

# What Is **SCIENTIFIC AMERICAN** For?

Martin Green

*The central feature of human life is the expanding sphere of human awareness. The edge of that sphere—the frontier between the known and the unknown—is the beat of Scientific American.*

—A Scientific American statement

Reading *Scientific American* is a different experience from reading other American magazines. The reader feels he is up against something formidably, though quite genially, solid. It is not only that science itself is factual, its effects enormous, and its establishment (comparatively) united. The impression the magazine gives of its subject field derives in part from its own structure, its mode of being, its style. It patrols such a large beat, the expanding sphere of human awareness, and it seems to be actually expanding that sphere itself. And yet one couldn't call it pompous. It is just consciously, but not self-consciously, big.

You get that impression first from the layout of the pages, the bold titles, and helpful summaries, and the lavish supply of graphs, charts, photographs, photomicrographs, infrared photographs, diagrams, all so large and bright. Then you find that the subjects are equally large and the sentences equally bright and clear. And as you turn the pages you realize that the ads are just like the articles, not only in layout and colors, but in subject matter and function. Western Electric reports on its new lead-acid battery, with photographs and diagrams and the fullest verbal description—everything you'd want to know if you thought of buying one and nothing of adland's usual purple mist and synthetic moonshine. Or Atlantic Richfield shows pictures of their TV sets, with a text tactfully recommending a free flow of information and discussion even in times when the

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MARTIN GREEN, author of *Science and the Shabby Curate of Poetry*, a member of the English Department at Tufts, appears to bridge the gap between the "two cultures."

news media are "the center of controversy." All that big, bright, expensive cheerfulness, all that establishment expertise, is harnessed to real thought. Every page of the magazine is explaining something, something that needs explaining, and the cheerfulness welcomes you to the team, assuring you that if you buckle down to it, and *work*, you too can participate. It is a moral cheerfulness.

And that impression of solidity is ratified by the facts of the magazine's readership. For one thing that readership is large—525,000 subscribers and a single copy sale of 96,000—and it is increasing; its growth rate is higher than, for instance, the *New Yorker's*. For another thing those subscribers form a decidedly powerful group of people. The magazine describes them on its rate card for advertisers as "industrial executives, engineers, scientists, and other professionals throughout industry, government, and the universities," the directors of our society, and one can believe this. To what better source could our directors turn for news of the new machines, and the new prototypes and Platonic ideas of machines, that will soon thereafter be shifting the spin and thrust of our hurtling globe? Moreover, their 1974 demographics seem to support their claim: 53.5 per cent of *Scientific American* subscribers graduated from college, which is the highest proportion for any of the magazines surveyed; *Esquire*, for instance, has only 23.7 per cent graduate readers. Indeed, according to a subscriber profile of 1973, 25 per cent of *Scientific American* readers have Ph.D's. Thus if America is becoming "a knowledge society," as the magazine assures us, *Scientific American* is going to be more and more the voice of its "leadership community."

In *Change*, a handsome booklet for potential advertisers, the magazine says that America now employs 61 per cent of its labor force in service industries, as opposed to goods-producing industries, and derives 60.4 per cent of its GNP from service

industries. Of seven leading nations compared, the U.S. comes top in those percentages and bottom in the proportion of its investment in agriculture and industry (except that England invests even less in agriculture). Moreover, the service sector of industry now embraces three times as many U.S. corporations as the goods-producing sector, and this tendency is increasing. By 1980, 50 per cent of the adult market will have gone to college, and the professional/technical class will have moved up from being the third largest class in the country to being the second. (It will have passed the operatives' class and will be second only to the clerical.) Thus "Information is the product. Knowledge is the basis for power. Teaching/learning occupies vast numbers of the population, for education is the means of entry." And *Scientific American* is the mirror in which America's intellectuals must look to recognize themselves.

