(iii) The coupling of the metabolic energy supply is explicit (the conversion of S to P). (iv) The specificity of ion transport can be interpreted in terms of the specific binding properties of the enzyme and/or enzyme-substrate complex.

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Rodenticidal Effect on Pine Mice of Endrin Used as a Ground Spray

For many years, poison baits have been the basis for control of mice in orchards. World War II stimulated research involving bioassays on toxicity of hundreds of potential bait type rodenticides (*1*). In orchard practice, zinc phosphide, with all its limitations, is still rated above the newer materials. However, the lack of effectiveness of zinc phosphide led Kalmbach (*2*) to anticipate its replacement by other more suitable rodenticides.

Experience has shown that the sublethal acceptance of poisonous bait by numerous mice, coupled with the high reproductive capacity of these animals, places the dependability of poisoned baits for orchard mouse control in great doubt. One large Virginia orchardist loses about 600 to 700 apple trees annually, even though he uses poisoned baits close to maximum advantage. Since numerous reasons exist for such failures (*3*), the need for more effective mouse control is evident.

Since 1949, a number of potential ground spray rodenticides have been tested in orchards of Virginia, including endrin, the coined name for an insecticide. Endrin has been 100-percent effective in each of the past 3 years as a pine mouse control.

In the experiments in apple orchards reported here, the chemicals were applied as a ground spray to heavily mouse-infested plots that contained 42 trees each. All replicated plots were six rows wide and seven tree spaces long, or about 1.2 acres per plot. Since the range of pine mouse colonies is reported to be about ¼ acre (*4*), test plots nearly 5 times the maximum colony area were selected. The six center trees in each such treated plot appeared to be well protected from mouse invasion by the sprayed strips of orchard 70 or more feet wide and occupied by two surrounding "guard rows" of trees. A uniform ground spray was applied to a continuous straight strip 11 feet wide on each side of each row of trees. Preferably the treated strip reached to the trunk. For large trees, only 11 feet inward from the limb ends could be covered. Because pine mouse activity was concentrated in the tree rows (*3*), alleys between rows were not sprayed. The spray coverage was usually about 65 percent of the total orchard floor.

Table 1 indicates that there was a rapid decline in mouse activity to near final levels in 6 days or less during 1954. For 1953, a period of 3 to 6 weeks was required for a similar action. Apparently the difference in response is associated with moisture differentials in soil and cover. In 1953, the spraying was done under extremely dry conditions, which continued for some time. In 1954, at the time of spraying and subsequently, the orchard floor litter was moist, and the surface soil moisture was near field capacity.

As is the case with numerous other recent organic pesticides except DDT, the effect of endrin ground sprays on human beings and wildlife has not been well evaluated. The evidence that exists indicates that the orchard use of endrin as described here causes little or no evident deleterious effect on men or game animals. In the fall of 1954, one orchardist with extensive fruit plantings sprayed with a gun about 1000 acres of apple orchard. Members of the spray crews felt no ill effects. Neither was there any apparent reduction in numbers of quail or deer. None of the pets that had free range of the orchard died. A dog that closely followed one workman during the spraying was not visibly injured. In another 6-acre orchard area that was treated with endrin, active rabbits were observed during the period when mouse activity declined to zero. No increased vulture activity following endrin application was observed.

Table 1. Decline in pine mouse activity following endrin ground sprays in apple orchards. Mouse activity before the spraying was considered to be 100 percent.

