

the Illinois prairies are the Dickcissel, Lark Sparrow, Western Henslow's Sparrow, Leconte's Sparrow, Nelson's Sparrow, Western Meadowlark, and Yellow-headed Blackbird. Most of these birds are still uncommon as far east as Ohio, but the Western Henslow's Sparrow nests in considerable numbers at some places in Ohio and Pennsylvania and has increased also in New York State. Prairie-Horned Larks have long been common in open places, but until the land was cleared there were none within 300 miles of Toledo. Western Meadowlarks have been observed in larger numbers, 1938-1945, in Michigan, and near Indianapolis and Chicago.

Man has also purposely augmented the food supply of birds. He has left, in fence rows and hedges, weeds and shrubs whose seeds or fruits are relished by the birds. He has planted sunflowers and numerous other herbs, shrubs, vines, and trees to provide food for them. Man has aided the birds in other ways. Shelter of plant growth on the borders of fields, nesting boxes, feeding shelves, and drinking and bathing places have added to their safety and comfort. Putting out food for them has enabled many to survive in bad weather.

Many kinds of birds are safer when living near man. He no longer confines them to cages to hear them sing. In this country, except in lawless communities, he does not shoot song birds for food or because he has no other living creatures to shoot at. This changed attitude toward birds has come about mainly in recent decades. Much credit for it is due the Audubon Societies and other associations for the protection of birds. Probably even more has been done by the schools, many of them aided by natural history museums. They have succeeded in getting the children interested in finding out more about the life of birds and in that way becoming more sympathetic toward them.

Bowling Green
Ohio

BARON VON PERNAU,
PIONEER STUDENT OF BIRD BEHAVIOR

BY ERWIN STRESEMANN

HARDLY anyone interested in the study of bird behavior will have heard of Ferdinand Adam Pernauer, Baron von Perney. His name has never been mentioned in any of the treatises on the history of ornithology, and his writings have remained in almost complete obscurity until quite recently, yet he deserves to be ranked among those who paved the way for the modern methods of inves-

tigating bird life; his originality is comparable only to that of the most eminent promoters of this branch of science—Altum, Heinroth, Eliot Howard, Edmund Selous—not to mention those still active in our midst.

The aim of descriptive biology is to register facts, while a student of behavior, passing beyond the mere descriptive stage, endeavors to find out the causes of behavior, using as his methods comparison or experiment or both together. No wonder, therefore, that behaviorism developed only when scientists, after a century or more of registering facts, no longer wanted to know only what is going on, but also why the actions take this and no other course.

The more astonishing it is that already in the early 18th Century there lived a close observer of bird life who found satisfaction in comparison and, as we would call it nowadays, causal analysis. The study of the biology of birds was, at his time, almost a virgin field. The few books relating to birds were more or less concerned with grouping them according to their external features, like Willoughby's 'Ornithologiae Libri Tres' (1676), or if they entered on the subject of life history, it was still done in a rather superficial way and with scanty personal experience, like Gesner's 'Historia Animalium' (1555).

Pernau had practically all the boundless freedom of the first explorer. What he knew and recorded were the fruits of his own efforts; how to deal with the facts was left completely to his ingenuity since no predecessor had developed a method and, by so doing, curtailed the inventive activity and variety of investigations of his successors. He found himself in a position held later on, in the field of morphological facts, by Linnaeus.

When Pernau, in 1702, started writing about birds, no attempt to classify them according to relationship had yet been published in Germany. This was a subject which fascinated him and, being a close observer of the living animal rather than a cabinet zoologist, he proceeded to group birds on the basis of their behavior. With this method he became the forerunner of a now flourishing school.

Before quoting some of the choicest samples of Pernau's skill as an observer and interpreter, it seems indispensable to give a few biographical and bibliographical details. For a fuller statement, see the writer's articles in *Journal für Ornithologie*, 73: 603–621, 1925, and 74: 688–689, 1926.

The hero of this appreciation, Johann Ferdinand Adam Pernauer, Freiherr von Perney, Herr auf Rosenau, was born November 7, 1660,

at Steinach in Lower Austria. When he was a boy of about ten years, his family, because of its Lutheran faith, had to leave Austria and settled in Franconia. Here Ferdinand Adam, at the age of 16 years, entered the University of Altdorf near Nuremberg, at this time of high reputation, and here he obtained his doctor's degree. There followed the career of young men of wealthy nobility—various positions at court and in government, and travels to distant countries like Italy (1684), France and Holland, all of which helped him to become a man-of-the-world. Gifted as he was, he became highly interested in the literary productions of some of his great French contemporaries, and his translations of Madeleine de Scudéry's and Boileau's selected writings were by far the first to appear on the German book market (1682, 1694). In 1692 he married Maria Elisabeth Hendt von Römingsdorff, and soon afterwards seems to have acquired the manor of Rosenau, near Coburg, where he lived until his death on October 14, 1731, mourned by his widow who survived him by 23 years.

