

with the force of Paul's address on Mars' Hill: "God that made the world and all things therein, hath made of one blood all nations of men for to dwell on all the face of the earth." (Acts xvii. 24 and 26). Will, then, in the present time legal restraints and hindrances still bar the recognition of the equal humanity of the Mongolians? And how long will the Japanese endure these discriminations against them from the nation which set out with this declaration of the equality of *all* men?

SOME SKETCHES IN COMPARATIVE ANIMAL AND HUMAN PSYCHOLOGY.*

BY ERNST MACH.

With Illustrations by Felix Mach.

THE idea of applying the theory of evolution to the physiology of the senses and to psychology in general, was advanced, prior to Darwin, by Spencer.¹ It received an immense impetus through Darwin's book *The Expression of the Emotions*.² Later P. R. Schuster (1879) discussed the question whether there were "inherited ideas" in the Darwinian sense. I, too, expressed myself in favor of the application of the idea of evolution to the theory of the sense-organs.³

Ewald Hering in an academic anniversary address characterized memory as a general function of living matter.⁴ Memory and heredity come under one concept, if we reflect that organisms which were parts of the parent-body leave it and develop into new, independent individuals, preserving their characters in the transformation. In grouping memory and heredity together, however, we gain wonderfully in breadth of outlook, for by this thought heredity is rendered as intelligible to us as the retention of the English language and other institutions by the Americans of the United States.

Recently Weismann has conceived of death as a phenomenon of heredity; greater length of life and lessened propagation, ac-

* Translated from manuscript by Lydia G. Robinson.

¹ Herbert Spencer, *The Principles of Psychology*, 1855.

² Charles Darwin, *The Expression of the Emotions in Man and Animals*, London, 1872.

³ *Sitzungsberichte der Wiener Akademie*, 1866.

⁴ E. Hering, "Ueber das Gedächtniss als eine allgemeine Function der organisirten Materie," *Almanach der Wiener*, 1870. Translated into English and published with two other essays on allied subjects under the title *Memory*. Chicago: The Open Court Publishing Company, 1913.

ording to his researches, are conceivable as mutually restricting adaptations.⁵

When a gymnasium student I heard my esteemed teacher, Professor P. F. X. Wessely, say that plants from the southern hemisphere bloom in our latitudes when it is spring in their native place, and I thought instinctively of a "memory" in plants.

The so-called reflex movements of animals may be explained in a natural manner as phenomena of memory outside the organ of consciousness. For instance, pigeons whose brains have been removed, drink even mercury and other liquids with clock-work precision when placed with their feet in cold water. Goltz, in a work on the nerve-centers of the frog (1869), described a whole series of such reflex habits.

Nevertheless A. Weismann is probably wrong in opposing the "inheritance of acquired characters," and advancing a new germ-plasm theory.⁶ According to this, the processes of evolution and descent are processes entirely independent of the influences on the evolution of the individual which would abrogate the unitary viewpoint of the evolution theory. I agree with Hering that this feature breaks the harmony of the whole doctrine of evolution, and that such an hypothesis means, as it were, to saw off the branch on which one is sitting.

The expositions of Jean Henri Fabre of Serignan, a master of experimental method and an extraordinary artist in the poetic presentation of the insect world, give us reason to distrust Weismann's theory. Thus Fabre⁷ describes in detail the life of the larva of the cerambycid beetle. When eating, it bores a passage into the trunk of the tree which will accommodate its increasing size; it stops the opening lightly with dust, so that the developed insect as it creeps out after its metamorphosis, can escape without difficulty.



By virtue of self-continuing memory this recurs in each succeeding generation. But if the larva is knocked out of the trunk of the tree by a woodpecker without being eaten on its excursion, then is it compelled to return to the tree or will it seek refuge elsewhere?

⁵ A. Weismann, *Ueber Leben und Tod*, Jena, 1884.

