molt a part of their feathers, so that the old dead feathers, mixed with the live ones, greatly detract from the appearance of the bird; and that there are numerous other little things affecting the preparation of poultry for exhibition, — and he looks after all these points.

Conditioning exhibition poultry. The natural conditioning of birds for exhibition is a continuous process. The expert exhibitor not only plans to have birds developed at a certain time, but grows them under conditions which, as far as possible, insure freedom from faults which can be prevented by giving the birds a favorable environment and a proper diet. All that has been said of the advantage of natural conditions in growing poultry for market and egg production applies with added emphasis to the growing of stock for exhibition purposes. Bad conditions, lack of range, overcrowding, and improper diet while the stock is growing are the causes of lack of size and weight, and also of poor form and of color defects as the birds approached maturity. While occasionally a back-yard fancier giving close attention to every detail produces specimens that can hold their own in any competition, as a rule the finest specimens are grown where the range is more than ample and the food always in full supply, and where the birds frequent sun or shade at will. Under such circumstances the characters of an individual develop in their finest form; it grows to full size, it is symmetrical, and it is not so likely to develop faults in the line of weakness of color as when conditions are less favorable. Birds grown under such favorable conditions are often taken right from the range to the showroom, and if they are not shy, and take kindly to show conditions, they are the most attractive birds seen in the shows.

Birds which are intended for the winter shows, and must be kept housed for several weeks or months before being exhibited, require most careful handling. With fowls the males need special attention and, as far as possible, separate quarters for each bird; for when a number are running together after reaching sexual maturity, only the "boss" of the lot develops fully; the others are cowed and worried and, though full fed, will not shape up and fill out as a cockerel does when master of his companions. Whenever it can be done, each male intended for exhibition should be housed with a pen of hens or pullets that are not laying, or not laying heavily, or if the special quarters provided for fitting males for exhibition are large enough, from one to three hens should be kept with each male. These should be hens not intended for exhibition. The best fitting pens are pens on the floor, from four to six feet square; in these, hens may be kept with the males. When movable exhibition coops or permanent coops of similar size and construction are used, it is better not to put more than one bird of either sex in a coop. The pen on the floor is in every way the best, especially if the birds are to remain there for some time. When it is desirable or necessary to handle the bird frequently, small coops are suitable only for a short period before showing. Females that are being fitted for exhibition need not be kept separate. Those to be shown together in pens should be together, if possible, for some weeks before being shown. In any case the number kept together should be small, not more than six or eight, that there may be no crowding in any way. Crowding when feeding or drinking, or on the roost, or when dusting, always causes more or less damage to plumage, and often leads to quarrels in which combs and ear lobes are permanently damaged. The clear, enameled surface of a white ear lobe is spoiled if the lobe is injured. A small piece may be taken from a comb in a fight, or a wattle torn and permanently damaged. A common cause of injuries to combs is the wire netting so much used about poultry houses and yards. The absence of spikes on many rose combs, and of points on single combs, is due to their accidental removal by wire. To guard against this, cotton fish netting may be used in place of wire where valuable birds are kept.

It is of prime importance that birds be kept free from lice when growing the plumage in which they are to be exhibited. Lice not only sap the vitality of the birds, and so cause general deterioration of the color of the plumage, but some kinds gnaw the growing feather next the skin as it emerges from the sheath, damaging the web. It is much better that the birds have ample opportunities to keep themselves free from lice than that the poultryman try to do it by frequent applications of insecticides.

For all clean-legged birds a floor littered six or eight inches deep with clean, quite long oat straw, or with leaves, should be provided, and unless it is necessary to force feeding to complete growth, or to make the desired weight within the time limit, they should be fed principally on hard grains, in variety, scattered in this litter. Working in it cleans and polishes both plumage and legs. Feather-legged fowls, on the other hand, must be kept from scratching while their exhibition plumage is growing,[1] for if they are not, the foot feathering is likely to be kept worn off quite close to the outer toe. Floors for them may be lightly littered with short cut straw or with hay, leaves, or planer shavings. They should be fed largely on hard grain. To birds of any kind deficient in weight, corn should be fed liberally, and some moist mash may also be given. Many exhibitors, when preparing birds to be cooped by a company which feeds its special brands of poultry foods during the show, use those foods for a part of the ration for a week or two preceding the show, that the birds may not be affected by a sudden change of diet.

Grooming and faking. Artificial methods of conditioning poultry for exhibition are of two distinct classes, — *legitimate* and *illegitimate* (faking); between these two classes are a number of cases the status of which is not clear.

Legitimate conditioning (practices that are plainly right) includes all those things which the exhibitor must do to birds individually

[1] This is one of the principal causes of the loss of vitality in exhibition stock of this general type.

to have them in their best natural condition when shown. It is unquestionably proper for a poultry keeper to remove dead or broken feathers so that new ones may grow before the bird is shown, to feed to promote growth or to increase weight, to wash a bird to remove dirt, and to clean scaly legs.

Illegitimate methods (practices commonly considered plainly wrong) are performing surgical operations to remedy defects of head parts, removing feathers from shanks and plugging holes left by the removal of feathers, splicing and trimming feathers, dyeing or staining the plumage and legs, and bleaching white plumage with chemicals, — things which materially alter conspicuous characters.

Debatable methods of most importance are removing defective feathers in the soft plumage, removing small stubs and down from smooth-legged fowls, and washing white birds with weak chemical solutions. In the same category, though little discussed, is the practice, very general among expert exhibitors, of removing feathers not conspicuously defective (when their removal will improve the general color pattern) and of plucking main tail feathers (when the new feathers will make the tail of the desired length and shape at the time the bird is shown), and the removal of fine stubs and down from the legs and feet of birds of clean-legged varieties.

For all of these practices there is a larger measure of justification than can be found for plain faking, yet the difference is generally one of degree, not of kind ; and in the final analysis the difference between legitimate and illegitimate methods of fitting fowls for exhibition is tersely expressed in the cynical maxim "Faking is faking only when it is found out." Though not morally beautiful, that sentiment is materially correct. A rigid observance of the rule that fowls must be shown in "natural condition" would require a higher code of ethics in the poultry show than is found anywhere. Among experienced exhibitors the use of the debatable forms of conditioning is general.

Those whose scruples will not allow them to follow custom refrain from exhibiting, because under a strict application of the rule the number of specimens which can be shown with any chance of winning is so small that it is not worth while to make an exhibit exclusively of such specimens at any place where competition compels close scrutiny of the birds. These debatable practices are commonly used by fanciers who will not use any of the "rank" forms of faking. They are justified by them on these grounds: (1) that the rule as it applies to things not detectable is, and always must be, a dead letter; [1] (2) that the rule is too strict, — does not give due consideration to the difficulties of securing absolute conformity to type and would too severely punish trivial faults; (3) that the practices do not in any way mar the appearance of the specimen, but distinctly improve it; (4) that they consist (except as to washing white birds) in removing defects individually so insignificant that their removal leaves no trace, and that there is no difference in effect between washing white birds with mild chemical solutions and washing them several times with a solution of soap and water.

Exhibitors' practice in conditioning. The commonly approved rule of practice in artificial fitting of exhibition birds is to draw the line on things that may be easily detected, or on compound processes. The basis of this rule is not the desire to escape detection, for every experienced exhibitor assumes that every other experienced exhibitor follows the rule. The rule simply establishes the most convenient line of division between what is and what is not permissible in practice in regard to the removal of defects which are in themselves alike. The rule is based not on the similarity of the defects but on the differences in the effects of removing them, or in methods of dealing with them if allowed to remain.

NOTE. The removal, from the body of a white fowl, of forty or fifty feathers slightly ticked or splashed with black would not perceptibly affect the outline of the bird, would improve its appearance, and (unless a great many of them happened to be close together) could not be detected; the removal of one such feather from the wing would at once be apparent. So in a black fowl, many feathers showing some white may be removed from the body without the fact being discovered; a gray tip on a wing feather cannot be removed without showing the loss or mutilation of the feather. It is an important feather. The defect might be remedied by dyeing, — by adding something. This, by common consent, the mass of exhibitors refrain from doing, not merely because the feather is important, but because the treatment *adds something.* The removal of a few very small stubs and bits of down is considered

[1] It is natural to ask, Why, then, is it not changed? The best answer is found in the great number of provisions of municipal state and national laws that are neither enforced nor repealed.

justifiable when removal alone will serve, but not when the stubs are numerous or so large that, to conceal the fact of their removal, the holes must be plugged. The use of chemicals in washing birds is considered permissible if they are not of such strength as to injure the texture of the feather; that is, they may be used in such moderate quantities as would be safe in washing white clothes. The removal of feathers not in themselves defective, to improve the general pattern, has generally been considered unquestionably allowable when the removal of defective feathers is condoned. The regulation of the growth of the tail to bring the desired stage of development at the time when the bird is to be shown has generally been regarded as belonging more to natural than to artificial conditioning, and justified on the ground that the object and the result were to show the bird at its best.

Ethics of conditioning. The evil of the artificial manipulation of poultry for exhibition, while often serious in particular cases, is, on the whole, much less than one would suppose could be the case when principles of importance are involved. Exhibitors following the same general rule are practically competing on terms of equality, for in birds of any variety that are nearly the same in quality the common removable faults are much the same both in kind and in extent. A bird of poor quality cannot be made good by any form of manipulation, either legitimate or illegitimate. Artificial conditioning and fitting of inferior specimens is a waste of time and always unprofitable. In practice artificial fitting is wholly a matter of remedying relatively insignificant defects in specimens of extra good general quality.

