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# Scientific Concentrates

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# FIFTY YEARS EXPERIENCE IN THE WEATHER BUREAU

U. G. PURSSELL
*Former Head of Minneapolis Weather Bureau*

Mr. Purssell presented a very interesting report of his experiences and activities during 50 years of service in the employ of the Weather Bureau of the United States Department of Agriculture.

# SCIENTIFIC CONCENTRATES

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This brief paper is in the nature of a proposal for a joint attack on a problem that presents an ever more baffling situation. It is a problem that all of us have pondered many times, a difficulty we often hear discussed. With the advance of science and the tremendous increase in scientific publication, the possibility of being reasonably well informed concerning the changing concepts in the various sciences has virtually disappeared. This difficulty is due not only to the impossibility of reading the vast literature even in abstract form, but to several other conditions as well. The workers in each scientific field tend to develop a vocabulary and method of expression intelligible only to the initiated. How many of us find the reading of certain articles in a general scientific publication, such as the journal, Science, difficult? There is, moreover, the inability to evaluate studies in fields other than our own. These difficulties, together with preoccupation with our own expanding fields, our individual researches, and numerous other duties, seem adequate justification for the restriction of men of science to constantly narrowing fields of interest. Perhaps the realization that penetration will be in somewhat inverse ratio to the range of our efforts has led to rather general acceptance of the principle that one need not attempt to follow scientific thought outside one's own restricted field.

Obviously one can not hope to be highly informed in many fields of science, but the possibility of being rather generally informed does not seem to have received the attention that it merits. If some system could be devised whereby generalizations and viewpoints commonly recognized in the various fields could be made available in concentrated form, it might do much to remedy the situation. There are many services which such scientific concentrates might render. There is, first of all, the service to research workers. A broad as well as a penetrating knowledge is essential for the interpretation of our findings. Problems have, as a rule, many aspects. There are countless examples of unsound conclusions and partial misinterpretations of experimental data due to ignorance of concepts that are well substantiated in some other field. Then there is the great need for these concentrates as instructional aids in our schools and col-

leges. Those of us who are engaged in teaching as well as research can testify to this urgent need. They would be of great value to workers in the social studies and various other fields whose work is in varying degrees dependent upon science, and who now find it exceedingly difficult to locate the fundamental scientific truths which they might utilize as foundations for their rapidly growing and shifting superstructure. The possible contribution of these concentrates to the popularizers of science is also important. We have long hurled at these persons our criticisms of inaccuracy and of failure to distinguish between hypotheses and reasonably well established scientific truths, without providing them with more reliable briefs of scientific knowledge.

The formulation of scientific concentrates is by no means simple, and their use may involve certain undesirable features. There is the danger of encouraging superficiality through acceptance of profound sounding statements without critical examination of their bases. There is necessarily a certain amount of inaccuracy and lack of qualification in any attempt to express involved situations in a few words. There is also the difficulty in evaluating conflicting theories and contradictory evidence as well as in deciding which generalizations represent significant viewpoints. Some of the objections that might be raised represent only difficulties. Others constitute definite limitations inherent in brevity. But the need of some form of summation of scientific knowledge is so very urgent as to justify the effort, though the results be considerably short of the ideal. If we can not know all, we may at least hope to gain a better knowledge of the more significant broad concepts of science through such admittedly imperfect scientific concentrates.

If these statements have struck any responsive chords in your own thoughts and desires, you must by this time be asking yourself, "How can it be achieved?" "Who is to formulate these scientific concentrates?" I am not prepared to state what is the best technique of procedure, but the answer to the second question seems clearer. They must be formulated by workers in the various fields. No one person is able to accomplish the task. Some of you are probably familiar with the tentative list of generalizations which appeared in Part I of the Thirty-first Yearbook of the National Society for the Study of Education entitled A Program for Teaching Science. Some experiences during the past few years in attempting to make a simple contribution along this line through my class in the teaching of science have further convinced me that only through enlisting the efforts of men with broad knowledge of their fields can we hope to arrive at a tentative group of statements which will be of considerable value. Perhaps representative groups of such an organization as this Academy of Science could make a very valuable contribution. You will recall that Science, the official organ of the American Association for the Advancement of Science, has undertaken to summarize the achievements in the various scientific fields during the past year. The need to which attention is called in this

paper is not for summaries of science in the making, but rather for concentrates of the reasonably well established broader generalizations, concepts, and viewpoints. Naturally, any such brief would be tentative and require continued revision, because one of the best established principles is that our concept of truth changes.

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## RHYTHM IN BLOSSOMING

*With Special Reference to Hayfever*

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Everyone acquainted with things in nature has observed that certain phenomena of plant life are periodic. It is also obvious to most of us that these manifestations are seasonal. In our latitude, the trees and shrubs leaf-out in April and early May; lilacs bloom in late May, roses in June, asters and goldenrod delay their floral display until July and August. These are familiar facts, and it is well known that many of the successional phenomena of plant behavior are closely correlated with the gradually rising temperatures of spring and early summer. One can also safely assume that a more or less definite periodicity has become established for each species through hundreds and thousands of years of adjustment to its environment, but this does not answer the question as to why species of different families, or of different genera, or different species of one genus, bloom at different times of the season. Neither does it account for the definiteness of the rhythm, which in some cases is so precise that the opening day of bloom may fall on the same date year after year. Many other phenomena of plant behavior are tied up with this general problem, and it is necessary to cite only a few examples to emphasize the complexity of it and to point out how remarkably well means have been adjusted to ends.

If we take a census of all our native wind-pollinated trees and shrubs, we find that practically all of them blossom before the leaf-buds have opened or while the leaves are only in the early stages of unfolding. Among these are the Alders, Hazel, Birches, Silver Maple, Box Elder, Poplars, Cottonwoods, Elms, Oaks, Ash, Hackberry, Hickory, Butternut, and Walnut. These are the hayfever species of the spring season. It does not seem reasonable to assume that all these species bloom early in order to allow enough time for the proper maturation of the fruit because some of them develop their seeds in a few weeks, others in one to two months, while some of the Oaks require 15 to 16 months. More likely, it is directly correlated with the method of wind pollination. If the blooming were delayed until the full development of the leaves, pollination would be greatly interfered with by the leaf canopy. Blossoming before foliation is, therefore, an efficiency measure, designed to ensure fertilization of the greatest possible number of flowers. The flowering rhythm is adjusted to conform to this fundamental biological law.