⁶ A. Weismann, *Die Continuität des Keimplasmas als Grundlage einer Theorie der Vererbung*, Jena, 1885.

⁷ J. H. Fabre, *Bilder aus der Insectenwelt*, Series 1-4, Stuttgart, Kosmos Verlag.

As an answer my wife once found between her skirts a fat, living lump, which seemed to protest strenuously against the exposure of its abode. Another time we found a larva under a garden seat which stood at the foot of a giant ash. When placed on the tree I saw it run quickly up the trunk and disappear in one of the many bore-holes to be seen in the bark. These two cases seemed to be connected with our observation of a fine big black woodpecker which we had found dead the previous winter.

Aside from disturbances by the woodpecker or other animal life, evolution can run its course exactly as Fabre has conceived. But when such disturbances intervene the variation they cause in the course of progress is very great. For the particular animal in question, it is of little consequence whether it meets its end in the stomach of a woodpecker or in that of a world-controlling (i. e., a world-tyrannizing) gormand, as a stewed or fried "cossus."⁸

Finally, I am indebted to my father, proprietor of the Slattenegg Estate in Carniola, and also to my sister Marie, for certain illuminating information with regard to Weismann's germ-plasm theory. My father raised the Chinese mulberry silkworm—a very dependent degenerate domesticated creature—and also the much larger and hardier Japanese oak-feeding silkworm out in the open oak woods. When the time arrives for the mulberry silkworm to pass into the chrysalis state it has for years been the custom to give them bundles of straw upon which to spin their cocoons. They wait, as it were, for this signal, and follow it obediently. Now it one day occurred to my father not to prepare the usual straw bundles for a small colony of these silkworms. The result was that the majority of them perished, and only a small number, the "geniuses," followed their own cravings and spun their cocoons. Since my sister believes she observed that the next generation spun cocoons in greater numbers, the case certainly deserves further investigation.

Of course it depends upon chance and also upon circumstances *whether* and *how* the personally acquired "engrams"⁹ are transmitted. Those which have been put in practice for generations of course make their appearance much more definitely and more true to type. It the question relates to personally acquired and inherited engrams, I cannot help thinking how little of these I myself possess, though that may be because my father was a philologist, and I am

⁸ J. H. Fabre, *Ein Blick in's Käferleben*, Stuttgart, pp. 27-29.

⁹ This is the term used by R. Semon, in *Die Mneme als erhaltendes Prinzip im Wechsel des organischen Geschehens*. Leipzig: Engelmann, 1911.

a naturalist. But if one tries to think of the son in the same line as the father, then he can understand how perfectly the later acquired engrams are transmitted.

I will now give a few observations previously recorded¹⁰ but now expanded, especially by illustrations, and I believe that for the latter reason they may be of interest to the readers of this journal. At the same time these sketches, as the results of a long and in part very painstaking study, give more than a detailed and circumstantial description, and only experiences (results of experiments) which are given permanent form in pictures are of real value because they are not affected by any personal coloring or increment.

In the autumn vacation of 1873, my fifteen-year-old son brought me a sparrow a few days old, which had fallen from its nest, and wished to keep and raise it. But it was not so simple a matter, for the creature could not be induced to swallow and would soon have succumbed to the indignities of an artificial feeding. Then I fell into the following train of thought: A new-born child would certainly perish if it had not the specially formed organs and inherited impulse to suck. Something similar in another form must exist likewise in the case of the bird. I exerted myself to discover the appropriate stimulus which could incite the reflex movement of swallowing. Finally a small insect (a grasshopper) was swung rapidly about the head of the bird. Immediately the bird opened its bill and beat with the stumps of its wings. I had thus discovered the right stimulus for setting free the impulse and the automatic movement. The bird now grew perceptibly stronger and greedier; it began to snatch at the food, once seized an insect which had fallen on the table, and from that time on ate of its own accord.

