It must be a hard job for an editor to build up a reliable corps of reviewers. I wonder whether the best reviewing might not be done by relatively young men, whose eyes are not yet clouded by the accumulated prejudices of their working careers. Ferreting out such talent would not be easy for an editor, and this is something in which we might all help by keeping alert to the potentialities of our younger colleagues and forwarding suggestions to our journal editors.

In writing about the criticism of scientific books, I have tackled only one small angle of the large problem of the explanation and interpretation of science, but I think it is a key angle: both because it should influence and enhance the prestige value of successful popularization among scientists themselves, and because it seems a basic mechanism for sorting out the good from the bad in the annual flood of books.

Actually, I think the outlook for an increasing understanding of science by the American public is very good. During 1950, with *Worlds in Collision* and *Dianetics* keeping their steady place on the best-seller lists, the outlook was gloomy indeed. But, for many months now, a glance at the weekly papers has always been reassuring. There, at the top of the list, *The Sea Around Us* kept its place. I do not believe scientists had anything to do with the establishment of Miss Carson's book,[1] but her accomplishment proves that there is a wide audience capable of appreciating a serious interpretation of a field of science. We cannot, then, blame the public for failing to notice our writings; we must look to ourselves and see how we can manage a better and more persuasive job within the limits of our canons of taste and integrity.

[1] As an editorial note, it might be mentioned that Chapter 7 in Rachel L. Carson's book was published in *The Yale Review*, where its merit was recognized by scientists. It received the AAAS–George Westinghouse Science Writing Award for magazines at the Cleveland meeting of the Association in 1950, several weeks before *The Sea Around Us* was published.

Reporting Science

Frank Carey

Science Reporter, Associated Press, Washington, D. C.

EVERY ONCE IN A WHILE I get a letter from some young man with ambitions to become a science writer for a newspaper, asking me how to go about it. My first advice is: "Go get yourself a job on a small newspaper and go out and cover a fire." If this sounds like heresy to a scientist, so be it. But, actually, it is not only sound advice for the prospective science writer, but possibly an indirect contribution to the advancement of science itself. The point is that if anyone expects to write science for laymen he must be first and foremost a good all-around reporter of news.

The obvious way of getting reportorial training is to do all the things that work on a small-town newspaper requires. It can mean chasing the fire engines to a big blaze, riding with the cops to the scene of an accident or to a raid on a bookie joint, buttonholing the mayor or the city councilors at City Hall, or interviewing labor leaders on a picket line on a rainy day. It can also mean covering a concert, a ball game, a clambake, a strawberry festival, or the "carrots-peas-and-chicken-a-la-king circuit" of service club luncheons.

And why is all this grist for the mill of the would-be science writer when, of itself, it isn't even remotely connected with science? First of all, if he has the makings of a reporter, it teaches him what constitutes *news* and also how to get facts straight—often under conditions of rush and other stress. (And if you don't think a science reporter is called upon to work under such conditions at times, watch one trying to interview a gun-shy scientist who, after making a controversial statement at a scientific meeting, insists he has only ten minutes to make a train. Or watch a science reporter break for a telephone after a news conference of the Atomic Energy Commission has produced the makings of a page one story.)

Second, it teaches him that the particular story he's covering on a certain day must compete, for inclusion in the paper, with stories coming in to the newspaper from all over the city, the state, the nation, and the world. Thus, he may learn to marshal his facts and to lay down his story in such an interesting way that even on a day when hot news is breaking everywhere, he'll still make the paper with his yarn. Also, he should learn that, even though his story may wind up on the city editor's desk spike, tomorrow is another day—and he'll keep pitching. As a science reporter, he'd face that situation constantly, particularly if he became a science reporter for a wire service like the Associated Press. Stories totaling more than 100,000 words a day move on the wires of the AP to newspapers all over the world—and news interest is the prime criterion in the selection of stories that make the wire. The wire is not made of rubber.

If the science reporter comes up with a story about a new and effective treatment for the common cold, he's in the money so far as getting it on the press association wire and into an individual paper is concerned. The same may be true, even on a hot news day, of a science story that reports NO new treat-

ments, NO new cures, yet has elements of human appeal that allow it to stack up against fast-breaking news.

