each was capable of rotating (though with very great friction). When brought near each other they repelled each other forcibly. I experimented with these pieces for several minutes without perceiving any diminution in their electrification. Both sides of the paper seemed to be in the same condition. I then laid them down, and left the room to fetch a piece of sealing-wax to test the nature of the electricity. But by the time I returned, all trace of electricity was gone, and by no means could I repeat the experiment so as to get the slightest charge of electricity.

It is more than probable that the electricity was developed by the chemical action of combustion of the coals, and that the hot air rising up and brushing past the paper acted as a carrier of electricity of one kind to the paper, and of the opposite kind from it, until it acquired a very high potential. But it would be interesting to learn exactly in what manner this action takes place, and whether the electrification was positive or negative.

Andersonian College, Glasgow GEORGE FORBES

Strange Star.—Meteor

ON going out last Saturday evening about 8.55 P.M. my attention was arrested by a large deep red star in Serpens which I had never seen before. Its magnitude was greater than Arcturus, though its deep colour made it seem less bright. About ten minutes afterwards I saw it increase and diminish in magnitude two or three times producing the effect similar to a "flashing" light on the coast, after which it suddenly disappeared.

On the same evening, at 9.56, I saw a very fine meteor of a bright pale blue colour with coruscations of ruby colour at the nucleus. Its course was from Gemini over Aldebaran, disappearing below Pleiades. Of a long pine-cone shape, duration about three seconds. W. M.

Gunnersbury, March 19

SCIENCE IN GERMANY[1]

THIS book forms a continuation of the researches which in vol. i. treated of the season dimorphism as the result partly of exterior influences and partly of atavism. The present (second) volume comprises: (1) the origin of the markings upon caterpillars; (2) on the phyletic parallelism in metamorphous species; (3) on the transformation of the Mexican Axolotl into an Amblystoma; (4) on the mechanical conception of nature. The third treatise was published separately some time ago and was reviewed in NATURE; here we particularly wish to draw the attention of the lovers of natural science to the first paper. Weismann tries in the treatise in question to prove by his observations, and the deductions therefrom, that exterior influences and natural development or adaptation (Naturzuechtung) only can be the causes of the markings upon caterpillars. The observations referred to were made upon the caterpillars of several genera of *Sphingidæ*, and relate to the history of their development.

I. *Chærocampa*.—The caterpillars of *Ch. elpenor*, which have just left the ova, show no markings of any kind in this first stage, being of a uniform greenish colour; after the first change of skin (second stage) they show a bright longitudinal streak on each side, between the dorsal line and the line of breathing apertures (stigmata). To this first streak Weismann gives the name of "subdorsal streak." In the third stage eye-shaped spots form in the fourth and fifth segments, inside of these streaks, and these are completely developed in the following stages, *i.e.*, after the subsequent changes of skin, while at the same time the subdorsal streak decreases and leaves only imperfect traces. In the fifth stage the greenish colour changes to a brownish one, and the horn at the tail of the caterpillar becomes shorter. In the sixth and last stage the other segments begin to show eye-spots, but these are not developed to perfection. *Ch. porcellus* shows the same form and development of the larva, with the only difference that most of the phenomena occur one stage earlier than with *Ch. elpenor*. This conformity and accord of both genera in the order in which the markings upon the caterpillars appear and are developed, lead to the conclusion that the markings were acquired in the same order during the progress of development (phylogeny) of these caterpillars; the oldest form (*a*) therefore showed no markings at all even when perfectly developed; the following form (*b*) had only the subdorsal streaks; then in form (*c*) the eye-spots occurred in the fourth and fifth segments, and finally in all segments (form *d*). It is probable further, that of the two genera of caterpillars now living, *Ch. elpenor* is the original, *i.e.*, older form, on account of its still showing the different stages of development in their completeness; the younger or more advanced form, viz., *Ch. porcellus*, proves that each new marking, acquired during the progress of development, appears first in the later stages and then gradually extends to the earlier stages. The whole of this view is well supported by the markings upon the complete form of the other species belonging to the genus *Chærocampa*, of which the development of the larva is still unknown in its different stages. These other species may be divided into three groups, corresponding to forms *b*, *c*, and *d* of the phylogeny in such a manner that wherever the subdorsal streak remains in perfection, the eye-spots are not developed, and wherever these show themselves the subdorsal streak is decreasing. Form *a* (first group) is known in the full-grown caterpillars of three species (*Ch. syriaca*, *Daraspa myron*, and *D. chærilus*); to the second group (form *c*) belong the above described *Ch. elpenor* and *Ch. porcellus*, together with several others; the last group (form *d*), which shows completely developed eye-spots on all segments, is even more numerously represented by *Ch. bisecta*, *oldenlandiæ*, *alecto*, *actæus*, *tersa*, and *celerio*. The species of the genus *Chærocampa* which Weismann examined, therefore represent three phylogenetic stages of development, and it is interesting that the tropical species are the most advanced ones. It is probable, indeed, of one species, viz., *Ch. celerio*, that in Europe it shows form *c* in the markings of its caterpillars, while in India the larvæ of the same species have already attained form *d*.

