from the other's fence. But when the camps are small, they bother up and down after each other all day.

There should always be a supply of crushed bones in each camp; and on sour veldt an occasional supply of salt is advisable.

The fact of the birds having paired is known by the cock leaving an unmistakeable mark on the left side of the tail. The oftener it has been done the more conspicuous becomes the mark.

Many breeders get their birds so savage that they are hardly manageable: this is from want of care or knowledge. If men are allowed to enter the camps with bad bushes, and the birds get fighting with them, or, worse still, if they go with none at all, and then dodge about, the quietest bird will in a week or two be made perfectly rampant. But if good bushes are taken the bird gets to know that he can do nothing, and seldom attempts any nonsense. If they are always treated like this, on a pinch a man could walk through the camp with only a walking-stick held out, and they would not charge; though if he had nothing in his hand they would.

CHAPTER XVI.

THE EGG.

EXCEPTING a few of the very lowest forms in the animal kingdom, everything possessing animate life has come from an egg; not as we see it when laid by a bird, but as such an egg would appear if stripped of the shell, the different parchment-like coverings, and the albumen. The ovary of the bird, situated under the hump of the back-bone, consists of a cluster of yolks like a bunch of grapes, the yolks being held to the stems somewhat as an acorn is held in the cup. As puberty comes on, the yolks which have been small, but of various sizes, grow rapidly, and as they reach the full size are ready to be fertilised by the male; after which they drop off, and in passing down the ovary duct, first the albumen (the white), is added to them, then the white skins, of which there are two, then the shell, and lastly the colouring, when the egg is given forth, containing within its shell all that will constitute the future bird. The germ floats on the top of the yolk, being suspended from the two ends of the egg by two spiral cords, the mechanism of which is so beautiful that no matter how

the egg is turned the germ will come to the top; and all that is required to effect the wonderful change of this mass of liquid to the natural chick with its solid bones, muscles, flesh, and vital organs, is the application of a certain amount of heat given in a certain manner.

So much the Great Creator has permitted man to discover, but what this vital spark is He alone knows. It is generally supposed to proceed from the male only, the female simply receiving it on one of her ova, and in mammals stamping her impress upon it during the period of gestation. But this can hardly be so with aves, as with these the germ so quickly leaves the female, after which she can exercise no influence over it.

The popular delusion is that the yolk contains the materials that go to compose the chick. But this is not so. The albumen contains the whole, the yolk simply feeding the embryo and the chick for the first few days after its birth; though we may suppose that a considerable chemical change takes place, as the yolk, which was at first yellow, becomes green by the time the chick comes forth from its shell, and the yolk-sac is taken into the abdominal cavity, which closes over it. The amount of the yolk that must be consumed prior to the chick hatching must be very small, as up to that time it has only lost about one-

sixth of its weight, being about the same proportion as the total loss of weight of the egg by evaporation during the time of incubation.

The yolk-sac is connected to the chick about halfway down its small intestine, and as the action of the bowels (which is always at work in every living animal, forcing everything contained in them from the head towards the anus) is at work previous to the chick leaving the shell, as proved by the excrement which the chick voids before leaving it, the yolk must be digested, and nourishment drawn from it by the large intestines and the lower half of the small one; the liver, the stomach with its gastric glands, and the gizzard not coming into use until the bird swallows food through its mouth. So that the popular fallacy of the bird being born with a "yellow liver," having any connection with the yellow yolk is disproved—first by the yolk, as we have seen, not being yellow at this time, and secondly, that by no possible reasoning can the yolk be supposed to enter the liver.

A certain class of philosophers, known as evolutionists, have attempted to reduce the works of the Great Creator to the action of two laws, viz., that of the "survival of the fittest," and of "sexual selection." That these two laws are in operation neither we nor any one else who watches nature can deny, but that they

are sufficient to account for all the wonderful and beautiful things in nature which we see around us, is to us a monstrous idea, and can only be entertained by those who, observing the working of these two laws, become so wrapt in them that they lose sight of the innumerable other laws which Providence has placed to keep everything in the same order in which it was created. These men refer all the gorgeous and wonderful colouring in the vegetable kingdom to the attraction these form to the various insectivora to settle on them, thus carrying the pollen to the stigma; whilst they account for the gorgeous colouring of moths and butterflies, and of birds, by the greater attraction which the more gorgeously-coloured males present to the females than do the less-favoured ones.

By the action of these laws they attempt to prove that all the various forms in the living world have been developed from one, or, at the most, four or five species. But in all their arguments they carefully ignore the scarcely less beautiful and varied colouring of birds' eggs, which cannot in any way be accounted for by either of these laws, as the law of the "survival of the fittest" would have kept all eggs to neutral tints, or to tints closely resembling that of the surface on which they are laid. That occasional cases of this may be found, we are aware; but for every such case dozens

may be given exactly the reverse, showing these are mere coincidences; whilst the law of "sexual selection" can by no stretch of imagination have the slightest influence on the future colouring of the egg, as this colouring has no connection or resemblance to the bird's plumage.

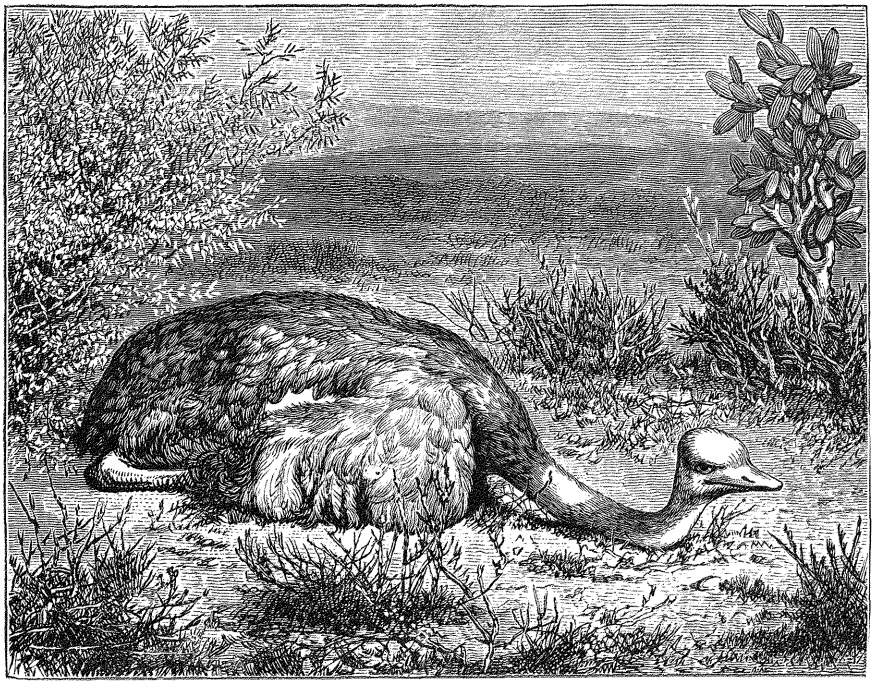
Neither has the food on which the parent bird exists any connection with the colouring of the egg; if it had, carnivorous birds would always have one colour, and graminivorous another, but such is not the case. In the family of which we are now treating, the Ostrich has a white egg, the most conspicuous colour to attract its enemies; whilst the Emu, having the same habits and living under the same conditions, has a dark-blue egg. The colouring of the egg appears to be one of those inscrutable ordinances of the Creator, for which man can give no reason, as it appears to serve no purpose but that of endangering the life of the enclosed chick, by attracting the attacks of its enemies: which is utterly opposed to the doctrine of evolutionists, who hold that no variation in colouring or form can exist unless it in some way benefits the future chances of the possessor's survival or multiplication. This it certainly does not do whilst the chick is in the shell; and as at its birth it casts away the shell, the colouring can exercise no influence on its after-life.

