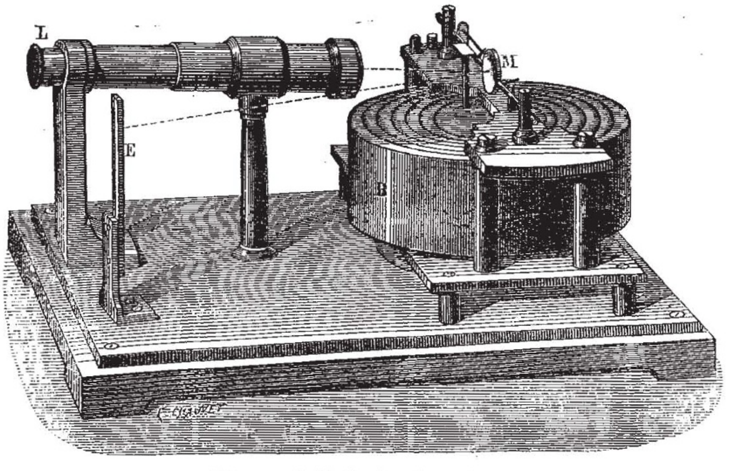
tion both at home and abroad, for take it all in all, as Mr. Bullen says, "no catalogue in the world, whether in print or in manuscript, is equal to that of the British Museum." We hope, therefore, that the proposal of the Society will speedily meet with a favourable response from Government, and that should it be decided to print the British Museum Catalogue, some plan will be formed by which proofs may be revised not only by qualified bibliographers, but that the various departments of literature, science, and art will be represented on the staff of revisers.

A MIRROR BAROMETER

M. LÉON TEISSERENC DE BORT has invented an aneroid mirror barometer, which is described in a recent number of *La Nature*. It is based on a method analogous to that well-known since the researches of Gauss for the reading of small rotations. M. Teisserenc de Bort has sought to obtain an aneroid barometer which will give precise observations at sea, especially in rough weather, when it is impossible to read the mercury barometer. The principle of this barometer is very simple. The elastic tub or box B carries, as in most aneroids, a metallic point, which follows its movements. In the ordinary aneroid the transformation of the vertical movement into a rotating movement necessitates either a chain or a curb, or a sort of fork which works in a spiral furrow cut in the axis which supports the needle. These various systems have the inconvenience of producing frictions; some of them are liable to dust and rust. In the mirror barometer, the transformation of the movement is obtained by the simple contact of a small palette supported on the axis of the mirror and of the point spoken of above. As the angle which the plane of the mirror may describe does not exceed 12° on each side of the vertical, it follows that the contact of the point in the palette is always precise.



Teisserenc de Bort's mirror barometer.

As to the amplification of the movements necessary to enable us to appreciate millimetres and their fractions, this is obtained by reading with the aid of a small reticled telescope, L, the image of a graduated scale E which is reflected in the mirror M. By combining the enlargement of the telescope with the distance of the scale from the mirror, we succeed in giving to the apparatus a length of less than 20 cm. by 12, which renders it quite portable. It is important to remark that the amplification of the movements of the box, which, in ordinary barometers, is obtained by means of several levers, is obtained here by an optical process; it follows that the numerous frictions and the time lost in contacts are mostly eliminated. There remains only a single movement, that of the axis which bears the mirror; in the barometer figured the pivots are of steel and the cap of platinum, and in order to avoid rust, the whole is nickel-plated.

M. Teisserenc de Bort proposes to construct others, in which the axis will be mounted on rubies. This garniture will not sensibly increase the price of the apparatus. This instrument is too new to allow us to appreciate the full degree of precision which it can attain. In a trial in a captive balloon by Capt. Perrier of several aneroids as compared with the mirror, the latter showed a great sensibility, and it quickly resumed its original position on landing.

BUTTERFLIES WITH DISSIMILAR SEXES

NATURALISTS have long been familiar with the fact that the two sexes of certain species of lepidoptera often differed from each other in colour and marking, and sometimes in form and size to a very considerable extent. For this phenomenon the convenient term "Antigeny" has been proposed by Mr. S. H. Scudder.[1] In accordance with Darwin's theory of sexual selection we find that when the sexes of a butterfly differ to any marked extent in colour, it is generally the male which is the more gaudily coloured, although there are certain genera in which the reverse obtains; but, as I pointed out in NATURE (vol. iii. p. 508), there is reason to believe that in these exceptional cases the males may be the selecting sex. Mr. Charles Darwin having recently called my attention to a paper on this subject in *Kosmos*,[1] by that most philosophical entomologist, Fritz Müller, I have thought that an abstract might interest readers of NATURE.

