(4) Under conditions where wall decay has been minimised and the gaseous process predominates, no appreciable change in the order of the reaction takes place with time and no apparent alteration occurs in the afterglow spectrum so far as λ4000 Å.

(5) In glowless nitrogen the chemical activity is either absent or scarcely detectable; addition of photogenic gases causes, however, a development of chemical activity which generally increases less rapidly than the corresponding rise in luminosity. No simple relationship apparently exists between glow intensity and concentration of chemically active nitrogen, except possibly under certain conditions which are determined by the state of the walls; in this case there is direct proportionality.

(6) Addition of small amounts of oxygen or nitric oxide to a stream of glowing nitrogen causes a large development of radiations which lie in the blue and regions of shorter wave-lengths. (This has also been observed by Mr. G. C. Eltenton, using the writer's former apparatus at Cambridge.)

(7) The intensity of the green flame produced when 5 per cent or so of nitric oxide is fed into a stream of glowing nitrogen appears to follow the same intensity relations towards the concentration of chemically active nitrogen as does the luminosity of the nitrogen alone under the same conditions.

(8) The decay rate of a stream of luminous nitrogen can be varied by addition of photogens without affecting the amount of the chemically active species present. This suggests that two bodies of different types are concerned in the production of the glow, one being very susceptible to surface conditions and the other (which may be the chemically active form) much less so.

The existence of these strong wall effects would seem, assuming the analogy with active hydrogen to hold, to be very strong evidence in favour of the hypothesis that atoms are concerned in both the luminous and chemical phenomena associated with active nitrogen, and recent work by Compton and Boyce (*Phys. Rev.*, 1929) and Kaplan (*Phys. Rev.*, 1929) shows that two species of metastable atom (2·3 volts and 3·6 volts) and a metastable molecule (8·5 volts) are present.

Spectroscopic evidence is thus provided for a body of an energy content which agrees very closely with the energy of active nitrogen as found by Dr. E. K. Rideal and the writer, in agreement with Lord Rayleigh, the value of 2·0-2·2 volts (46,000-50,000 cal./gm. mol.) having been obtained from experiments upon the chemical reactions of this mysterious substance. But even if this does bring into harmony the physics and chemistry of active nitrogen, an explanation has still to be found as to why the other excited species present are apparently chemically inert and why also only about one-sixth of the total energy available is apparently effective.

If it could be proved that the chemical activity is due to these 2·3 volt metastable atoms and their precise nature established, it would clearly be of great value in leading towards an understanding of the nature of chemical reaction.

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July 24.

Natural Selection.

IN a communication in NATURE of Aug. 10, Prof. E. W. MacBride, while admitting the reality of natural selection, denies that it applies to random variation. He dismisses ill-adapted types found in Nature as "pathological", and states that selection favours "the most vigorous individuals". It is not clear to me that much is gained by substituting the words 'vigorous' and 'pathological' for Darwin's 'fit' and 'unfit'.

Little valuable result is likely to arise from a discussion of the subject which ignores the large amount of quantitative work that has been done in recent years on natural selection. Unfortunately, most of this work is published in Russian periodicals, which are not easily available in England. However, the readily available work of Sukatschew (*Zeit. Ind. Abst. u. Vererb.*, **47,** p. 54) illustrates the nature of the 'fitness' or 'vigour' which distinguishes varieties. Two races of dandelion, *B* and *C*, from the same lawn were grown at the same density in pure and mixed cultures. After two years, 49 per cent of *B* and 24 per cent of *C* survived in the pure cultures, 20 per cent of *B* and 58 per cent of *C* in the mixed cultures. The numbers of flowers per plant varied in the same direction. Clearly, vigour in this case is simply fitness in a given environment, and is mainly determined by physiological causes. No one could have predicted the above results from an examination of the morphology of the varieties.

Detlefsen and Roberts (*Genetics*, **3**, p. 573) in mice, and Pearl and his colleagues (*Am. Nat.*, **55-58**) in *Drosophila melanogaster*, have shown that Mendelian genes may determine differences in 'vigour', that is, in viability under the conditions of culture observed. Not all genes cause measurable differences. Thus only one out of the three tested in mice caused any appreciable difference in mortality during the first three weeks of life. The reason why black mice in captivity are about 2 per cent less viable than grey is not known, but has clearly nothing to do with protection from predatory enemies. Nevertheless, it is a fact, and one which should surely not be ignored in discussing why most wild mice are grey. When, in addition, it has been shown that local races of *Drosophila* and rodents, and also rodent species, differ by Mendelian colour genes, it is clear that such a discussion is relevant to the problem of evolution.

It seems likely that, as Prof. Watson suggests in his presidential address to Section D of the British Association (see "Adaptation", p. 231 in NATURE of Aug. 10), physiological differences between varieties, such as exist between *B* and *C* dandelions, or grey and black mice, may prove to be of greater selective value than the morphological differences which immediately strike the eye of the taxonomist or geneticist. But if the value to a species of such morphological differences has often been exaggerated, quantitative work shows clearly that natural selection is a reality, and that, among other things, it selects Mendelian genes, which are known to be distributed at random through wild populations, and to follow the laws of chance in their distribution to offspring. In other words, they are an agency producing variation of the kind which Darwin postulated as the raw material on which selection acts.

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Rate of Dissociation of Nitrogen Tetroxide.

THE speed at which the reaction $N_2O_4 \rightleftharpoons 2NO_2$ attains equilibrium has been a subject of investigation for the last half-century. Since ordinary methods are valueless, attempts have been made to determine this rate by using the velocity of sound in the dissociating gas.

Einstein (*Sitzungsber. d. Berl. Akad.*, 1920) has developed equations for the change of velocity of sound with frequency. At low frequencies the reaction is always in equilibrium as regards pressure changes due to the sound waves, while at high