The magazine itself measures the change in society if you compare what it is now with what it was when Rufus Porter founded it in 1845. *Change* describes the knowledge-society by saying that "Theory has replaced trial and error; the inspired tinkerer has been replaced by the theorist," and Rufus Porter (1792-1884) was the inspired tinkerer of all time. Though born into a well-established Massachusetts family, he devised a very disestablished lifestyle for himself in the post-Revolutionary period. He was the anti-Brahmin Yankee. He invented every kind of thing, from a flying machine and a portable house to an engine lathe and a balanced valve, and spent most of his life pushing a handcart through the villages of New England, painting murals or drawing portraits with the aid of his patented camera obscura. He sold innumerable scientific and technological ideas without much financial profit.



The first issue of *Scientific American*, dated August 28, 1845, says that the magazine is especially entitled to the patronage of mechanics and manufacturers as the only paper in America devoted to the interests of those classes. Its strictly scientific content is very small and is limited to tiny essays on gravity, electroplating, and the principles of chemistry. The bulk of the paper is taken up with news items about oil wells, new methods of treating zinc, and the social and educational achievements of the Lowell mills, etc. There is also a long list of new patents; the magazine was for a long time associated with a patent house, and one of its major functions was this semiofficial catalogue. At the same time, it is quite definitely a cultural magazine. There are several moralizing or humorous poems—one on the perils of drink, another on the

rewards of home life, and another beginning "Be active—be active. Find something to do."

There is a series of one-line jokes and comical news items. And there are various attacks on the Church of England and all established and aristocratic institutions. The first editorial promises to "exercise a full share of independence, in the occasional exposure of ignorance and knavery, especially when we find them sheltered by arrogance and aristocracy. . . . We shall advocate pure Christian religion, without favoring any particular sect, and shall make it a point to adhere to reason and common sense. . . ." in defiance of orthodoxy and privilege. The readers of this *Scientific American* will have no truck with any kind of establishment, nor with any kind of High Culture. Their homes will be decent to the point of dullness, and their workshops will be busy until 3 A.M. every night. They will put their imaginative energies into patenting new devices and investing in new schemes and hoping to realize a fortune. Their patron saints will range from Edison to Ford.

It is a far cry from this sensibility to that of the magazine we now read. This has eight essays every month, and the formula is that two should describe new work in the physical sciences, two work in the life sciences, two in the social sciences, and the others in medicine and technology. The editors describe this formula as being derived from the universities' way of organizing the sciences, and the content and decorum of the articles are certainly academic. Nearly all the contributors belong to universities in some way, and the magazine as a whole practically counts as a university itself—as one of those so-established institutions at which Rufus Porter impudently pecked. American science has moved out of Porter's handcart into an opulent building on Madison Avenue, over a Bankers Trust.

When this new version of *Scientific American* was sent out to the magazine's old subscribers in May, 1948, it gave them a considerable shock. One of them wrote a letter of protest (it was published in the July issue) complaining that the new editors had ruined "the finest shop and hobby magazine in the world. Gone highbrow." They had lost the idea of a magazine helpful to people of all walks of life, and wrote only for the college-educated. None of them, he guessed, "had ever cleaned his hands on a piece of dirty waste." Rufus Porter too might have felt that the magazine's democratic and radical character had been betrayed.

But there is more than one way of being radical, and within two years the new editors had an issue burned by agents of the Atomic Energy Commission on the grounds that it included classified information in an article attacking government armaments policy. The offending article (written by Hans Bethe) was published simultaneously in *Bulletin of the Atomic Scientists*, and was hostile to the decision to build

the hydrogen bomb. *Scientific American's* publisher, Gerard Piel, himself went on to write articles attacking Washington's policy in armaments, science funding, foreign aid, economic development. The attack was quite bitter and was published in magazines like the *Bulletin*, the most politically radical of scientific magazines. *Scientific American* itself, in a new department, "Science and the Citizen," printed items about the reluctance of scientists as a group to work for the federal government, though its own attitude was only implicit. Thus the establishment of politics was criticized by the establishment of science. The criticism was radical, but still establishmentarian. This was mugwump radicalism, though the basis of the establishment behind it was intellectual rather than purely social.