Though continuing to hold high and responsible positions at the court of the Duke of Coburg and Gotha, it was the study of nature, and in particular that of birds, to which he became fully devoted since living the country life at Rosenau. This was, he realized, the best antidote against the depravity of his time, and his ardent desire to help others out of the general breakdown of morals became the principal motive of his writing books on birds. He never entered his name on the title page, refusing, as he put it himself, "to hunt after honors with this printed work." In the 1707 edition of his first book the author presents himself as "A fancier contemplating the creatures made by God beside us human beings."

All his books remained anonymous for more than 200 years, when the present writer succeeded, in 1925, in unravelling the mystery.

In 1702, Pernau's first book on birds was published without the author's consent. It bears the title:

*Unterricht / Was mit dem lieblichen Geschöpf, denen Vögeln / auch ausser dem Fang / Nur durch die Ergründung Deren Eigenschafften / und Zahmmachung / oder anderer Abrichtung / Man sich vor Lust und Zeitvertreib machen könne: gestellt Durch den Hoch- und Wohlgebohrnen Hn. / Herrn v. P. . . . / Freyherrn. Anno 1702. [small 4^{vo}, 94 + 12 pages.]*¹

There followed a second (authorized) edition, considerably augmented, in 1707, published at Coburg by Günther Pfothenauer [8vo, 240 + 62 pages].

¹ Instruction / What pleasure may be derived / from these charming creatures, the birds / besides their capture / also through a thorough study of their habits / as well as their taming and training.

The third edition, containing material additions, appeared at Nuremberg in 1716 (P. C. Monath, publishers) under the new title:

Angenehmer Zeit-Vertreib, welchen das liebliche Geschöpf Die Vögel, Auch ausser dem Fang / in Ergründung deren Eigenschaften / Zahmmachung oder anderer Abrichtung / dem Menschen schaffen können; Mit vielen Anmerckungen versehen / und mit schönen Kupffern gezieret / Durch einen Die erschaffenen Creaturen beschauenden Liebhaber. (8^{vo}, 318 + 49 pages + Register.)¹

This was so well received by the public that Pernau decided to add a second part to it, thereby making use of many additional experiences. He gave it the title:

Angenehme Land-Lust / Deren man in Städten und auf dem Lande, ohne sonderbare Kosten, unschuldig geniessen kan, oder von Unterschied / Fang / Einstellung und Abrichtung der Vögel [etc.]. Franckfurt und Leipzig, zufinden bei Peter Conrad Monath, 1720. [8^{vo}, 512 pages.]

All these editions are extremely rare now, especially those of 1702 and 1707, of which I could only trace three copies in German libraries.

Nothing could introduce us more fully into the scope of these books than the author's own remarks, written in that somewhat long-winded German of baroque times and thereby hard to translate.

"Many experiences have taught me that the delight searched for in *rebus naturalibus* is not subjected to such instability as are those *divertissements* that are based on human invention only, like playing and such like. The provincial nobility are mostly fond of hunting; but very few of them gain thorough knowledge appertaining to it. And because a deer yields more than a lot of partridges, it is impossible to convince many of them that, compared with the joy of seeing a stag collapse at the report of the musket, the investigation of the nature of various birds should not be something paltry. But ignorance would not have reached that mark yet if the contempt of physical studies were not more deeply rooted and would only lead to preferring, when dealing with natural things, that which best fills the pan and the purse. But the evil sticks far deeper. In high places people are not at all ready to believe that the delight which is offered by natural subjects, nay, that the inspection and examination of the trees, herbs, flowers and innumerable other products, that the investigation of the nature of the beasts, birds, fishes, of the metals and minerals and so on, is apt to lead young people much nearer to morality than playing, dancing and other vanity, by which the mind

¹ Agreeable Pastime / which the lovely creatures, the birds / can give man / besides their capture, the study of their characteristics / their taming or other training. . . . By a fancier who observes the living creatures.

² Agreeable Country-Pleasure / which one can enjoy innocently and without expense in towns and in the country / Or all about the differences, trapping, taming and training of birds.

of young folk becomes mild and friendly in outward appearance while in reality obdurate, haughty and conceited. Who would like to trouble a prince with exploring the properties of natural objects? Who would charge him with reflecting on the culture of trees, or with learning the differences of birds and fishes? Or with taking pains to understand what his gardener's reason might be when he transplants the flowers on his pleasure grounds? The world wants to be ruled by Alexanders only. No wonder, therefore, that their countries are sometimes getting too narrow for them and the inhabitants are expelled!" [From the "dedicatio" of the "Zeitvertreib," 1716.]