II. In a similar way the author shows that markings upon the larvæ of the genus *Deilephila*, to which the well-known *D. euphorbiæ* (commonly called Sphinx) belongs, have passed through seven phylogenetic stages of development, viz., (1) caterpillars without markings; (2) with a subdorsal streak; (3) with a ring-shaped spot upon the last segment but one; (4) with similar but not altogether perfect spots upon all segments; (5) with eleven perfect ring-spots upon the subdorsal streak; (6) with these ring-spots but without the streak; (7) with a double row of ring-spots. Nowhere in the development any deviation from this order is noticed, and the living species of this genus form five groups, the markings of their full-grown caterpillars corresponding to the phylogenetic forms Nos. 3 to 7.

III. A somewhat smaller number of stages of development is apparent in the genera *Smerinthus*, *Macroglossa*, *Pterogon*, *Sphinx*, *Anceryx*, which Weismann investigated less extensively than those mentioned before; however, he points out that upon their larvæ the simple subdorsal streak combines, in the course of development, with other longitudinal or oblique streaks, or becomes less distinct as the others increase in intensity.

Now Weismann considers that the remarkable conformities in the development of all the larva markings he investigated is the surest proof that we are dealing with a phenomenon of inheritance. Indeed three laws may be said to be established by these conformities, viz., (1) the development begins with the simple and progresses to the more complicated markings; (2) new markings first appear in the last stage of individual development; (3) these new markings then gradually pass backwards to the earlier stages and thus replace the older ones, causing them to disappear entirely. Weismann gives the following explanation of the phenomenon referred to in the second law:—Supposing that the respective markings are of use to the caterpillars, that therefore they are retained in subsequent generations by natural adaptation, this use can only be real if the caterpillars are big enough to resemble the different parts of the plants on which they feed, and thus escape being noticed by their enemies; and if a sufficient lapse of time is given for carrying this protection into effect. Both these conditions, however, are united in the last stage of development, where the caterpillars have attained the necessary size, and which is the longest of all stages. The use of the colour of caterpillars, and the markings upon them, is also perfectly evident. The younger ones are green as long as during the day they remain on the leaves of the plants they feed on; they do not then form a contrast with the colour of the leaves themselves. The older caterpillars remain green if the thick foliage of the plants protects them under all circumstances; if, however, the foliage is less dense, so that the caterpillars, as soon as they have grown bigger than the leaves, can be easily distinguished among them, they leave the green leaves in the day-time, and try to hide on the stems of the plants and among withered leaves; in that case, to complete the protection, their colour changes from green to brown. The biological value of the characteristic markings upon caterpillars, quite independently of their colour, may be recognised from the fact that

[1] Weismann, "Studien zur Descendenztheorie" ("Researches on the Descent Theory"). Vol. ii. On the last Causes of Transmutations.

the caterpillars which live permanently in the dark, or those of the Microlepidoptera, just as little as those of the first stages of development of most butterflies, have no markings at all; their small size, or their habit of hiding themselves, sufficiently protect them from their enemies; they, therefore, need no markings to insure their safety. When the caterpillars are getting bigger the longitudinal streaks become useful, as through them they do not contrast so much with long-shaped leaves, fir-needles, or stems. The caterpillars with longitudinal streaks, such as those of *Satyridæ*, *Pieridæ*, &c., almost without exception live on fir-trees, grass, or plants growing among grass. The oblique streaks in the segments of other green caterpillars imitate the lateral ribs of the large leaves upon which these species live. The eye- and ring-shaped spots form another means of protection. On the one hand, they may imitate the berries of the plants on which the caterpillars feed, and protect the latter, inasmuch as the berries are still unfit to be eaten at that particular time (*Deilephila hippophaes*). On the other hand, the spots, greatly resembling eyes, most decidedly act as means of frightening the enemies of the larvæ; this is particularly the case with the *Chærocampa* species, as, whenever any danger threatens them they draw their foremost segments into the fourth and fifth ones, and the eye-spots upon these then glare on the puffed-up fore-part of the animal. Weismann has proved this experimentally, by throwing such caterpillars as food before birds, and then watching the expression of fear on the part of the latter. There are other caterpillars the markings upon which cannot possibly be looked upon as means of frightening their enemies, as their repulsive odour or taste alone suffice to ward off the insectivora. Wallace has shown that such insects bear their many coloured marking like a stamp of their unfitness for food, and already by this frighten off insectivorous animals Weismann has proved by some experiments that lizards not only refuse certain caterpillars (*Smerinthus*, *Sphinx*, &c.) at all times, but are even diffident towards others which are marked in a similar manner although quite edible, and only eat them after minute examination.