An AP story on the discovery of "hooked-tailed mice" was published in a lot of newspapers recently, even though it was written on a day when political, international, and other news was running a high temperature. And it wasn't just a gag story about an oddity of nature; it was intended to illustrate, in an eye-catching way, some of the unusual aspects of research on heredity.

Sometimes scientists are inclined to shudder at the "hooked-tailed mice" type of story, or at least some of them say they do. They don't object to the scientific content, but to the approach a reporter makes to such a story. They maintain reporters go out of their way to emphasize the bizarre. Yet they forget that, if it weren't for the publication of this type of human-interest story, a lot of people might forget that scientists are working on many fronts to solve still-unanswered questions about heredity and many other things. And scientists, whether they admit it or not, need the interest of the people, because the people, directly or indirectly, foot the bills for much of research.

All right. Let's say the prospective science writer has become somewhat of a hot-shot as an all-around newsman. Does that equip him to write science day in and day out as a regular thing? Far from it. Like any other specialist in the news field—be it labor, politics, diplomacy, or military affairs—the science man must train himself in ALL the fields of activity about which he'll be called upon to write. These fields extend literally from A to Z—from atomic energy to zoology and from astronomy to the physical properties of zirconium. Most scientists have a rather thorough knowledge of their own particular field of activity, whether it be physics, chemistry, biology, or whatever—and a cursory knowledge of most of the other fields. A science reporter must have somewhat more than a cursory knowledge of ALL fields—a large order, true, but the science writer must build it up by his own reading, by interviews with scientists as he goes along, and, if he has the chance, by further formal education.

Some science writers happened to have specialized in science while in college, and that's all velvet. But some of the top men in the science-writing field today didn't have even that much background. *They* simply had to work all the harder to acquire their skill. A good, all-around reporter—including the man whose regular job is to cover the police station—can cover a science story adequately if he has the persistence to keep hammering away at questions on points that aren't clear to him. In fact, one of the early winners of the AAAS–George Westinghouse Science Writing Award for newspaper science reporting was a reporter who was not a specialist in science.

But the science man can oftentimes catch a story that other reporters would miss—a top story that might develop from a chance phrase at a news conference, or from two or three key words in a rough-reading technical article in a scientific journal. With his background, he can provide fast amplification when a science story breaks in the news.

The science reporter is sensitive to the strange lingo of science, and some of his best stories come from journals that are, perhaps, combed more thoroughly by science writers than by scientists themselves. In fact, some scientists will admit that the first knowledge they had of certain scientific developments came from reading about them in the newspapers.

Sometimes a science reporter does things that the scientific world, for one reason or another, has not tackled itself. Some months ago, this reporter set out on a project designed to explain the issues in the controversy between Sister Elizabeth Kenny and most of the medical profession regarding the nature and treatment of infantile paralysis. He read scientific books and journals totaling many pounds in weight, yet nowhere could he find any completely clear-cut exposition of the issues by either side of the controversy. So he had to write letters to doctors in various parts of the world and personally interview scores of doctors and technicians before he could nail down a reasonable explanation of what the scrap was all about. Regardless of which side is right in this controversy, it would seem that some impartial scientific group should long ago at least have outlined the issues to the public.

It was indicated earlier in this article that good science reporting could help science itself by explaining research projects to a public that ultimately pays many of the bills. Good science reporting can also help the public in a way that goes beyond education for education's sake. Thanks to accurate reporting of medical and public health news in newspapers and magazines during the past few decades, the general public should be fairly well informed on such matters—to the extent that it can ask intelligent questions in talking to doctors and have a good idea of the meaning of his replies.

When you call in a doctor, you imply your faith in him to handle the situation. But you're entitled to ask questions, and no fair-minded doctor should resent them, regardless of how busy he may be. Also, an intelligent understanding of the case by the patient or the patient's relatives should help the doctor in administering effective treatment.

Good science reporting can also alert the public to health hazards and to early symptoms of diseases such as cancer and diabetes. There are science writers who know of instances where a story they wrote about some recently developed drug was the means of calling it to the attention of a patient and his doctor in an out-of-the-way place. Many scientists and medical men cooperate with science reporters in the job of describing the things of science and medicine to the public. But there are still too many rhubarbs on the science beat.