"I feel convinced that, if one would not disdain such-like matter, but instead, in accord with God's will, would encourage our children from the cradle on to admire God's creatures, with which they would have occupation enough for all their lifetime, because their number is uncountable, the devilish masquerades, the vain and often ridiculous pomp, nay even the bloody wars, would soon diminish." [From the preface of the "Unterricht," 1702.]

"The Lord is so mysterious in all his creatures, and his wisdom shines forth so abundantly from those which we take to be the humblest, that man's life is far too short to fathom sufficiently all properties even of a single one. I therefore have often wondered how some authors dealing with such matter dared to promise more than all men on earth, if working together, ever would be able to effect and to accomplish.

"It therefore happens that the known and the unknown, mixed together, are passed off as truth, making the one suspect by the other; the reason is that one wants to remove suspicion of something remaining that one doesn't know. That is something I refuse to do, freely confessing that there are many birds which I do not know at all; others, of which I know the name without being aware of their properties; and others again familiar to me by appearance but not by name—all of which I have reason to pass by. For it is not my intention to describe how to capture the birds; I resolved, instead, to show how greatly Man can delight in these lovely creatures of God without killing them." ['Unterricht': 1, 1707.]

Pernau became thoroughly familiar with bird life by being both a field naturalist and an aviculturist. A bird fancier with marvelous gifts for observing and interpreting facts, he finds his equals in only a few ornithologists of our day, and may be ranked with Oskar Heinroth and Konrad Lorenz. The similarity of his methods to those used by Konrad Lorenz is indeed surprising. The most im-

portant one was that of training birds to fly out and in the cage or aviary at will, and letting them spend some of their day, or even a whole season, in the wild. By so doing, he not only became acquainted with intimacies of bird behavior, but also learned to discern influences of captivity as such. In his time this was as unusual a way of keeping birds as it is in our day, and he had to turn ever again to clever inventions and experiments, all of which he describes in due detail, to overcome the many difficulties. But the satisfaction given by the results made him untiring. The number of birds of different kinds which he kept in this way (besides those always held in cages) must have been very considerable; it included even House Sparrows, which he rightly considered a most remarkable success. What he took to be the finest task of aviculture he himself set forth as follows: "No store at all can be set by the pains taken to breed hybrids, or to make a bird learn a song that is not its natural one. On the other hand, it is a well-founded opinion that one cannot gain a finer pleasure from birds than through taming them and through making them accustomed to flying out and in; for Man cannot possibly render something more perfect than the Lord created it. . . . A Finch, for instance, will learn to imitate some of the Nightingale's strophes, but not with all the vigor and the beautiful alternation that brings about the greatest charm. By taming the birds, however, chiefly if one trains them to flying out and in, one preserves the bird in its natural beauty and will be delighted, besides, by the loveliness of its song, also by the elegance of its colors. Thereby one gains something without losing some other thing; one gains what, according to some, Man lost through the fall; in Paradise the animals did not flee Man, but allowed him to handle them as he liked.

"It is far more curious to send a bird away for several miles (as I have frequently done) and to see it returning to its owner, than to cause it to get another bird's color or song, whereby one certainly will notice that it is borrowed only." [1716, p. 201.]

Besides being an aviculturist, Pernau also was thoroughly familiar with many devices for capturing all kinds of birds, a technique developed to almost a science in his times and, therefore, called "Avi-ceptology" by some French writers. He frequently refers to a German book about bird catching, Johann Conrad Altinger's 'Kurtzer und Einfeltiger Bericht von dem Vogelstellen' (1577-1637), which, having first appeared at Rothenburg in 1626, had three more editions, the last one in 1688. This way of experimenting, too, led him to understand bird behavior.

In the light of his thorough experiences, Pernau judged all features of bird structure and bird life to be a manifestation of God's never-erring wisdom, and that made him a passionate opponent of the Atheists and Mechanists, who, already in these times, had ventured to explain those facts in their way.

"Nothing can be improved with natural things, for God's Wisdom is without an end." [1716: 148.]

"In all natural matters, one has to aim at keeping to nature." [1720: 365.]

"All that has been made by God completely harmonizes with the life for which it is shaped, even if it seems deformed." [1720: 121.]

"I wonder what the so-called *esprits forts*, those *Messieurs les Athéistes*, will have to say! Should they perhaps believe their *Atomi* or grains of dust did cause, through joining by hazard, just the Owl (which has to prey in silence and flies about by night) not to be heard when on the wing, whereas other birds, large and small, cannot fly silently?" [1716: 8.]