Chemical	Endrin per 42-tree plot (lb)	Post-treatment mouse activity (%)		
		After 3–7 days	After 21–25 days	After 43–51 days
Plots sprayed 26–29 Nov. 1954				
Controls		67	83	58
(3 plots)		55	73	73
		90	91	91
Emulsifiable	2.50	0	9	0
endrin	2.50	0	10	0
(3 plots)	2.50	0	0	0
Emulsifiable	3.25	0	8	0
endrin	3.25	0	0	0
(3 plots)	3.25	8	8	0
Wettable endrin	2.50	0	0	0
(2 plots)	2.50	27	0	0
Plots sprayed 13–18 Nov. 1953				
Emulsifiable	1.5		30	40
endrin	1.5		0	30
(4 plots)	1.5		33	42
	1.5		8	33
Emulsifiable	2.5		25	0
endrin	2.5		0	0
(4 plots)	2.5		25	0
	2.5		33	0

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As is the case with numerous other recent organic pesticides except DDT, the effect of endrin ground sprays on human beings and wildlife has not been well evaluated. The evidence that exists indicates that the orchard use of endrin as described here causes little or no evident deleterious effect on men or game animals. In the fall of 1954, one orchardist with extensive fruit plantings sprayed with a gun about 1000 acres of apple orchard. Members of the spray crews felt no ill effects. Neither was there any apparent reduction in numbers of quail or deer. None of the pets that had free range of the orchard died. A dog that closely followed one workman during the spraying was not visibly injured. In another 6-acre orchard area that was treated with endrin, active rabbits were observed during the period when mouse activity declined to zero. No increased vulture activity following endrin application was observed.

An indication of the relative safety in the use of endrin is its acceptance for the control of insects on food plants. A label has been issued by the U.S. Department of Agriculture for the use of endrin on cabbage plants. This material was accepted earlier for tobacco insect control. As presently used against rodents, endrin is not applied either to the tree or to its fruits. Moreover, the treatments have been fully effective only in the dormant season when surface contamination of fruits could not occur.

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Citation Indexes for Science

Eugene Garfield's article, "Citation indexes for science" [*Science* **122**, 108 (1955)], is interesting beyond doubt. If we had in our library a citation index such as he proposes, I should use it to advantage.

Amid today's overwhelming difficulties in scientific communication, however, this index would solve too few problems to justify its surely great cost at this time.

Even though all the cited references in a given article were indexed, those ideas and key words not covered by the cited references would remain excluded, according to Garfield's system. The most

valuable parts of a research paper, the author's own contributions, would thus fare no better than they do today.

In our present indexing journals, many key words are not indexed at all; a paper's title—and even its summary—often can display only a few of the author's ideas. Excellent thoughts, particularly concerning technique, may lie buried deep within an article, lost to the index-reading "public." It is precisely the inventive, busy author who will neglect to publish a significant idea in the form of a separate paper. A citation index, much as it may be worthwhile, would fail to catch and broadcast such an idea.

My suggestion in regard to literature indexing would be to continue and greatly expand the sort of skilled, discriminating indexing that is found in the Armed Forces Medical Library's *Current List of Medical Literature* and in *Chemical Abstracts,* publications that are excellent despite their limited budgets.

The status of the Armed Forces Medical Library should be changed to that of an independent Federal Medical Information Bureau. *Chemical Abstracts* and similar publications should be supported *in part* by the government. Congress should appropriate a truly adequate sum of money to provide these organizations with highly trained indexing personnel (minimal education: M.S. degree).

An impractical dream? All right; but this sort of action, which would conform to the Hoover Commission's recommendation for greater support of basic medical research (*Philadelphia Inquirer,* 1 July 1955) is just what is needed to begin the attack on our massive problem of scientific communication.

Other subsequent efforts in this direction would include the formation of an International Scientific Journal Union (to supervise prompt publication) and the development of departmentalized scientific newspapers as reported by J. A. Behnke [*Science* **120,** 1055 (1954)].

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If the cost of preparing a citation index were comparable to the cost of conventional indexes, this cost would be justified by virtue of the time and money it could save in research. Fortunately, the cost of citation indexes per entry is extremely low because the bulk of the work can be performed by clerks and machines. *Shepard's Citations* adds more than 1 million citations to its cumulations each year. Even though Shepard's Citations, Inc., has a large staff of qualified attorneys, their published volumes are not exorbitantly priced. As Schoenbach surely knows, the subscription rates for such indexes as the *Bibliography of Agriculture* and the *Current List of Medical Literature* do not reflect their true publication costs. And the government does, in fact, do what Schoenbach wishes it did—support such activities *in part.* If any additional support is forthcoming, it should be from industry and other nongovernmental index users.