The species of which the author treats, *Epicalia acontius*, has such very dissimilar sexes that Fabricius described them as distinct species, calling the male *Antiochus* and the female *Medea*, while in Doubleday and Westwood's "Genera of Diurnal Lepidoptera" the two sexes are placed in different genera, the male in *Epicalia* and the female in *Myscelia*. It is not known with certainty who first pointed out that *Antiochus* and *Medea* were the sexes of the same species; but this fact is now

[1] *Proc.* Amer. Acad., xii. 150.

[1] "Epicalia acontius. Ein ungleiches Ehepaar," *Kosmos*, January, 1879, p. 285.

established beyond doubt. Were this not the case *Antiochus* would be without a female and *Medea* without a male. Indeed Fritz Müller has reared from larvæ both sexes of an allied species, *Epicalia numilia*, which differ from one another to the same extent as do the sexes of *E. acontius*. In both sexes of this latter species the general ground colour of the wings is black, the male having a broad oblique bar of a bright orange colour extending from about the middle of the inner margin to about the middle of the fore-wing in the direction of the apex. There is a corresponding blotch near the middle of the hind-wing, so that when the wings are extended the bar on the fore-wing is continuous with the blotch on the hind-wing, the whole forming one oblique orange bar. The female (*Medea*) has two oblique rows of pale yellow spots across the fore-wings running nearly parallel with the costal margin, and two similar rows across the hind-wings; when the insect rests with outstretched wings, the fore- and hind-wings overlap so that the spots of all four wings form three straight parallel rows which are continued on the body by spots of the same colour. The sexes of *E. numilia* differ in a similar manner.

Further, in the female of *E. acontius* (as in both sexes of *E. numilia*), the inner margin of the fore-wing is nearly straight, while it is markedly curved in the male. Both wings in this latter sex are also much broader in proportion to their length than is the case with the female, and in consequence of this, the wings of *Antiochus* overlap each other to such an extent that nearly half the hind-wing is hidden beneath the fore-wing, the space thus concealed being fully twice as broad as in *Medea*. The curvature of the inner margin of the fore-wing of a butterfly when exaggerated on the over-lapping portions of the two wings, is, according to the author, a never-failing indication of the presence of a scent-secreting organ at this spot. Thus, having read in Doubleday and Westwood's "Genera" that in the fore-wing of *Ageronia* "the inner margin in the male is occasionally dilated," Fritz Müller caught a male specimen of *A. arethusa*, and found a strong odour to be emitted by a scent organ concealed between the wings. Now in *Antiochus* a similar organ exists, while it is absent in the male of *E. numilia*, and in this latter the fore and hind wings overlap only to the same extent as in the female.

When in lepidoptera the sexes of a species differ from one another to any great extent in colour and marking, the female is generally inconspicuous or is coloured gaudily in imitation of some other species (mimicry). Thus in *Thecla hemon* the male is bright blue, while the female is dull brown, while in *Dyschema amphissa* the male is white, and the female is one of the numerous mimickers of *Acræa thalia*. This explanation, however, does not apply to the female of *E. acontius*, since there is no species marked in a similar manner which might serve as a model for mimicry. On the other hand, the *Medea* type of marking is to be found in a large number of species of the same and of allied genera (the female of *Myscelia orsis*, for example). Neither can the coloration of Medea be considered protective, since it is very conspicuous, and the insect has a habit of sitting with wings fully expanded.

According to Darwin's theory of sexual selection,[1] the ancestor of the present genus *Epicalia* was probably of the *Medea* type—the present form of the male having resulted from selection by the female. The author then asks whether *Medea* has preserved the form of marking common to both sexes of the progenitor, and whether this marking has any present significance; also: "Is the colour ornamental, or for offensive or defensive purposes, or both?—for the one does not exclude the other." In reply to the latter part of this question, dissent is expressed from Prof. Gustav Jaeger's view, that yellow is as a rule an offensive or defensive colour. It is next pointed out that in the female of *E. numilia*, the row of spots is replaced by a broad oblique yellow bar, this alteration of pattern being attributed to sexual selection by the males, which must have thus preserved but at the same time slightly modified, the taste of the common ancestor of the genera *Epicalia* and *Myscelia*, the females of a few species of which have been made to depart to a much greater extent from their congeners by a greater divergence of taste on the part of their mates. The females of most of the species of these genera had, however, "set the fashion" in a completely new direction, and thus brought about the dissimilarity of the males.