Some few quotations from his books will show how far Pernau proceeded in his striving for knowledge, and how sound he was in his interpretation of facts. As an introduction he discusses the many differences of birds as shown by behavior. There are ten main differences of interspecific value, according to him, that have to be considered by the student of bird life. These are: grinding or swallowing the food, ecology, migratory drive, nesting habits and number of clutches, social habits, degree of territorialism, seasonal color changes (bill and plumage), song period, bathing (mostly in water only, but some in sand only, like the larks and the gallinaceous tribe, and others in water as well as in sand, like the House Sparrow and the Tree Sparrow), and manner of feeding their young.

This fascinating introduction is followed by a treatment of birds more or less familiar to the author "by appearances as well as by name," with especially long chapters devoted to the Chaffinch, the Goldfinch, the Greenfinch, the House Sparrow, the Skylark, the Nightingale, and the Partridge. They are teeming with ingenious remarks, strewn in like shining jewels.

A small selection, translated as verbally as seems possible, will best be quoted here under headings from modern terminology.

BEHAVIOR AN AUXILIARY TO TAXONOMY

"The Mudlark ["Kothlerche," today's Tawny Pipit or *Anthus campestris*] should rather be called Field-Wagtail, because it moves its tail like a Wagtail [*Motacilla*] and because the call note is almost

the same in both when running about with their young on the fields and roads, though by color and by its song flight it resembles a Lark." [1720: 44.]

"The Goldfinches ["Stieglitz," *Carduelis carduelis*], in contrast to the Chaffinches ["Buchfink," *Fringilla coelebs*], carry the food for their young in the crop and not in the bill; it is surprising, therefore, that some people rank them with the finches by calling them Thistlefinch ["Distelfink"]: while the said property (to say nothing of others) sufficiently shows how far the bird is removed from the finch tribe." [1716: 284.]

"As opposed to the Yellowhammer ["Emmerling," *Emberiza citrinella*], the Ortolan Bunting ["Hortulan," *Emberiza hortulana*], if it wants to move quickly on the ground, does not hop but advances by steps." [1720: 125.]

"There are two tribes of rail ["Schnerffen"], those living on the meadows and fields, and those dwelling along and on the waters. With the last-named, one has to count the so-called water-hens of different kinds and the Moorhen ["Blässlein," *Gallinua chloropus*], for they do not belong in fact to the ducks, even though they seem to have some similarity to them as regards their feet and by being able to swim; their proper place is with the rails." [1702: 70; 1707: 211; 1716, p. 268.]

"If one wants to refer several species to one genus, these should at least have a marked similarity of voice and other characteristics." [1720: 117.]

"It is strange that a hybrid between a male Canary and a female Linnet, if set free without one of its kind, will not associate with the Linnets, but with the Greenfinches, from which it can be concluded that the Canaries are more closely related to the latter than to the former." [1716: 58.]

ECOLOGY

"If I knew all species of snipes ["alle Arten von Schnepfen"] and of the so-called "Waterhens," and would describe them with due differentiation according to their characters (as, for example, among the snipes there are some inhabiting the woods, others the swampy meadows, others the dry meadows, others the borders of running water, those various groups being divided again into different species) I could fill several quires of paper about these birds alone." [1720: 347.]

MIGRATION

"It is a very strange opinion if some believe the birds would emigrate, driven away by hunger only. Instead, they are usually very fat when about to leave us." [1720: 35.]

"The Scriptures say: 'The Turtle Dove knows her time.' But it would be a mistake to believe that the bird reasons, as it were, and concludes, 'It is time now!' In fall the Turtle Dove is driven in due time by some secret impulse and obeys it, whereas Man frequently withstands the same." [1720: 36.]

"It has still to be investigated whereto the Nightingale, the Stork, the Swallow, and others may migrate. It can be reasonably judged only that the place where they go must be of the same character as the place they leave. This can be concluded from their habits during migration, for any bird migrates towards places that suit him as abodes." [1720: 37.]

"All our migratory birds follow the same course, directed on fall migration between evening and midday [= SW], in spring, however, between morning and midnight [= NE]." [1720: 40.]

TERRITORIAL HABITS AND FLOCKING

"Not without good reason God has given the Partridge the property to surpass all other gallinaceous birds in its eagerness for being surrounded by its family. When there is snow in winter, a single one gets its food with difficulty, because the task of scratching through the snow cover, especially if it is frozen, is too much for it. If, however, the flock is large, they can work themselves even through the deepest layer of snow with little trouble and so rejoice in the green grain of wheat. On the other hand, the Nightingale is forced, for the sake of her feeding requirements, to chase away her own equals, for if many would stay together, they could not possibly find enough worms and would inevitably starve. Nature therefore has given them the drive to flee from each other as much as possible." [1707: 203; 1716: 242-244.]