The greater evil is in the actual or implied suppression of facts as to the faults of stock when the birds themselves, or eggs from them, go into the hands of other breeders. While to exhibitors whose competing birds are judged on their general quality or excellence it makes no real difference what the particular removed faults of any kind may be, to the breeder it may make a great deal of difference. He is entitled to know what he is buying and to have full opportunity to use his own judgment as to the advisability of buying stock with certain faults. This phase of the question comes properly in the chapter on trade in pure-bred poultry, and will be discussed there.

Details of artificial fitting. The removal of dead, broken, and otherwise defective feathers is the first thing requiring special attention. Adult birds should be carefully examined for these from two and a half to three months before they are to be exhibited. Old cocks are the most troublesome in respect to defective molting and broken feathers, but heavy-laying hens are sometimes as bad. A bird that has hardly begun to molt at this time may as well be dismissed from consideration for exhibit at the show for which it was to be fitted, unless the show is a very early one at which most of the adults will not be fully molted. Molting may sometimes be accelerated by starving for a period and then feeding heavily, but such practices are likely to be in some measure injurious to the birds, and results are not uniform. If a bird has partly molted but has many dead feathers, they should not be removed all at once, but taken a few a day until all are out. Defective feathers of all kinds may be removed at this time, even by the most conscientious exhibitor, for the same defects do not always reappear in the same feathers, and a good feather may grow in place of a bad one. The weight and condition of the bird should also be carefully considered, and its diet and habits of life during the conditioning period should be adapted to getting it in perfect condition for the show. If it is under weight it should be fed all it will stand, yet with care to avoid overfeeding. If it is over weight it should be kept on a light diet. In either case the object should be to avoid radical measures and to bring it gradually to the desired condition.

The next most important point is to look after the condition of the feet, and if they are affected with scaly leg, corns, or bumblefoot, to treat these troubles at once, for they are all slowly cured, and the sooner the cure is effected, the better condition the bird will be in when shown. Foot troubles are not only in themselves serious, but affect the general condition and carriage of the bird. Bumblefoot and corns are sometimes very stubborn. Scaly leg, if not too far advanced, is easily cured but takes time. There may be some excuse for showing birds with the first two troubles, but there is none whatever for scaly leg.

With proper attention given to the points mentioned, no other artificial fitting is necessary until just before the show.

Finishing touches in fitting birds for exhibition. Final preparation for exhibition may require only a few hours just before shipping, or it may take a little time daily for several days or weeks. If dead and broken feathers have been removed at the right time, bad feet put in proper condition, and the bird brought to the desired weight and permitted to keep itself clean, the fitting of a colored specimen consists only in training it for handling and for the exhibition coop, giving it a thorough examination for removable defects, and deciding finally whether it will be shown. White birds must also be washed.

Training. Birds vary greatly in adaptability to showing. Some are easily handled, and even if not handled at all while growing, when cooped become as docile in a few days as if they had been handled all their lives; others never handle well, though the exhibitor works patiently with them for weeks. Some that handle well at home do not take at all kindly to showroom conditions. In general, however, fowls handled for a few moments daily for a week or two will become as docile as necessary. Other kinds of poultry do not handle so well, but all kinds, if accustomed to being handled and to being held in various positions have, when judged, an advantage over birds that are not "coop broken." The birds should be trained to stand in various positions in the coop, and also on a stand or table outside of it. Particular attention should be given to the carriage of the wings and tail, and if either is unsatisfactory, persistent posing of the bird with the part adjusted as desired may teach it to stand, when the judge poses it, in the attitude in which it will show to best advantage.

Picking. If small removable defects are to be removed, it is done just before the birds are shipped. Experienced exhibitors go over all birds very carefully for such faults, and to remove undesirable feathers not seriously defective. Of the thoroughness of the examination which the expert exhibitor makes for this class of faults, the novice rarely has any conception. An hour and a half or two hours is required to pick a specimen that is comparatively free from defective feathers, or in which they are easily detected, while some specimens take half a day. Against such painstaking attention to every detail of fitting, the novice who looks over a bird in a few moments has no chance. The most troublesome of all the removable faults is down on the shanks and between the toes. No variety of fowl is free from this fault. In the angle between the toes, and on the upper side of the foot, it often escapes notice, even when a careful examination is made of the outer side of the shank. It is quite well established, too, that down may develop and become visible within from twelve to eighteen hours after a thorough examination failed to find any. The heat of the showroom is supposed to be the cause of such quick development of down.

Cleaning the legs and feet to remove dirt in the wrinkles of the skin and under the edges of the scales is always necessary. The parts should be washed first with castile soap and warm water, scrubbing them with a toothbrush or a nailbrush. After washing, any dirt showing under the edges of the scales may be removed with the point of a wooden toothpick. The legs, when thoroughly cleaned and dried, should be well rubbed with cottonseed oil or sweet oil, rubbing the oil in until none is left on the surface to catch dust.

Washing white birds is now so universally practiced that it is useless to put unwashed white specimens in a show unless the exhibitor is sure that no well-washed birds will be there. White birds to be exhibited should not be washed until shortly before shipment. An exhibitor who has had no experience in washing birds should begin weeks before the show to practice on cull specimens, and be sure before he tries with a good one that he can do the work in such a manner that the specimen will not look worse after his washing than it did before. There is a knack in washing so as to thoroughly cleanse the feathers without mussing them up. That part of the operation cannot be described. Some persons seem naturally to handle the bird and maniputate the feathers right; others never acquire the knack; most are awkward at first, but with practice attain some skill. The washing must be done in a warm room (85° to 90°), and everything must be in readiness before the work begins. Three or four tubs are required. The bird is first thoroughly soaped and lathered in a tub of warm water, then rinsed in a tub of lukewarm water, then in one of cold water, and sometimes through another tub of cold water. After washing, the rinsing must remove every trace of soap. The bird is dried in the same room, in a clean coop, with clean litter in the bottom, the room being gradually cooled to about 70°.

Shipment to shows. For shipping birds to shows many fanciers use the ordinary light shipping coops used by poultrymen for shipping birds to customers. These answer very well if only a few birds are to be shipped each season. Exhibitors who send strings of birds to a number of shows each year often have substantial compartment coops made, with two, three, four, or more compartments for single birds. Even birds that are to be shown together are better shipped separately. The plumage is not then in danger of being damaged or soiled by other birds in transit. For a local show, when the exhibitor has control of the means of transportation, it is well to keep birds at home as late as possible. If they are to be shipped by rail the shipment should be timed to arrive at the earliest hour at which entries are received. Then if there is delay, they may still be in time. If shipments are held back and timed to arrive at the last moment at which they will be received, and delay occurs, they may not reach the show in time to be judged with their class.

Care of poultry at shows. An exhibitor ought always to look after his own birds at a show, or engage some one on whom he can rely to look after them. Show associations look after exhibits in a general way; they feed and water the birds impartially, clean the coops, and if a bird is sick, remove it. Those birds attended by owners or others who will take special care of them have a great advantage over competing birds looked after by the show attendants. An exhibitor, or his attendant, should see that his birds are not cooped in a draft or too near steam pipes. If birds are placed in such positions and cannot be moved, he should take proper measures to screen them from heat, or from cold-air currents. So far as the birds are concerned, a cold hall is much better than a heated one. If the hall is overheated, or the birds are in too warm a place, their combs may grow considerably, and if large, lop badly. Birds will keep in much better condition through a long show if not full fed on grain and if given a little meat and green stuff daily. Most experienced exhibitors prefer to feed their own birds, and thus be sure that they are regularly fed and not overfed. A bird in a coop, with nothing to do, will stuff itself with food if it has the opportunity.

Returning birds from shows. If the usual quarters of the poultry are cold, and the showroom has been heated, it is often better (especially in very cold weather) to leave the birds there for a day or two with the heat turned off than to take them home at once. If the exhibits must be removed promptly at the close of the show, and the weather is very cold, it may be advisable to keep the birds cooped in a place where the temperature is moderate, for a few days before placing in their regular quarters. As in the special fitting, showing, and transportation they will usually have been quite closely confined for from one to two weeks, and are likely to be a little soft and out of condition, it is a good plan to give them well-littered scratching floors, and feed only hard grain for a while. They should be quarantined until sufficient time has elapsed for the development of any disease to which they may have been exposed.

CHAPTER XXIX

JUDGING

Judging defined. Judging poultry and poultry products is estimating their value according to commonly accepted standards of quality. The quality value of a thing and its money value are not correlated, though the prices of different grades of goods (as of eggs, dressed poultry, and exhibition stock) at any time and place should (and generally do) vary as the qualities of the grades. What are called qualities are attributes of the thing itself; money value is determined by many external factors. Of two fresh eggs, identical in every quality, one, in Kansas or Texas, may be worth two cents, the other, in Boston or New York, worth five cents. The unknown novice who happens to produce a bird of surpassing merit may congratulate himself on disposing of it for five, ten, or fifteen dollars. The same bird, in the hands of a breeder of wide reputation, may bring ten times as much. In judging poultry and its products, money value is not considered at all, though in selling them, prices may be adjusted to quality. In judging pure-bred poultry for external qualities the standards used are those adopted by the American Poultry Association or, in case of non-Standard varieties, those adopted by specialty clubs or agreed upon by the breeders. In judging eggs and dressed poultry on exhibition the standards are determined by market requirements and preferences, and are, for the most part, unwritten standards, their specifications, when printed, being in general terms and not specific as to details, as in standards for fancy poultry.

