

Packaging Research: A Challenge to Industry

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Drawing a parallel to the rise and development of food science, this clarion call is for the unification of the disciplines that go into packaging research. It outlines the benefits that would stem from bringing a unifying—and scientific approach—to it all. The need is for a major drive toward unification. The universities, associations, and the government can do much but the impetus must come from industry.

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WHEN YOU COMPARE packaging research with research in other product-oriented fields, it sometimes seems to be lagging behind—badly. Consider, by way of contrast, the progress of food research—which is probably 25 to 30 years ahead of packaging research. Yet, it was not too long ago that food research was virtually homeless, being scattered among many sciences and arts—horticulture, home economics, nutrition, dairy husbandry, animal husbandry, and a half dozen more. Nor was it getting anywhere as a recognized discipline.

Food Science Becomes an Entity

Then, in the 1940's, a small group of scientists and technologists concerned with improving food in all of its aspects began to think: why not consolidate all of these separate activities into one grand unifying discipline, to be known as *food science*? You know the rest of the story. Food science is now a highly sophisticated endeavor, with departmental status in many leading universities, in the major food companies, and in at least two government departments, Agriculture and Defense. As a direct

result of organizing (or let us say, institutionalizing) food research and its counterparts, food technology and engineering, the sum of knowledge regarding food has greatly increased. Many new ideas, for example, freeze drying, radiation preservation, and a host of convenient ready-to-eat foods, have emerged. A multitude of specialists has been developed. And most important of all, the food industries have been able to solve scores of basic problems that would not yield to old, inefficient empirical approaches. All this has been to the great profit of food manufacturers, large and small.

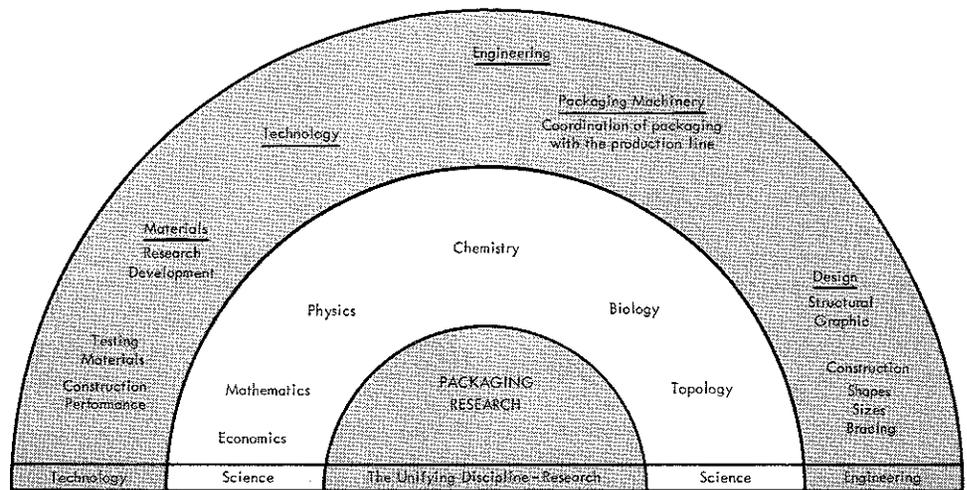
Need: to Unify Packaging Research

No such success story can be told of packaging research. Packaging research is not yet a unified, organized effort motivated by the scientific approach. This is most unfortunate because packaging is a science—and we should put science into packaging. (See Fig. 1.) There has been research, excellent research, but it has been done for the most part separately, not always by, or necessarily for, packaging people, and never as part of an organized whole. Packaging research, to repeat, is 25 to 30 years behind the march. These observations, regrettably, are rather negative in tone.

To speak constructively and more hopefully on the problem of packaging research, it is necessary to recall that scientific activity—the mainspring of modern technological progress—is composed of three interrelated activities: (1) finding new facts, i.e., expanding knowledge; (2) integrating new facts with old, established facts, i.e., arranging knowledge in new patterns; and (3) arriving thereby at a new, better, or more inclusive understanding of natural phenomena—an understanding that may open up great opportunities for technological prog-

The findings in this report are not to be construed as an official Department of the Army position.

1 Packaging research as central feature of organized whole, motivated by scientific approach.



ress. This, in essence, is the scientific method. Those in packaging have not made nearly enough use of it. The real challenge of the years ahead is just that—how to get packaging, as a function of industry, established on a firm scientific base. This is to give it a place to stand, as it were, from which to move the packaging world.