"The Chaffinch gives the most pleasure by the males, as soon as the sun in March gets stronger, selecting a special place, just as other birds do, often consisting of a few trees, and by afterwards not allowing another male to show up there. They sing very fervently all day long from the tops of such trees, to induce one of the passing females (that always arrive last on migration) to come down." [1707: 77; 1716: 87.]

"A cock Partridge that starts growing angry and wants to mate, does not allow more than one hen to stay around him, chasing away all the rest, hens as well as cocks, which have to get out of his way farther from day to day. But it is not a single one that starts like this; the mating impulse drives them all at the same time, causing them to lie apart only 20 or 30 paces at the beginning, but after-

wards to increase the distance more and more, until they separate completely." [1720: 410.]

BIRD PROTECTION

"At some places the authorities expect to increase the number of Nightingales by strictly forbidding their capture. This however, is a completely futile measure, founded on conjecture only. Experience will show that, even if such an interdict is kept for many years in succession, the following year only one Nightingale, and never more, will be heard in any garden or shrubbery where one had sung before, unless one increases the number of bushes and hedges. It is true that at places where a Nightingale had been caught after the 24th or, at the latest, the 26th of April in normal years, none will be heard again the same year, and the pleasure will thus be spoiled for the owner of the garden. This is due to the fact that migration had already ceased at this time and, therefore, the vacant place could not be filled. It will, however, not remain vacant for a single day if the trapping is done between April 19 and 26. For it is essential to know that all through migration time (which begins, in fine weather, April 17, 18 or 19 or even later, and lasts, according to weather conditions, for eight to ten days) a Nightingale will appear at exactly the same place where, the day before, one had been caught, until, no later than ten days after migration started, the females conclude it, arriving all together in two or three days. . . . He that wants to see the Nightingales increase around a town need not, therefore, forbid their capture regardless of date, but has only to decree that people should let hedges grow large and thick." [1716: 210 and 218.]

"In spring the young Partridges that failed to find a place at their native ground will all emigrate and disperse for many miles; in the light of this, those persons show lack of experience who believe they can preserve and increase the Partridges by catching only a few of them and by being very careful to spare the adults. They ought to know that an adult cock bird occupies a bigger territory [Platz] every year and, therefore, checks the increase of pairs, and that the young emigrate for many miles, as already mentioned, unless they find an especially good spot near by which has remained vacant. If, however, one removes only the old cocks, some of the young hens will always stay behind if there is place for them. They will mostly pair with strange cocks that come along, and not with their brothers, so to say, for these migrate in advance, as with other birds, and are already gone at the height of the pairing season." [1716: 237.]

SIGNIFICANCE OF CALL NOTES

Species of strictly territorial habits like "the Nightingale, the Robin and the Redstart, which do not allow another bird of their kind to come near, except in spring their female," are devoid of that special attraction call note which is to be found with the species of social habits. [1716: 24; 1720: 76.]

"The Wood-Lark ["Heyde-Lercht," *Lullula arborea*] eagerly follows the attraction call, in contrast to the Skylark that does not care about it; the reason for that difference probably is that God's inexpressible wisdom, which shines forth from the humblest things, did not implant in the Skylarks that method of attracting each other, because they can see their companions on the flat field and can find them without such help, whereas the Wood Larks, when flying among bushes and over completely wild ground, would often lose each other if they did not utter the attraction call constantly." [1702: 46; 1707: 138-139; 1716: 164-165.]

"The Skylark ["Feld-Lerche," *Alauda arvensis*] does not enter the underbrush; instead, on migration, it either flies high in the air in a large flock, or it settles down on open fields. Therefore it cannot easily go astray from its companions and does not need to call them to its vicinity by aid of a special attraction note, and consequently Nature did not supply it with such; for even though the Skylarks do call their companions constantly when rising or on the wing, that is not in reality attracting, as it is with the Wood Lark and other birds, but it only serves to induce flying." [1702: 53; 1707: 156; 1716: 184.]

"The Blackbirds ["Amseln," *Turdus merula*] sometimes call each other, but not with the intention of gathering, but either for inciting each other to fly, or to warn each other, or as a means of threat; for the Blackbirds do chase each other, though not to such a degree as the Nightingales and the Robins." [1720: 73.]

SEXUAL STIMULATION

"Experience has shown [me] that a female pigeon, put in a dove-cote together with six single males and trodden now by one, now by another without them billing with her, did not lay one egg in spite of this going on for 14 days; when, however, the other males had been removed and only one left with her, she very soon started billing with him and afterwards copulated; when this had gone on for about six days, she laid two eggs. It seems probable, therefore, that no pigeon would lay without billing, in spite of having copulated." [1716: 301.]

