

the details of the procedure were not finally standardized until the lapse of several years. I have been fortunate enough to have had the advice of several persons who are far better informed in this field than I am.

These remarks are offered in the hope that they may be of service to some of those who wish to treat the colors of biological objects in a quantitative way. It is not claimed that the procedure adopted by me records absolute values, or ones which are accurate enough for the exacting requirements of physics. But it is, so far as I know, the only practicable method yet offered for measuring individual and racial differences of color and shade in the pelages of mammals, and it renders possible the treatment of these characters according to familiar biometric procedure.

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SPECIALIZATION AND COOPERATION IN SCIENTIFIC RESEARCH

PROFESSOR COMPTON'S interesting address delivered at Lehigh University and printed in *SCIENCE* of November 11, 1927, brings up pointedly the question as to whether the conception of mass production is to dominate the teaching of advanced physical science. Two remarkable statements on this subject have recently come, one from the Bishop of Ripon who pleaded for a ten-year holiday in research at the recent meeting of the British Association, and the other statement from Sir Ernest Rutherford, the president of the Royal Society, which was made at the opening of a new physics laboratory at the University of Bristol. "When I look back over the thirty years or more of my connection with research," says Sir Ernest, "I am conscious that I have always been looking for a breathing space when, for a few years, no advances of consequence would be made; when I should gain an opportunity for studying in more detail, at my leisure, the ground already won. Alas, that breathing space has never come, and I am sure will never come in my time."

A plea for limitation of the intensive methods of research which are at present advocated and practised in our universities is unpopular. But the intensive methods are bringing on very peculiar results. The quantity of "research" output has grown to be immense. It is not unlike the production of motor cars. The aim is not the very best, but something new and "salable." Anything that is good enough to hold its own is good enough to be produced as a piece of "research." An enormous amount of duplication has followed in the wake of this mass research. This is very noticeable in connection with the issue of elec-

trical patents many of which are granted on devices which have been clearly described ten and twenty years previous to the date of the applications. Some very extraordinary examples might be cited in this connection besides the one referred to by Professor Compton.

The thesis work is growing more intricate and complex. In the majority of cases it must be difficult to secure proof of the accuracy of much of the work done. But it is new, or it appears new, and that suffices. Now, in the historical development of science we have the example of Darwin holding his manuscript of the *Origin of Species* for twenty years, checking and re-checking before publishing. It would not be difficult to name other examples though less noted. If this so-called research work were more carefully done, its rate of increase would slow down of its own accord. If scientific teaching was set into the proper historical relief, it would be more thoroughly done and there would be less of it. When we plead for the teaching of fundamentals it is this which we mean. It is not clear whether Professor Compton pleads for teaching the "easiest way" by following altogether the inclinations of the students. The kind of research work he refers to is a little like athletics and much of it can be done without a long systematic training but such training is the essence of science. If the test is to be utilitarian, science as we like to see it taught will depart. If the criterion is to be that taught and urged by such teachers as Huxley and Helmholtz, then it is the "truth" which is the standard. Constant care as to whether new work is worth publishing, whether previous workers have received the credit which their work deserves, whether experiments are accurately made, whether the theory is simplified to the point where it is something other than a cloud of symbols, such considerations would, of their very nature, slow down this high speed production and permit, to some extent, the realization of the hours of philosophic contemplation of the work already done for which Sir Ernest Rutherford makes his plea.

Mass production in science may prove to become as fatal as it is likely to become in industry, where it bids fair to be master instead of servant.

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A FUNCTION OF REGIONAL SCIENTIFIC SOCIETIES

ONE thing of prime importance to be stressed by regional groups of scientific workers which seems to have been entirely forgotten by the various secretaries of State Academies of Science as reported by Professor Segerblom, *SCIENCE*, October 16, is the incentive for young researchers which comes from being per-