CHAPTER XVII.

NATURAL HATCHING.

Some people are prejudiced against artificial hatching, and prefer letting the birds sit. If it is intended to take the chicks away as soon as hatched, it is then an immense waste of time and condition of the parent birds to allow them to sit; and by the incubator a much larger percentage of chicks can be obtained, of equal if not superior robustness. But with the incubator experience is required; some have not a room adapted for the machine; some cannot afford to purchase a thoroughly good machine, and unless this is done they are better without one, so that natural hatching is still largely practised, though it was fast going out of date till the yellow liver disease appeared, when some farmers were driven into letting their birds sit, so that the parent birds might rear them for the first month or so, as the only way of getting over this delicate time.

Whilst some pairs will bring out nearly every egg, nest after nest, others again never bring out more than a small percentage. This is generally caused by one of



HEN BIRD SITTING.

(From a Photograph taken at Heatherton Towers.)

the parents beginning to sit before the other, when it is only the last laid eggs that are not addled. In these cases, the less the birds are visited or noticed in any way the better, as also in the frequent cases (especially with young pairs) where the cock will not sit at all; this latter is, I believe, almost invariably caused by the birds being artificially fed, and the camps being near the homestead or road, or where the cock gets teased, and consequently too excited to sit.

The other great cause of failure is the nests getting full of water in wet weather. When this happens the eggs never come out well; but this with proper care should never happen. As soon as two or three eggs are laid, a round hole, two yards wide and eighteen inches deep, should be dug close to the nest, the excavated ground being thrown up in a heap, and the hole filled in level with coarse sand or gravel. A few days afterwards the eggs should be moved on to it; then all fear of rain is over. The waiting a few days before moving the eggs is to avoid the risk of the hen taking fright. Making the hole so broad is to prevent the birds throwing up dirt amongst the sand with their bills, as they invariably will do if the sand does not extend beyond their reach as they sit.

Birds vary much in their habits in sitting; some

pairs sit so closely that the eggs are constantly hot from the first to the last day, whilst others will be constantly off for an hour or more at a time, and yet bring out nearly every egg.

Some birds get very impatient, especially if there are many days between the hatching of the first and the last chick, and are apt to leave the nest before all are hatched, but the less they are visited the less likely they are to do this. But if they do abandon the nest, and the forsaken eggs appear quite cold, do not despair, because if these are put in an incubator, or even wrapped in blankets and put in a warm place, they will most likely recover.

Some pairs will let a good many chicks die in the shell from want of assisting them, whilst a good pair will break with their breast-bone all that they evidently know by instinct are fast in the shell, repeating the operation till they liberate the chick; and sometimes they will even take the chick by the head and shake it clean out of the shell.

When it is intended to let the birds rear the chicks —and, mind, we say that unless this is intended it is a great mistake to let the birds sit at all—poison should be freely laid about for some time before the brood is expected to hatch, otherwise some will be sure to be taken by cats or jackals. And after the brood has left

the nest, a boy should go about with them all day, otherwise they will get very wild; and although when taken away from the old birds this wildness may appear to leave them, it has not really done so: it will show out again as they get older.

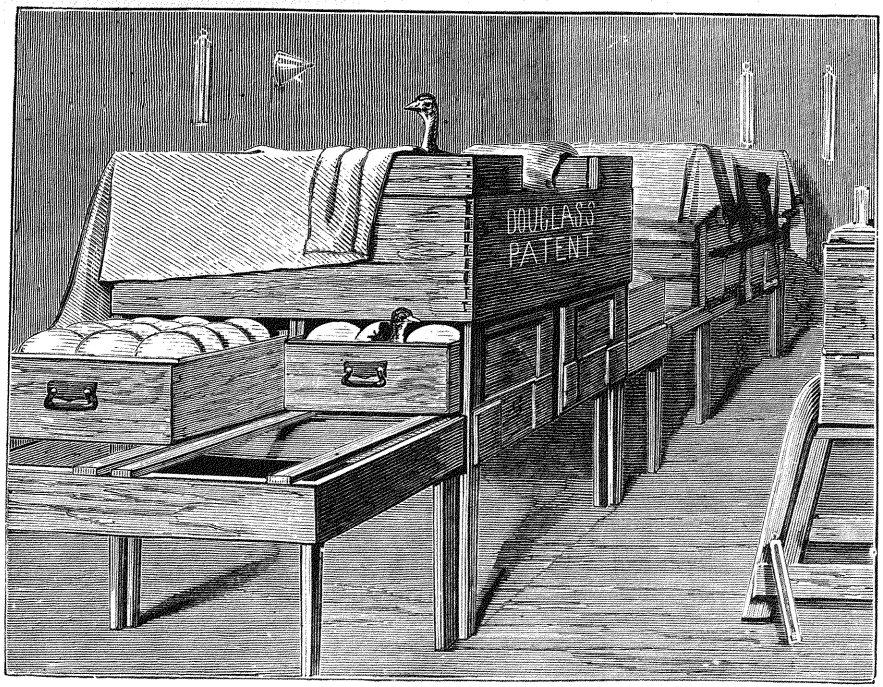
In most broods, if examined, some will be found to have a hard lump hanging to the navel. This is part of the yolk-sac that has not been taken in when the chick hatched, or was helped out by the parent bird, and the navel has contracted and left it out. In artificial hatching we always push it in, but in nature it dries up, and the chick is deprived of so much of the yolk. It will be noticed that these chicks when left to nature do not thrive at first as well as the others.

Some farmers build little huts or weather-screens over the nests, but they do not answer well, whilst the sand nests are perfect in themselves.

Many breeders consider it detrimental to take the feathers of breeding birds. As far as their inclination for breeding goes this is quite a mistake, though the feathers may help them to cover their eggs, and they are certainly beneficial to them in rearing their young. But in artificial hatching and rearing, leaving the feathers on the birds is simply a dead loss.

