ILLUSTRATION BY CHARLES SLACKMAN

Bucking The Scientific Establishment

article By THEODORE J. GORDON *burning at the stake may be a thing of the past, but today's unorthodox theorists often see their careers, grants and reputations go up in smoke*

IN THE LATTER PART of the 16th Century, an Italian philosopher named Giordano Bruno speculated that the stars were really suns like our sun, surrounded by planets like our own earth. Bruno was accused of heresy and pursued through Switzerland, France, England and Germany. Finally, in 1593, the churchmen caught him in Venice. He was thrown into prison, excommunicated and finally turned over to civil authorities with the request that he "be treated gently and without the shedding of blood." He was burned at the stake on February 17, 1600.

Ignaz Semmelweis was the first man to suspect that disease might be carried by unclean hands and surgical instruments. He forced students and nurses in his hospitals to scrub up after dissecting corpses and treating the festering wounds of patients. He proved beyond doubt that fever deaths after childbirth were drastically reduced by these practices. He wrote papers, he taught, he cried, he pleaded. He saw his patients live while others died. Yet *(continued on page 134)*

The Scientific Establishment

(continued from page 127)

practically no one believed him. He died in 1865 from a wound on his hand, victim of the very infection against which he had fought so hard.

In the early part of the 19th Century, man faced indescribable pain during surgical operations and had only the barest chance of survival. There were no anesthetics. Surgeons cut through the flesh and bones of patients who could see and feel the tearing saw teeth. When Dr. Horace Wells, a Hartford dentist, proposed that nitrous oxide could mask the pain of tooth extractions, the establishment laughed. After arranging a demonstration of his discovery in the most famous hospital in the East, he was introduced to the gallery as an inventor of anesthesia (*snickers*). He could, said his sponsor, make the patient fall into a deep sleep while the surgeon operated (*laughter*). Wells called for a volunteer from the audience. A heavy-set fellow with a bad tooth stepped up. "Breathe deeply," said Wells. And soon the patient seemed to be asleep. Wells reached in and pulled. "Ouch!" shouted the patient. "Humbug!" The audience exploded into raucous laughter. Wells didn't know that a heavy person required a larger dosage of the gas. The world was not yet ready for anesthesia.

History? Not at all. To this day, any concept that smacks of scientific revolution is destined for trouble. Radical innovators can still be ostracized, prevented from speaking about or publishing their ideas, cut off from research money, fired, even jailed. Today, the burning continues only figuratively, but the means of rejection are as effective as in the Middle Ages. Concepts that challenge the mother beliefs of the scientific community are usually dealt with harshly. The inertia of the scientific establishment protects its dogma from all but the most insistent intrusion; it works to preserve the *status quo* of its hierarchy with what occasionally amounts to militant and abusive dedication. Take Velikovsky, for example.

In 1950, Dr. Immanuel Velikovsky, an obscure scholar, completed his book *Worlds in Collision*. His premise was that the ancient writings and folk tales of the people of the world might describe true events and that perhaps we should take them literally. Everywhere he looked, from Mexico to China, Velikovsky found folklore about oceans leaving their shores, rains of fire, darkness that lasted for years, parting of the seas, catastrophic death. He established a chronology that indicated not one but a series of calamities that occurred in relatively recent historical times.

Suppose these cataclysms really happened, Velikovsky speculated; what could have caused them? If we rule out superstition and the supernatural, there is only one explanation. In its endless travels around the sun, the earth had been approached by other celestial bodies. These near collisions raised the waters of the earth in floods, caused earthquakes and either slowed the earth's rotation or shifted its axis. The book of *Exodus* and other writings of the same period tell of such a near miss. The body that nearly hit the earth in the time of Moses, Velikovsky believes, was a massive comet torn centuries earlier from the planet Jupiter. It had swung in a highly elliptical orbit, then passed near the earth with devastating results. Its partially opaque tail caused the 40 years of darkness the Israelites suffered in the desert. The comet's atmosphere was rich in hydrocarbons, which fell to the earth as great sheets of fire. The manna of the Israelites was a form of this hydrocarbon, perhaps carbohydrates or proteins. The comet also approached Mars and disturbed its orbit. Mars, in its turn, came close to the earth before it was shifted into its present orbit. The destructive comet then settled into a path between the earth and the sun and is known today as the planet Venus.

This explanation led Velikovsky to certain astronomical predictions. In 1950, most astronomers believed that Venus was cold. Velikovsky wrote that the surface of Venus must be quite hot, since it is such a new planet. The sun, the planets and comets must be electrically charged, he said, and extended magnetic fields must permeate the solar system. Jupiter, because of its size, must emit radio noises; Mars must be a dead planet.