Stating the challenge carries with it an obligation to suggest some ways to meet it. The rest of this article focuses on this obligation. For the sake of clarity in discussing a rather complex subject, we are keying the remarks that follow to the interrelated activities we mentioned above—finding new facts, integrating them with known facts, and thereby achieving a new, better, or more inclusive understanding of the phenomena out of which new ideas and new opportunities are born.

FINDING NEW FACTS

What we are talking about here, obviously, is acquiring new knowledge applicable to packaging. Let us be realistic in discussing this matter of finding new facts through research. Granted that research may discover facts that could revolutionize the industry, why do we need them? Why, for example, risk changing the packages now in use, the old standby's that have served so well over so many years, for something novel? Why change manufacturing methods, or package structure, or package design, or package sizes, just because something new has appeared?

The answer to all of these hardheaded questions is very convincing—new ideas are necessary to meet competition. We do not need to tell you that the heart of the product—and packaging—competition is a new, better, and precedent-shattering product. To meet this kind of competition, a firm needs new

ideas and new facts to implement those ideas. Firms that ignore research go broke, as the records will show.

Competition Provides Drive

Almost all new ideas in packaging in recent years have emerged from a need or an urge to meet and preferably to beat the competition. The idea often derives from a careful analysis of how the package can be so matched to the product that the product, in one way or another, takes on added appeal for the distributor and/or the consumer.

Aerosol packaging is the classic example. It would be impossible to discuss all of the instances where aerosol packages have given product appeal a new order of magnitude. The important point is that here is a case where a new idea hit the packaging industry like a bolt from the blue. The scramble to capitalize on this brilliant idea was a sight to see. But a bright idea is one thing; finding the new facts to integrate with other facts to implement that bright idea is another.

Must Do Research on New Idea

After the brilliant idea, finding the new facts, the new knowledge necessary, is the first step in research—any research. Sometimes to those of us in the midst of it, this first step in packaging research seems to be a rather feeble one, at least in all too many cases. We in packaging need to take a longer, firmer stride into the basic chemistry of materials, into the physics of load vs. container, the molecular engineering involved in bonding the interfaces of laminates and closures, the bio-sciences concerned with deterioration, for example. We need new facts—new facts to implement new ideas.

The outlook for developing new facts through

basic investigations is presently not bright. The amount of academic training in the sciences that is specifically applicable to packaging is very limited. In food research, by contrast, there are graduate level courses in food chemistry, food bacteriology, food engineering, food acceptance methodology, and many others. Where are comparable courses in packaging? Yet out of such courses, in time, would come the people who could supply the new facts that would implement our new ideas.

The Need: a Scientific Approach

Those in packaging must break away from the old, inefficient empirical method of solving their problems, and to repeat, meet the challenge of the future by the scientific approach. This means (1) participating in the movement, now gaining some momentum, to give packaging research academic standing, and (2) organizing within our own bailiwicks long range research programs where the trained packaging researcher and his counterparts, the technologist and the engineer, can find a happy home and produce the new ideas and the new facts we have been talking about.

This, then, is the first part of the answer as to how the packaging industry can meet the challenge of this highly technological age—namely, by embracing the scientific approach and taking a strong stand in favor of academic training in the sciences that support packaging research.

INTEGRATE NEW, OLD FACTS

In discussing the importance of finding new facts,



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we have already touched on the scientific task of integrating new facts with existing facts to achieve a new understanding of natural phenomena. Integrating new facts with old is a part of the scientific process. What we wish to emphasize here, however, is that the package engineering field has at its command, but is not using it to full advantage, a very sizable stock of established facts pertinent to package improvement. Our journal literature is of high quality.

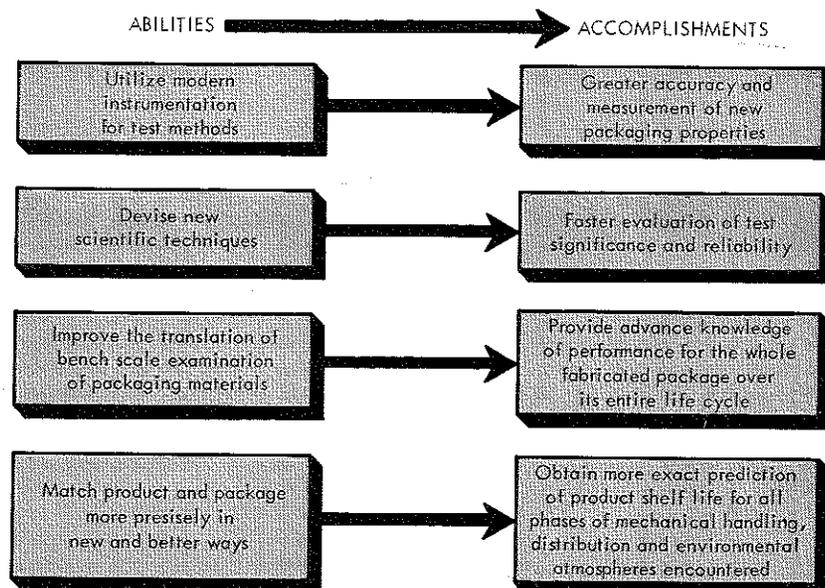
Further, PATRA has abstracted the literature relevant to packaging and we also have available periodic patent summaries of packaging import. There are, additionally, a multitude of one-time technical reports published, though not widely circulated, by public and private research groups interested in packaging. There are books, though too few of them directly in our field, that provide excellent sources for technical data. But how are we doing in regard to integrating the hard-won facts in these articles, reports and books with new facts? Not very well, one suspects.

