dates of Herschel's observations are given sensibly the same.

PROPER MOTION OF B.A.C. 793.—Prof. C. P. Smyth has lately drawn attention to an apparent variation in the amount of proper motion of the star B.A.C. 793, shown by the Edinburgh observations between 1837 and 1868, involving a diminution in the motion in R.A. and an increase in that in N.P.D. The star is No. 31 of the list included in Argelander's *Untersuchungen über die Eigenbewegungen von* 250 *Sternen*, Bonn Observations, Vol. vii., Part I., where, from a rigorous discussion of seventy years' observations, the proper motion in R.A. is found to be + 0·1245s, and that in N.P.D., − 1″·456. The comparison of the normal place for 1855·0 with the whole course of published observations to 1865, in which every refinement of calculation is introduced and the above proper motions employed, with Bessel's precession-constants, does not afford any indication of the variability of proper motion suspected by Prof. Smyth. The last Edinburgh observations in 1866 and 1867 show a difference from Argelander's formula of only − 0·08s. in R.A., and agree exactly with the N.P.D. The Washington position, depending upon two observations towards the end of 1870, is in close agreement with Argelander in R.A., and differs − 2″·0 in N.P.D. If a position of the star depending upon a good number of observations should be obtained during the present year, the point may be definitively settled, but thus far variation of the proper motion appears to be at least questionable. Upon this subject see Bonn Observations as above, pp. 20, 54, and 109.

MINOR PLANET NO. 146.—The number of small planets is rapidly approaching *one hundred and fifty*. M. Borrelly, of the Observatory at Marseilles, announces his discovery of No. 146 on the evening of June 8. At 10 P.M. its place was in R.A. 17h. 20m. 16s., and N.P.D. 111° 20′ 15″; it is as bright as stars of the eleventh magnitude, and therefore for the present should be readily identified by means of Chacornac's Chart No. 52.

SCIENCE IN GERMANY

(From German Correspondents.)

HERR VON BEZOLD, of Munich, has published some interesting researches on the periodical changes in the frequency of thunderstorms during long periods of time. These researches are particularly noteworthy for the original manner in which the author has used the statistical materials on thunderstorms which he could obtain (principally within the kingdom of Bavaria). As the character of our reports will not permit us to give details with regard to the manner of treatment, we pass at once to the results which Herr von Bezold has arrived at.

First of all it was found that the frequency of thunderstorms during a long period is generally either on a continuous increase or decrease, and that these variations are periodical.

If we ask on which other meteorological phenomena these variations could possibly depend, the first thing to be considered is the temperature. It is further advisable, on account of the numerous relations that have lately been discovered to exist between sunspots and meteorological phenomena, to turn attention also in this direction. It has been found in reality, that if we represent the variations of the frequency of thunderstorms by a curve and compare the same with the curve of the frequency of sunspots, the minima of the thunderstorm curve coincide exactly with the maxima in the sunspot curve. On the other hand, the thunderstorm curve forms, to a certain extent, the mean between the sunspot curve and the curve of the deviation of the average yearly temperature for our latitudes.

We must observe here that although the path of the thunderstorm curve shows a general and unmistakeable connection with that of the sunspot curve (so that, for instance, for the period from 1775 to 1822 the maxima of the thunderstorm curve coincide almost completely with the minima of the sunspot curve), yet the details of the thunderstorm curve coincide better with the details of the curve of temperatures, so that nearly every rise or fall in the latter can be distinctly traced in the former. This connection between thunderstorms and the deviations of the yearly temperatures from the total average, shows itself still clearly, even where that between the thunderstorm and sunspot curves is less apparent.

Herr von Bezold recapitulates the results of his investigations as follows:—High temperatures, as well as a solar surface free from spots, cause a greater number of thunderstorms during a year than the reverse. Now, as the maxima in the frequency of sunspots coincide with the maxima of the intensity of aurora borealis, it follows that both groups of electrical phenomena, thunderstorms and auroræ, complement each other, as it were, so that in years with many thunderstorms auroræ will be rare, and *vice versâ*.

