The Evolution of Beauty.

DARWIN sought for an explanation of the ornaments of animals, their bright colours, beautiful songs, and all their structures and habits that could not be explained as the result of natural selection, and he found a perfect one in the instincts possessed by the unornamented sex, usually the females, of choosing as mates the more beautiful of their suitors. But this theory, although it explains the ornaments by the instincts, makes no reference to the evolution of the instincts.

It seems plain that a female which gives her descendants dangerous habits and structures will soon have no descendants, yet some of the practices and structures of the males are dangerous, and the female instinct to choose these has evolved, apparently in defiance of natural selection.

The better mate an animal can get the more chance its descendants will have of survival, and it is obvious that a male that has to face more danger and yet manages to survive has in all probability a greater capacity for keeping alive than one which lives through less danger. Therefore the female that chooses a mate with a dangerous habit or structure chooses what is, apart from the dangerous part, a better and more fit mate.

No species can rise directly above its environment, for if there is less killing there is less selection, and variations for the worse soon drag the whole species down into the arena, even if it does contrive to climb out. The only way in which selection can be escaped is for some individuals to be handicapped and sacrificed, taking the selection upon themselves, so that their descendants, or at all events some of them, may escape it.

This is exactly what has happened. The female has forced the male to seek danger and endure rigorous selection in order to win her, and, while his handicap has descended only to the male line, the vitality which was his that he might bear it has descended to both sexes equally..

The whole advantage is on the female side, consequently anything which tends to make the female more valuable than the male favours the development of sexual selection. Compared with the females the males of polygamous animals are valueless, and it is noteworthy that among the higher animals all, or almost all, the polygamists indulge in sexual selection.

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The Line Spectra of Isotopes.

COMPARISONS of the spectra of the isotopes of lead have shown that they are indentical, except for slight wave-length differences of the order of a few thousandths of an Ångström unit. Our inability completely to separate the isotopes of other non-radio-active elements in quantities for spectroscopic investigation has left this the only experimental result of a direct nature. In order to find possible evidences of the effect in two other elements, the writer has made an accurate comparison of the spectra of samples of mercury having different atomic weights, and also of similar samples of chlorine. These have been produced by long-continued fractional diffusions in the laboratory of Prof. W. D. Harkins, who kindly made them available for this investigation.

The best mercury used had an atomic weight difference of 0·18 units. A calculation showed that the proportions of isotopes 198 and 204 in these samples differed by about 20 and 27 per cent., respectively, of their values for ordinary mercury. The lines were compared, using an echelon of R.P. 400,000 and a plane grating the R.P. of which in the fifth order was 478,000. No differences in the wave-lengths of the lines λλ5461, 4359, 4078, and 4047, or any of their satellites, were found which were greater than the error of measurement (3×10^{-4} Å.U.). The relative intensities of the satellites of a line were always visually identical in the two spectra. This observation has a direct bearing on some recent discussions which have appeared in the columns of NATURE, particularly those of Nagaoka and his associates, according to whose ideas we should expect intensity differences of 1/4 and 1/5 in the satellites corresponding to isotopes 198 and 204.

The chlorine lines from two specimens differing by 0·097 atomic weight units, when examined with the echelon, showed distinct evidence of shifts in some cases. Wherever these were observed, the heavier chlorine appeared to give the shorter wave-length. The shifts were small, however (0·0012 Å.U. in the largest of the trustworthy cases, λ4741), and their exact values cannot be given, since they were at most only two or three times the experimental error.

The experiments were carried out in the Physics and Chemistry Departments of the University of Chicago, and the writer is indebted to Prof. H. B. Lemon for many valuable suggestions. A fuller report of these results will be given elsewhere.

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The Isotopes of Sulphur.

SULPHUR is one of the elements used in the fundamental calculation of atomic weights, and there is no reason to doubt the substantial accuracy of the fractional value 32·06 ascribed to it. The results of its analysis by the mass-spectrograph (NATURE, July 1, 1920, p. 547) were indecisive, owing to the fact that the resolving power of the instrument, about 1 in 130, was insufficient to separate the line due to molecular oxygen from that of a sulphur atom of the weight above, if the latter existed. There were many other lines on the plates, which might have been due to isotopes present in small percentages. Those at 33 and 34 were particularly noted (*Phil. Mag.* **40**, 632, 1920), but with the knowledge then available it seemed safer to ascribe these to hydrides and to rest content with the certain conclusion that atoms of mass number 32 were present in preponderating amount.

I have now been able to raise the resolving power of my new instrument to about five times that of the old one, sufficient to show the lines of O and CH_4 clearly separated by more than half a millimetre. Subject to this analysis the line 32, obtained under conditions such that O_2 and S must both have been present, showed no sign of doubling. This proved that isotopes of higher mass-number must exist. Further study with gases containing SO_2 indicated that the suspected faint companions at 33, 34 (S); 49, 50 (SO); 65, 66 (SO_2), were present on all spectra, even when the conditions were such as to make the presence of hydrides very unlikely. They also showed intensity relations consistent with true isotopic character.

The matter has now been put beyond reasonable doubt by the negative mass-spectrum obtained by using pure SO_2 and exposing for an hour with both fields reversed. All three lines were visible, and again showed the same intensity relations. Sulphur is therefore a triple element like the two even ones,