It is certain that many of these useful markings were acquired by natural adaptation (Naturzuechtung), and it is quite beyond doubt that others have resulted from the internal laws guiding the formation or growth of caterpillars, *i.e.*, through correlation of the different parts of the insect, independently of all usefulness. This is proved by the retrograde movement of the markings acquired in later stages towards the earlier ones, where the markings can but be perfectly useless. The eye-spots, in the same way, first appear through natural adaptation near the head or the tail of the animal, and are then of use; but later on they spread over the other segments also, and here they only reappear, because in articulata the *general* tendency exists to develop all segments in an equal manner. On the other hand the gradual disappearance of certain markings must be ascribed to natural adaptation, because under different conditions of life, more useful markings supplanted the existing ones, which had become useless. If the second phylogenetic form of the *Sphingidæ* caterpillars with single longitudinal streak, seems to indicate that the animals then lived on grass, these streaks became useless and even obnoxious when the caterpillars selected shrubs and trees for their food, and were then replaced by the more appropriate and useful eye-spots.

In short, as far as Weismann investigated the markings of caterpillars, particularly those of *Sphingidæ*, he could prove their development to be caused by external influences (natural adaptation and subsequent correlation), and could consequently reject the assumption of a special creative or form-shaping power.

D'ALBERTIS'S EXPEDITION UP THE FLY RIVER, NEW GUINEA

THE *Sydney Mail* of Saturday, January 20, contains a long account of the expedition of the Italian naturalist, D'Albertis, up the Fly River, New Guinea, translated from his diaries, and communicated by Dr. George Bennett. Signor D'Albertis left Sydney, April 20, 1876, in the mail-steamer, *Brisbane*, and reached Somerset, Cape York, on May 1, where the steam-launch *Neva*, which had been provided for the purpose of the expedition by the liberality of the good citizens of Sydney, was disembarked and equipped. On May 19, after various small casualties, a start from Port Somerset was effected, and Katow, on the coast of New Guinea, reached on the second day. Hence the mouth of the Fly River, already well known to D'Albertis from his previous expedition in the *Ellangowan*, in 1876, was soon entered, and more or less progress was made every day. The land traversed appears to have been mostly low and swampy. On June 20, being on shore, Mr. D'Albertis ascended a hill 250 feet high, and from the summit saw some "very high mountains" in the north-east, fifty or sixty miles distant—probably part of the "great Charles Louis range." On June 28, after having been for some time aground, and only got off by an unusually heavy flood, it was determined to return and to try the western branch of the Fly River. The strong current and other adverse circumstances rendered it necessary to abandon this attempt likewise, after about a week's struggle, and the *Neva* returned to the coast, when the expedition passed several months amongst the islands, and finally returned to Somerset in November. The following is Mr. D'Albertis's summary of his discoveries:—

"After my long narrative I shall conclude with a few words expressing my regret at not having been able to do more. But it is often not the pioneer who shows the way that attains the most glory, but those who follow him; it is easy to hear of a road, but very difficult to find one out. I wish every success to any explorer of this part of New Guinea (should I not be able to return and complete my work), and I hope that the little I have done will be some guide and enable him to find his way more readily than I did mine, and to correct any errors I may have made. By this exploration we are now acquainted with a road into the interior of New Guinea, which is of the more importance, as it is so near to Somerset, where a line of large steamers calls twice every month. We have also found a passage from Moatta to the Fly River, shorter and safer than the one previously known, and a passage which, when properly surveyed, may be found navigable for larger ships. The richness of the land we visited, its vegetable, and probably mineral, products, the soil suitable for many of the most valuable plants, as coffee, sugar, cotton, india-rubber, sago, tobacco, nutmeg, &c., ought to attract the capital of the colony to open up the country. The Dutch from their part of New Guinea, although on a small scale, derive some trade. The part of New Guinea into which we penetrated, was in latitude 5° 30′ S., and ran about 500 miles on the winding river, the course of which may be seen on the chart appended, and it almost forms a line of demarcation between that part of New Guinea claimed by the Dutch, and that remaining as yet unclaimed by any nation.

"About the Fly River, as far as I could judge, the natives appear less numerous than I have seen in other parts of New Guinea, and the land is cultivated in a smaller quantity, so that in this part of New Guinea the settler will not find the same difficulties which I have pointed out on former occasions when speaking of the south-eastern peninsula, where the natives are more numerous, and possess and cultivate all the best land. I have appended Baron von Mueller's report on my collection of dried plants;[1] and on the return of Prof. Liversidge to Sydney he will report on the small collection of minerals, &c., I submitted to him for examination. On a day not far distant I hope to give the ethnological report on the natives, their weapons, &c., also on the mammals and the birds collected, the latter consisting of about fifty species, many of which are new, or only recently described from specimens obtained during my first visit to the Fly River. I have also a rich collection of reptiles, fishes, both of salt and fresh water, some beetles, and some fresh water and land shells. I confidently expect that the voyage of the *Neva* will be remembered by those who take an interest in New Guinea, and by the scientific world."

[1] Some extracts from this were given in our last issue, p. 438.