Objects of judging. The objects of judging are (1) to determine the relative quality of specimens exhibited in competition, (2) to determine (with or without competition) their approximate value as compared with an assumed ideal, or perfect, standard, and (3) to give training in observation and analysis of characters, perception of types, etc.

Methods of judging. For determination of the relative general quality of a limited number of specimens, or of particular quality in few or many specimens, *comparison* is the natural, simple method. In an exhibition where all that is required is to select and rank the few best specimens in each class this method may be sufficient. If classes are large and competition close, it may be so difficult to decide, by observation alone, comparisons involving many characters, that the judge adopts some simple system of marking birds as he examines them, and uses these records to assist him in reaching his final conclusions. From this method of marking for quality is developed the system of judging by score card, now in common use for judging many things.

Scoring is merely a mode of comparison which may be described as *formal comparison, with registration of estimated values of parts as compared.*

Whichever method is used, the actual standard of comparison is the perfect form of each character as the mind of the judge sees it.

In judging, each character is considered separately, though an expert judge may make his observations so rapidly that he really considers a number of related characters collectively. When the number of particular characters is small, a score card may provide for specific records of the estimate of the value of each. When the number of characters to be considered is large, as it is in judging poultry on external points, a card providing for specific records of estimates of all characters is too elaborate for ordinary use, and, to simplify the process of recording the score, parts are grouped in sections, and all their qualities considered and their values recorded together.

NOTE. Theoretically, scoring (including comparison and the making of the record) consists in deducting from 100, taken as the symbol of perfection, a specific amount for each fault noted, the difference between 100 and the total amount to be deducted giving the *score* of the specimen.

On the erroneous assumption that the arbitrary symbol 100 is an expression of actual value in the thing judged, the sections in which characters are grouped have been assigned numerical values, the allotments being in every case so distributed that the aggregate of "points" gives the total 100. Standard scales of points are variable both as to the numbers of sections and as to the numerical values allotted to them. The scales of points in the Standard of Perfection are arranged on the theory that sections may differ in relative value in the same class or breed, and that corresponding sections may differ in value in different breeds and classes. If this principle is admitted, it opens the way for indefinite variation and confusing multiplicity in scales of points. That is exactly what has taken place. The Standard of Perfection specifies more than twenty different scales of points. In the decimal system of scoring, the number of sections is fixed at ten, and each allotted ten points, — the same for all kinds, classes, and breeds of poultry. Theoretically the decimal system is very much simpler than the other; actually the two systems are almost identical both in process and results, because the specific cuts are the same and the mathematical symbol of perfection the same. A slight difference in results may occur quite regularly, because the number of sections is less in the decimal system, and the number of specific cuts is consequently less. This would make no difference if, where sections are combined in the decimal system, the ordinary cuts are increased proportionately, but with the common practice of making the same specific cut for the same estimated degree of defect in each section, the general result of reducing the number of sections is to reduce the number and total value of cuts, and so to increase slightly the score of birds judged by the decimal system.

On the theory that scoring consists in deducting, from the number of points assigned to a section, the percentage of fault in that section, it has been generally assumed that the scale of points was a prime factor in score-card judging. The fallacy of this becomes apparent when we turn from the theories of scoring and consider what it is in fact. Scoring consists simply in making specific cuts for defects. The cuts usually made are $\frac{1}{2}$, 1, and $1\frac{1}{2}$, but occasionally cuts of 2 and, more rarely, $2\frac{1}{2}$ and 3 are made. That these cuts are specific and do not represent carefully computed percentages any one may demonstrate for himself by taking a few score cards of different breeds, made out by a competent judge, and computing the percentages which would give the same specific cuts in the corresponding sections in different varieties. A demonstration of this kind will show very plainly that the ordinary cuts, $\frac{1}{2}$, 1, $1\frac{1}{2}$, are simply convenient symbols for indicating three grades of moderate defects, and the extraordinary cuts, 2, $2\frac{1}{2}$, 3, symbols for indicating grosser defects.

Percentage as applied to things not measured by an absolute standard is merely a figure of speech. Its association with the theory of score-card judging has only served to confuse those who undertake to get, by a percentage system, results which in practice are reached by a system of specific cuts. The scale of points is an absolutely negligible factor in judging. Attempts to introduce it only serve to confuse.

Essential factors in score-card judging. The specific cuts and the symbol of perfection 100 are the essential factors in score-card judging. The use of a score card serves its purpose only when the score secured approximately represents the common expert estimate of the general quality of the specimen. Scoring, as has been shown, is not judging, but recording judgments. To score properly, that is, in accordance with commonly accepted ideas of quality, one must know first the requirements of the standard used, and the common interpretations of Standard specifications, and then what is the common practice in applying specific cuts. In the use of the score card the practical question for the novice is not, What is the percentage of a fault, and its numerical value when computed from the value allotted the section in which it appears? but, What is the usual specific cut made for that fault? Accuracy in score-card judging consists not in expertness in mathematical calculations, but in thorough observation, point by point, and registration of the appropriate cut for every fault. One may score according to his own ideas, just as he may interpret the Standard and breed according to his ideas (and the personal equation always has some influence on judging), but to judge so that his scores will indicate approximately the same quality as the same scores by others, he must learn by observation and practice to make the same specific cuts for the same faults.

Advantages of score-card judging. The particular advantages of score-card judging are that it is complete, both as to individuals and as to classes and exhibitions, where it is applied, and that it furnishes a record which indicates in a general way the locations and measures of faults. In class instruction and drill in judging, the use of score cards is necessary.

Limitations of the score card. In the ordinary use of the score card, while specific cuts are made in each section where fault is found, the symbol recorded on the card does not identify the fault farther than to indicate whether it is a color or a shape defect. The conditions of competitive judging do not admit of the use of score cards which specify the particular faults in each section, but for personal and class use score cards may be as elaborate as desired. The forms in common use for judging have blank spaces for "Remarks," but these are not used systematically, and give space for only the briefest possible statement. For class and private use larger cards with more space for descriptions of faults are sometimes used, also cards with the common faults in each section indicated, so that in marking the card the defect may be checked with a single mark as the specific cut is registered. Simple as this seems, the use of such a card in the showroom almost doubles the time

OFFICIAL SCORE CARD OF THE AMERICAN POULTRY ASSOCIATION [1]

Date______	Variety______
Owner______	Sex______
Address______	Band No.______
Entry No.______	Weight______

	Shape	Color	Remarks
Symmetry			
Weight or size			
Condition			
Head and beak			
Eyes			
Comb			
Wattles and ear lobes			
Neck			
Wings			
Back			
Tail			
Breast			
Body and fluff			
Legs and toes			
*Hardness of feather			
†Crest and beard			

Total cuts______ Score______

*Applies to Games and Game Bantams.
†Applies to crested breeds.

Name of judge______

Secretary______

[1] By courtesy of the American Poultry Association.

required for judging. It is not advisable to make score cards more definitely record the character of faults by increasing the number of sections, because to considerably increase the number of sections and still have the birds make the usual scores for their quality would require a revaluation of specific points too difficult to work out and apply.

Use of score cards. The arrangement of sections on a score card is devised to secure rapidity and thoroughness of examination of the specimens under consideration. Taking the official score card of the American Poultry Association for purpose of illustration, it is noted that the form provides first for the general description and identification of the specimen, and for the record of its weight. At a show which is judged by score card the birds are usually weighed by officials or attendants before judging begins, and the weight is marked on the card as given to the judge.[1]

The first three sections on the card are general sections. *Symmetry*, as defined in the Standard of Perfection, really means *breed shape*, or *type*. This section has been the subject of endless controversy, many judges insisting that to cut for symmetry after having cut shape faults in every section was to punish such faults twice. In common practice little effort is made to value this section discriminatingly. Some judges make a cut of one half on symmetry on every card before looking at the birds at all. Cuts for *condition* penalize an exhibitor for failure to properly fit his birds or for showing birds in any way out of condition. These points may be judged without handling the bird. The other sections are usually marked in order, as the bird is handled, though such points as shape of breast and back, spread and carriage of tail, etc. may have been noted by the judge before he took the bird in his hands. An inexperienced person is not likely to carry such points accurately in his mind, and should place the bird in proper position for inspection before deciding on the cut for each section. Examination begins with the head, and proceeds section by section — head and beak, neck, wings, back, tail, breast, body and fluff, legs and toes. Every Standard specification for each section is considered,

[1] In judging by comparison the judge is supposed to consider size and weight and to disqualify specimens that are under the disqualifying weights, but the birds are not weighed, and the rule is a dead letter in comparison shows.