From this connection between sunspots and thunderstorms an immediate electric action between the earth and the sun does not necessarily follow, but it may be simply a consequence of the magnitude of insolation, which depends on the frequency of spots. These changes in the insolation are not felt simultaneously but successively in the different latitudes. The phenomena of thunderstorms, however, do not only depend on the conditions of temperature at a given locality, but also on the state of the atmosphere at far distant points, belonging to another zone; and this is most evident with thunderstorms accompanying strong currents of wind or tempests. In this manner the peculiar intermediary position which the thunderstorm curve occupies between the curves of temperature and sunspots might perhaps find its explanation eventually.

IN zoological investigations experiments are rare, and therefore the results obtained by them are all the more valuable. The latest work of this kind—"Researches on the Theory of Descent: I. On the Season-dimorphism of Butterflies," by Dr. August Weismann, Professor at Freiburg—will, however, interest not only the narrower circle of entomologists, but also the amateurs in this branch of science, as it will furnish them with a sort of guide for the pursuit of their hobbies in such a manner as to do great service to science. Weismann bases his researches on the fact, which has been known for some time, and which has been called "season-dimorphism" by Wallace, that certain butterflies, when issuing from their winter chrysalis in the spring, show a different coloration and design upon their wings than do those which appear in the following summer; so that until this fact was discovered, the two forms were thought to be two distinct species of butterflies. We will only mention one of many examples, as it refers to one of the commonest kinds of day-butterflies. *Vanessa levana* is only the winter form of *Vanessa prorsa*, which is the summer form produced by the former; the latest offspring of the latter, which survive the winter, reappear as *Vanessa levana* in the following spring. Weismann exposed the caterpillars produced by *V. levana* in May, which in the normal state should have produced the imago of *V. prorsa*, to a continuous temperature of 0° − 1° C., after they had changed to nymphæ. The result was that they yielded the winter form *V. levana*, with few exceptions. The same result was obtained with the second summer generation, which under ordinary conditions would still have appeared as *V. prorsa*. On the other hand, Weismann succeeded only very rarely in forcing the last generation in the year again to take the *Prorsa* form, by keeping the nymphæ in hothouses at 15° − 30° C., instead

of in the ordinary winter temperature. Most of the nymphæ passed the winter even in hothouses or in heated rooms, and produced *V. levana* in the spring. Similar researches were made by Weismann with another common day-butterfly species, *Pieris napi*.

Weismann thinks that the winter form of these butterflies was the original one, which existed alone and in a single annual generation in Europe, during the so-called ice period. As the summers became longer and warmer, a second and finally a third annual generation could be produced, and these were changed to the *Prorsa* form by the higher temperature. The return of the colder season then always caused a return to the original form (*Atavism*), just as it occurred in the experiments. To confirm this view, Weismann quotes the fact that in Lapland and in the upper Alps only a winter form of *P. napi* exists. As with an incomplete return to the original form intermediate forms result, the varying aspects of which prove that the change of the original form always takes place in a certain direction, Weismann thinks that the change of temperature might certainly have given the impulse for a change of form, but that the particular direction of the same lies in the constitution of the animal in question. We may certainly consider as a result of these investigations, that a change of climate, together with other causes, may have directly produced a great number of different species of butterflies.

Another fact mentioned by Weismann refers to the above, and is no less interesting. There is one of the lower Crustaceæ, *Leptodora hyalina* (Siebold's and Köliker's *Zeitschrift fiir Wissenschaftliche Zoologie*, 1875), which is remarkable in many ways. This animal, according to the observations of the Norwegian Sars, shows similar phenomena, as the winter breed is differently developed from the summer breed, although the perfect forms are not so widely different as those of the butterflies.

ZOOLOGICAL NONSENSE

NOT many months since a controversy which had been raging for several weeks in the columns of the so-called "leading journal" was suddenly and completely put an end to by a well-known writer in a contemporary calmly and dispassionately pointing out that both disputants had been uttering what was absolute nonsense. "I use the word nonsense," he went on to say, "not as it is often used as a vague term of disapproval, but with a strict specific meaning, as contradistinguished from sense. All words—all articulate words—must be either sense or nonsense. They are sense if their meaning can be imagined, conceived, represented in some way or other to the mind. They are nonsense if their meaning cannot be imagined, conceived, or represented in any way to the mind. When a man says, 'I saw six men and two women walking down such a street, dressed in such a way, and heard them talking on such a subject,' anyone can understand, whether he believes it or not. The speaker is talking sense, whether truly or falsely. If he were to say he saw two crooked straight lines standing in the five corners of a square, you would say he was talking nonsense, that his words were neither true nor false, and that he might as well keep silence, or utter any other unmeaning sounds. The difference between these two examples consists solely in this, that the first assertion can, whereas the last cannot, be pictured to the mind. Each particular word by itself is as clear in the one case as in the other."