Beginners want cautioning, that, no matter how tame the parent birds may be, directly they hear the chicks

squeak in the shell their whole nature changes, becoming intensely savage, the hen being worse than the cock; they will then charge with such force that unless a man has a thoroughly good bush he might easily be killed; but if he has a really good bush with him, after a few charges the bird finds it is mastered, and tames down.



HEATHERTON INCUBATING ROOM.

(From a *Photograph.*)

CHAPTER XVIII.

ARTIFICIAL HATCHING.

A LITTLE consideration of what was known of Artificial Hatching, previous to our applying the art to the multiplication of Ostriches, will prove, I believe, both interesting and instructive to the farmer.

In nature we have only one kind of bird that does not sit on its eggs, using instead artificial heat: this is the "Megapadius tumulus," the jungle-fowl of Australia. This bird is described as making immense heaps of vegetable matter, said in some cases to be fifteen feet in height by fifty in circumference, and to be used by several pairs of birds jointly, for several years in succession. The eggs are laid singly at a depth of several feet in the heap, and the holes filled in, the requisite heat being generated by the decay of the vegetable matter, as they are observed to be made where the foliage is thick and the rays of the sun cannot penetrate. In the back parts of Western Australia, on the sandy plains, where probably the necessary amount of vegetable matter and deep shade are hard to procure, the birds lay their eggs inside great heaps of sand

exposed to the rays of the sun, a coating of vegetable matter being placed round the egg only, and this probably acts as a non-conductor to save the eggs from the excessive heat of the sand by day, whilst retaining enough at night.

The artificial hatching of fowls' eggs is supposed to have been practised in Egypt for many centuries. Most books on this country profess to give us descriptions of how it is done, though some say the art is known only to one small section of the people, and is handed down by them as a close secret; which, taken in conjunction with a letter from Colonel Gordon, the then Pacha of Soudan, asking us about two years ago for particulars of our incubator, and how to work one, as he was anxious to introduce Ostrich-farming there—eggs from the wild birds being easily procurable—makes us think all published statements about it should be taken with caution. The following is Lane's description, as given in his "Modern Egyptians":—

"The Egyptians have long been famous for the art of hatching fowls' eggs by artificial heat. This practice, though obscurely described by ancient authors, appears to have been common in Egypt in very remote times. The building in which the process is performed is called, in Lower Egypt, 'Maamal el-firákh,' and in Upper Egypt 'Maamal el-farraag.' In the former division of the country there are more than a hundred such establishments, and in the latter more than half that

number. Most of the superintendents, if not all, are Copts. The proprietors pay a tax to the Government. The maamal is constructed of burnt or sun dried bricks, and consists of two parallel rows of small ovens and cells for fire, divided by a narrow, vaulted passage; each oven being about nine or ten feet long, eight feet wide, and five or six feet high, and having above it a vaulted fire-cell of the same size or rather less in height. Each oven communicates with the passage by an aperture large enough for a man to enter, and with its fire-cell by a similar aperture. The fire-cells also, of the same row, communicate with each other, and each has an aperture in its vault (for the escape of the smoke), which is opened only occasionally. The passage, too, has several such apertures in its vaulted roof. The eggs are placed upon mats or straw, and one tier above another, usually to the number of three tiers in the ovens; and burning 'yelleh' (a fuel composed of the dung of animals, mixed with chopped straw, and made into the form of round, flat cakes) is placed upon the floors of the fire-cells above. The entrance of the maamal is well closed. Before it are two or three small chambers, for the attendant and the fuel, and the chicks when newly hatched. The operation is performed only during two or three months in the year—in the spring—earliest in the most southern parts of the country. Each maamal in general contains from twelve to twenty-four ovens, and receives about a hundred and fifty thousand eggs during the annual period of its continuing open, one-quarter or a third of which number generally fail. The peasants of the neighbourhood supply the eggs; the attendant of the maamal examines them, and afterwards usually gives one chicken for every two eggs that he has received. In general only half the number of ovens are used for the first ten days, and fires are lighted only in the fire-cells above these. On the eleventh day these fires are put out and others are lighted in the other fire-cells, and fresh eggs

placed in the ovens below these last. On the following day some of the eggs in the former ovens are removed and placed on the floor of the fire-cells above, where the fires have been extinguished. The general heat maintained during the process is from 100° to 103° of Fahrenheit's thermometer. The manager, having been accustomed to this art from his youth, knows from his long experience the exact temperature that is required for the success of the operation, without having any instrument, like our thermometer, to guide him. On the twentieth day some of the eggs first put in are hatched; but most on the twenty-first day—that is, after the same period as is required in the case of natural incubation. The weaker of the chickens are placed in the passage: the rest in the innermost of the interior apartments, where they remain a day or two before they are given to the persons to whom they are due. When the eggs first placed are hatched, and the second supply half hatched, the ovens in which the former were placed, and which are now vacant, receive the third supply; and in like manner, when the second supply is hatched, a fourth is introduced in their place."

The descriptions by other writers on Egypt agree in the main with this; one point in which they differ, and that one on which if Lane was correct would have puzzled us much, is where he says the eggs are placed tier upon tier to the height of three tiers; now if this was the case the lower and middle tier would have a superincumbent mass of cold matter on the top of the egg, where the vital germ is, and which our experience would tell us would be fatal. But other writers say the eggs are placed simply in the ovens on some non-conducting substance; this is as we should have supposed, for the

bottoms of the eggs are thus kept cool, whilst the heat is given from above to the top of the eggs—two things, as our experience shows us, of the very first importance. The other processes, viz., that of the heat from the slow fire for the first ten days and then the reduced heat, and then the eggs moved to the upper chambers, where the heat would be given equally all over, agree also with our experience. We believe imitations of these ovens have been tried in other countries and failed; probably from the greater variableness of the climate, which we are assured is in Egypt during the incubating season very steady, it never raining, and the days and nights being of nearly the same temperature. Whether their process is sufficiently accurate for them to succeed in hatching Ostrich eggs is very doubtful.