Schoenbach implies that a citation index for science is meant as a substitute for the conventional subject indexes rather than an adjunct. This is by no means true. The lawyer may use a digest —that is, a conventional index—as his starting point. Having located an array of references pertinent to his search, he then goes to *Shepard's Citations* for all subsequent citations to the cases in point.

Schoenbach also implies that the *Current List* and *Chemical Abstracts* do keyword indexing—that is, indexing based on titles. This is also incorrect. Each of these publications indexes articles in great depth. However, the number of indexing entries applied has an economic as well as an *intellectual limit.* In a paper I recently presented before the American Chemical Society, "Breaking the subject-index barrier—A citation index for chemical patents," I discussed this all-important "barrier"—the inability of the indexer, no matter how conscientious, to catch the total import of an author's remarks. Furthermore, the author himself is not always aware of the implications of his own discoveries. It is precisely because, as Schoenbach states, "Excellent thoughts, particularly concerning technique, may lie buried deep within an article, lost to the index-reading 'public' " that a citation index is needed. When the use and construction of the citation index is properly understood, then it will become apparent that it can help to "broadcast" these otherwise buried ideas.

When Schoenbach criticizes the limitations of the proposed citation index, he really criticizes present citation practices. There are numerous instances when an author could provide a citation that would establish the necessary association between his new contribution and what has gone before. If it is completely new and unrelated to anything previously published, then the idea will in most cases be caught by the indexer. If neither the author nor the indexer is aware of its significance, some other author will bring it out through a subsequent citation. Through the citation index, one could then use the antecedent article as a new starting point.

I would wholeheartedly support any move to expand the services of the *Current List* through increased financial support from the government or any other interested parties. Hopefully, its expanded services could include a citation index. Since the conventional subject index and the citation index complement each other in a synergistic fashion, this would, I think, be a great stride forward for science. However, this important problem is in no way related to the merits of the citation index and should receive a more thorough treatment in the pages of *Science* and elsewhere.

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Bactericidal Reaction of Mouse Serum

The lack of bactericidal effect of mouse serum on some gram-negative organisms *in vitro* has been reported (*1*). The mouse is unique in this respect since the normal serums of other mammals exert a marked bactericidal effect on gram-negative organisms. This bactericidal effect of normal serums results from the concerted action of normal antibody and C′ (*2*).

Because of the widespread use of the mouse in immunological investigations, it was significant to determine whether the lack of bactericidal action of normal mouse serum results from a lack of normal antibody or bactericidal C′ or both. Most studies of the action of C′ have used a standard hemolytic system of rabbit antiserum against sheep erythrocytes. Mouse C′ is practically lacking in hemolytic activity in the standard system, although some reaction may be elicited under particularly sensitive conditions (*3*). Guinea pig C′ is extremely active in this system. Bovine serum is without activity, but it is among the most potent sources of C′ in the bactericidal system against *Brucella* organisms (*4*) and *Salmonella typhosa* (*5*). The failure of mouse serum to exert a bactericidal effect could not be attributed arbitrarily, therefore, to a low level of hemolytic C′ since no simple association exists between hemolytic and bactericidal C′.

The turbidimetric growth assay technique was used for determining bactericidal reactivity with *S. typhosa* 0901 (*5*). The assay technique consists of two phases: (i) a reaction period of 60 minutes during which the organisms are exposed to the inhibitory action of antibody and C′ in the presence of an optimum concentration of Mg ion (*5*) that is incorporated in the saline diluent; (ii) the relative numbers of surviving organisms are then estimated by subculture and optical density determinations in a photoelectric colorimeter. Assays of hemolytic C′ were performed with the standard hemolytic system (*6*), C′ was fractionated by the dialysis method, C′3 was in-