THE DECIMAL SCORE CARD[1]

Date ______

Breed ______ Sex ______

Entry No. ______ Coop No. ______ Weight ______

Ring No. ______

Exhibitor or Owner	Each Section 10 Points				Directions for using this card
		Condition, weight, or size			To cut for weight, comb, head, or legs, check (x) the defective feature and cut in the column. For shape, make the cut above the dotted line; for color, below the line. If shape is more defective than color, cut in the space for shape, but low enough to include the dotted lines. If color is the greater evil, commence the figure just above the dotted line and carry it deep down into the color space. This secures dispatch in the use of this card for exhibitions.
		Comb, or crest and comb			
		Head and adjuncts	Beak Eye Ear lobe Wattles		
		Neck	Shape Color		
		Back	Shape Color		
		Breast	Shape Color		
		Body and fluff	Shape Color		
		Wings	Shape Color		
		Tail	Shape Color		
		Legs and toes	Shape Plumage Color		
		Total defects			Score

______ Judge

______ President ______ Secretary

[1] By courtesy of I. K. Felch.

and the total specific cut for shape or color in each section is the aggregate of the cuts for the faults of that kind found.[1]

If an obvious disqualification is noted as inspection begins, it is not usual to score that specimen in competition. Under other conditions scoring may be completed with the disqualification marked. Usually a judge, as he examines each section, looks for disqualifications in that section. A novice in scoring should have before him the Standard description of the variety he is judging, and should be sure, before he passes a section, that he has duly considered every specification under it. Omissions often cause faulty scores and account for many mistakes in making awards by the score card.

Ties are of common occurrence when score cards are used, — more so than in comparison judging, because in using the latter method a judge who finds birds equal in one or more sections may make his decision on other sections. In comparison judging, two or more birds are always actually under consideration. In professional score-card judging, each bird is independently compared with a mental standard. In practice work an instructor with the ideal in his mind gives the appropriate cuts for faults for certain specimens or sections, and students determine cuts on other specimens by comparison with these. In any case scoring is sure to give many duplicate scores, and often birds which score alike may be quite unlike, because the faults and cuts are differently distributed. Ties in scoring need not be broken unless it is necessary to determine rank for the award of prizes. The common rule for breaking ties of scored birds is to give the preference to the specimen having the least cuts on shape. If a tie cannot be broken in this way, comparison on any point agreed upon may be made and the birds ranked accordingly. If shape cuts are equal, the specimen nearest to the Standard weight may be ranked first.

[1] The judge may not actually estimate and add all cuts. Except for conspicuous faults requiring a heavy cut he is more likely to consider shape or color in each section as a whole, and mark on his estimate of the general quality of the section. He could cut all faults in detail only by using smaller specific cuts than $\frac{1}{2}$, and that would require the use of similar fractions all along the line, and a cumbersome increase of the grades of quality noted. The Standard contains a list of faults for which specific cuts are recommended, but these are definite only as to such things as mutilations. In most cases the range of the cuts — $\frac{1}{2}$ to $1\frac{1}{2}$, or whatever it may be — is indicated, and the judge must decide which to use.

Uniformity in judging. Estimates of quality can never be uniform, but general consistency in the judgment of many persons is possible if each considers the various sections and qualities impartially. Many judges cut heavily for faults in some sections, lightly for equally serious faults in others. The result is to lead breeders exhibiting under those judges to give special attention to improvement of the sections they cut severely, and to neglect those they cut lightly. In comparison judging, the partial judge gives the preference to specimens with characters he particularly admires, though on the whole inferior to others, and the influence on breeding is the same. Broadly speaking, characters in an organism judged on appearance must be considered as of equal value. This is attained if the person judging them has a true appreciation of perfection, or of the most desirable form of each character, and makes specific cuts in all sections consistently, or, in comparison judging, gives due consideration to every point.

Recognition of utility values in judging exhibition poultry. Characters being divided for convenience into sections, impartial consideration of sections will usually result in estimates of value not seriously open to criticism from the practical poultryman's point of view. While, from that point of view, color and some superficial points may be of little importance, as long as substantial qualities are not neglected, consideration of the others should not be condemned, but rather encouraged, for, as has been said, observation shows that few people indifferent to superficial beauty in poultry show marked appreciation of essential properties of form. For this reason, judging solely on utility points is of doubtful value as an aid to the improvement of utility qualities. When the subject is fully considered, a large proportion of what are commonly called fancy points are in a very literal sense utility points.

Judging poultry products. Judging dressed poultry and eggs is a much simpler process than judging poultry on all external points. In judging dressed poultry and eggs the number of characters, qualities, or points to be considered is small; slight differences in quality do not make great differences in value, as in high-class birds, and degrees of quality are more readily appreciated. While score cards are sometimes used for judging dressed poultry and eggs, the number of sections into which a card may appropriately be divided is so small that there is little if any advantage in scoring, and if, to develop a system of scoring, many sections are made, the process of judging is complicated when it should remain simple. The points to be considered are so few, and the values so apparent, that judgment of all is practically instantaneous. Again, commercial grades of these articles are established with designations more suitable and more generally intelligible than scores obtained as in judging exhibition poultry. The commercial standard of highest excellence is 1, and increasing numerical value of symbols indicates decreasing quality. The rational method of judging dressed poultry and eggs is to grade them according to market quality and value. If then it is desired to indicate the rank of an exhibit in any grade, it can be done for the best few in the usual way, by cards or ribbons, or for an entire class by placing them in order of merit. The assignment to a known or described grade gives the approximate value as accurately as scoring exhibition poultry.

CHAPTER XXX

THE TRADE IN PURE-BRED POULTRY AND EGGS

Textbook treatment of the trade in poultry for exhibition and breeding discusses it for both buyers and sellers, for the beginner in this line of trade is interested in it in both capacities, and is usually in need of information and advice in both; it is as necessary to buy right as to sell right, and more difficult to learn how. Through inability to buy right most novices lose from one to three years in getting a good start in breeding fine poultry. It is not possible for any one to wholly avoid mistakes, — experienced breeders often make them, — but any beginner may greatly reduce the number of his mistakes, and save money and time, by learning something of the general conditions of this trade, and of the obligations of buyer and seller in it, before he begins to buy or places an order for stock, instead of learning by repeated mistakes how not to buy. In many of the matters treated in this chapter it is not necessary to distinctly specify the interests of buyer and seller, for they partly coincide, and when they do not, the particular interest of each is obvious. Special statements of different interests are made wherever the conditions require.

Composite character of the trade. There are very few instances where staple food products are also developed for their æsthetic values, — none where it is done extensively, as with poultry. In consequence of this combination of economic and æsthetic elements in the trade there is more or less conflict between the advocates of utility and the advocates of fancy, and a tendency for the extremists in each cult to emphasize their devotion to their own ideas by pointed disregard of those of their opponents. On the whole, however, the compound nature of values in pure-bred poultry is rightly appreciated in America, and while some friction between these interests is inevitable, the extremist in either direction has little influence. The great body of persons giving special attention to poultry recognize beauty, in its way, as serviceable as utility, and consider some combination of the two desirable.

Values in pure-bred poultry and eggs. Three kinds of value are distinguished in high-class stock: (1) food, or *consumptive*, value; (2) breeding, or *productive*, value; and (3) exhibition, or *æsthetic*, value. It is usual to consider food values as strictly real values, and the others as in a measure fictitious, and therefore less stable. Both views are at fault.

The food value of poultry and eggs as indicated in the price may be in part an æsthetic value. When a consumer pays a premium for white eggs over brown, or vice versa, the difference in price represents what he is willing to pay to gratify a fancy (developed by custom) for eggs with shells of a particular color. There is no difference in the quality of the eggs. When he pays a premium for a particular color of skin in poultry, that premium represents not value in the poultry, but preference or prejudice, according to the point of view. When he pays twice as much per pound for a squab broiler as for a nice fowl (or buys a green duck), he is not buying on a basis of actual nutritive value, but catering to his appreciation of beauty through the sense of taste and sight, just as in paying a high price for a bird externally beautiful he caters to his appreciation of beauty perceived by the eye alone.

Recognition of the æsthetic element in what are commonly considered strictly economic values enables us to better apprehend the substantial nature of æsthetic values. The physical needs of man are his primary needs; normally they must be satisfied first. But with the physical wants satisfied, his mental and spiritual nature as insistently craves beauty. Capacity to enjoy beauty, and desire to possess what is rare, lead men, according to their means, to willingly pay much more for a beautiful object or creature than for an equally useful one lacking that quality. The laws of supply and demand regulate the prices of exhibition poultry as constantly as they do the prices of market poultry. Æsthetic value in the living bird is relatively greater than æsthetic value in table poultry and eggs, not only because it is more durable in the individual but because it may be multiplied through the individual. Even in its lowest grade of excellence the pure-bred bird is more valuable than the mongrel, because through it may be reproduced more certainly those qualities which command a premium in the food markets. For every grade of pure-bred poultry, from the most ordinary breeding stock to the finest exhibition specimens, there is a demand at a price corresponding to its æsthetic value. Not only so, but the scale of prices for the finest specimens is steadily rising.

Profits from fancy poultry. The profits from pure-bred poultry and eggs sold for breeding and exhibition are rarely greater and often less than those from market poultry. While the scale of prices is higher, the cost of production is slightly greater, and the expense of selling very much greater. Even when pure-bred stock of good quality is used to produce market poultry and eggs, and some of the best stock and their eggs sold at fancy prices, the cost of selling this stock may be so great that the net profit is no greater than if everything had been sold at market prices. A person with an abundance of capital, which he is willing to put out on a prospect of future returns, may do a business of this kind at a loss for some years and ultimately make it very profitable. Most persons engaging in the business have to begin in a small way and build up slowly. All such should be very careful not to spend more money to get business than the amount of stock they are likely to sell will warrant. Building up a trade in this line is usually a very slow process.