It was at this time that I also experienced, as I now remember, a horrible hallucination, although three years ago on the occasion of a visit from Dr. E. v. Niessl-Meyendorf, on his express inquiry, I denied any such thing absolutely; but I will now state it as it occurred. I had fed my sparrow with grasshoppers until it had become large and fully fledged. Then I dreamed that I saw a gigantic grasshopper with its forelegs against my breast playing in an uncanny fashion with its antennae and feelers around my face as if it fain would say:

"Shall my herds before thee fall?
Room there is on earth for all!"¹¹

¹⁰ E. Mach, *The Analysis of Sensations*, Chicago, 1914. [Where the author quotes literally from this work we adopt also without further acknowledgment the text of this translation, extracts on pp. 71-76.—Tr.]

¹¹ From Schiller's well-known ballad, "The Alpine Hunter."

Then I awoke, and the sinister character of the illusion could not continue in the face of my waking consciousness. But I was conscious of having torn out the saltatorial legs of hundreds, yes thousands, of little grasshoppers within a few weeks, and of thus violating my Buddhistic conscience, for since the years of childhood I have consciously perpetrated no act of cruelty nor practiced vivisection.

If I had been an adherent of the Winter King and after the battle on the White Mountain had been handed over alive to the



FEEDING BABY SPARROWS.

executioner by some clerical relative I might also not have come away without terrible hallucinations—and one does not know whether he should pity or envy the man who has never had such illusions. How often may not this emotional drama have been played in the imaginary space behind the mirror-like plane of a knight's castle in Bohemia!

After this digression I return to my nursling. In proportion as its intellect developed, a perceptibly smaller part of the original releasing stimulus was required. The creature gradually became independent and took on successively all the characteristic ways of sparrows. It would jump up on my finger when I held it out, would

whet its bill on it, and delighted the eye by assuming a great variety of the movements of sparrows which it had never seen and could never have learned. The now fully-fledged creature feeling itself in harmony with its surroundings began to indulge in all sorts of pastimes, and when it whetted its bill upon my finger with "childlike

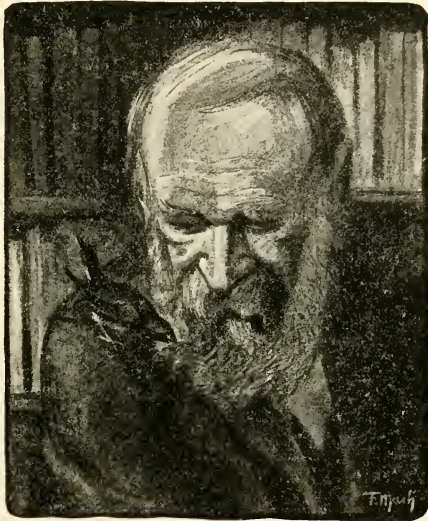


SEEKING SHELTER.

affection" I experienced a real parental joy. Nor did it by any means behave with discretion; it often pecked my hair and beard and sometimes tweaked my ears. Hence the relation between us closely resembled that of potentate and court fool which is sometimes established between parents and children, although the bird

could not take into account the degree of intelligence or power of his human companion.

When I would take my walk in the morning in the meadow near a row of trees I used to take my sparrow with me. He would fly up into the trees but always come down again upon my fingers when I called "tsip, tsip." Finally it became evident that the supposed "he" was a "she," for after the grasshopper diet was changed for more solid and miscellaneous food she began in a parthenogenetic fit to lay an egg and thus after a time yielded to this manner

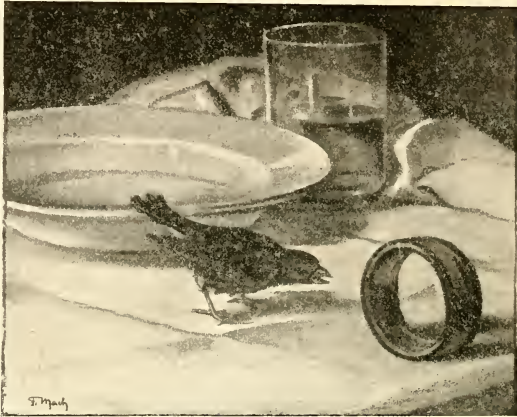


UNDUE FAMILIARITY.

of life. So I would have little more to tell if my daughter had not continued these experiments with other baby sparrows.