The Chinese are said to have hatched their ducks artificially from time immemorial. The process is very different to that of the Egyptians, and is described by the Rev. J. D. Gray, in his work on "China," as follows, though it is exceedingly doubtful if any European has had the chance of thoroughly investigating it :—

"Throughout the empire there are institutions called Pao-ap-chang, in which ducks' eggs are artificially hatched in large quantities. The process of incubation as practised in such establishments is as follows:—A large quantity of rice husks, or chaff, is placed above grates filled with hot charcoal embers When heated the chaff is placed in baskets, and the eggs are laid

in it. The baskets with their contents are then taken into a dark room and placed on shelves of lattice-work, which are arrayed in tiers on the walls. Underneath the lowest of these shelves several portable earthenware grates are placed, containing hot charcoal embers. In this dark and heated chamber the eggs are kept for a period of twenty-four hours. They are then removed to an adjoining room, where they are deposited in rattan baskets, which are three feet high, the sides being two inches thick, and lined with coarse brown paper. Here they are allowed to remain for ten days. In order that they may be equally treated, it is usual to alter their position once during the day, and once during the night. If the servants are careful, the eggs which in the day are in the upper part of the basket, will be in the lower part during the night. After fourteen days they are removed, and arranged on long and very wide shelves. Here they are covered up for warmth with broad sheets of thick paper, made apparently of cotton. After they have occupied these shelves for fourteen days, hundreds of ducks burst into life. The principal establishments of this kind in the vicinity of Canton are at Fa-tee and Pou-tai-Shuee."

In Europe, the first to attempt artificial hatching was Réaumur, the inventor of the thermometer. His first attempts were with decomposing dung, something after the style of gardeners' forcing-frames; with this he succeeded in hatching a few. His next attempts were with ovens, in which he was partially successful, and in 1749 he published a book called "Art de faire Eclaire," but he failed to make it so sure of hatching as to be of any value, and little more was heard of it till 1840, when Mr. Cantilo invented the Hydro-

incubator, so called from water being the medium by which an even temperature was secured. From that time to the present various spurts have been made to make it commercially a success, but these have only partially succeeded, as in England it is used mainly for hatching the eggs of game that are disturbed in the hay-fields, and as a fancy amusement. In America great efforts have been made in the same direction, but with results similar to those in England. Mr. Halsted, who seems to be recognised as the great authority there, being the inventor of their great prize-taking machine, winds up an exhaustive paper, written in 1870, with the advice, that, owing to the difficulties and ready susceptibility of the eggs to be injured by any imperfection in the hatching, it is best to let the hens sit on them for the first three days. But this is admitting that the incubators are far from perfect, as they cannot be considered a success as long as it is necessary to do this.

It was left for Ostrich-farmers, who could easily observe the habits of the parent birds, to define the amount and kind of help that the parents give to the chick when it is unable to escape unaided from the shell, and to ourselves to discover the means of telling when that time had arrived; and the great profits, that we clearly saw would accrue from the successful hatching

of Ostrich eggs, gave the necessary stimulus to bring the machines to perfection. We will now treat of the first introduction of the art into Africa.

Thirteen years ago the very name "incubator" was scarcely known at the Cape; and when I imported a machine to experiment with Ostrich eggs, those that heard of it looked upon it as a mad idea. Of course I did not succeed at first; many things had to be found out: notably, the necessity of reducing the temperature towards the end of the incubation, and how to tell when the chicks were ready to come out, so as to save those that were glued fast and could not break out; and how to manage the temperature with such large bodies, and to provide for the long period of six weeks' incubation, and other niceties, which all seem very simple now they have become generally known, but which entailed many weary days of study and watching the habits of the birds to find out.

Now, as is natural, other inventors are in the field, and many kinds of incubators are made and sold in all the large colonial towns, some good, some decidedly indifferent, but all pretty well successful if the eggs are left under the old birds for a fortnight or more, and then put in the machines. But this, of course, loses half the advantage of artificial hatching; 1st, in that it is during the first few days that the birds

generally spoil their eggs, as we have shown in the last chapter; 2nd, in that the great pull of artificial hatching is in making the birds lay double or treble the number of eggs they otherwise would. Twelve to sixteen is a full laying, if the eggs are left, but if they are taken away as fast as laid, and only a couple of dummies left in the nest, they will lay thirty or more without stopping. No eggs are lost, and the birds do not go out of condition, as they do if they sit a few days. But it is in starting the eggs the first few days that many of the incubators fail, and in which my trebly patented machine is universally acknowledged to beat all competitors that have sprung up.

The great mistake which is made by most who have assayed to bring out a machine, is not recognising the first great provision of nature, that of the germ being so suspended to the two ends of the egg, that no matter how the egg is turned, the germ rises to the top. To prove this, take a number of eggs and break them over a dish, and in every case the vital spot will be observed on the top of the yolk. It is one of those wonderful provisions of nature that meet us at every turn, if we could only observe them. The object is that the vital spot should be brought into contact with the heated body of the old bird, the heat being given to this part of the egg only, the under side remaining quite cold till

a late period of the incubation, when the blood-vessels have extended right round, and the heat is circulated. It is thus nature provides, whilst giving the necessary heat to the germ, to avoid almost entirely any evaporation from the egg.

Now, many machines are made regardless of this, giving the heat all over the egg, and setting up a large evaporation. This they attempt to remedy by giving moisture by sprinkling the eggs, or inserting drawers of wet earth, or moist sponges, under or amongst the eggs. But this is contrary to nature, and causes the embryo chick to breathe an unnatural atmosphere, to the detriment of its future life.

But the best proof of the comparative perfection to which artificial hatching has now being brought at the Cape, is the numerous testimonials sent me, of from 80 to over 90 per cent. of hardy chicks being hatched from large numbers of eggs, taken when fresh laid and incubated. The incubators are so constructed that the eggs can be put in daily as laid.

In natural hatching, the birds should be in pairs, otherwise the hens are apt to fight over the eggs and cause loss, but with artificial hatching two hens to a cock are best.

As an example of what can be done by artificial hatching: one set of three birds, a cock and two hens,

during the period from 30th June, 1872, to 30th June, 1873, laid 188 eggs, which produced 133 chicks; of these 18 died, leaving 115 young birds. Of these, 74 were sold at three months old for £16 each, and allowing the remaining 41 to be worth only £12 each, we have a return of £1,676 from one set of birds. The next year the same set laid 113 eggs, producing 77 chicks, and the first six months of the third year they laid 97 eggs, producing 81 chicks, being over 80 per cent. After this the cock was killed by a rascal for his feathers. This was before my incubators were brought to anything like their present perfection. But the same price would not be obtained for chicks now, neither in the last few years would so few of the chicks be lost in the rearing.

Even if a farmer does not intend to incubate as a regular thing, he should have a machine and know how to work it; or else the first time a bird refuses to sit, or comes to grief in the middle of it, he will lose heavily.

A notion was started some time ago, by the introducers of some machines, which worked with hot water instead of lamps, that the smell of paraffin was injurious, both to the eggs and chicks: but this is utter rubbish; if anything, the smell is good for them, acting as a disinfectant, some of the most successful men we know

having two or more machines working with lamps in a tiny room.

The proportion of eggs that are not fertile is much smaller than is generally supposed; as a rule, when the birds pair and lay in a nest, they may be taken to be all fertile; but hens, especially young ones, will often lay a number of eggs about the veldt before any cock has paired them.