INNATE AND ADOPTED SONG

"One has to consider that a young bird of any species, which neither hears an adult of its kind nor has another young around itself, never will attain its natural song completely, but will sing rather poorly. If, however, there are two young together, one will help the other in composing, until both attain the real song, though much more slowly than if they would hear an adult." [1707: 172; 1716: 200.]

"Birds which have learned the song of another species may, in general, not hear their species' song during their first year at all, or they will drop the adopted song. It is different, however, with the Chaffinch [*Fringilla coelebs*]. A Chaffinch, after having studied the alien song from February to May and being released afterwards, no longer adopts the song of his kind, but will remain inseparable from his mate, if he gets one, and if he does not succeed in this, will utter his adopted song the more fervently, endeavoring to entice the other sex, and does not take time to learn something else. As long, however, as he is kept in the aviary [until May] it is not advisable to let him hear another finch uttering its usual song. (Yet it cannot be denied that some Chaffinches which had learned alien songs to perfection, after having been in the woods for one year had lost them and returned home with the Chaffinch's song.) There is nothing more agreeable than to hang a well-singing Tree Pipit ["Gereuth-Lerche," *Anthus trivialis*], which has a very long-drawn-out song, next to several young Chaffinches. The training starts in February. The young finches will have to be captured, however, in August the preceding year before they have completely molted, or, still better, raised from the nest. If, by this method, one causes three or four finches annually to adopt a Tree Pipit's song (for which purpose one does not need a Tree Pipit at all the next year, but only the trained and imitating finches), one can, within some years, fill quite a forest with such-like song. These finches, trained to leave the aviary and to return to it, if released again after spring migration will spread in the near-by woods and, so to speak, will fill the whole district with their adopted song, and, even if emigrating in autumn, will nest in the same place as long as they live. One can mark them by cutting off a toe, and thereby know them after the song period. The danger of losing them by emigration to another district applies to young birds only; the adults, however, that have already nested once at a certain place, and also the young which had been prevented from undertaking their autumnal migration, either will not migrate at all, or if they do so, will return to their former

place in the breeding season; and even though they are not allowed to visit their window in summer, because, after the finches' nature, there are only one or (on a larger ground) two that nest in the same garden and chase away all the others, they will return there in fall before migration, or in winter after snowfall." [1716: 110-112.]

"It is worth knowing that [semidomesticated] young Canaries reared and led not by Greenfinches [Grünling," *Chloris chloris*] but by Linnets ["Hänfling," *Carduelis cannabina*], if they meet outdoors in the wilderness Greenfinches that are their closer relatives, do not learn the Linnet's song from their foster parents, but the Greenfinch's song. If, however, they happen to hear the song of an adult Canary, placed at home under the window by which they are accustomed to fly to and fro, or behind another window, they all will settle together in the nearest tree and eagerly study it, and instead of adopting another song will learn that of their master so well that the first brood, if caught between St. Bartholomew [August 24] and St. Michael [September 29] and transferred from their freedom into the aviaries, will already sing, though not so loud, yet just as well as the adult." [1720: 405-406.]

Whereas other birds, according to the author's experience, do learn their song by imitation, "the Great Tit ["Kohlmeise," *Parus major*] can produce her notes from nature and does not need to copy it." [1716: 195.]

REPRODUCTION

"The fancier soon will notice how great a difference there is concerning the propagation of Nature's children, whether one sets everything to work after Nature's method as much as possible, thus giving preference to Nature over art, or whether one wants to master Nature through art, which seldom ends successfully." [1720: 397.]

"If asked at what period a female bird will be most worn out—when laying eggs, when incubating, when feeding the young—I should answer that it is laying that tells on her most; incubation, on the contrary, makes the female healthy, as anyone will concur with who is able to perceive in a bird whether it is ill or well. Feeding their young does not exhaust the adults as much as one would expect, for it is a natural performance." [1720: 367 and 382.]

DIFFERENT WAYS OF FEEDING THE YOUNG

"All birds that bite and grind their food belong to the group that feed their young out of the crop, except the Sparrow and the Chaffinch which cannot do so because their nature requires that the young must be fed at first with all kind of insects, as gnats, grass-

hoppers, and the like; such food they cannot carry to the young within the crop as is done by those birds which feed them with seeds only."

"Young birds, which are fed with worms, have not been endowed by Nature with the *instinct* or natural drive to hurry towards their parents, but, instead, the adults fly eagerly towards the screaming young. The cause of the difference is this: A bird, if it feeds from the crop, will hold so much at one time that it is able to satisfy all its young with its load. Therefore the Lord has ordered that they all should fly towards the adult, as soon as the latter gives a sign that he wants to feed them, to accept their meal while sitting around him. A bird feeding with worms, however, is unable to carry more at one time than will be sufficient for one young only; it therefore would be futile if all the young would fly around their parents, considering the fact that not more than a single one can get something at one time, or the adults would have to make a special flight for the food of any one of the young looking for it. Yet the Sparrows form an exception; they, too, are fed with worms and do, nevertheless, fly towards the adults." [1716: 79-80.]