The cultural atmosphere of our *Scientific American* is focused in the special issue of September, 1950, entitled "The Age of Science, 1900-1950." The editors' preface noted that "Whatever else it may be, the 20th century is above all the age of science. . .," and by science it meant the work of the theorist and not that of the inspired tinkerer. The first essay, bearing the title of the whole issue, was written by J. Robert Oppenheimer, the most public figure then available of the scientific theorist and a *statesman* of science, a philosopher-king. The other ten essays dealt each with a particular science and were each written by a leading figure in that field. Thus Max Born wrote about Physics, Linus Pauling about Chemistry, Harlow Shapley about Astronomy, and so on.

This special issue has been followed by another such in the September issue of every year, and one of their functions has been to celebrate the majesty of science. They are occasions; a number of celebrities are assembled on a podium; the readership rises mentally to its feet. It is to the magazine's great credit that what these celebrities say, once assembled, is scientific; that the discourse does not sink to the level of a commencement address. But still that symphonic Sibelius music, that fanfare and Triumphant March, does blend in with and reinforce the naked and thoughtful voice of the essays.

By 1950, of course, American science was a very different entity from what it had been in 1845, culturally speaking. It was to be represented by J. Robert Oppenheimer rather than by Rufus Porter. There had been very few real scientists in America before 1900, and even through much of the Age of Science, 1900-1950, the intellectual style of science in America had less dignity than it had in, say, nineteenth-century Germany. One can trace that development in Oppenheimer's career; as a student at Göttingen in the late 1920's he studied alongside men like Heisenberg and Dirac, at a moment of intellectual revolution in science, in an atmosphere where physics was continuous with philosophy. Returned to America, he worked at Berkeley with

Ernest Lawrence, a leading figure in American science but as a general intellectual very limited. Lawrence, one may say, saw the progress of physics in terms of using bigger and bigger machines each year; and his cultural interests outside physics were not much wider than Rufus Porter's.

Oppenheimer took the chance at Los Alamos to create a community of scientists in America which had something of the character of that Göttingen he had so much enjoyed. He gave American science a cultural dignity it had never had before. The conflict between his style and Lawrence's was one element in the complex antagonism that enmeshed the two men and contributed to Oppenheimer's later disgrace. Thus it was appropriate in many ways that Oppenheimer should write the leading article for that 1950 issue of *Scientific American*.

The magazine was then newly in the hands of Gerard Piel and Dennis Flanagan, who are still its publisher and editor today. In 1947 they were science journalists working for *Time/Life* and planning to bring out their own magazine for scientific readers when they heard that the old *Scientific American* was going out of business. They took it over and soon transformed it into the magazine we know today. That special issue of 1950 can be taken as one of their first full statements. They were thus in some metaphorical sense followers of Oppenheimer. The prestige of American science in 1947, which is what made their magazine feasible, derived, after all, more from the Manhattan Project than from anything else. And they followed the controversies in which Oppenheimer was involved over the further use of nuclear weapons. In 1950, after Harry Truman announced that research would begin again into the possibility of making a hydrogen bomb, the *Scientific American* had four articles on the subject—in March, April, May, and June—which expressed the anxieties of the scientific community over that decision.

It was one of those articles that provoked the action of the AEC agents; an action which Gerard Piel has recounted with glee in his *Science and the Cause of Man* (1961). Piel is as proud of being a political radical as of participating in the Age of Science, and his peculiar combination of resistance to government with loyalty to established intellect lies behind his magazine's official discretion. He was educated at Andover and Harvard and now has three honorary degrees, gives evidence to Congressional subcommittees, and heads committees reporting to the Mayor of New York; but the reports he makes are often full of indignation. *Scientific American* is his creation, and he sees it as a spearhead of democratic radicalism. He tells us in *The Acceleration of History* (1972) that technology makes men free and science can never be retrograde. He blames America's troubles, including the threat of a "technologized" future,

on its business-dominated economy and on a popular culture bamboozled by businessmen. He claims that the intellectual tradition of the West is heretical and dissenting and that clerks *should* be treasonable. He applauds the recent students' revolt and says that all real scientists are revolutionaries.