Even with the most perfect incubator and with every attention, occasionally a batch of eggs will come out badly, the chicks being gluey and often deformed; many people fancy that the thunder affects them, but this we do not believe—we believe that the fault is in the eggs themselves, which if left to nature would have failed to incubate at all, or have died in the early stages; but with the more perfect provision of heat in the incubator they are brought to maturity.

COOLIE FEEDING CHICKS.

(From a Photograph taken at Heatherton Towers).

CHAPTER XIX.

REARING THE CHICKS.

For the first few years little difficulty was experienced in rearing the chicks; the principal art consisted in giving them plenty to eat. Our instructions supplied with the incubators used to be:—

"Send them out with a boy the second day after hatching, if the weather is fine, and put them where they are sheltered from the wind and there is a good supply of gravel. The third day they will pick up gravel, and when they have filled the gizzard on the fourth day, they will eat any soft green food, with which they should be supplied as much as they will eat, lucerne cut up fine being the best. They should have water once a day, but it must not be brack. Return them to the incubator at night till a month old, or if there are too many for the machine, after a few days they can be put in boxes, lying on sacks or straw, and the boxes covered over, leaving a small air-hole. If too hot they will stand up with their mouths open and wings out. They should be freely supplied with crushed bones. The third and fourth day they will eat the dung of any

larger birds if they can get it; if this is not to be had, fresh cow-dung will do as well. For the first four days the chick lives on the yolk that it has taken into the stomach. In wet weather they must be kept in a warm, light room. When two months old they can be put in a shed at night, provided it does not face the cold winds, and at three months old can be left out altogether, except in very bad weather. The great secret is keeping them supplied with as much green food as they will eat."

Such were the instructions we always supplied, and acting up to which we used to rear nearly all the chicks, ten to twenty per cent. being the extent of our losses, including accidents. But a few years ago the chicks in the up-country districts began to die in spite of every care, every chick on a farm being often swept off. The first we heard of their dying was on a farm in the Middleburg district about six years ago; we then heard no more of it till it appeared in the Colesberg district about two years afterwards, where it became prevalent all over the district, the Cradock district soon following; and last year it appeared in Albany, and as far as we know all over the colony, here and there missing a farm for one or two seasons, but sooner or later breaking out everywhere.

The disease has got the name of "YELLOW LIVER,"

from the post-mortem revealing a bright yellow liver if death ensues before they are three weeks old, and of a nutmeg colour with yellow spots when older. But a more descriptive name is "fever."

The greatest mortality occurs when the chicks are about a month old, but this season we have known farms where it has been very fatal at the age of two and three months. From rumours in the last two months, we suspect the same thing is occurring in birds up to nine months old, but we have not had opportunities of holding post-mortems to decide if the cause was this or the worm "Strongylus Douglassii."

The symptoms are:—The birds are brisk and show every appearance of health, till some morning they are observed to crimp their necks, to appear languid, and to constantly make a short little plaintive grunt. The following days some are observed to drop behind, and to be rapidly losing their condition; the belly loses its healthy greenish-yellow tint, becomes pendulant and of a deep blue colour; a white circle is observed round the eyelids; the legs grow a pinkish skin colour and thin; the birds sweat underneath at night, appear to feel the slightest cold, lie down much when out of doors, and huddle in the corners when indoors; easily fall when running about, and rise again slowly; give forth a peculiar aromatic smell from their feathers, which have a sticky

feel and a dark, dirty look; generally, but not always, intense and obstinate constipation sets in. The first signs of an outbreak are often some of the larger chicks apparently protruding the anus; this Mr. Hutchins, the Colonial Veterinary Surgeon, assured me was nothing but piles, but these were quite unknown to us till this fever made its appearance. The temperature of the chick at first is the normal temperature of the Ostrich, viz., 103° to 104° Fahrenheit, but it gradually falls, till at about 95° death ensues. These are the symptoms which will never be mistaken by a farmer who has once had a taste of this fatal fever amongst his chicks. Some birds die off sharp, especially if the weather is moist and muggy, with the wind from the southward; others linger on for a long time, and a few recover and grow out fine chicks; whilst others, although they grow up, always appear delicate.

The post-mortem appearances are the colour of the liver; or, where this is not so bad, small yellow abscesses will be found on the edges of the lobes. Not an atom of fat is to be observed in the body. Dropsy of the abdominal cavity is generally highly developed; the coats of the stomach peel off with the least touch. The entrails are flabby and watery. The folds of the maniply are swollen and the cœca distended, and in these stones will be found that have escaped from the gizzard, which

in health never happens. The lungs generally, but not always, show congestion. The heart is flabby and dropsical, and small ulcers will often be found on the tongue and entrance to the throat. The outside coating to the gizzard has several inflamed spots, and inside the gizzard one or more punctured and discoloured spots will be noticed; this should be borne in mind, as it is as yet an unexplained phenomenon, and may point to parasites. Such are the post-mortem appearances, clearly proving that it is no sudden disease of any one organ, but a rapid and complete break-down of the whole system.

What is the cause?

Here we must at once state that we cannot as yet write with any certainty. At first, lots of men, whose experience, probably, did not go beyond one brood, were ready enough to repeat the old story of teaching their grandmothers to suck eggs, and with the dogmatism that is the sure sign of ignorance would tell us straight off what was the cause. Some declared the chicks were kept too warm at night; others, that they were too cold; or that they ate too much, or not enough, or, *ad infinitum* of any nonsense, all forgetting that it was not likely that those who had been successfully rearing chicks for twelve years would suddenly forget all they had learnt. Others, again, laid it straight off on the

parent birds, that they were inbred; whereas, by a little trouble they could have found out that the chicks of old pairs that had always been healthy and reared without difficulty were now as hard to rear as any, and that the chicks of birds where the different sexes were from different parts of the colony were as bad as any others. Some again, laid it down as a fact that artificial hatching had been at the bottom of it; whereas they could have known that the first outbreak occurred with men who had never used an incubator, and whose original stock were wild birds. Besides, I have been assured that our inland farmers find the chicks captured in the veldt from wild birds as hard to rear as the tame ones. But this latter requires confirming before much importance can be attached to the statement; if it is true, it tells against the only theory to which I have attached much importance, namely, that the mischief has been brought about by over-feeding the parent birds, especially on grain.

It was soon discovered that the birds were mere machines in one sense—that, given unlimited food of a stimulating nature, there was hardly any limit to the number of eggs they would lay; but it has been observed by others, and our own experience somewhat confirms it, that the eggs under these circumstances are not so large. We do not believe that a few months'

high feeding makes any perceptible difference to the future progeny, but we do think it highly probable that the continued high feeding has gradually affected the stamina of nearly all our domesticated Ostriches, causing the progeny to be weakly and easily affected by change of weather or other unfavourable circumstances. That it is so with other domesticated animals we know. Look what puny little pups a very fat bitch has, or how weakly is the progeny of a very fat sow, mare, or cow, especially if they get very little exercise! And even with the human race, is it not notorious that the children of the upper classes, living in the lap of luxury, feeding on highly stimulating food, and taking no exercise, are born more puny and more weakly than the children of the labourer, who get food enough but not of too stimulating a kind, and sufficient but not excessive work?