Some scientists still have the impression that science writers think—and write—only in terms of the

melodramatic and the bizarre, generously sprinkled with inaccuracies. Rarely, however, can they cite specific instances. Most of their inhibitions are throwbacks to the bygone days when some newspapers kidded science and scientists, or sketched their doings with a lurid pen. Today, the average science reporter plays a science story for what it's worth. He doesn't strain to be cute or melodramatic, but if there is humor or drama inherent in the story, he plays that to the hilt, too. If his facts are straight—and he bends over backward to try to make them so—his one thought is to present them in the most readable fashion from the standpoint of a layman. He hopes the scientists will like his story, too, but he's writing primarily for people who do not necessarily have any background in the subject discussed.

Most of the men and women who report science for newspapers and magazines belong to the National Association of Science Writers (NASW), which was organized in 1934 for the express purpose of promoting accurate, responsible science reporting. The organization has grown from a virtual handful of charter members to close to 150 active and associate members today. The NASW is affiliated with the AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE; but, to my knowledge, no member has ever allowed that affiliation to influence his writing toward the overtechnical side of the fence.

How does the science writer know what is interesting and readable to a layman? Well, if you'll pardon the obvious, he's a layman himself. Although he associates a lot with scientists and has close personal friends among them, most of his cronies are laymen—and he knows what interests them. Personally, I sometimes try some of my stories "for size" on the fellows around the office or on neighbors who come into my house—and if I detect a faraway look in their eyes, I junk the story.

So far as I know, no definitive public opinion poll has ever been taken to determine *exactly* what *all* readers want in the way of story content and presentation. But a newsman who has read all kinds of papers for years has a fairly good idea of the type of story that is used by most papers. And you can't get away from the conclusion that papers wouldn't be using them if their publishers were not sure that the stories were the kind liked by their readers.

The National Association of Science Writers recently helped conduct a poll of newspaper editors to determine their preferences among different kinds of science stories. Medicine and health stories ranked high. Scientific polls like that, conducted on still other questions in the science-writing field, should prove increasingly helpful. The science writers have every confidence that they have the right slant in presenting their stories, but, like the man in the laboratory, they are continually seeking specific evidence.

It has sometimes been stated by scientists that popular presentation of science should be done by the scientists themselves, *not* by laymen. In fact, when Kent Cooper, executive director of the Associated Press, decided years ago that everyday people were interested in science and that science could be handled just like any other news, a scientific friend suggested that Cooper get a scientist and train him to be a reporter. "No," said Cooper, "we'll do it the other way: we'll take a good reporter and train him, in effect, to be a scientist." Cooper was one of the pioneers in introducing straight reporting of science in newspapers and magazines, and the idea has paid off richly.

Although there are brilliant exceptions, most scientists simply cannot write the type of article that makes for good reading by the laity. It's not that they can't handle the English language; it's just that they are accustomed to talking most of the time in scientific jargon. Even some of the down-to-earth men I interview are occasionally inclined to throw in a few "one-to-the-minus-tenths" in the course of our conversation. Fortunately a science reporter can translate that in writing his piece, but it gives you an idea of the fast curves the scientists might throw in writing for popular consumption themselves.

Now and then I get a so-called abstract of a scientific paper from a scientist who tries to be helpful by writing it in what he thinks is good journalese. Invariably, it's not so hot, to put it mildly. Most of the writing done by scientists is for their own scientific journals, and I sometimes think that even within their own lodge they could make some improvements. I speak especially of the writing in journals of scientific organizations whose memberships include scientists in every field. You can't tell me that a physicist always knows what a chemist is talking about; or that a geologist is hep on all the phraseology of zoology.

The technique of the science reporter, who attempts to make his articles understandable to everyone of average intelligence, might well be adopted by the scientists in their own league. In fact, it might step up circulation.

Speaking of "abstracts" supplied by scientists to reporters—and I use the words "abstracts" and "supplied" advisedly—there's another big problem. In covering big scientific meetings, where several hundred different papers may be presented at scores of different sessions, it's obviously a physical impossibility for the best legman in the world to cover everything personally. He should be supplied *in advance of the meeting* with full texts, or at least fairly comprehensive digests, of what the scientists are to discuss. This enables him to pick the best news possibilities from among them. Sometimes he can work directly from the paper or abstract to get his story; often he may have to interview the scientist to get further explanation. But at least his battle plan can be outlined in advance.