Peculiarities of the trade. The producer of market poultry and eggs, wherever located, is in touch with an informal system for the distribution of his products through which he can at any time dispose of his produce at prices fixed by general market conditions. The collection and distribution of his products is done by nonproducers. The trade organization is such that a surplus at any point is removed, or a shortage relieved very quickly, and by the use of cold storage a general surplus at one season is carried over to a season of scarcity. The trade in pure-bred poultry and eggs is largely direct from producer to consumer. A comparatively small number of concerns are in this line as dealers. Some breeders, who have developed a demand for more than they can produce, buy to sell again. Most producers sell, or try to sell, what they produce, and a large part of what is distributed through dealers is stock the producer had first tried to sell direct. The business is largely a "mail-order" business.

In a well-established large business of this class the egg trade may run through nearly half the year and sales of poultry be made throughout the year, but the bulk of the egg trade comes in two or three spring months, and the bulk of the sales of stock in two or three preceding months. In a new business, trade in both lines is quite closely limited to the short periods of greatest demand. In most cases this means that a great deal of stock (the best of the ordinary good breeding stock) must be carried, at heavy expense, for several months after it is ready to ship, and must then be sold in competition with later-hatched stock of distinctly less breeding value. The breeder having an established and growing trade can work off a large part of his early-hatched stock in the fall and early winter, and can usually get prices for the rest, when sold later, which warrant his holding it.

Beginners, as a rule, hold too much stock for the trade which comes late in the winter, when small poultry keepers begin to think of mating breeding pens, and hold too many specimens of inferior quality. Many breeders make it a rule to carry nothing over that cannot be sold at five dollars for males and two dollars and fifty cents or three dollars for females. A beginner with ordinary stock may make his minimum prices somewhat lower, but to be on the safe side of profit he should make it a rule to sell no fancy stock for less than double its market value, and to carry over none (males especially) that he cannot sell on that basis. Male birds sold for market the last of the winter will often bring less than if sold as broilers the preceding summer.

Confidence the basis of trade. Trade in this line depends, even more than usual, on the buyer's confidence in the seller, who is usually the producer and so is presumed to know absolutely the merits and faults of the goods. The purchaser of eggs for hatching has only the seller's word for their quality. The purchaser of breeding stock relies upon the seller to deal honestly with him in regard to removable faults and faults in ancestry. Only by securing the confidence of customers is it possible to retain their trade. A dishonest breeder may maintain himself in the business by working new trade, but it is the consensus of opinion of those in the trade that honesty is the best policy, — that it costs less to hold old customers by square dealing than to get new customers by advertising. The confidence which is the foundation of trade in this line pertains to the personality of the breeder to such a degree that the "good will" of a business is not transferable. It may be bought and sold, but cannot be delivered.

Advertising. To be profitable, advertising must be done systematically and with a view to direct results. In a line where competition is keen and reputation of great importance, a newcomer cannot reasonably expect that his advertising will bring considerable immediate returns; but as what it does bring is all that he will get from it,[1] he should not expend more in advertising than the amount of stock he has to sell will justify, or than he can afford to spend if the returns prove small. One who has little capital and no experience in selling through advertising does well to advertise, for a season, in a very modest way. At an expenditure of from two dollars to five dollars per month, according to the style of advertising and the circulation of the paper, he can buy in any of the poultry papers space large enough for an announcement which may bring him in a year several hundred dollars' worth of business. It is usually best for a beginner to select a good paper in his own territory, and to advertise only in that for the first season. On the basis of that experience he should be able to decide whether to go on with this paper on the same scale, or to increase, or to try another paper. Poultry papers are usually the best mediums for advertising poultry, but some of the general agricultural papers, especially those of large circulation, are excellent mediums. Newspapers, except when they make a specialty of poultry advertising, generally give poor returns to poultry advertisers. In writing advertisements one should be plain and direct, stating just what he has to sell, the price, and his address. In reading advertisements with a view to buying, the apparently conflicting claims of advertisers are often so confusing that the buyer in search of the best is at a loss where to buy. The real difficulty here is not in the advertising but in the attitude of the buyer. The stock of competing breeders is usually about equal in quality. One breeder's stock may be especially strong in one character, another's in another. As

[1] This is practically, not literally, correct. As poultry papers are often preserved for reference, some sales are made from dead advertisements. There is also some cumulative value in advertising, but the amount of this in small, intermittent advertising is practically negligible.

between such breeders, statements based on winnings and claims of winnings are immaterial points and may be ignored. In transactions of importance it is not usually advisable to order direct from an advertisement. A fuller description of the stock should be secured, either from the breeder's circular or from correspondence.

Correspondence. In the initial stages of the ordinary business of this character, printed circulars are of doubtful value as aids in selling stock. A circular is effective for this purpose only when it has the personality and force of a letter. A circular which lacks these may make a favorable impression, but rarely brings matters to a conclusion ; correspondence is still necessary. The novice will, as a rule, find it to his advantage to answer by letter inquiries received from advertising, at sufficient length and with such attention to details as will give the inquirer all the information he needs in order to decide whether to buy. Every inquiry should be answered promptly and fully so far as it actually relates to business, but a poultry breeder is under no obligation to answer general inquiries, such as many correspondents make, not relating directly to the transaction, nor is it good policy to reply to such inquiries with the idea that it helps sales. Promptness and directness in replying to proper inquiries are of the greatest importance. Most poultrymen are slack in both respects. Much of the value of advertising may be lost by not taking proper care of inquiries as received. An accurate memorandum of the reply to each letter received should be made on it. Copies of letters of special importance, whether relating to purchases or to sales of stock and eggs, should be preserved.

Terms and obligations. Transactions in pure-bred poultry and eggs are mostly on a cash basis, — as a mail-order business must be. Poultry is sometimes sold on approval, sometimes on specifications as contained in correspondence. Transactions on approval afford most protection to the buyer. If the specifications are clearly understood by both sides, transactions on specifications are on a basis more satisfactory to both. Misunderstandings on this point, and inadequate statements by both parties, are responsible for most of the differences arising out of transactions in poultry of this class. When poultry is sold on approval the buyer pays transportation charges one way, unless it is specified that he shall pay both ways. The time given for inspection may be from one to three days, according to agreement. A consignee should not receive from a transportation company and receipt for a shipment not in good condition. It is assumed that the transportation company does not receive goods not in good condition and properly packed, and the receipt given the shipper is evidence that the shipment was right when received from him. For damage in transit the transportation company is liable.[1] A consignee, having accepted a shipment of live poultry from a transportation company, cannot complain of either the consignor or the carrier if birds are found sick or become sick shortly after receipt. He cannot, after accepting them from the carrier, return birds for sickness developing within the period he is allowed for examination. If he does, the consignor may properly refuse to accept them or to refund the money.

When birds are sold on specifications the buyer may insist on receiving everything according to specifications, but cannot refuse to accept stock for a fault not mentioned in the specifications, except in cases where a general statement of quality has been made which is a misrepresentation of a specimen with such a fault. One of the most serious causes of trouble to inexperienced buyers comes from misunderstanding the relations of disqualifications to value. Without a disqualifying fault anywhere, a bird may be so poor as to be worthless for either exhibition or breeding purposes. Many breeders consider it legitimate to sell such birds to people who want cheap breeding stock, on the negative representation "not disqualified" or "free from disqualifications"; the buyer should be sure that his order calls for positive quality. The shipper who works off cheap stock in this way loses more than he gains.

Sales of eggs for hatching may be unconditional or on a guaranty of fertility or of per cent of hatch. Much dissatisfaction arises in egg transactions because of the poor appearance of eggs of high-class stock. This cannot always be avoided when stock is bred primarily for exhibition quality. Those not willing to accept that

[1] It has been repeatedly decided in court that a transportation company is liable to the full value of birds lost or killed in transportation, even though the shipper had signed the express receipt in common use, limiting the liability of the transportation company to a small valuation per bird, but as a rule claims for damage in excess of the amount specified in the "release" can only be collected in court, and in ordinary cases the trouble and expense of a suit deter the shipper from pressing his claim.

fault with exhibition excellence should buy only where they can find the combination they desire. A buyer cannot complain to a seller for poor appearance of eggs unless eggs were represented otherwise, nor can a buyer refuse to accept a shipment of eggs in a package in good condition, or, because he does not like their appearance, discard them for incubation and seek redress from the shipper. If the package is damaged he should refuse to accept it from the carrier; if the package is not damaged, and the eggs are sold under a guaranty, he must incubate them or he is not entitled to the benefit of the guaranty. When a buyer refuses to accept a shipment from a transportation company, and the goods are returned, the seller should refund the money, according to terms, and adjust the matter with the transportation company. He cannot protect himself, at the expense of his customer, while the matter is in process of adjustment with the transportation company.

Scales of prices. In a preceding paragraph the statement was made that double the market value was the lowest price that should be made on this class of poultry and eggs. Unless this can be realized, it is better to sell at market prices and under conditions which insure that neither stock nor eggs will be used except for food. This is easily managed by selling poultry dressed and by mating only hens actually needed for breeding purposes. It is not good business policy to sell breeding stock and eggs at a slight advance over market prices, except where they can be sold in large quantities and without expense for advertising, packing, etc. Those who sell in small quantities at such prices make little or nothing, and hurt the trade both for themselves and for others. A breeder should not be satisfied to sell much of his product at the minimum prices indicated, or to sell any of it at such prices very long. If he cannot, within a few years, develop a growing trade and reach the usual prices for ordinary good breeding stock (one dollar and fifty cents and up per thirteen for eggs, and two dollars and up for fowls and ducks, with corresponding prices for other kinds of poultry), he may well conclude that there is something wrong, — that either he has not the right kind of stock, or he is not adapted to this trade. In selling at usual prices for eggs and for most of the stock sold, the breeding stock used should be of distinctly better quality, and any birds of quality equal to or approaching that of the breeders should be held at prices which fairly represent their value. A small breeder does not often have many of these after he has selected his own breeders; hence he can afford to hold them until he gets his price, even though he has to carry them into the second year.