If this is so, then it is for us to be contented with fewer nests, where the birds are left to sit, letting them gradually recover their condition after the eggs are hatched, and we must not, as is now almost universally the custom, force them rapidly forward again by unlimited food. Or, far better still, incubate every egg, and never let the birds get into that exhausted condition they do after sitting out; and thus, whilst getting the advantage of a large number of eggs, the necessity for stimulating food is avoided.

Incubating every egg was my constant practice for many years, when I never knew what it was to have any trouble in rearing. The birds were never fed and were never allowed to sit for a day. In the extraordinary increase, particulars of which I have given in the chapter on Artificial Hatching, the birds scarcely ever saw a mealie or any sort of artificial food. They had a good camp, and fed themselves entirely.

A remarkable and apparently proved fact, and one which bears strongly in favour of this theory, is that, of the chicks that die of fever, an immense preponderance are cocks.

But what is to be done when an outbreak of fever comes? will be the question on every one's lips who has had a taste of it. First, we may state that all physicking has as yet availed nothing; it has only aggravated the disease. By changing the food, and by giving them aloe and prickly pear leaves cut up fine, onion or shallot tops, every effort should be made to keep the bowels open, whilst we should avoid lowering the system either by physicking or by giving them, as some do, Epsom salts in their water to drink. Redouble the care in not letting them get wet or cold, and keep them warm at night. Do not give them boiled wheat, wet bran, or any sort of cooked food, but give them dry wheat or Kaffir corn!! Above all, see that neither the

room they sleep in, nor the one they are in on wet days, has any draught in it, and is free from damp; and, if possible, get a room with a large loft above it; the chill that strikes through a level iron roof towards day-break is very fatal to them!! See that no cold wind blows on them through the doorway of the room!! Keep them out of the hot sun!! See that their food is cut up very small, and that it is not of a young, succulent growth; if lucerne, it should be in blossom!! A change on to another farm has undoubtedly proved beneficial in some cases, whilst it has failed in others. We do not think the good is in the change of air; the benefit is, that if there is any aggravating cause, such as dampness or bad housing where they are, when changed to another farm this is avoided. It is generally supposed that the system wants supporting; and such things as giving them meat and milk, or tonics in the shape of sulphate of iron in their water, peppercorns, chilies, small doses of spirits and other things, have had their advocates, who have often been loud in their cry of having found an infallible remedy; but none of these things have stood the test of prolonged experience. As is the case when any sickness becomes prevalent, and a farmer has a lot of sick animals: he gives them something, or changes their diet, and they recover. He at once rushes to the conclusion that what he did was the

cause of their recovery, when in reality it was a change in the weather, or the natural vitality of the animals, that effected the cure. The good old proverb, "One swallow does not make a summer," should be borne in mind by all farmers. Whilst we would be the last to have farmers reticent in speaking of and publishing any cure or preventative they believe would be effective or beneficial, they should avoid the mistake prevalent all the world over of proclaiming as a proved fact that of which the data they go upon is insufficient to constitute proof.

As soon as the chicks are about two months old, put them on a field of old lucerne, if possible, and let them pick entirely for themselves, putting them in a shed at night. The sooner they are left to run day and night the better: if kraaled they will persist in eating the dry dung; besides, their feathers get dirty, and they never thrive so well as birds that are allowed to run at night. Spec boom is an excellent thing to feed them on in dry times.

Since fever has become so prevalent, some farmers have taken to letting the old birds rear the chicks for the first month or two. By this means more are lost by accidents, and of course a great waste of the parent birds' time is entailed; but as yet, in the upper districts, this has succeeded excellently, though we are

informed it has not done so in the long grass on the coast. What is the secret of the old birds' success is not very apparent, with the exception of the immense amount of exercise they give them, as they keep them on the trot from daylight till dark, and expose them to the wet dews and cold in a way that would be fatal in hand-rearing. When the chicks are a few days old, a pair of birds will brood and nurse thirty, but these should be as nearly as possible of one age. There is a little difficulty when the old birds are sent back to their camp, as the young birds fret. An excellent plan is to put any old tame, lame, or other large bird with them. They will quickly take to it in the place of the parent bird, but it will not brood them, so care must be taken to house them in bad weather, and great care is required to keep them tame.

Some people have an idea that the mischief is caused by a louse, with a blue body and red legs, which fastens itself on the body of the chick, and in its ears, and that even one or two of these are sufficient to set up blood-poisoning. Now, we know that one little red tick on a good-sized lamb can cause paralysis, and eventually death if not removed, whilst its removal will cause the lamb to recover in a few hours; so that we must not be too ready to condemn this theory, strange as it appears. It is said that this louse will always be

found in buildings where poultry have been, even for years afterwards, and that it is easily carried and spread into all the buildings on a farm. This louse is exceedingly prevalent on birds that sleep in dirty ill-kept buildings. And without going further than saying that it is detrimental to the health of the chick, it should be sufficient to impress upon farmers the necessity of constantly cleansing, whitewashing and disinfecting all buildings used for chicks.

The chicks should also always have access to a good dusting-ground made of dry ashes, with a little "flowers of sulphur" mixed with it; and if the chickens are found to be lousy, some carbolic powder should be sprinkled over them.

CHAPTER XX.

DISEASES.

In writing of diseases in Ostriches I must not be understood to lay claim to any special knowledge of the science of medicine; but in the absence of any scientific work on the subject I feel it a duty to give the results of an experience as large as anybody's, coupled with a habit of devoting some portion of my time to study, and of making post-mortem examinations on all animals that die on my own farms or on others where I can get the chance, and to place the conclusions arrived at in plain language and in a practical manner before my readers.

Would that our legislature could become sufficiently enlightened to see that it is little use to spend money on agricultural shows, and to encourage men to spend large sums on importing thorough-bred stock, whilst diseases are left rampant in the country, some of them being peculiar to South Africa; and whilst no serious effort is made to give our farmers the invaluable benefits that would accrue from the government employing at least two veterinary surgeons under the leadership of one of the great men of the day in the profession. We have

now one man, but be his abilities ever so great, how little can he accomplish of what is needed in a vast country such as this. At least two are wanted, one in the east and one in the west, to study and advise on our great new industry of Ostrich-farming—unless we would see what are possibly preventable diseases assume such proportions and acquire such strength that it will be too late for science to help us much. At least one botanist and one chemical assayist are also urgently required, to advise in what parts the various alkalies are deficient in the herbage and soil, without which alkalies it is pretty well proved the Ostrich cannot continue in health.