INSTINCTIVE OR ASSOCIATIVE ACTION?

"He that searches for a proof of animals having some kind of reason, may allow a Marsh Tit ["Hanfmeise," *Parus palustris*] to fly about in his room in which a tree was set where she can live. After she gets used to that room, one has to withhold food from her for half a day and then to strew uncrushed hemp on the table, or on the floor. Immediately the Marsh Tit will come and carry away in her bill three or four grains all at once. Not being able, however, to deal with and to mince more than one grain at a time, she will place all the others on a thick branch next to the stem, and then proceed to eat the first grain, frequently at quite another spot in the room. This done, she will fetch the rest of the hidden grains, one by one, and afterwards more grains from the table. This device of hiding the hemp grains seems, indeed, to prove some kind of reflection and cannot be explained with the *instinctus naturalis*." [1720: 227.]

HOW TO TRAIN PARTRIDGES TO FLY OUT AND IN

One can gain much pleasure from taming Partridges ["Rebhuhn," *Perdix perdix*], and if one has a pair one can train them to stay at a certain place continually and allow themselves to be driven into a chamber to which they are accustomed. But it is not necessary to induce such utter tameness; when half tamed, only, they will give even greater pleasure. It only needs putting, in autumn, a pair of

Partridges with clipped wings into a little garden which is safe from cats, close to a field and carefully fenced. Herein one will have to keep them all through winter and to feed them in a corner protected against snow. In April, one month before the laying time of Partridges (which lay at the end of May), one has to pull out the clipped quills from the female. By this procedure she will become able to fly over the fence and to breed outside, but frequently will return to her mate and eventually train her fledged young to stay in the garden, all the day long.

Still better is it to set a hen Partridge with clipped wings into such a little garden, surrounded by a wooden fence, at the beginning of March. After a few days a cock bird will appear which will not leave the hen again, even if chased away twenty times a day. After he has flown in and out in this way all through March and has started to tread her, one must pull out all of the hen's clipped quills within an hour, at the beginning of April. Subsequently the cock will continue his habit of flying in and out through April, too. In the first days of May, however, she will find herself, with her growing quills, capable of flying out of the garden and joining her mate. From that time on, one usually does not see either cock or hen in the garden all through summer and up until late autumn. At the beginning of November, it is advisable to strew there a handful of wheat, and certainly at snowfall, if not even earlier, the cock with the female, and, in case they have reproduced, quite a flock of young, will appear at the old place. By setting free two or three of these young females next spring, one may expect more than one covey in the garden in the following winter, but they will fight each other furiously when they meet.

A device for having tame Partridges fly out and in one's courtyard (just as can be attained with Wild Ducks) is the following. A rectangular place in the court, the size of a medium room, has to be fenced with boards to such a height that no Partridge with clipped wings would be able to escape. This fenced place must be situated at a spot frequently passed by people, in order to make the birds accustomed to being continually close to men; for the same reason the side where people usually pass has to be fenced with boards to the height of three-quarters of a yard [*eine Elle*] only, and the upper part provided with lattice or laths, narrow enough to prevent a Partridge from passing through. At one of the short sides of this enclosure there should be placed, on the outside, a low wooden case, three-quarters of a foot high, with the opening inside, into which

the birds are driven for the night. Over that case a number of vertical bars have to be fixed, with interstices large enough to allow a Partridge to force itself through with some difficulty. To enable the birds to enter the enclosure from the outside by these openings, the case must project outward onto a large shelf, so that they can jump upon it or climb there by a step or chicken ladder. The Partridges that stay inside cannot pass by the openings, for even if they could reach them in spite of their clipped quills, they would find nothing to set foot upon, and would therefore fall backward again.