My grandchild brought her a whole nest which had fallen to the ground with five or six sparrows in it, among them males distinguishable by pretty black cravat-like marks. Now a mother could not indulge in the luxury of a grasshopper hunt to bring up sparrows, and so a simplified procedure was devised which served the purpose very well. White bread (a roll) was soaked in milk, and just a pinch of this between the fingers was enough for the

meal of one bird. In this case the process was greatly facilitated by the fact that the old birds helped to procure food as soon as



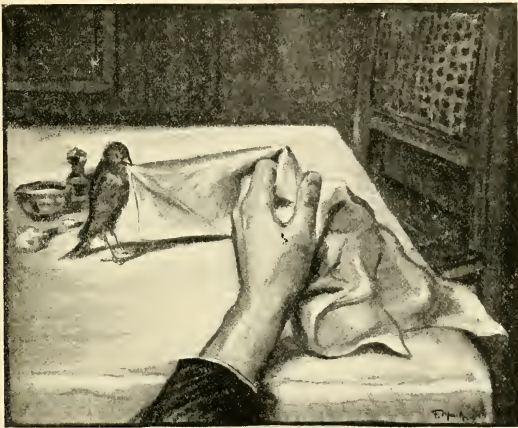
A SUSPICIOUS OBJECT.



VARIOUS PASTIMES.

the window was open or the young birds were set outside. After the young birds had been set free they would come back into the

room of their own accord when the weather was bad and as soon as the care of the parents became insufficient. Once when my daughter returned from the country she brought me a male bird which had been reared in this way, but hardly had the maid who accompanied her placed the cage upon the table in the garden when the neighbor's cat appeared on the scene and the bird was eaten before I had even seen it. So I was again prevented from studying a male as I had wished to do, and must content myself with completing the bringing up of the weakest, which was another female that had been kept back for fear that it was not equal to the struggle for existence. This one lived with me eight years, and



VARIOUS PASTIMES.

my son Felix and I were able to make plenty of observations of the little creature and continue where I had left off years before.

It delighted my grandchildren when the sparrow pulled my hair or whiskers, and often pecked me hard enough to feel it, for then they thought the bird wanted to wake me up. I could almost have shared this simple interpretation, but what an intelligence, what humor and what a standpoint we would have to believe any young creature capable of if we were to assume the idea of teasing! This might prove to be the case in an intelligent little dog which had been educated by a human being and so had attained a clearer idea of its own ego and that of others. Intelligent creatures like spar-

rows might perhaps reach this stage by training, but it certainly is not innate. Therefore I think that this one had only her own concerns in view and was exerting her native instinct for nest building, for instance, when she played with the hairs on my head and beard.

What more I have to say about this second female sparrow supplements the first and rests upon new personal observations which coincide almost perfectly with those made by my daughter and grandchildren quite independently.

My sparrow regarded a napkin ring as quite harmless when it stood or lay motionless upon the table, but as soon as it rolled or rocked to and fro on a projection around its outer circumference,