The American and Russian probes to Venus and radar observations have since confirmed that Venus is, indeed, very hot. The temperature appears to be above 500° Fahrenheit on both the dark and the light sides. In 1955, astronomers B. F. Burke and K. L. Franklin announced their discovery of radio noise from Jupiter. Our space probes have confirmed that magnetic fields and plasmas extend throughout the solar system. Our probe to Mars, Mariner IV, showed the surface was pock-marked and moonlike—to all appearances dead.

With this kind of performance, you might expect that Velikovsky is now a renowned and respected astrophysicist. This is not the case. *Worlds in Collision* was first published by Macmillan and became an immediate best seller because of the publicity that preceded it in popular-magazine accounts. Velikovsky's theories so outraged scientists and educators that a tremendous amount of pressure was brought to bear on Macmillan. Some scientists and educators even went as far as to threaten boycotting the firm's textbooks unless the book was dropped. Even though it was a best seller and certainly one of the big money-makers on Macmillan's list, the firm agreed to transfer the book to Doubleday. The threatened boycott has been defended by scientists as the "democratic privilege of organized protest." Macmillan fired the editor who brought the book into the company.

A distinguished panel, at an annual meeting of the American Association for the Advancement of Science, discussed with publishers the means of ensuring that such "crackpot" literature was properly reviewed before being foisted on the American public in the name of science. Suggestions at this meeting included the formation of a scientific board to weed out the wrong kinds of scientific books before publication.

Velikovsky did, in fact, submit his work to scientific review before publication. Professor H. M. Kallen, then dean of the graduate faculty of the New School for Social Research, read the manuscript and wrote to astronomer Harlow Shapley that Velikovsky "had built up a serious theory deserving of the careful attention of scholars." John J. O'Neill, who was then the science editor of the *New York Herald Tribune*, called the work magnificent. Gordon Atwater, director of the Hayden Planetarium, recommended publication of the manuscript. But before Mr. Atwater could conduct a special showing at the planetarium devoted to Velikovsky's theories, he was dismissed.

Velikovsky was roundly denounced and refuted after the book appeared. The arguments were many and varied. The most telling was this: If Venus was, in recent times, on a highly eccentric orbit ranging beyond the earth's, why is its orbit today almost circular and within the earth's orbit? Either the Mars-Venus-earth collisions produced an extremely unlikely cosmic billiard shot that left the three bodies in almost circular orbits, or forces that we have not yet recognized are at work in the solar system to produce rapid circularization of planetary orbits.

As to Velikovsky's predictions, "Lucky guesses," say his detractors. In December 1962, astronomer Lloyd Motz and physicist V. Bargmann, in a letter to the journal *Science*, accorded Velikovsky that rare scientific tribute—priority in predicting correctly that Venus would be very hot, that Jupiter would be a source of radio noise and that the earth's magnetic field extended well above the ionosphere. They recommended that his other ideas be objectively re-examined, even though they disagreed with his basic theories. Three months later, the magazine contained a letter that said, in part: "While one bad apple spoils the rest, the accidental presence of one or two good apples does not redeem a spoiled barrelful."

New data is still being collected.

(continued on page 150)

The Scientific Establishment

(continued from page 134)

Radioastronomy studies of Venus have recently shown that the planet rotates on its axis in a direction opposite to its motion around the sun. Today, the most popular theories of the creation of the solar system do not permit this type of motion; all such antirotating bodies are regarded as captives, which came into the solar system after the planets were already in orbit around the sun. Furthermore, Venus is rotating on its axis at a unique speed; it turns the same face toward the earth every time the planets are closest. Though not fully understood, these two new bits of data also appear to confirm Velikovsky's ideas. Velikovsky waits impatiently for the world to catch up with him. The embattled astronomer now lives in a gray-stone two-story house, vintage 1930, on a quiet street in Princeton, New Jersey, not far from the campus. He does not teach there; universities were closed to him until quite recently. Now, because of the series of remarkable confirmations, he is being invited to debate his ideas at some universities. He says, "The large portals of science are slowly but widely opening before the nonconformist of yesterday."

Others before Velikovsky had postulated a chaotic universe, but their ideas also were rejected, in favor of the satisfying, predictable, unchangeable solar system. Velikovsky taught disorder in our solar system; our space probes have found disorder there.