In such an enclosure a covey of young Partridges, reared all through the summer by a hen turkey in a little garden, must be put as soon as they are fully grown and so well tamed that they will come to take bread from the hand. (That little garden must, however, be close to a spot constantly passed by men and dogs so that the young Partridges will keep their familiarity with them, acquired in earliest youth through being led by a turkey until finally grown, after which time there is no danger that they will turn shy even if they do not constantly see people. It is important, in taming birds of all kinds, to prevent them from getting shy before they molt and attain perfection. Besides, the young Partridges should have become accustomed to the enclosure and the use of its little gates when still half grown, for that is the time they best learn to discover them. This can be accomplished by putting the turkey and her foster children inside the enclosure now and then for some hours.) The quills of all save one have to be clipped. This single one will soon fly over the fence and alternately join the domestic chickens at the court or creep inward again by the said openings. When this has continued for a fortnight, one has to pull out the clipped quills of one of the Partridges, and to repeat this with the next one in another fortnight, and so forth, by this method causing them to attain flight one after another, until the whole covey will fly out and in. If one would start with allowing more than one to fly, these flying birds would get lost by becoming accustomed to some other place; if, however, one bird becomes used to creeping inside toward his comrades twice or three times a day, the next will confidently follow his example when having gained the power of flight after several weeks' interval. In a fortnight, the third is able to do the same thing, then the fourth, and so on, until the whole covey flies out and in. At first one has to drive those that are capable of flight, together with those still flightless, into the sleeping case every night to protect them from vermin, but may cease to do so as soon as they all can take wing. After another week

they all will fly out every evening towards the fields, obeying Nature's drive, and will return again at daybreak to the court and into their little garden where they will run about as tame as the Partridges one keeps in the chamber.

As soon as the pairing time approaches, most of them will stay away, not more than one pair remaining. One may clip the hen of this pair once more in order to take her eggs for resuming last year's procedure by giving the eggs to some domestic hen for incubation and the chicks after hatching to a hen turkey for care.

Late in fall the others will arrive, together with the young they have reared, though grown rather wild. Whenever one notices such a covey it has to be caught, because the tame young reared that year and the wild Partridges would fight each other too violently. [Condensed from 1716: 238-258; 1720: 256-262, 276-278.]

THE PROBLEM OF THE CROSSBILL'S BILL

"It is surprising, and needs investigating, how it comes about that with the Crossbills ["Krummschnabel," *Loxia curvirostra*] the bills are not of one shape; the upper bill turns to the right side in some, to the left side in others. One might discover the cause while they still are in the nestling stage." [1720: p. 209.]

THE MENDELIAN LAWS

"Whoever has some experience with breeding canaries will know that, if a white Nightingale (a male) is mated to an ordinary Nightingale (a female), there will result no other than Nightingale of ordinary color in the first year. Next year, however, if one mates a young female of this offspring again with the white male, the white color will appear in some of their offspring, and in the third year (after mating white with white) no others than white birds will result." [1716: 213; see also p. 101.]

MUTATIONS

"The Chaffinch's bill is completely white with some, and dimmed by dark brownish with others, but in any case it becomes beautifully blue in the males as soon as they enter their song period; though once I had a pied male that kept its snow-white bill and nevertheless did sing. It is beyond my comprehension, therefore, how it happens that a snow-white male, which I saw mounted in the house of one of my friends, had a fine blue bill when it died in the song period. It is something to be wondered at, and there must be a special cause why the bill of the pied bird did not turn blue through

song, whereas the snow-white male developed a pretty blue bill like other finches." [1720: 134–135.]

As these proofs will have shown sufficiently, Pernau was far beyond his contemporaries with many of his views and interests, even so much so that his books soon fell a prey to oblivion. Only one of them, the last published (1720), which is of lesser importance than the "Zeitvertreib" (1716), was circulated for half a century or more within the small circle of hunters, fowlers, and fanciers, as testified by Johann Matthaeus Bechstein, who himself prepared a new edition of it that appeared at Nuremberg and Altdorf in 1796 under the title:

Gründliche Anweisung alle Arten von Vögeln zu fangen, einzustellen, abzurichten, zahm zu machen, ihre Eigenschaften zu erkennen [etc.].¹

On this occasion Bechstein stated: "I always have been surprised to notice that in all our books on systematic ornithology which have appeared up to recent times, this work has been considered so very little or not at all."

Yet it would be a mistake to believe that this great naturalist had failed completely to stimulate the development of ornithology in Germany, and that all the pains he had taken to encourage bird study and to guide it, had been bestowed in vain. He soon found an admirer and gifted scholar in the person of Johann Heinrich Zorn (1698–1748), whose 'Petino-Theology, or attempt to incite men to admire, love and worship God their most potent, most wise, most gracious Creator, through closer inspection of the Birds' appeared in two parts, published in 1742 and 1743, respectively. This remarkable book of a splendid field ornithologist might never have been written without the encouragement and mental guidance its author had found when using Pernau's books, to which he frequently refers. And both these authors, Pernau as well as Zorn, could not possibly have failed to have a great influence on Bechstein, who is generally held to be the spiritual father of German ornithologists. He will have accepted from these sources as much as he could grasp, leaving the rest—including some very material statements and viewpoints—for a far later period to rediscover and to appreciate deservedly.

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¹ Fundamental directions for catching, caging, training, taming, recognizing the characteristics of all kinds of birds.