Unfortunately, getting these papers or abstracts is often like pulling teeth. Moreover, some of the abstracts that do come in are frequently two-line affairs disclosing such "complete" information as this: "New studies of the action of certain pathogens *in vitro*

will be discussed. Interesting contrasts with previously described organisms will be reported. Period."

Maybe there's a good story there; maybe it's just a washout. But the reporter, with no means of knowing, must barge out and buttonhole the scientist—perhaps winding up with nothing, and meanwhile losing an hour or so of time. Reporters have deadlines to meet; they can't afford many wild goose chases.

Many scientists try to cooperate with the reporters. But some of them are fuss-budgets about minor things. Some of them have sincere fears about being made to appear to be publicity seekers merely because they talk to reporters. They forget that reporters may be just seeking additional information on something the scientist has already reported at a scientific meeting or in a technical journal. If their scientific colleagues condemn them for that, scientific organizations should do something about protecting their men from such criticism.

Some of the top medical and scientific organizations have issued policy statements urging their members to cooperate fully with responsible reporters. That's all to the good; but there ought to be more of it. We sometimes have to deal with really stuffy characters among the scientists and occasionally encounter one who is just plain rude and coarse.

All in all, however, the science-writing job is nice going, and it looks like an exciting future. Who knows? Perhaps we'll someday go on a press junket to the moon!

The Impact of Science on Literature

Fred A. Dudley

Department of English, State College of Washington, Pullman

TWO THOUSAND YEARS AGO the Roman poet Lucretius wrote *On the Nature of Things,* a great poem and a serious consideration of science. He was not the first literary man to reflect the thinking of students of nature. The impact of science on literature is almost as old as science itself and has grown more pervasive with the passing generations.

Except for the work of a few scholars the study of that impact is comparatively new, unorganized, and hampered by the literary scholar's lack of specialized knowledge about science. But it exists, and for twenty years or so it has been fairly active. Among its products are works that not only illuminate history for the student of literature, but might also command the attention of the thoughtful scientist.

Curry's masterly monograph on Chaucer (*1*), for example, clarifies a major author's total knowledge and use of the science of his time. Beach (*2*) and Lovejoy (*3*) trace the manifestations of seminal ideas partly rooted in science, Lovejoy dealing with pre-Darwinian views that now sound evolutionary, and Beach with the nineteenth-century concept of nature. Nicolson (*4*) makes vivid the intellectual and literary excitement created by the work of Newton. Stevenson (*5*) does something similar for the consternation that Darwin caused. Babb on Elizabethan psychology (*6*) and Johnson on Renaissance astronomy (*7*), each examining one science at one period and seeking out its reflections in literature, demonstrate how essential to the history of culture is some awareness of the course of scientific thought.

More limited explorations are numerous. How sound are Henry Adams' literary and philosophical applications of physics? What is the proper estimate of Goethe's passionate scientific misconceptions? How did the Royal Society's program for the clarification of scientific prose affect literary style? On such questions the journals of literary scholarship are stockpiling materials for a history of science in literature.

The outburst of eager praise that celebrated the achievements of Newton is almost unique in literary history. Copernicus and Galileo were dangerous heretics and made way slowly. Lyell and Darwin were shockingly irreverent. Einstein is fascinating but incomprehensible. Science has so often angered or bewildered literary men that at almost any time in history it is possible, and at most times easy, to find poets deploring or opposing current scientific thought.

One central force in this hostility, religious antiscientism, long antedates the nineteenth century and is vigorously alive in the twentieth. Since the days when "science" meant about the same as "magic," pious obscurantism has found something evil in curiosity about the secrets of nature. The Faust legend is full of the idea of forbidden knowledge, of black magic, of secret and horrible commerce with Satan. In Elizabethan and Restoration drama scientific ideas abound; but the "virtuoso" himself, whether awesome sorcerer or contemptible quack, is often a damned soul. Milton's cosmological ambiguities reflect at least some hesitation on theological grounds. Geological impiety shocked the gentle Cowper:

> Some drill and bore
> The solid earth, and from the strata there
> Extract a register, by which we learn
> That he who made it, and reveal'd its date
> To Moses, was mistaken in its age.

Tennyson rebelled against theories he could not reject. Grieving to have lost a clear intellectual sanction to