We could mine this vein of published data to much better advantage, if packaging research were more systematically organized, better unified, and better equipped with a set of long-range objectives—one of which might be to assure that this body of established fact is made more accessible, more retrievable, more widely used. We are deficient indeed, in this regard, when we compare ourselves to the Petroleum Institute with its great information repository and retrieval system. We have scarcely touched another great reservoir of established findings, the basic science journals. Individual investigators, it is true, have made use of these resources but we have not begun to exploit, as a group, the vast amount of data that has been accumulating through fundamental studies.

We could use selected data from these sources to great advantage as we establish our own body of facts. By integrating new facts with old, systematically and continuously, we could greatly extend the range of knowledge useful in the field of package engineering.

Bright Spot: Knowledge of Materials

We have already done remarkably well in one area, that of packaging materials. Here we have mated new facts, pertinent to packaging, with established facts in basic chemistry, physics, and biology. As a result of this marriage, we have today plastics that are readily molded into desired container shapes, materials that are resistant to microbial attack, lightweight materials of phenomenal strength-to-weight ratio, and so on. But have we taken full advantage of these established facts when it comes to improving the design, structure, and performance capacity of containers? It would not seem so.



2 Job description of packaging research man looks like universal job sheet. It simply dramatizes burden that entire package engineering field must shoulder.

To change this situation, to take full advantage of the rich resources of today's chemistry, physics, biology, engineering, and other disciplines will take time. However, one of the first rewards of establishing packaging research on a high technical level will be a better and more profitable use of the extant literature.

FIND "MAN OF ACTION"

What we have said to this point has chiefly concerned the need to establish a firm academic base for packaging research. This is to rescue packaging science and technology from its present diversity, to bring the parts together, and thereby create an organic whole. But now let us turn to what industry can do to complement the university approach. Specifically, by what mechanism can we translate packaging research into package improvements?

We can explain in the simplest terms what packaging research can and should do. Let's take the minimum: the situation where the size of a business and the long-range economic potential can justify a packaging research department of only one man. What qualifications and capabilities should this man, ideally, have? How do we expect him to function in his job, and what accomplishments may we look for?

Must Have Research Background

This man must be a laboratory man, research and development oriented, rather than production-line oriented. This is not to say that he is to have no understanding or appreciation of production-line problems. He obviously must. But his job is to go beyond the present production line. He is there to take a new look at packaging, and he has got to do it from a research and development viewpoint.

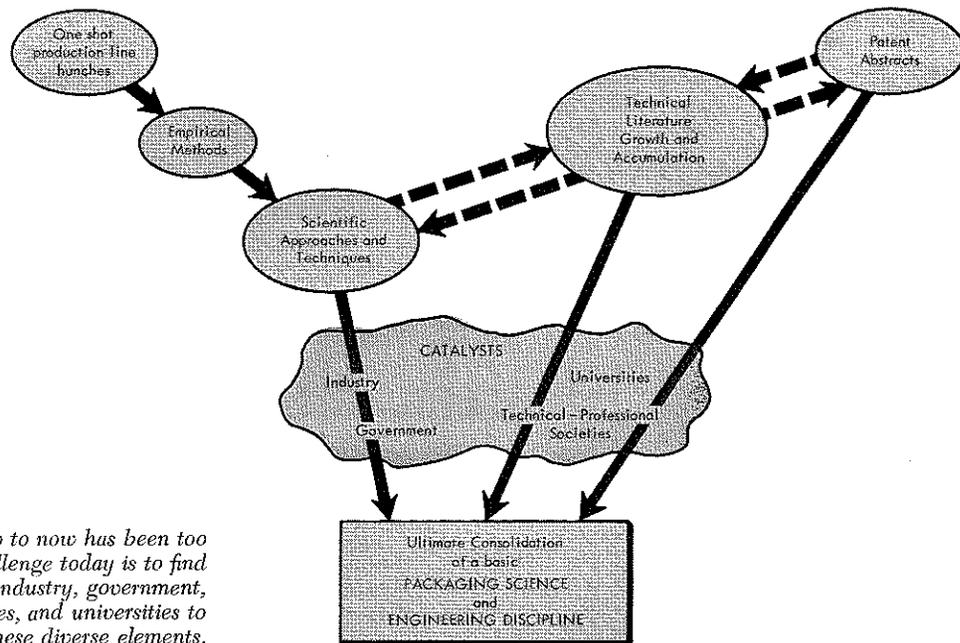
We've already stated that packaging research must follow the scientific method and further, that its successes will derive from applications of pertinent data from practically all the basic sciences. Therefore, this man may have his training in bacteriology, chemistry, industrial engineering or any of the other physical and engineering sciences, or he could be a man with just a general science training background. The important thing is that if this man has a good basic training in any one of the sciences, he can fit into the packaging research job. Once he becomes acquainted with the product involved, we can expect him to be capable of advancing the science and art of packaging.