But above all a minister of agriculture is urgently required, who would receive all reports from the government scientists, and from farmers who notice anything peculiar, but who now, from want of some recognised person with whom to communicate, never give the public the benefit of their observations; and who would see that all information bearing on agriculture and stock was brought out in such a way as to reach the farmers. It seems incredible that in a great country like this, almost entirely dependent on farming pursuits, they should be left almost uncared for by the government. The time is fast passing when many of our farmers, wrapt in the egotism and prejudice that is begotten of ignorance, believed that scientific men could not teach

them anything about how to farm. The introduction and rapid development of new industries, and the partial failure of old ones, has taught them the great facts: that a man cannot go on in the same groove as his father; that with each successive generation we must advance to something higher and more complex, unless we are prepared, both as individuals and as a nation, to sink in the great struggle of the world.

The known diseases of Ostriches can be conveniently divided into simple and complex: the simple being those where the cause and effect are easily perceived and directly connected, such as the eating a poisonous plant, or stop sickness from hard and indigestible food; the swallowing of some sharp implement, or abscess of some organ, resulting from a wound; hoven or keil-sickness, resulting from eating a great quantity of very young grass; overgorging with some tempting food to such an extent that the action of the stomach is stopped; inflammation of the lungs from a cold; diseases of the eye caused by a blow, &c. The complex are those where the cause is obscure, and where so many of the vital organs are affected as to make it very doubtful as to which was the original seat of the disease—as in "yellow liver" in chicks, of which we have already treated; or the effects of parasites, either external or internal, where they act, not as does the

"tape-worm," by directly consuming the bird's food and simply depriving it of nourishment, but where they act by destroying, or greatly injuring, some vital organ, and thus causing a general break-down of the system, as with the "Strongylus Douglassii;" disease of the kidneys, where the cause may be either a parasite in them, the effect of a cold, of bad food, or other causes; a disease of the lungs said to closely resemble the "lung disease" (pleuro-pneumonia), of cattle, and reported to have been prevalent in the Graaf Reinet district last year, but of which we have never seen a case.

All diseases were formerly divided into two classes: namely, those that were either infectious or contagious, and those that were neither infectious nor contagious; the infectious being those that were spread by inhaling the breath or the gases given off from the skin or stool of a diseased animal, the contagious being those that were spread by the contact of some absorbent gland, such as the tongue, lips, or generating organs with a diseased animal, or with the mucus which has come from a diseased animal; the others being all those that were not transferable from one animal to another. But of late years it has been noticed that these terms would not embrace all diseases, and the name "communicative" has been applied to all those which, whilst neither infectious or contagious, were capable of spreading from one animal

to another. As yet no disease has been observed in the Ostrich which can be pronounced either infectious or contagious, but they are highly susceptible to those which are communicative, such as internal parasites.

The digestion of the Ostrich is proverbial: pieces of iron, or even, as we have known, a small table-knife, a gimlet, and a lot of nails and pieces of wood, are readily dissolved in the bird's stomach; and yet no animal or bird has proved itself so terribly susceptible to the attacks ot internal worms, finding their habitat in the stomach and intestines, as the Ostrich. To the two principal worms to which the Ostrich is subject, namely, the "tape-worm" and "Strongylus Douglassii," we have devoted separate chapters. A short time ago we were asked to go to two adjoining farms, in the grass veldt, and see two troops of birds, about a year old, that had another new worm. The birds were in good condition, and none had died, so that the nature of the worm could not be told, but hundreds of what appeared to be ova of a new tape-worm were passing out in the stools. These were full of life, and moved like caterpillars. After a few hours they turned red. The disease has only just made its appearance, so that whether it would prove very serious or not remains to be seen. Anyhow, if any one observes it, he should take it in hand with vermi-

fuges at once, and by isolating the birds from his others, whilst feeding them up well, try and stop its spreading. With these things a stitch in time is worth doubly nine.

The other principal worm inhabiting the Ostrich is a white one, from one to two inches long, located in the cœca, and found, we believe, in nearly every Ostrich. As science has yet to decide what part the cœca play in the economy of animal nature, it is impossible to say to what extent they exercise an injurious effect on the bird. It apparently belongs to the tribe "Lumbricoides," and is found swimming about in the liquid contained in that part. When the bird is in a low condition they become very numerous. We have known large and repeated doses of santonine given daily for a week, and the birds have improved; but how far this was due to the birds being kept up at the homestead, and consequently better fed, we cannot say.

In one instance we found two very long worms threaded under the outside skin of the gizzard, apparently "guinea" worms; but as this was some years ago, and we have not since come upon it, it does not appear that it spreads.

Birds are subject to lice in their feathers, especially when in low condition or out of health; no doubt dressings of flowers of sulphur or carbolic powder

would be effective, but we have not had occasion as yet to trouble about it.

Stop sickness or constipation may be either a secondary effect of worms, or a direct effect of hard, indigestible food, fever, or deranged liver. In the former case the treatment must be aimed at the worms, in the latter there is nothing as an aperient to beat one pound of Epsom salts, with one-and-a-half ounces of turpentine, mixed with hot water and given warm to a full-grown bird, the dose being correspondingly reduced for younger ones. At the same time, in a full-grown bird, the hand may be inserted up the rectum, and the hard lump of excrement—that can often be felt—removed; whilst at the same time, and in cases where this cannot be done, an injection of some gallons of warm water and soap can be given. A simple and effective enema, consisting of a large syringe, can be bought at the chemists' in Port Elizabeth or Cape Town. There is a little difficulty in inserting it, owing to the situation of the bladder, and as long as no force is used, and the point of the syringe is kept pointing in an upward direction, no harm will be done. Croton oil, up to 30 drops for a full-grown bird, is often given, but the effect is generally uncertain, and when it acts it does so too violently. In all cases the medicine should be followed by a feed of aloe or prickly pear

leaves, and the bird for some time after fed on soft green food.

Sometimes a whole lot of birds when herded will be taken violently ill from eating some poisonous plant. They will be observed stretching their necks, falling about, lying down and getting up again. Heavy losses have occurred through this, principally with middling-sized chicks. They should at once have a dose of some ounces of Epsom salts, according to their size. The Dutch are great believers in a very strong decoction of coffee and chicory, and, I have heard, with very beneficial effect.

Of diseases of the kidneys little is known. That they are subject to being affected is evident, from the bird's urine when it is out of sorts becoming small in quantity and very thick, as though lime had been mixed with it. A dose of an ounce of turpentine will generally put it to rights. A remarkable feature about the urine of ostriches is, that at times, generally in the spring, it becomes quite red. I have never heard any explanation of this, and from it occurring in birds to all appearance in good health, it need not alarm the young farmer, as it probably would do if he was to observe it in his birds without having previously heard of it.