[1] "Descent of Man." i. 388.

In support of this view the author remarks, that although sexual selection is generally regarded as being exerted by the females, yet, as Haeckel has maintained,[1] the selection by the males must have an equal influence on the opposite sex. That such a choice is exerted by butterflies the author has already pointed out.[2] In the present case we must believe that the two sexes manifested completely different tastes,[3] just in the same manner as much that we consider physically or intellectually superior in woman would be considered unfitting for men.

The acquisition and modification of the *Medea* type of marking may have occurred at a time when both sexes of the ancestral form were alike. Such peculiar marking could not have been produced by the direct action of external conditions nor by any innate "laws of growth," neither can it be considered as a protective colouring produced by natural selection. Sexual selection is thus the only explanation left open.

It has been shown by Weismann that the colour and marking of butterflies' wings are undoubtedly affected by external conditions, and in the case of larvæ markings, which, through such conditions, make their appearance on one segment, not unfrequently extend to other segments (by correlation of growth?). The same appears to hold good for the wings of butterflies: markings which through any cause appear in any one wing-cell tend to be repeated on corresponding places in the other wing-cells. When such markings serve as signs of distastefulness or for other protective purposes, they would be preserved, and even increased in brilliancy and size by the action of natural selection. Thus a striped butterfly might be produced from a simple grey or brown one, and the markings regularly repeated on the corresponding places of the wing-cells would not fail to give us a pleasing impression, although no selection with special regard to beauty had taken place. In such cases, however, it is obviously immaterial whether the markings of the fore- and hind-wings harmonise or not. When, however, we have an unbroken bar across both fore- and hind-wings so arranged that the pattern is only complete when the insect sits with outstretched wings, or is in an attitude of flight, while in every other position the bar is broken, it may be safely assumed that the ever-vigilant eye of selection had brought about this result.

The markings of *Medea* are then considered from this point of view. The two rows of yellow spots on each wing, as already described, form three straight rows when the wings are spread out as in flight; in any other position—if, for instance, the fore-wings are pushed too forward or too far backwards—the symmetry is broken. Special attention is called to the fact that the hindmost rows of spots on the hind-wings have been distorted so as to form a straight bar parallel with the other rows; this results from the displacement of the spots, each of which, although situated in one wing-cell, does not appear on the *corresponding place* in each cell; were this the case, the row would be curved instead of straight. That it was the sense of beauty of a critical eye which straight-

[1] "Generelle Morphologie," 1866, ii. 244.
[2] *Kosmos*, ii. 42
[3] The term "reciprocal sexual selection" might be advantageously applied to such classes of cases.—R. M.

ened the original curved row of spots to a straight bar, is most strikingly shown by the two foremost spots of the row which are unsymmetrical with regard to the corresponding row on the front wings, and which really form the commencement of a curved bar, *but these are hidden by the overlapping of the front wings.*

Thus it was perhaps the selection of males by the females that first perfected the *Medea* type among the progenitors of the genus. Later on the males of some of the species may have been completely modified (as with *E. acontius*), while the females retained their peculiar pattern (by reciprocal selection or by sexually limited inheritance ?) down to the present time.

In conclusion, attention is directed to the scent-secreting organ of *Epicalia acontius* as compared with that of another butterfly belonging to a quite different group, viz., *Antirrhæa archæa*, the organ being almost identical in these two widely-separated species, and thus affording a striking instance of what is well known to evolutionists as "analogy," in contradistinction to "homology."

R. MELDOLA

SUN-SPOTS AND COMMERCIAL CRISES

I HAVE been repeatedly told by men who have good opportunity of hearing current opinions, that they who theorise about the relations of sun-spots, rainfall, famines, and commercial crises are supposed to be jesting, or at the best romancing. I am, of course, responsible only for a small part of what has been put forth on this subject, but so far as I am concerned in the matter, I beg leave to affirm that I never was more in earnest, and that after some further careful inquiry, I am perfectly convinced that these decennial crises do depend upon meteorological variations of like period, which again depend, in all probability, upon cosmical variations of which we have evidence in the frequency of sun-spots, auroras, and magnetic perturbations. I believe that I have, in fact, found the missing link required to complete the first outline of the evidence.

