

[Uncorrected Proof.]

The term 'Mutation.' By Professor E. B. POULTON, F.R.S.

1. The word 'Mutation' was originally introduced by Waagen¹ to express a simultaneous and probably gradual change in a relatively large proportion of the individuals of the species, if not the whole species. 'Mutation' expresses the change itself, not the process by which it has been produced. Waagen nowhere states that his 'Mutations' are discontinuous variations or 'Saltations.' Waagen's material was exclusively palaeontological, and his 'Mutations' are variations in time. He was inclined to believe that they were produced by a developmental force resident in the organism.

2. 'Mutation' was re-introduced by de Vries as equivalent to 'Saltation,'² and applied to Darwin's 'large' or 'single' variations as opposed to his 'individual differences.' The latter de Vries called 'Fluctuations.' According to de Vries as well as Darwin *both forms of variation are hereditary.* De Vries distinguished between them by supposing that a 'Mutation' leaps at once to a new position of genetic stability—it is what Galton previously called 'transilient.' De Vries' 'Fluctuations,' on the other hand, are subject to Galton's 'regression to mediocrity,' and there is a limit to the advance which can be achieved by selection.³ It must be added that de Vries is disposed to explain 'Fluctuations' as due to the action of the environment, and, so far as they are concerned, to accept the 'hereditary transmission of acquired characters.' The majority of biologists will prefer to conclude that de Vries' 'Fluctuations' are of two very different kinds, some of them being (a) Germinal characters that are hereditary, and subject to Galton's 'Regression'; and others (b) Somatic characters that are not hereditary. De Vries uses the term 'Mutation' to express (1) a single 'Saltation' and (2) the theory that evolution progresses discontinuously by means of 'Saltations.' He states, however, that his 'Mutations' may be small.⁴

3. Bateson, Punnett, Shipley and others have erroneously stated in recent years that de Vries 'pointed out the clear distinction between the impermanent and non-transmissible variations which he speaks of as *fluctuations*, and the permanent and transmissible variations which he calls *mutations*.'⁵

In this third use of 'Mutation'—Batesonian, not de Vriesian—the word is applied to any and every hereditary character and becomes the same as Weismann's 'Blastogenic Variation.' 'Fluctuation' similarly in this second use, restricted to (b) as explained above, becomes the same as Weismann's 'Somatogenic Variation.'

This mistaken reading of de Vries has unfortunately been widely followed, so that the Dutch botanist is now generally credited in this country with the bestowal of Waagen's term 'Mutation' upon a form of variation previously announced by Weismann, instead of upon one ('Transilient') previously announced by Galton.

¹ 'Die Formenreihe des *Ammonites subradiatus*, &c.' *Geogn.-palaeont. Beiträge* ii, Heft 2, b (1869), p. 186.

² *The Mutation Theory*, Engl. Transl., Vol. i, London (1910), p. viii. 'These saltations, or mutations. . .'

³ *Ibid.* p. 123 :—'Continued selection [of fluctuations] by no means fixes the character chosen, but, by separating the race further from the type from which it sprang, continually adds to the risk of regression.' This is precisely Galton's conclusion, just as 'Regression' in this sense is Galton's term. Darwin also 'fully recognised the limits which may be set to the results achieved by the artificial selection in one direction of individual variations,' and 'he admitted the necessity of waiting for a fresh "start in the same line."' (*Darwin and the Origin*, Poulton, London (1909), pp. 48, 49).

⁴ *Ibid.*, p. 4.—'Of course every peculiarity of an organism arises from a previously existing one; not however by ordinary variation, but by a sudden though minute change. . . . The name I propose to give to this "species-forming" variability is Mutability. . . . The changes brought about by it, the Mutations. . . .'

So also on p. 55 :—'. . . many mutations are smaller than the differences between extreme variants' [here used as equivalent to 'Fluctuations.']

⁵ *Mendel's Principles of Heredity*, Bateson, Cambridge (1909), p. 287.

The existing hopeless confusion can only be set right by restoring the term 'Mutation' to its rightful owner Waagen—a measure of justice for which geologists have been contending for several years.⁶

For the two other uses of 'Mutation' and for the two kinds of 'Fluctuation' the following changes are suggested :—

For 'Mutation' II. (de Vries), both large and small, substitute Galton's 'Transilient,' used as a substantive. The old associations of 'Saltation' are always with large variations, and the term should never be applied to small 'Transilients.' The term 'Magnigrade' to be used as substantive or adjective, may be conveniently applied to a 'Saltation' or 'Large Transilient,' 'Parvigrade,' similarly to a 'Small Transilient.' 'Magnigrade Evolution' is 'Discontinuous,' 'Parvigrade Evolution' 'Continuous.'

For 'Mutation' III. (Bateson *nec* de Vries) substitute 'Blastogen,' the substantive form of Weismann's 'Blastogenic.' Other synonyms are 'Constitutional,' 'Congenital,' 'Genetic,' 'Inborn,' 'Innate,' 'Inherent' and 'Centrifugal.' The term 'Variation' has also been used in this restricted sense.

For 'Fluctuation' I(a) (de Vries) substitute Galton's 'Regressive,' used as a substantive.

For 'Fluctuation' II. (Bateson) = I(b) (de Vries) substitute 'Somatogen,' the substantive form of Weismann's 'Somatogenic.' Other terms are 'Acquired' (going back to Erasmus Darwin, 1794, and Lamarek, 1809) antithetical to 'Inherent,' 'Centripetal' to 'Centrifugal,' and 'Modification' to 'Variation.'

The relationships are shown below :—

I. Hereditary characters originating in the

germ

A. Blastogens

1. Transilients 2. Regressives

a Magnigrades b Parvigrades.

II. Non-hereditary characters acquired
by the body

B. Somatogens

⁶ F. A. Bather in J. E. Marr's Presidential Address to the Geological Society of London, 1905, *Proceedings*, pp. lxxii, lxxiii. In drawing up the present abstract I have received much kind help from my friend, Dr. Bather.