Faces Wide Range of Tasks

What do we want this man to do? Bear in mind that he is not there just to apply what we now know. For one thing, we want to make a thorough study of product-package relationships so that he may match product to package in a new and better way. Further, he must do more. He must fundamentally concern himself with refining our whole procedure of examination and testing. He must find methods of testing that are unique, simple, reproducible, and accurate. He must try to measure things we never thought that we could measure. He must utilize the advanced, sophisticated instruments in use in the various physical sciences today, the gas chromatograph, the spectrophotometer, the infrared spectroscope. He must employ these newer methods to measure more accurately package properties, either not measured accurately enough before or perhaps not measured at all.

He must dig deeply into the basic problem of predicting in advance the performance of a given container and the protection it will give his product before it leaves his plant. He is going to have to look for scientific techniques that are a lot less

3 Packaging up to now has been too diverse. Challenge today is to find catalysts within industry, government, professional societies, and universities to consolidate these diverse elements.



time-consuming and much more accurate than the commonly accepted empirical methods of today. He must develop systems that will operate within the confines of his laboratory. He must develop tests, mathematical formulae and the like, so that he can compute meaningful predictions. Furthermore, he has to be able to verify this in his laboratory within a relatively short time period and come up with an answer that at least is in the ball park.

Bring Package Cycle into Focus

More importantly, this packaging research man has the major task of translating laboratory bench scale results into predictions as to the actual performance of containers at distant points. This will mean more than just routine tests on packaging materials and components; it will mean an approval of the package as a whole: i.e., the whole container with the product in it. In other words, this man must put the entire life cycle of the whole package under scrutiny. He has to measure the effect of the entire gamut of factors the package encounters in its life: handling, distribution, mechanical shock, storage temperatures, humidities, atmospheres, and other conditions of its existence.

As you read the foregoing list, you may have thought: "Wow, what a job description!" No one man, no one company, is going to do all of these things. Our point in loading all these heavy tasks and responsibilities on one man is to dramatize the size of the burden we all must share. And if we have missed anything, let us add "and other duties, as assigned." (See Fig. 2.)

Will Take Massive Unifying Effort

Where do the universities and the professional societies fit into this "universal job sheet"? Right now,

their role must be that of catalysts, i.e., initiators of a reaction, and one hopes a chain reaction. The professional societies and associations will have to be the initiators of a process for getting industry, government and the universities to really meet this challenge and then, when interest is aroused, to see that it proceeds to action. (See Fig. 3.)

The Packaging Institute might well be the prime catalyst, the agent for generating a course of action. What will eventually be necessary, perhaps, is the combined effort of the membership, effectively steered by industry and government leaders. The goal would be to develop a plan and an approach, by means of which industry, government and the universities would be brought together in the common cause of bringing more and more packaging into university training programs as mature, socially and economically valuable courses of study.

INDUSTRY MUST LEAD OFF

As we develop a body of technical knowledge on packaging, we shall have to see to it that it is transmitted down the years through an effective education program. The first step is up to industry, in the final analysis, and that first step is to sell the universities on this type of training. This may not be easy. But if industry can demonstrate that such an educational program will help the universities, the battle is half won. Fortunately, there is strong interest on the part of industry in getting such programs started. There is also some interest on the part of the universities. We must recognize that, at the moment, interest is greater at the industry level—which means that industry must start the ball rolling. One purpose of this discussion has been to take the ball off the rack and get it rolling. (End)