About ten years ago it was carefully explained by Mr. J. C. Ollerenshaw, in a communication to the Manchester Statistical Society (*Transactions*, 1869-70, p. 109), that the secret of good trade in Lancashire is the low price of rice and other grain in India.[1] Here again some may jest at the folly of those who theorise about such incongruous things as the cotton-mills of Manchester and the paddy-fields of Hindostan. But to those who look a little below the surface the connection is obvious. Cheapness of food leaves the poor Hindoo ryot a small margin of earnings, which he can spend on new clothes; and a small margin multiplied by the vast population of British India, not to mention China, produces a marked change in the demand for Lancashire goods. Now, it has been lately argued by Dr. Hunter, the Government statist of India, that the famines of India do recur at intervals of about ten or eleven years. The idea of the periodicity of Indian famines is far from being a new one; it is discussed in various previous publications, as, for instance, "The Companion to the British Almanack for 1857," p. 76. The principal scarcities in the North-Western and Upper Provinces of Bengal are there assigned to the years 1782-3, 1792-3, 1802-3, 1812-13, 1819-20, 1826, 1832-3. Here we notice precise periodicity up to 1812-13, which, after being broken for a time, seems to recur in 1832-3.

Partly through the kind assistance of Mr. Garnett, the Superintendent of the British Museum Reading Room, I have now succeeded in finding the data so much wanted to confirm these views—namely, a long series of prices of grain in Bengal (Delhi). These data are found in a publication so accessible as the *Journal* of the London Statistical Society for 1843, vol. 6, pp. 246-8, where is printed a very brief but important paper by the Rev. Robert Everest, chaplain to the East India Company, "On the Famines that have devastated India, and on the Probability of their being Periodical."

Efforts have, I believe, been made by Dr. Hunter, Mr. J. H. Twigg, and probably others, to obtain facts of this kind, which would confirm or controvert prevailing theories; but this little paper, which seems to contain almost the only available table of prices, has hitherto escaped the notice of all inquirers, except, indeed, Mr. Cornelius Walford. The last number of the *Journal* of the London Statistical Society contains the second portion of Mr. Walford's marvellously complete account of "The Famines of the World, Past and Present," a kind of digest of the facts and literature of the subject. At pp. 260-1 we find Everest's paper duly noticed. In this latter paper we have a list of prices of wheat at Delhi for seventy-three years, ending with 1835, stated in terms of the numbers of seers of wheat—a seer is equal to about 2lb. avoirdupois—to be purchased with one rupee. As this mode of quotation is confusing, I have calculated the prices in rupees per 1,000 seers of wheat, and have thus obtained the following remarkable table :—

Price of Wheat at Delhi

1763	50 M.C.	1800	22
1764	35	1801	23
1765	27	1802	25
1766	24	1803	65 M.
1767	23	1804	48 C.
1768	21	1805	33
1769	24	1806	31
1770	28	1807	28
1771	33	1808	36
1772	38 C.	1809	40
1773	100 M.C.	1810	25 C.
1774	53	1811	28
1775	40	1812	44
1776	25	1813	43
1777	17	1814	30
1778	25	1815	23 C
1779	33	1816	28
1780	45	1817	41
1781	55	1818	39
1782	91	1819	42
1783	167 M.C.	1820	46
1784	40	1821	38
1785	25	1822	35
1786	23	1823	33
1787	22	1824	39
1788	23	1825	39 C.
1789	24	1826	48 M.C
1790	26	1827	30
1791	33	1828	22
1792	81 M.	1829	21
1793	54 C.	1830	21
1794	32	1831	26
1795	14	1832	22
1796	14	1833	33
1797	15	1834	40 M.
1798	8	1835	25
1799	17	1836	— C.

The letter M indicates the maxima attained by the price, and we see that up to 1803, at least, the maxima occur with great regularity at intervals of ten years. Referring to Mr. Macleod's "Dictionary of Political Economy," pp. 627-8, we learn that commercial crises occurred in the years 1763, 1772-3, 1783, and 1793, in almost perfect coincidence with scarcity at Delhi. M. Clément Juglar, in his work, "Des Crises commerciales, et de leur Retour périodique," also assigns one to the year 1804. After this date the variation of prices becomes for a time much less marked and regular, and there also occurs a serious crisis about the year 1810, which appears to be exceptional; but in 1825 and 1836 the decennial periodicity again manifests itself, both in the prices of wheat at Delhi and in the state of English trade. The years of crisis are marked with the letter C.

[1] This view is confirmed by the opinion of Mr. E. Helm, as given in the *Transactions* of the same society for 1868-9, p. 76.