From the time he begins to sell stock a poultry breeder should make a practice of carefully grading it according to his scale of prices. Many beginners selling at low prices neglect this on the ground that, as the poorest they have are worth the price, every customer gets his money's worth, and if some get more than that, no harm is done. To say nothing of other aspects of the case, this is a serious mistake for a breeder to make, for while the egg trade must always be something of a lottery, the most important thing in selling high-class birds is to determine their money value correctly and give each customer good value — full measure of quality — for the price, but not the quality which should bring a better price. It is the buyers, — the public, — not the seller, that make prices in fancy poultry. Prices rise steadily because people are increasingly willing to pay high prices for fine specimens. The breeder always has to consider, before he sells his best bird at a price, however high, whether an inferior bird would suit that customer, and what, if he lets this bird go, he will do for a customer willing to pay a still higher price. Such conditions in a trade easily lead to abuse of the confidence of customers ignorant of values, but such abuses work their own cure by putting out of business those who practice them. The salesman in this line must have nice judgment of values, and apply it honestly; he should lose no opportunity to train his judgment. As a novice he ought also to consider that he is likely to make mistakes; and when complaints are made as to the quality of the birds he furnishes, he should consider them carefully and adjust any error found.

Packing and shipping. All poultry and eggs of this class are shipped by express. The question of shipping by freight is agitated occasionally, but general conditions of freight traffic make the risk too great.

Poultry is shipped mostly in light wooden coops, tight all round except at the top, which is slatted. Coops of this style may be bought in quantity, in "knockdown" form, at very moderate prices. Formerly light boxes used for light, bulky groceries were much used for shipping poultry, and some of them were easily converted into very satisfactory shipping coops. Since paper cartons have come into extensive use, the supply of second-hand boxes is limited, and most breeders find it more satisfactory, on the whole, to use the regulation coops. These are made in several sizes, from single-bird size up to a size large enough for a pen of five medium-to-small fowls. Valuable males should always be shipped in single coops. Ordinary good males, not to be exhibited soon, may be shipped in coops with females, but there is always some risk of the females injuring the comb or plumage of a male when closely confined with him for a long period. For a short shipment — say, of one day — it is not necessary to provide for feeding and watering in transit. For long shipments the coops should have tin drinking cups attached in a corner inside, and a small bag of feed should be fastened to the coop.

Eggs. Small lots of eggs for hatching are shipped either in common flat splint baskets, with or without pasteboard fillers or boxes, or in specially constructed boxes, with fillers. Valuable eggs sold in large quantities are usually packed in small lots, but sometimes heavy round half-bushel or bushel baskets are used, and the eggs packed in excelsior without other filler. Low-priced eggs in large lots are often shipped in ordinary egg cases or in cases of the same kind, with a little packing material to relieve the jar. While it is difficult to ascertain the facts, comparisons of results of hatches indicate that a jar which does not break eggs may seriously affect their hatching, and that, other things being equal, carefully packed eggs give the best hatches. For packing material in pasteboard fillers, bran, fine chaff, and broken cork are used. The fillers or boxes are usually placed in a basket or wooden box, with a packing of fine hay or excelsior under, around, and sometimes over them. For packing without fillers, in baskets, excelsior alone may be used, a thick layer being placed in the bottom of the basket, each egg wrapped in excelsior, and enough of the same material placed between the sides of the basket and the eggs, and over the eggs, to protect them. When the baskets used are of ample size, and sufficient excelsior is used, this is the best way to pack eggs for hatching. If too little excelsior is used, or the packing is carelessly done, it is one of the worst.

A novice in packing and shipping who has no opportunity to observe packing done by experts will benefit greatly by closely observing how both the poultry and the eggs that he buys are packed, and noting in eggs the results of hatches from differently packed lots.

Effect of weather on shipments. It is not advisable to ship fine poultry or eggs for hatching in either very cold or very hot weather. Usually a shipper uses his judgment on this point, and if a purchaser insists on shipment regardless of weather conditions the purchaser takes the risk of damages or loss which may occur as a result. In general, periods unfavorable to the shipping of birds and eggs are short, and a few days' delay makes little difference, except when birds are to be shipped to a show and must arrive on a given date. In that case the shipment must be made regardless of weather conditions, and it is usually understood that the purchaser takes the risks.

BIBLIOGRAPHY

The following lists of books and pamphlets include only such as are historically valuable or have original merit, and are published solely to give information. Publications which simply repeat matters of common knowledge, and those which combine information with advertising, are omitted, although many of the latter contain much valuable matter. Books marked with an asterisk are recommended as, in the opinion of the author, most desirable for those who want a limited selection of works on poultry culture for collateral reading and for reference. The dates of first editions are given when known. When a work published previous to 1890 has been revised recently, the date of revision is given.

General

Cheap and Good Husbandry. Markham. (1614)

Ornamental and Domestic Poultry. Dixon and Kerr. (1860)

Ornamental, Aquatic, and Domestic Fowl. Dolan

Our Domestic Fowls. Martin. (1847)

Poultry. Dickson. (1838)

Poultry. Moubray. (1815)

Rare Prize and Domestic Poultry. Ferguson and Culliford. (1854)

The American Poulterer's Companion. Bement. (1856)

The American Poultry Book. Cocke. (1843)

The Dorking Fowl. Baily. (1851)

The History of the Hen Fever. Burnham. (1855)

The Husbandrye, Ordring, and Governmente of Poultrie, practiced by the learnedste and suche as have beene knowne Skilfullest in that Aarte in our Tyme. Mascall. (1581)

The Illustrated Book of Domestic Poultry. Doyle. (1854)

The Malay Fowl and Malay Bantam. Branford. (1849)

The Poultry Book. Bennett. (1850)

The Poultry Yard. Boswell. (1841)

Note. The foregoing belong to the early period in poultry literature, the following to the modern period.

American Poultry Culture. Sando. (1908)

An Egg Farm. Stoddard. (1888)

Breeding and Management of Poultry. Felch. (1877)

Encyclopedia of Poultry. Chanticleer. (1909)

Farm Poultry. Watson. (1901)

First Lessons in Poultry Keeping. Robinson. (1905)
Fowls for Profit. Johnson. (1903)
How to keep Hens for Profit. Valentine. (1910)
Making Poultry pay. Powell. (1907)
Pleasurable Poultry Keeping. Edward Brown. (1893)
Pocket-Money Poultry. Norys. (1899)
Possibilities of Modern Poultry Farming. Hicks and Ewart. (1909)
Poultry Breeding. Purvis. (1910)
Poultry-Craft. Robinson. (1899)
Poultry Culture. Felch. (1889)
Poultry Culture for Profit. Sturges. (1907)
Poultry for the People. Comyns. (1889)
Poultry for the Table and Market *vs.* Fancy Fowls. Tegetmeier. (1892)
Poultry Keeping as an Industry for Farmers and Cottagers. Edward Brown. (1891, 1906)
Poultry Keeping in India. Tweed. (1903)
Poultry Management. Bell. *Farmers' Bulletin No. 287*, United States Department of Agriculture. (1907)
Poultry Management on a Farm. Palmer. (1902)
Practical Poultry Raising. Jull. *Bulletin No. 26*, Department of Agriculture, Victoria, British Columbia. (1910)
Profitable Poultry Production. Kains. (1910)
Progressive Poultry Culture. Brigham. (1908)
* Races of Domestic Poultry. Edward Brown. (1906)
Report on the Poultry Industry in America. Edward Brown. (1906)
Report on the Poultry Industry in Denmark and Sweden. Edward Brown. (1908)
Report on the Poultry Industry in Germany. Edward Brown. (1911)
The A B C of Poultry. Johnstone. (1906)
The Illustrated Book of Poultry. Wright. (1874, 1911)
The New Egg Farm. Stoddard. (1900)
The Poultry Book. Tegetmeier. (1867)
The Poultry Book. Weir. (1903)
The Poultry Manual. Sturges. (1909)
The Practical Poultry Breeder and Feeder. Cook. (1883, 1901)
The Practical Poultry Keeper. Wright. (1867, 1899)

Special Features, Classes, and Breeds

Bantams. Entwistle. (1894)
Bantams as a Hobby. Proud
Broilers and Roasters. Robinson. (1905)
Capons and Caponizing. Dow. (1891)