What the question then under discussion was, does not signify. Enough that it was nothing which had to do with natural science. But we are sorry to say that nonsense is still occasionally spoken or written by those who, if they do not exactly profess to be scientific, yet pretend to treat of things that clearly belong to the domain of science, and so make some approach to that character. Moreover, they are looked up to by some well-meaning though imperfectly instructed persons as authorities worthy of consideration. There was a time when there was a good deal of nonsense written by naturalists, and especially by zoologists, but we had been in hopes that the practice was entirely given up. It seems, however, that we are disappointed. Here is a melancholy instance to which our attention has lately been called :—

"I have never seen any reason to doubt, *first*, that the Vertebrata, or more properly 'Endosteata,' are the central group of the animal kingdom, the others being the Exosteates (or Articulates), the Anosteates (or Molluscs), and the Actiniates (or Radiates); *secondly*, that the Sucklers are the central group of Endosteates, the other groups being Birds, Reptiles, and Fishes; the Sucklers are connected with Birds through the Bats, with Reptiles through Pangolins and Armadillos, and with Fishes through Porpoises and Whales. The pectoral sucklers (Primates) are central, and MAN is the centre of these—not a mere unit on the circumference of the system."

There is no need to name the writer of this passage or the publication in which it appeared within the last few weeks, because our business is with the matter, not with the man, though we can hardly do otherwise than marvel at his style of easy assurance—"I have never seen any reason to doubt." We at first almost fear a platitude, then catching a glimpse of what is coming, we begin to think we are on the verge of a great discovery, or perhaps shall be brought face to face with intelligence itself. Sad is our disappointment as the sentence proceeds. The unwonted word "Endosteata" jars our bones within us, but we recover as we best can, and so far suppose it is all right; the expression of a "central group" may pass as a metaphor, and we feel a sense of relief and obligation at having the extraordinary names of the other groups translated for us; but then we thought we had somewhere been taught the Radiates had no existence. However, we hail a friendly semicolon, and find that we are arrived at the end of the author's first article of faith, which, though obscured by the metaphor, is yet intelligible. Now, then, for his "secondly." The word "Sucklers" strikes us as singular, but we discover that whatever it means forms another "central group," this time of "Endosteates"; so, to meet metaphor by metaphor, we exclaim "wheels within wheels," and it is a comfort to find that the surrounding groups are our old friends Birds, Reptiles, and Fishes; Amphibians, we suppose, being packed between the two latter. The next part of the sentence, however, is absolutely shocking: "Sucklers" connected with Birds through Bats, with Reptiles through Pangolins and Armadillos, and so on. Why, what is a zoological connection? Is it of affinity or analogy? Can the author have ever seen or examined the structure of the animals he mentions? We are taken back to the dark ages of zoology, if not to ages almost prehistoric. Needless to say that our confidence is gone. Then we have the concluding sentence with the old metaphor once more, and a new one; or is it that no metaphor is intended after all? that these concentric circles forming a system with a circumference on which man is *not* a unit —we wonder who ever said he was—exist in the author's mind? In our own we are free to say they do not. We are sure that they do not exist in nature, and we are so unimaginative that we cannot picture a representation of them to ourselves. Accordingly there is no help for it but to conclude that all this is clear, unmistakable, undeniable nonsense, as much so as the two crooked straight lines standing in the five corners of a square. These "circles," with their unit-bearing circumference, are, in the words of the writer from whom we first quoted, "the nonsensical shreds of exploded metaphysics"—relics of that silly "circular system" with its mystical numbers, its fives or its sevens—the will-o'-the-wisp of fancy that once