other compounds before solution. With the study of such crystal masses, it should be possible to determine the effects of various enzyme systems which may make for changes in the rate of solution. The persistence of the crystal deposits because of slow solution suggests that local therapeutic results may also persist for some time. This is borne out by our recent studies.

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Comments and Communications

Scientific Communication

JACQUES AVIAS' letter (SCIENCE, **115**, 250 [1952]) persuades me to state my own conviction that access to world literature is the next practical problem to be attacked in the art of scientific communication.

Nuclear Science Abstracts points the way. Every article published should be abstracted promptly at a central institute. Abstracts should be given serial numbers, each number unique. Authors and abstractors should list the words under which the article should be indexed, using single words for rare subjects, but using one or several modifying words for usual subjects. The ideal should be a bulky alphabetical subject index leading to the word (concept) desired, however deeply embedded, and without recourse to the title. The index of the *Encyclopaedia Britannica* is something on the order I have in mind, but it does not have enough modifiers on the index words to lead one directly enough to the few places where that word is used in the connection the researcher desires. The art of such indexing would have to be developed.

At present books are indexed by title, and there is no way of knowing from the indexing what the several chapters contain. It would be worth while to give each chapter an abstract, with its own unique number.

The power of such an index would be enormous. It would be attainable because the reference for every index heading would be only the bare abstract number, not the entire journal, volume, page, and year.

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The Teaching of Specific Dynamic Action

THE phenomenon of specific dynamic action seems to be a source of misunderstanding and perplexity to a great many students and to many teachers of biochemistry and physiology. I would like to suggest that the reason is the way the subject is usually presented by lecturers and in textbooks.

The student is likely to be told that the ingestion of protein equivalent to 100 kcal gives rise to 130 kcal. He may be told that carbohydrate and fat also have specific dynamic action, but in smaller degree. He will probably be told that, to allow for this, extra kilocalories must be added to the food intake that meets basal and activity requirements. An obvious way to think about these statements is that, if kilocalories are required to release those of the food, their release in turn must depend upon the expenditure of other kilocalories. How, then, can the effect ever be overcome? How can there be caloric equilibrium, or positive balance, or growth, and why do we not waste away because we eat? This seems to be a common complication of thought concerning specific dynamic action, and one can hardly believe that in such cases it is given credence.

Specific dynamic action as a topic merits only brief consideration in a general or elementary course, but the more briefly a subject is treated, the greater is the necessity of presenting the essentials clearly. This applies whether the course provides the student's only encounter with the subject, or whether it serves as preparation for more advanced study. The important thing in this particular case is that specific dynamic action has been demonstrated, and what it is and what it implies should be outlined. The following proposal provides a means of doing this without leading to perplexity. It depends upon stressing the relationship of specific dynamic action to the basal metabolism, which is more important than its relationship to the food.

When food is given to an animal under basal conditions, there is a subsequent period when the metabolic rate is higher, even though the same conditions are maintained. The length of this period and the degree of elevation above the basal depend principally upon the kind and quantity of the food. For any one food or food mixture the total increment is proportionate to the amount fed. Foods high in protein have the greatest effect. It follows that under such conditions, if the caloric value of the food given does not exceed the basal expenditure plus the increment, there will be negative caloric balance.

Quantitatively, the specific dynamic action is the energy increment to the basal which results from food utilization. The importance of the relationship of specific dynamic action to the basal metabolism must be realized for a proper understanding of the phenomenon. This is developed in the following example:

Suppose that an individual under basal conditions expends 60 kcal/hr. He is given food with a caloric