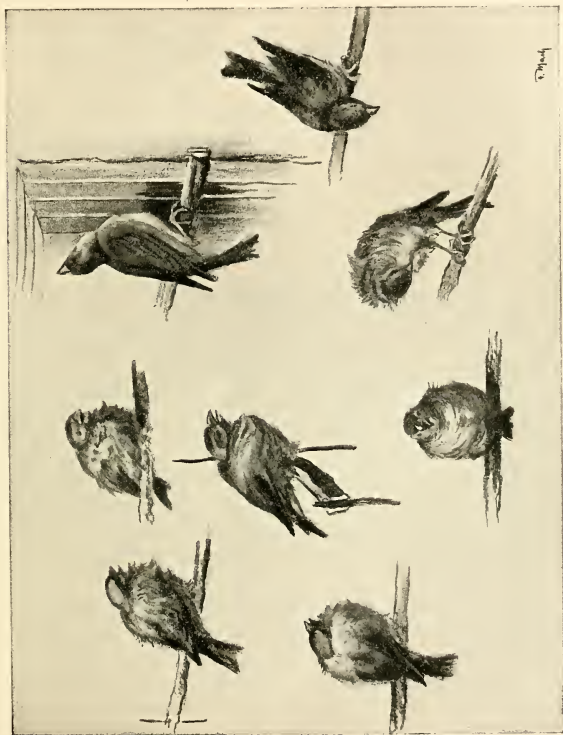


VARIOUS PASTIMES.

she set herself to fight it, with her legs sprawled out, head lowered and bill wide open, pecking at it furiously. She evidently considered it alive and perhaps regarded it with the suspicion that it was a competitor in the matter of eating! If any one is surprised at the sparrow let him recall the story of Peter Hele (also called Henlein, 1480) of Nuremberg, against whom a peasant and even his own wife brought complaint because they thought his ticking clocks were living creatures and believed him to be in league with devils and witches!

When I slowly advanced my finger toward the sparrow she attacked it vigorously in contrast to the gentle treatment the hand

of my daughter received, whereby the bird perhaps showed that she recognized the intimate friend who fed her. She would attentively follow up any fold in the tablecloth that started to move; yes, she would lie in wait for it and then rush upon it all of a sudden and belabor the suspicious place with furious strokes of her bill.



MOODS AND POSTURES.

If a napkin were pulled away from her she would often hold on to it resisting with all of the strength of her body. The little creature would pick up bread crumbs and caraway seeds, never forgetting to take a pinch from the saltcellar; sometimes stretching herself mightily, she looked into everything inquisitively, yet with a certain reserve and caution, often tasting of things. The little

pictures entitled "Various Pastimes" show instances of these instructive idylls on the dining table.

I easily discovered in the course of time that my little bird had quite a different physiognomy on beautiful bright days from that in dark, cool or foggy weather, and in every case the mood and temperament were to a great extent dependent upon the weather. The comfortable position when the sun shines in the cage, a siesta, soliloquies, after the bath, or when a favorite morsel came into her feeding bowl or was handed her from above, are easily distinguished in the last illustration.

My companion of many years finally was taken ill with a painful cancerous growth under one wing and became so weak that she was no longer able to get to a higher twig. So my son brought about her translation into the Nirvana of the sparrows by means of a dose of ether, and this quiet little life, and yet indeed so long a one, was at an end.

* * *

I have a few general observations to add. My sparrow early made the discovery that she could not get out of doors through the glass, and after the first attempt never flew against a pane of glass but always sat on the window sill. I mention this because invertebrates, like wasps, bees and butterflies, are incurable in this respect. Then too in the daytime (that is with mind awake) my sparrows were very trustful and friendly and not at all shy; they looked upon human beings as their own kind. But in the evening in the growing twilight other phenomena regularly appeared. The bird would then always seek out the highest places in the room and would not be quieted until it was prevented by the ceiling from going any higher. At my approach it expressed fear, horror, yes I may say the most extreme fear of ghosts, for it ruffled its feathers, puffed itself up, crowded into a corner, opened its bill wide and pecked furiously at any hand that came near it. These defenseless creatures have many kinds of enemies, and their behavior is therefore not without reason. The human child finds himself in very similar circumstances and it is doubtless an error to refer the fear of ghosts back to the stories of "Momus and Lamia" or "Hannibal at the Gates" or other more modern means of terror. This fear is much more probably an old inherent native "engram" passed down through preceding generations. The case is similar with religion, and this thought will admit of further development.