This is obviously a very special use of "revolutionary." It ignores the implications of two powerful experiences, given uniquely to scientists in the Age of Science: first, of a social structure, the community of science, which corresponds more or less to the merits of its members; and second, of an intellectual enterprise of enormous scope and prodigious achievement. The result of those experiences is an implicit faith in social process which no other intellectual can feel; and metaphysical extensions of that faith. The tone in which *Scientific American* authors talk of "niches in the ecosystem" is exactly the tone in which eighteenth-century optimists talked of the Great Chain of Being. Or let me quote two of the magazine's most brilliant contributors. Here is Freeman Dyson on "Energy in the Universe":

. . . many people have formed an impression of the earth as a uniquely beautiful and fragile oasis in a harsh and hostile universe. . . . I wish to assert the contrary view. I believe the universe is friendly. I see no reason to suppose that the cosmic accidents that provided so abundantly for our welfare here on the earth will not do the same for us wherever else in the universe we choose to go.

Here is George Wald on "The Origin of Life":

We are not alone in the universe, and do not bear alone the whole burden of life and what comes of it. Life is a cosmic event. . . . On this planet that is our home, we have every reason to wish it well. Yet should we fail, all is not lost. Our kind will try again elsewhere.

Where but in *Scientific American* could you find that lyrically serene note today? And what does "revolutionary" mean when spoken on a lyrically serene note?

Introducing a book on computers, the magazine's editors say that the contributors see no threat of a "brave new world" coming from these machines:

On the contrary, they find, the computer capacitates the individual to resist the conformist pressures set up by the preceding phases of the scientific-industrial revolution. They are even willing to conjure with a future in which man may find himself instructed by the presence in the world of intellectually superior beings.

It is something about the style as well as the statement there—something of the statesman or the bishop

of science—that brings Oppenheimer to mind again. It should be said that Oppenheimer is and was no hero to Piel, who admires scientists of a very different stamp; men like T.C. Schneirla, R.W. Wood, and Percy Bridgman. These names suggest something much more austere and pure in intellectual style, more concentrated on the logic of science than on its image, and congenitally indifferent to public relations. But *Scientific American's* own field of activity is the public relations of science, and so it can be compared with that aspect of Oppenheimer.

Of course, the magazine was not tied to Oppenheimer in any way that could make his trial and disgrace a problem to its own continuance. It did not defend him or his policies, or take up any controversial position. "Science and the Citizen" reported the facts of the trial, and the magazine made a point of publishing articles on disarmament (and on what has come to be called ecology), but its concern with public issues has been always moderate and discreet. Politically, it has represented always the center of science; not, like the *Bulletin of the Atomic Scientists*, the left wing.

Not a great deal seems to be established by social scientific means about the "cultural" characteristics of scientists in America, but what evidence there is suggests a general stability, not to say squareness. It suggests that the intellectual stylishness of Oppenheimer and his ilk have not entirely displaced the sober domesticity of Rufus Porter's subscribers. One five-year study, "The Origins of U.S. Scientists," reported in *Scientific American* (July, 1951), examined the educational origins of those scientists (Ph.D's in the natural sciences) who graduated from college between 1924 and 1934. It found a strongly marked pattern of such men coming from small liberal arts colleges in the Midwest much more often than from, say, famous universities in the East. (The Northeast schools, on the other hand, turned out a very high proportion of the nation's lawyers.) Of the fifty institutions that did best at producing scientists by this definition, thirty-nine were small liberal arts colleges; only three were large universities, and only two were purely technical institutions. State agricultural colleges produced 19.8 scientists per 1,000 male graduates. But since nearly all those graduates had majored in science, that proportion was much less striking than the 17.8 per 1,000 of the liberal arts colleges, where only one in three had been a science major. One hundred fifty-three of these liberal arts colleges, graduating between 30 and 200 students a year, were examined. They were found to be mostly in the Middle West and in the middle phase of such colleges' development, after their Protestant religious emphasis had declined and before they attracted socially and financially advantaged students.