Young birds often get a disease in the muscles of the legs, ascribed by some to rheumatism, but, I believe,

it should be ascribed to the after-effects of eating some poisonous herb. The bird knocks its legs together in walking; and as it grows, and its body gets heavier, the disease gets worse, and the bird eventually loses the power of walking, and dies.

A bird will often be found to be wasting away, to have little appetite, and, if neglected, it will die. A dose of three drachms of sulphate of iron daily, with as much food as the bird can be tempted to eat, will generally work a cure; but the best thing of all we have found are the Ostrich Condition Powders sold by Mr. Wells, chemist, Grahamstown. The Horse Condition Powders prepared by Messrs. Lennon and Co., Port Elizabeth, are also very good: one to be given daily for two or three weeks.

Dropsy of the "abdominal cavity" (the belly), and of the "pericardium" (the sac in which the heart hangs), is common in the Ostrich, but in every case we have examined we have found it to be a secondary symptom, resulting either from worms, constipation, or fever, &c.; and the treatment must be aimed at removing the cause, at the same time stimulating the kidneys.

Above all, the farmer should bear in mind that "Prevention is better than cure;" that the administering of medicine to animals is always more or less

unsatisfactory; that the true road to success is in studying the habits and requirements of his birds, and endeavouring to the utmost of the means he has to supply their every want; and, when he sees them falling off in condition and spirits, to change their pasture or their food.

Many doctors and scientific men do not attach very great importance to the presence of parasites in mammals, but all admit that aves are subject to sweeping epizoötic diseases directly caused by entozoa, and that their presence does not necessarily prove that the bird was previously diseased; and that, contrary to what would have been expected, the herbivorous and graminivorous birds are more subject to outbreaks than the insectivorous or carnivorous birds.

CHAPTER XXI.

TAPE-WORMS.

TAPE-WORMS are now nearly universal in the domesticated Ostrich till it attains its adult age; when, unless under exceptionally unfavourable circumstances, the bird throws off the worm by its own unaided powers.

For some years after their first domestication this was an unknown disease. It seems first to have made its appearance in the extreme northern districts, and the manner in which diseases are so rapidly spread when of a communicative nature was very clearly demonstrated in the way in which this was brought into Albany. On a neighbouring farm to my own, a speculator left some affected birds to rest whilst he went to seek a market for them. The owner of the farm, having never seen the disease, did not notice it till I pointed out to him the joints of the worm that were deposited on the bird's excrement, and which are now so well known to every colonist; but when I urged him to hurry the birds on elsewhere, he thought I was unduly alarmed. However, the birds in a few days were sold and moved on into the Uitenhague district; but a

month or two afterwards the worms appeared in my friend's birds, and from them it rapidly spread to other farms, and became general in the district.

The first outbreak of this disease in each new neighbourhood was attended with very fatal results, carrying off large numbers of birds; but now its virulence has much abated, and, with our acquired knowledge of what are the best vermifuges for this particular tape-worm, the disease is no longer much dreaded. On its first outbreak we knew a man who made a determined attempt to try and stamp it out by every month dosing the whole of his birds: his idea being that if no germs were deposited on the veldt for some considerable time, and with his farms fenced in to prevent a renewal by a fresh communication, he would be rid of it; but after some time it was discovered that the guinea-fowls, pows, corhans, fowls, and many of the small birds throughout the country had contracted the disease, and were spreading it in all directions, which of course made it impossible to stamp it out. It proved very fatal to the guinea-fowl; where there were large flocks of perhaps a hundred strong, they are now reduced to a few only.

The disease generally makes its appearance in chicks about four months old, and continues in them, more or less, till about two years old, when the birds throw it

off as long as the veldt is green and food abundant. Although the worms may be in great numbers in the birds, they suffer little inconvenience from them, but when the veldt gets dry and food scarce, the bird does not get sufficient sustenance to maintain itself in health and feed the worms at the same time. The worms are located in the small intestine, where they get the advantage of consuming all the best of the food as it leaves the gizzard; so that unless there is enough to satisfy the worms and also to satisfy the bird, it at once falls off in condition, and loses that most noticeable greenish-yellow tint of the skin that is so indicative of a bird in flourishing condition. This tint of the skin is caused by a thick layer of fat underlying it. The feathers, too, cease to lie level on the bird, lose their fluffiness, and the skin shrinks; and the time has arrived when the farmer, if he would save himself from loss, must dose his birds.

The family of tape-worms is represented by many species, and of the best-known vermifuges some are better adapted to one kind than another, whilst some kinds can only be effectually dealt with by a combination of two or more. The best-known tape-worm medicines are extract of male fern, turpentine, decoctions of pomegranate-root bark, kausau, pumpkin seeds, areca nut. Formerly steel or tin filings were used;

they acted by piercing the worm, but this mode of treatment is now out of date.

It should be borne in mind that the tape-worm not only feeds itself through its mouth, but that the whole of its body is provided with absorbent glands that suck in food; consequently, the longer the worm the greater amount of nourishment its host is deprived of. This is very important to the Ostrich-farmer; as, although it may be doubtful whether with the vermifuges at present known, and their necessarily more or less imperfect administration by the farmer, he ever succeeds in ridding the birds of the heads of the worms, still if he only rids them of the worms' bodies, leaving the heads fastened on to the mucous lining of the intestines by the two little hooklets with which they are provided, he has done a great deal. These heads will in twenty-seven days again have grown a body of several feet in length, from which the joints will begin to detach themselves and to be voided out in the stools to run their separate course in life. Even if this is all that is accomplished, it is much: it gives the bird a sudden start in vigour—very observable forty-eight hours afterwards—and enables it to shake off the dropsical tendencies that were setting in, and to rapidly lay on condition. From the inveterate tendency the disease has of showing itself again after a month or two, we cannot believe the germs

would be again taken in so quickly in such quantities, especially where the grazing-ground of the birds is changed.

A little insight into how man contracts this disease, and how it is treated in human practice, will help the farmer to an intelligent treatment of his birds. The two common kinds found in man are the "Tœnia Solium," so called from its being found singly in its host, and the "Tœnia Mediacanelleta." The former is contracted from eating diseased pork, commonly called "measly pork;" the latter from diseased beef, or—very rarely—mutton. The pig contracts the disease by swallowing a tape-worm when scavenging, or when fed on offal; the ox, either when grazing or drinking. The worm having thus got into the entrails of its host, burrows out and into the flesh, where it takes an hydatid form and lays its eggs, which are carried by circulation all over the body, remaining the thickest under the shoulder-blade, in the lower jaw, and under the root of the tongue, and forming the familiar appearance known as measly. This flesh is then eaten, some parts of it not having been sufficiently cooked through to destroy the vitality of the eggs; and if swallowed by one whose digestive powers are favourable, the egg hatches, and the worm is developed, some persons being more susceptible to the disease than others.