Capons and Caponizing. Slocum. *Farmers' Bulletin No. 452*, United States Department of Agriculture. (1911)
Domestic Waterfowl. Stoddard. (1885)
Ducks and Geese. Howard. *Farmers' Bulletin No. 64*, United States Department of Agriculture. (1897)
Ducks and Geese. Various authors. Reliable Poultry Journal Series. (1900)
Ducks and how to make them pay. Cook. (1895)
Duck Culture. Rankin. (1897, 1906)
Eggs and Egg Farms. Various authors. Reliable Poultry Journal Series. (1900)
Fancy Waterfowl. Finn. (1900)
Game Fowls. Cooper. (1889)
Hamburgs Up to Date. Holt
How we make Ducks pay. Weber. (1906)
Leghorns. Hesford. (1896)
Minorca Fowls. Biggs. (1893)
Ornamental Waterfowl. Hubbard. (1888)
Pheasant Raising in the United States. Oldys. *Farmers' Bulletin No. 390*, United States Department of Agriculture. (1910)
Points on the Breeding of Pheasants. Sudow
Private Game Preserves in the United States. Palmer. *Circular No. 92*, United States Biological Survey. (1910)
Sussex Fowls and Fattening. Hurst. (1905)
The Ancona Fowl. Briggs
The Asiatics. Various authors. Reliable Poultry Journal Series
The Bantam Book. Clough
The Bantam Fowl. McGrew. (1899)
The Blue Andalusian. Silver Dun
The Book of the Hamburgs. Baum. (1886)
The Book of the Hamburgs. Hewes. (1902)
The Brown Leghorns. Stoddard. (1885)
The China Fowl. Burnham. (1874)
The Cocker. Sketchley. (1814)
The Houdan Fowl. Lee. (1874)
The Improvement of the Farm Egg. Lamon and Opperman. *Bulletin No. 141*, United States Bureau of Animal Industry. (1911)
The Langshan Fowls. A. C. C. and C. W. G. (1877)
The Leghorns. Various authors. Reliable Poultry Journal Series. (1901)
The Light Brahmas. Stoddard. (1885)
The Minorca Fowl. Harrison. (1893)
The Old English Game Fowl. Atkinson. (1891)
The Orpington Fowl and how to breed it. Campbell. (1903)
The Orpingtons. Various authors. Reliable Poultry Journal Series. (1910)

The Plymouth Rock. McGrew. *Bulletin No. 29*, United States Bureau of Animal Industry. (1901)
The Plymouth Rocks. Various authors. Reliable Poultry Journal Series. (1899)
The Rhode Island Reds. Various authors. Reliable Poultry Journal Series. (1910)
The Turkey, Duck, and Goose. Johnson. (1904)
The Waterfowl Family. Sanford, Bishop, and Van Dyke
The Wyandotte. McGrew. *Bulletin No. 31*, United States Bureau of Animal Industry. (1901)
The Wyandottes. Stoddard. (1885)
The Wyandottes. Various authors. Reliable Poultry Journal Series. (1899)
The Wyandotte Book. McGrew. (1905)
The Wyandotte Fowl. Field. (1890)
The Wyandotte Fowl. Various authors. (1884)
Turkeys. McGrew. *Farmers' Bulletin No. 200*, United States Department of Agriculture. (1904)
Turkeys. Various authors. Reliable Poultry Journal Series. (1909)
Wyandottes. Hewes. (1908)
Wyandottes. Wallace. (1891)

Houses and Fixtures

A Gasoline-Heated Colony Brooder House. Rice and Lawry. *Bulletin No. 246*, Cornell Agricultural Experiment Station. (1907)
Building Poultry Houses. Rice. *No. 16, Cornell Reading Course for Farmers.* (1903)
Built and used by Poultrymen. Hare, editor. (1909)
Construction of a Poultry House. Atwood. *Bulletin No. 130*, West Virginia Agricultural Experiment Station. (1911)
Housing of Chickens. Dryden. *Extension Bulletin No. 2*, Oregon Agricultural College. (1909)
Low-Cost Poultry Houses. Darrow
New Poultry Appliances. Rice and Lawry. *Bulletin No. 248*, Cornell Agricultural Experiment Station. (1907)
Poultry Architecture. Fiske. (1902)
Poultry Architecture. Stoddard. (1879)
Poultry Houses. Lane, *Extension Bulletin No. 8*, University of Minnesota. (1910).
Poultry Houses and Fixtures. Hunter. (1907)
* Poultry Houses and Fixtures. Various authors. Reliable Poultry Journal Series. (1910)
Poultry-House Construction and its Influence on Domestic Fowls. Opperman. *Bulletin No. 146*, Maryland Agricultural College. (1910)

Questions on Poultry-House Construction. Rice and Lawry, *No. 33*, *Cornell Reading Course for Farmers.* (1907)

The Improved Gasoline-Heated Colony Brooder House. Rice and Rogers. *Bulletin No. 227*, Cornell Agricultural Experiment Station. (1910)

Foods and Feeding

Analyses of Feeding Stuffs. Willard and others. *Bulletin No. 158*, Kansas Agricultural Experiment Station. (1909)

Analyses of Miscellaneous Food Materials. Woods and Merrill. *Bulletin No. 75*, Maine Agricultural Experiment Station. (1901)

Breakfast Foods. Harcourt and Fulmer. *Bulletin No. 162*, Ontario Department of Agriculture. (1907)

Cereal Foods. Merrill. *Bulletin No. 118*, Maine Agricultural Experiment Station. (1905)

Commercial Feeding Stuffs. Carson and Fraps. *Bulletin No. 127*, Texas Agricultural Experiment Station. (1910)

Commercial Feeding Stuffs. H. J. Wheeler and others. *Bulletin No. 94*, Rhode Island Agricultural Experiment Station (1903); also *Bulletin No. 112*, same (1906)

Commercial Feeding Stuffs on the Connecticut Market. *Bulletin No. 145*, Connecticut Experiment Station (1904); also *Bulletin No. 177*, same (1905)

Comparison of Four Methods of feeding Early-Hatched Pullets. Rice. *Bulletin No. 249*, Cornell Agricultural Experiment Station. (1907)

Composition of Ontario Feeding Stuffs. Gamble. *Bulletin No. 138*, Ontario Agricultural College. (1905)

Concentrated Commercial Feeding Stuffs. Jones and others. *Bulletin No. 141*, Purdue University Agricultural Experiment Station. (1910)

Condimental Stock and Poultry Foods. Lindsey. *Bulletin No. 106*, Massachusetts Agricultural Experiment Station. (1905)

Cost of Egg Production. Wing. *Bulletin No. 204*, Cornell Agricultural Experiment Station. (1902)

Cottonseed Meal. Woods and Bartlett. *Bulletin No. 115*, Maine Agricultural Experiment Station. (1905)

Effect of Food on Breaking Strength of Bones. Burnett. *Bulletin No. 107*, Nebraska Agricultural Experiment Station. (1908)

Exact Calculation of Balanced Rations. Willard. *Bulletin No. 115*, Kansas Agricultural College. (1902)

Examination of Cattle and Poultry Foods. Lindsey. *Bulletin No. 112*, Massachusetts Agricultural Experiment Station. (1907)

Fattening Poultry. Lee. *Bulletin No. 140*, United States Bureau of Animal Industry. (1911)

Feeding and Management of Poultry for Egg Production. Jeffrey. *Bulletin No. 211*, North Carolina Agricultural Experiment Station. (1910)

Feeding and Rearing of Chickens. Cobb

Feeding for Eggs. Dryden. *Extension Bulletin No. 4*, Oregon Agricultural College. (1909)

Feeding of Laying Hens. Rice. *Bulletin No. 17*, *Cornell Reading Course for Farmers.* (1903)

Food Value of a Pound of Milk Solids. Beach. *Bulletin No. 31*, Connecticut Agricultural Experiment Station. (1904)

Food Value of Corn and Corn Products. Woods. *Farmers' Bulletin No. 298*, United States Department of Agriculture. (1907)

Gluten Feeds and Meals. Hills. *Bulletin No. 48*, Vermont Agricultural Experiment Station. (1895)

Inspection of Commercial Feeding Stuffs. Smith and Perkins. *Bulletin No. 136*, Massachusetts Agricultural Experiment Station. (1911)

Investigation Regarding Succulence. Robison. *Bulletin No. 32*, Michigan Agricultural Experiment Station. (1905)

Molasses and Molasses Foods for Farm Stock. Lindsey, Holland, and Smith. *Bulletin No. 118*, Massachusetts Agricultural Experiment Station. (1907)

Poultry Fattening. Edward Brown. (1895)

Poultry Feeding and Proprietary Feeding Stuffs. Jaffa. *Bulletin No. 164*, California Agricultural Experiment Station. (1905)

Principles and Practice of Stock Feeding. Hills. *Bulletin No. 81*, Vermont Agricultural Experiment Station. (1900)

Seven Methods of Feeding Young Chickens. Rice and Nixon. *Bulletin No. 282*, Cornell Agricultural Experiment Station. (1910)

Sugar Beets. Willard and Clothier. *Bulletin No. 103*, Kansas Agricultural Experiment Station. (1901)

The Computation of Rations for Farm Animals by the Use of Energy Values. Armsby. *Farmers' Bulletin No. 346*, United States Department of Agriculture. (1909)

The Mineral Elements in Animal Nutrition. Forbes. *Bulletin No. 201*, Ohio Agricultural Experiment Station. (1909)

Hatching and Rearing

Artificial Incubating and Brooding. Various authors. Reliable Poultry Journal Series. (1898)

Chicken Rearing and the Management of Incubators. Johnson. (1908)

Hydro-Incubation. Christy

Incubating and Brooding Chickens. Dryden. *Bulletin No. 6*, Oregon Agricultural College. (1910)

Incubation and Brooding. Jull. *Bulletin No. 27*, Department of Agriculture, Victoria, British Columbia. (1910)

Incubation and its Natural Laws. Cyphers. (1894)

Mortality of Incubator Chicks. Field, Marshall, and Warren, *Bulletin No. 61*, Rhode Island Agricultural Experiment Station. (1899)

Practical Artificial Incubation. Ferris. (1880)

Raising Chickens. Rice. *No. 19, Cornell Reading Course for Farmers.* (1904)

