The pathological and clinical (may I even say surgical ?) approach has thus furnished us with a working hypothesis on which the function of the thymus gland may eventually be elucidated. There are still many difficulties in the way of a final solution, and progress is likely to be slow. It may be thought safer to return for the present to Galen's belief that the thymus is just a cushion to protect the great vessels from contact with the sternum. This would certainly save us all a great deal of trouble.

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THE STATISTICAL SIGNIFICANCE OF BIOLOGICAL DATA

BY

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During recent years increasing reliance has been placed by all biological research workers upon the estimation of statistical significance. This attitude, of course, is very desirable, but it seems to be leading to a deplorable tendency to regard all numerical differences which are not "statistically significant" as in some way unreal or inaccurate, or at any rate as suspect and unreliable, and hence of no value as a basis for any inferences. But such non-significant differences, if observed accurately, are facts, and are entitled to the consideration given to any other facts; they may be due to chance, but they may also reflect real differences, which may be quite large under some experimental conditions.

We are surrounded by immense numbers of small biological differences which exist, however difficult it may be to demonstrate them statistically. Some very interesting examples of minute differences have been collected from the literature by J. B. S. Haldane (1949). The increase in length of ceratopsian dinosaurs from 1.7 to 6.5 metres in 22 million years took place at a mean annual rate of 6.1×10^{-8} times the length, which was equivalent, at the beginning of the period, to an increase in length of 1 mm. in 10,000 years. A dimension (height of paracone—that is, mesobuccal cusp) of an upper molar tooth in the ancestors of the modern horse increased at a mean annual rate of 3.6×10^{-8} . Man himself has developed from his ancestors through changes of this type, and Haldane gives some estimates of the rate of this process. One is, of course, aware that a statistician is not likely to be consulted on the question of whether any change has occurred between two successive generations of an evolving vertebrate, but the illustration given above shows the fundamental importance of biological changes which, considered as isolated numerical differences, would be utterly "insignificant."

The effects of this aversion to observed small differences is most undesirable in cancer research, because it leads to the

use of the strongest possible carcinogens in the largest possible doses in order to get a "result"—that is, something statistically significant which is therefore "something to publish" (Kennaway, 1948).

These very active carcinogens have now an adverse effect upon research. They have set a standard which is apt to induce neglect of less active compounds, although the latter type is that to which we are likely to be exposed ourselves. If a synthetic compound does not yield tumours in, say, 50% of animals in six months it may be supplanted by more active ones. The time has come to concentrate upon naturally occurring compounds, and tissue extracts, which produce tumours in, say, from 5 to 10% of the initial number of animals in two years. Thus the incubation period of 46 sarcomas produced in mice by subcutaneous injection of cholesterol in fatty media ranged from 11 to 29 months, with a mean period of about 19 months (Hieger, 1954). Hence the assessment of the carcinogenic power of such compounds depends upon the number of mice which live through the second year. Such work is wholly unsuitable for short-term grants. One would like to see a whole staff devoted for 10 years, with no obligation to publish anything during that time, to the search for carcinogens and co-carcinogens in human tissues.

The question, What quantities are "statistically significant?" is, of course, one for mathematicians alone; one may suspect that many persons use this term freely who have never given any very clear thought to its exact meaning.

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RESPIRATORY FAILURE IN THE ACUTE CASE OF POLIOMYELITIS*

BY

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In the intellectual history of mankind there are happily periods when the energies of many minds run together and the filament of human thought lights up. These are the moments when an age shakes off the sensibilities of the past and proclaims a new outlook. If, in quality, the scientist cannot vie with the artist, he is not inferior in the intensity of his mental processes, and when the energies of many scientific minds are directed to one end the outcome may be comparable, at a different level, with a shift of thought in the artist's world.

To those of us who deal with poliomyelitis there can be little doubt that the advances of recent years are of basic importance. The virologist and the epidemiologist have each contributed, fortunately in a complementary manner. Tissue culture is obviously an immense aid to the virologist in his laboratory research, but it also enables him to promise increasing help to the epidemiologist in the field. The epidemiologist has traced the path of the virus and has worked out many of the probable details of infection: much is still uncertain, but the importance of close contact and the significance of the minor illness seem established. These points are, in turn, of direct importance to the virologist: tissue

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