A psychologist's account of some eminent scientists she had examined (again over a period of five years) also appeared in *Scientific American* (November, 1952). (This was the time, and the place, for the scientific culture to examine itself.) The most striking conclusion this psychologist came to was that natural scientists worked seven days a week, that they made their lives out of their work, and were mildly bored by most forms of entertainment, social life, and even politics and religion. Their married lives, on the other hand, tended to greater stability than the average man's. This, again, seems to be borne out by *Scientific American's* demographics for 1974, which show that only 4.2 per cent of their subscribers are "Divorced/widowed/separated," as against an American average of 11 per cent. On the other hand, 26.9 per cent of them are single, while the national average is 11.5 per cent.

What all of this suggests is that the readership of *Scientific American* is the last surviving stronghold of the work ethic and the traditional WASP virtues. Though they are not so likely to be still literally WASPs (Oppenheimer might be a convenient symbol here too), they do seem to be the contemporary representatives of the intellectual and temperamental type that built up the world empire of the West. Certainly it would be hard to point to any other *intellectual* group who could challenge them for that title.

This means that they are predominant in the world of the mind when that is viewed from outside, for instance, by the representatives of government or the army or business, but that within the world of the mind their position is beleaguered. The heritage of the WASP virtues has long been under attack in the world of high culture. The most embittered of those who attack belong to the arts and to those of the humanities which ally themselves to the arts, i.e., literary and artistic criticism. But a similar hostility is to be found in, for instance, history too. The case of empire building in the literal sense provides an example. Stanley was still collecting his official awards, and his books (like *In Darkest Africa*) were still selling in the hundreds of thousands, when high-cultural opinion turned against him. The historians of Africa have been almost as cynical as the novelists (like Conrad) about Stanley's achievements and have morally deplored what had seemed the WASP achievement of opening up the Dark Continent to enlightenment. The same cynicism and the same moral disapproval are today always ready to be turned against the achievements of science and technology. And they surround the intellectual and temperamental style of the scientific culture with distaste and distrust.

This, after all, is what got expressed in F.R. Leavis's angry reply to C.P. Snow's famous lecture

on "The Two Cultures." It is the force that keeps the gap between the two cultures from closing. Snow was appealing for measures to close that gap, and Leavis's anger was in effect a declaration that it must be kept open. Now *Scientific American* is quite consciously an attempt to bridge it. The editors are non-scientists themselves—only two of the ten have degrees in science—and they have resolutely kept the articles nonmathematical. They have always seen their magazine in the light of a two-cultures theory. In the introduction to *The Scientific American Reader* (1953) they say: "Illiteracy in science presents its most alarming aspect as it prevails among otherwise educated members of our society. It promotes the anti-rational, illiberal mood presently ascendant in our culture. It has resulted in the almost complete estrangement of arts and letters from the sciences. . . ." And in a recent article Dennis Flanagan reports a social clash between himself and Pauline Kael which repeated on a small scale the clash between Snow and Leavis. When he was introduced as an editor of *Scientific American* to the *New Yorker's* film critic, she immediately defined her position by saying, "I know nothing whatever about science," with what sounded to him like complacency. "Whatever became of the idea that an educated person should know a little something about everything?" he replied. And she, "her eyes snapping a bit," exclaimed, "Ah, a Renaissance hack."

This anecdote does, as Mr. Flanagan says, capture the antihumanist tone of the humanists today, their rather snarling repudiation of any attempt at intellectual community. The Renaissance Man idea figures to them as essentially a lie. It is Snow, and *Scientific American*, and other scientific journals, and some scientific faculties who carry the banner of a wide-ranging humanism. For instance, *American Scientist* carried an article on the poor standards of scientists' writing in its issue for March, 1973, which provoked several replies in the July/August issue from teachers of science who expressed an active cultural conscience about the matter.