Raising Chicks Artificially. Stewart and Atwood. *Bulletin No. 98.* West Virginia Agricultural Experiment Station. (1906)

The Art of hatching and bringing up Domestic Fowls. De Reaumur. (1750)

The Chick Book. Various authors. Reliable Poultry Journal Series. (1905)

The Eccaleobion. Bucknell

Diseases

A Manual of Poultry Diseases. Vale

A Nodular Tæniasis in Fowls. Moore. *Circular No. 3.* United States Bureau of Animal Industry. (1895)

A Quail Disease in the United States. Moore. *Circular No. 109*, United States Bureau of Animal Industry. (1907)

A Tapeworm Disease of Fowls. Gage and Opperman. *Bulletin No. 129*, Maryland Agricultural Experiment Station. (1909)

Apoplectiform Septicæmia in Chickens. Norgaard. *Bulletin No. 36*, United States Bureau of Animal Industry. (1902)

Bacillary White Diarrhea of Young Chicks. Rettger and Stoneburn. *Bulletin No. 60*, Storrs Agricultural Experiment Station. (1909)

Bacillary White Diarrhea of Young Chicks. (Second Report.) Rettger and Stoneburn. *Bulletin No. 68.* Storrs Agricultural Experiment Station. (1911)

Blackhead in Turkeys. Hadley and Kirkpatrick. *Bulletin No. 141*, Rhode Island Agricultural Experiment Station. (1910)

Chickens and their Diseases in Hawaii. Sedgwick, *Bulletin No. 1.* Hawaii Experiment Station. (1901)

Diseases of Chickens. Pernot. *Bulletin No. 5.* Extension Department, Oregon Agricultural College. (1910)

Diseases of Domestic Poultry. Burnham. (1876)

Diseases of Fowls. Bradshaw. *Farmers' Bulletin No. 15.* Department of Agriculture, New South Wales. (1909)

Fowl Cholera and Methods of combating it. Hadley. *Bulletin No. 144*, Rhode Island Agricultural Experiment Station. (1910)

Parasitic Diseases of Poultry. Theobald

Poultry Diseases and their Treatment. Pearl, Surface, and Curtis. (1911)

Roup. Harrison and Streit. *Bulletin No. 125*, Ontario Agricultural College. (1902)

* The Common-Sense Poultry Doctor. Robinson. (1907)
The Diseases of Poultry. Hill
The Diseases of Poultry. Salmon. (1899)
The Farm-Poultry Doctor. Sanborn. (1896)
The Poultry Doctor. Lehman. (1911)
White Diarrhea of Chicks, with Notes on Coccidiosis in Birds. Morse. *Circular No. 128*, United States Bureau of Animal Industry. (1908)

Experiment and Research

A Record of 600 Hens. Stewart and Atwood. *Bulletin No. 115*, West Virginia Agricultural Experiment Station. (1908)
Analyses of Eggs. Willard and Shaw. *Bulletin No. 159*, Kansas Agricultural Experiment Station. (1909)
Appliances and Methods for Pedigree Poultry Breeding. Pearl and Surface. *Bulletin No. 159*. Maine Agricultural Experiment Station. (1908)
Ash and Grit for Growing Chicks. F. H. Hall and W. P. Wheeler. *Bulletin No. 242*, New York Agricultural Experiment Station. (1903)
Bacteriology of the Drawn-Poultry Question. Higley
Biology of Poultry Keeping. Evans. (1899)
Data on the Relative Conspicuousness of Barred and Self-Colored Fowls. Pearl, *American Naturalist*. (February, 1911)
Data on Variation in the Comb of the Domestic Fowl. Pearl and Pearl, *Biometrika*. (March, 1909)
Digestion Experiments with Poultry. E. W. Brown, *Bulletin No. 56*, United States Bureau of Animal Industry. (1904)
Experiments with Poultry. W. P. Wheeler. Summary of investigations at the New York Agricultural Experiment Station. (1908)
Fattening Chickens. Graham. *Bulletin No. 151*, Ontario Agricultural College, (1906)
Feeding Experiments. W. P. Wheeler, *Bulletin No. 126*. New York Experiment Station. (1897)
How Much Meat shall Ducks eat? F. H. Hall and W. P. Wheeler, *Bulletin No. 259*, New York Experiment Station. (1904)
Importance of Constitutional Vigor in the Breeding of Poultry. Rice and Rogers. *No. 45*. *Cornell Reading Course for Farmers*. (1909)
Incubation of Chickens. W. R. Graham and others. *Bulletin No. 163*, Ontario Department of Agriculture. (1908)
Incubator Experiments. Dryden. *Bulletin No. 100*, Oregon Agricultural College. (1908)
Infection and Preservation of Eggs. Lamson. *Bulletin No. 55*, Connecticut Agricultural Experiment Station. (1909)

Inheritance in Blood Lines, with Special Reference to the 200-Egg Hen. Pearl. American Breeders' Association. Vol. VI. (1910)

Inheritance in Poultry. C. B. Davenport. The Carnegie Institution of Washington. (1906)

Inheritance of Characteristics in Domestic Fowl. C. B. Davenport. The Carnegie Institution of Washington. (1909)

Inheritance of Fecundity. Pearl and Surface. *Bulletin No. 166*, Maine Agricultural Experiment Station. (1909)

Loss of Weight in Eggs in Incubation. Stewart and Atwood. *Bulletin No. 73*, West Virginia Agricultural Experiment Station. (1901)

Mash or Whole Grain. Stewart and Atwood. *Bulletin No. 88*, West Virginia Agricultural Experiment Station. (1903)

Notes on the Osteology and Mycology of the Domestic Fowl. Vaughn

Poultry as Food. Atwater, *Farmers' Bulletin No. 182*, United States Department of Agriculture. (1903)

Poultry Experiments. Mairs. *Bulletin No. 87*, Pennsylvania Agricultural Experiment Station. (1908)

Poultry Work at the Maine Station. Woods. *Bulletin No. 157*, Maine Agricultural Experiment Station. (1908)

* Seasonal Distribution of Egg Production. Pearl and Surface. *Bulletin No. 110*, United States Bureau of Animal Industry. (1911)

Some Observations and Experiments on the Natural and Artificial Incubation of the Egg of the Common Fowl. Albert C. Eycleshymer, in the *Biological Bulletin*. (May, 1907)

Studies on Hybrid Poultry. Pearl and Surface. *Bulletin No. 179*, Maine Agricultural Experiment Station. (1910)

Studies on the Physiology of Reproduction in the Domestic Fowl. Pearl and Curtis. in the *Biological Bulletin*. (September. 1909)

Studies with Sudan III. In Metabolism and Inheritance. Riddle, in the *Journal of Experimental Zoölogy*. (March. 1910)

The Chemistry of Flesh. A Preliminary Study of the Effects of Cold Storage upon Beef. Veal, and Poultry. Emmett and Grindley, in the *Journal of Industrial and Engineering Chemistry*. (July and August, 1909)

The Development of the Chick. F. R. Lillie. (1908)

The Fertility and Hatching of Eggs. Pearl and Surface. *Bulletin No. 168*, Maine Agricultural Experiment Station. (1909)

The Ligaments of the Oviduct of the Domestic Fowl. Curtis. *Bulletin No. 176*, Maine Agricultural Experiment Station. (1910)

The Molting of Fowls. Rice, Nixon, and Rogers. *Bulletin No. 258*. Cornell Agricultural Experiment Station. (1908)

What Chemistry finds in Foods. Hall, Jordan, and Jenter. *Bulletin No. 166*, New York Agricultural Experiment Station. (1899)

Marketing

* How to kill and bleed Market Poultry. Pennington and Betts. *Circular No. 61*, Bureau of Chemistry, United States Department of Agriculture. (1910)

Marketing Eggs through the Creamery. Slocum, *Farmers' Bulletin, No. 445*. United States Department of Agriculture. (1911)

Marketing Poultry Products. Rice. *No. 26, Cornell Reading Course for Farmers.* (1904)

Studies of Poultry from the Farm to the Consumer. Pennington. *Circular No. 64*. Bureau of Chemistry. United States Department of Agriculture

The Egg Trade of the United States. Hastings. *Circular No. 140*. United States Bureau of Animal Industry. (1909)

The Marketing of Eggs. Phillips. *Bulletin No. 162*, Kansas Agricultural Experiment Station. (1909)

The Poultry and Egg Industry of Leading European Countries. Fossum. *Bulletin No. 65*, United States Bureau of Animal Industry. (1904)

* The Poultry Packer's Guide. Bickel. (1909)

Exhibiting and Judging

Poultry for Prizes and Profit. Long. (1872, 1909)

Preparing Fowls for Exhibition. Cobb

* The American Standard of Perfection. The American Poultry Association. (1874, 1910)

The Philosophy of Judging. Felch, Babcock, and Lee. (1889)

Miscellaneous

Farm Drainage. Stewart. *Extension Bulletin No. 13*. University Farm. St. Paul, Minn.

How to destroy English Sparrows. Dearborn. *Farmers' Bulletin No. 383*. United States Department of Agriculture. (1910)

How to destroy Rats. Lantz. *Farmers' Bulletin No. 369*. United States Department of Agriculture. (1909)

The Cement Workers' Handbook. Baker. (1906)

The Preservation of Hen Manure. In *Bulletin No. 98*, Maine Agricultural Experiment Station. (1903)

INDEX TO TEXT AND ILLUSTRATIONS

With this index is included a glossary of technical terms not defined in the text. All numerals refer to pages