normal blood and two samples from anæmic patients, kindly supplied by Dr. G. P. Claridge of Norwich, were analysed and distinct differences were noted in the iron, calcium, magnesium, and potassium content. Further, the rubidium line $\lambda 4202$ was present in the spectrum of the normal blood; rubidium, in fact, is present in most parts of the body, and it is present in both human milk and cow's milk.

It will be seen that there should be many applications for methods of spectrographic analysis on the lines described above. The spectra contain few lines

FIG. 2.—Parts of body, dried at 100°C ., 0.05 gm. of each. 1 (top), cartilage, epiglottis; 2, spleen; 3, kidney; 4, lung; 5, abdominal muscle; 6, heart muscle; 7, brain; 8, liver.

as compared with arc or spark spectra, and the lines are easily identified in practice. The methods are worthy of more attention than they have received and they should be especially useful, and possibly prove indispensable, to those interested in the detection and distribution of the metals essential to life, and even of phosphorus, in the parts of plants and animals.

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Evolution through Adaptation.

DR. BATHER'S interesting survey of "Evolution through Adaptation" in *NATURE* of Mar. 30 prompts a few supplementary suggestions. There is a tendency in writing upon this subject to think of 'a variation' appearing in the soma under some stimulus which, if maintained for a sufficient number of generations, may produce in the germ a mutation in harmony with the variation in the soma. The concept of a mutation of the germ, arising in such a way as to harmonise with an alteration in the soma that has already appeared, is a concept which strains probabilities in many, though not necessarily in all, types of cases. Dr. Bather's illustration of an animal with defective pigment and sight skulking in dark corners, where alone it is likely to escape its enemies, is used by him to suggest selection of environment by organism, but it is also a reminder to come back to thought of the organism as a whole.

Experiment and observation have shown that considerable alterations in the balance of growth can be produced in a population through alteration in environmental influences. Such influences operate in Nature generally; we have clear evidences of secular variations of climate through the geological periods, and we know that, in spreading, a form of life encounters modified conditions as its range extends itself.

Observation and experiment further show that for various stocks there are 'fringing conditions' under which the individual can indeed live, and even, it may

be, grow, but the race cannot reproduce itself, or can do so only very exceptionally. The sensitiveness of the reproductive process is a noteworthy fact.

If now we set these two points side by side, we may picture a 'marginal case.' Let us suppose that the changed conditions of the environment have induced changes of growth, but that the germs remain as before. These germs are presumably like all living things in that no two are alike. Some variations in them may be towards greater, and some towards lesser, viability in the altered environment. It will be from

the former that the survivors will be bred. We thus think of a process of selection operating on the germs, and operating so as to eliminate, very probably, quite a large proportion of them. It is a selection not of a germ that has mutated so as to produce a change in harmony with some change that has appeared in the soma, but a selection of a germ viable in an altered environment. The plea here is one which to some extent supplements Dr. Bather's suggestions, or, for that matter, Prof. Lloyd Morgan's concept of organic selection, for it demands less in the matter of variation of the germ. It looks upon variation of the environment of a stock, whether because that stock spreads in space, or lasts through phases of climatic change, as in some sort the initial factor, and it suggests that the extra sensitiveness of the

reproductive process, as compared with the other vital processes, is one of the main determinants of the viability of a stock in a fringing zone of distribution. It looks upon the germ as basic capital undergoing slow modification, less through the addition of particular mutations corresponding to changes already in the soma than through the selection under marginal conditions of viable variants.

These suggestions are in no way in opposition to Dr. Bather's, nor does the point of view here developed conflict with that of the advocates of organic selection. It merely attempts to supplement them by burrowing under the problem of the inheritance or non-inheritance of acquired characters. It leaves abundant room for the idea of evolution by germ-mutations and so on, and it suggests that growth changes may be essentially physiological responses, some of which may increase, others decrease, viability. It leads on to the suggestion that, as cumulative growth changes occur as responses to cumulative environmental change, and are themselves followed, at a long interval, by attainments of the germ which are attainments to environmental changes, the germ in the course of its evolution becomes more and more highly specialised the more and the more recent and the more rapid have been its attainments. Thus, if a new series of environmental changes should afterwards supervene, such a highly specialised organism would be less likely to be able to respond than would a less specialised form, a form which had had a longish record of relative evolutionary passivity.

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PROF. FLEURE is careful to explain that his remarks are not in criticism of anything said by me; yet they seem intended to evade the difficulty that I have found in certain beliefs for which there does appear to be some evidence—the difficulty, namely, of understanding why and how a germinal mutant does appear sometimes to accord with a previous modification of the soma. Prof. Fleure says this "is a concept which