*Scientific American*, for its part, teaches these days by example; by the "aggressive editing" it boasts, which enables it to go always to leading authorities in each field, confident of making their theories intelligible and interesting by dint of editorial effort in the magazine's own offices. In the magazine's first years it used to take articles from scientific writers, but recently they have gone straight to the horse's mouth. They solicit their articles from the men who made the discoveries in question and supply the literary half of the labor themselves. "The relationship between author and editor in *Scientific American*," the editors say, "is closer and more painstaking than in perhaps any other magazine published today. The readers' critical and insistent demand for both integrity and clarity prevents any slackening of this relationship."

A bridge does not, of course, abolish a gap; especially when the gap is not just a static matter of ignorance but a dynamic matter of distaste and disapproval. Thus we are not surprised to see that of the Ph.D. readers of *Scientific American*, according to the subscriber profile of 1973, 0.3 per cent got their Ph.D. in English. A bridge just makes it possible to cross the gap for those who wish to do that. And *Scientific American* is such a bridge. I am planning to shepherd my next section of Freshman English across it by teaching exclusively from issues of that magazine. The effort my students would have to make to master the contents of those articles, and to master their reasoning to the point of criticizing it, is probably the best training they could get in the art of reading at the age of eighteen.

The magazine is itself a kind of floating university. Thirty-one per cent of its readers are between eighteen and twenty-four (only 14.1 per cent of *Fortune's* readers are in that age bracket), and its reprints, at twenty-five cents each, sell to students in great numbers. There are 904 such offprints for sale now, and about two million copies are sold each year. Books made up of articles from the magazine are sold by W.H. Freeman and Co., a firm taken over by *Scientific American* in 1964 as it expanded. There is a Scientific American Resource Library of twenty-one volumes and many individual titles like *The Ocean* or *Science, Conflict, and Society*. These are highly recommended by teachers all over the country as background reading and as textbooks in specific courses in high school, college, and graduate school. There is an international edition of the magazine in English (selling widely in England) as well as editions in Japanese, Russian, and Italian.

Science is a professedly international culture, and *Scientific American* does its bit to make that truth prevail. All these things, of course, contribute to the impression of solidity I spoke of. A floating university is in some ways more solid than a bricks-and-mortar building. *Scientific American's* efforts go almost exclusively into the most respectable part of academic work—the expounding of new knowledge; none of them are wasted on the social and organizational

aspects that absorb so much of a university teacher's energy. The emblem of *Scientific American* is a test tube at work, or a specimen prepared for a microscope, not some pseudo-Gothic bell tower or falsely smiling dean.

Of course we cannot dismiss entirely the qualms of anxiety and guilt, the sensations of succumbing to philistinism and worse, that seize us as we turn these glossy pages. We have been taught those qualms by so many modern masters. We might, for instance, recall Norman Mailer's attack on university teachers in *Armies of the Night*. "Like the scent of the void which comes off the pages of a Xerox copy, so was he always depressed in such homes by their hint of over-security. If the republic was now managing to convert the citizenry to a plastic mass. . . , they were responsible. Mailer seems to condemn his liberal academics by assimilating them all to scientists, engineers, or perhaps just readers of *Scientific American*. His enemies' opposition to the government's Asian policy "seemed no more than a quarrel among engineers . . . they were the natural managers of that future air-conditioned vault where the last of human life would still exist." I wouldn't deny that some such group identity does exist; I do sometimes feel myself being absorbed into that identity as I read *Scientific American*, and that does give me pause. Those reproductions of Old Masters that illustrate the recent issue on population *can* look as if they mask the doors to Mailer's air-conditioned vaults.

But to think of Mailer may remind us that even his generous-minded rebellion against all *Scientific American* stands for is not a very authoritative alternative to it. This solidity may seem stolidity at times, and these gleamingly blank surfaces may promise sterility, but what happens when one turns away from science? Don't we soon feel trapped by our fiercer "imaginative" writers, our prophetic novelists in their would-be sinister Coney Islands, their Hollywood-set fantasies, all painted on rotting canvas? Let us enjoy the solid clarity, confidence, seriousness of these pages, where the editors really understand and respect the writers, and the readers' letters are written on the same level of learning and seriousness as the original articles.