Just as according to Chamisso and Darwin the birds on an uninhabited island learn to fear men only through generations of

experience, so we must reverse the process and strive to unlearn the "shivers" in the course of generations, and this would be a very good thing for us.

According to the observations of my son-in-law the terror of the birds was further increased by covering one's head with a white cloth. My last sparrow became quite excited from this cause even in bright mid-day.

* * *

It is a great drawback to the observation of animals that for the most part they must be fragmentary, since the most important moments are missing. Therefore it is probable that the "engrams" experienced for many generations become alive in one moment, although it is possible to make great mistakes in such moments. *Continuous* observation simply cannot be replaced by anything else. It is remarkable how quickly the animals learn to take man into account as an analogous agent. Thus in one village the sparrows knew the call of my sister and came when they heard it, but they paid no attention to another call, and would fly from a priest who had shot at them.

All animals have a brain with the exception of the very lowest,¹² and there must be continuity in nature as well as in the systems of philosophers, so we must assume that every beginning of psychic life, analogously to the principle of Roux, may be capable of evolution at and from every stage.

Further I agree with the opinion of C. M. von Nuruk¹³ that to live with animals is incomparably more valuable than merely to observe them. In this sense the station among anthropoid apes on Orotawa on the Island of Teneriffe may be welcomed as a promising new undertaking.

Further an exact investigation of the processes in the cerebrum would be highly important—the development of experiments of which I need only call to mind the fine observation of Lloyd Morgan's dog,¹⁴ which first began to follow a rabbit on its zig-zag path, but after a few failures took the straight road to the kennel and in that way obtained his prize.

I think that one can often obtain an insight into the psychic life of animals through the emotions, for on the side of feeling

¹² Cf. L. Edinger, *Die Lehre vom Bau und den Verrichtungen des Nervensystems*, Leipzig, 1909.

¹³ C. M. von Nuruk, *Leben mit Tieren*, Stuttgart, 1905.

¹⁴ C. Lloyd Morgan, *Animal Life and Intelligence*, London, 1891.

and will man and beast come closer together than on the side of the intellect.

The miracles of the insect-world furnish an immeasurably rich source of material, inviting further investigations through their relative simplicity which makes them more easily accessible to an empirical analytical method. I will refer to single chapters of Fabre's like that on the musical instruments of the locusts; to experiments in the poison of scorpions resulting in the discovery that the sting which was fatal to the matured insect was of only slight injury to the larva; to the fertilization of the emperor moth which we know is accomplished by a fine pollen which the male has brought from miles away.

Thus we become acquainted with systems of reflexes adapted to different ends, which for this reason cannot act together in their combination as a unity toward one end as in the case of the vertebrate. It seldom happens with them that the death of one of the partners takes place in the transport accompanying the act of pairing, whereas in the case of spiders, beetles and grasshoppers the usually weaker male is very often, or almost regularly, eaten.

In spite, however, of this psychological difference, in spite of this enormous disparity, we must not believe it is not an advantage to the study of human psychology to observe the lower animals. On the contrary, whoever understands how to observe the single reflexes taken separately will also know how to combine and unite them in the case of the higher animal, man.

In a subject which is so rich and varied and possesses so many possibilities and conceptions I may close with the words of Solon:

πᾶσιν ἀδεῖν χαλεπόν.

THE SOLDIER-WOMEN OF MEXICO.

BY VINCENT STARRETT.

ON May 20, 1914, the Associated Press correspondent in the City of Mexico sent the following dispatch from Estacion Amargos:

"Women, who follow every Mexican army, took a prominent part in the fight at Zartuche. As the federal soldiers swarmed from the cars some of the women dragged out and broke open boxes of ammunition, carrying the cartridges to the federal soldiers in the face of the constitutionalist fire. Others crouched on the iron