• • •

Little green worms, a half inch long, find themselves in the middle of another scientific controversy. Dr. James McConnell of the University of Michigan trained a group of flatworms known as planarians to contract their bodies whenever a strong light was turned on them. He used a classical conditioned-response situation: Whenever a light flashed during training, the worms were given a mild electric shock. After about 150 trials, the light alone was enough to make the worms contract. Planarians, like many other worms, can regenerate from worm pieces. Cut one in half and two worms will grow back. Cut one into five or six pieces and each will grow into a complete worm, with all organs properly placed and all worms indistinguishable from worms that mature naturally from eggs.

McConnell cut his trained worms in two. The trained head grew a new tail and the trained tail grew a new head, as expected. Then he placed them one by one in the training trough. After a few reminder shocks, the old-head, new-tail worms remembered to contract to the light. This is not so surprising; the old heads could have carried the memory. But when the old tails with their brand-new heads were tested, they also showed memory and required about the same number of reminder shocks as the old heads.

Planarians are sometimes cannibals. McConnell chopped up trained worms and fed them to their untrained cousins. The cousins, through some mechanism not explained, learned the light trick in a significantly shorter time than other untrained worms.

Confirmation that memory can be transmitted in the reproductive process —and that learning can be chemically enhanced—would, of course, be of enormous importance. Later experiments performed by McConnell and others seem to indicate that the cellular chemical RNA, ribonucleic acid, is linked to learning. RNA produced in trained animals seems to transmit some of that training to untrained animals when it is injected into them. In other experiments, chemicals were injected into laboratory animals to retard their production of RNA; these animals proved to be underachievers.

But it hasn't been all beer and skittles for Dr. McConnell. The pattern of opposition is familiar: antagonism, refusal of publication space, difficulty in funding research projects and the close protection of established reputations. McConnell freely admits that when he started his experiments, he was not using the jargon of invertebrate physiology or of biochemistry. He is a psychologist by training. More detailed knowledge in these fields might have made life easier, not because his experimental results would have changed but because failure to use the right scientific slang is a red flag to the experts. It says: "Look out. Here comes somebody who didn't study what we studied. He must be a kook." But if McConnell had been well versed in these fields, he might not have gone into this pioneering work, because one of the established tenets in the field is that worms can't retain learning. As one zoologist said of McConnell's early reports, "It can't be true: If it were, a zoologist would have done it years ago."

Few scientists are independently wealthy. A scientist's career and income depend largely on the reception accorded his work. In order to develop a reputation, he must present his work at symposia or in scientific journals. When opposition to his work has formed, particularly when that opposition stems from respected scientists, publication becomes less likely and funding continuing experiments becomes vastly more difficult. When the criticism comes from a Nobel Prize winner, catastrophe may be imminent.

McConnell told me this story: In 1962, Dr. Melvin Calvin, winner of the Nobel Prize for chemistry, invited McConnell to the University of California campus at Berkeley to talk about worm research. McConnell lectured there and Calvin soon undertook his own worm-learning experiments. McConnell furnished two graduate students to help set up the Berkeley laboratory and demonstrate techniques established in his own laboratories at the University of Michigan. But something happened to turn the work sour. There were personality clashes. Data was less convincing than that gathered at Michigan. McConnell thinks the Berkeley group was discouraged by slow progress. Finally, when the students left, the technicians they had been training took over. McConnell said, "With no psychologist around, with no one who had a feeling for the worms, the results became even worse. The research wasn't planned well, their attitude in the laboratory was negative to start with and the interpretation of the data they did obtain was wrong."

The Berkeley studies were published in the *Neurosciences Research Program Bulletin* for July–August 1964, and carried the message: "Experimental planarians could not be distinguished from naïve." Beyond that, the article implied that only a few reports of positive test results had appeared before, and most of these were authored by McConnell and his co-workers. If this report were correct, McConnell would be, at best, a misguided scientist; at worst, he would be a fraud. McConnell asks: "How do you fight someone with a Nobel Prize? When there are biases anyhow, doesn't authority always win?" McConnell felt that he should have been permitted to rebut in the same journal, but the *Bulletin* wouldn't take his manuscript without some rewriting. As a result, he printed his manuscript himself.

He pointed out that a 1964 survey showed 50 articles in print on worm learning—only about ten of them were by McConnell and co-workers and, of the 50, only six were negative reports. As for the poor learning demonstrated by the Berkeley worms, McConnell said that Calvin had interpreted his data incorrectly. In some of his experiments, "even a crude [mathematical] test shows that the improvement is significant."

McConnell has carried on his work at the Mental Health Research Institute on the campus of the University of Michigan. He has received personal recognition and awards in the midst of proposal rejections, money limitations and criticism. He is clearly annoyed at the scientific experimenters who fail to duplicate the results of his experiments and then launch personal attacks against him.

McConnell has often faced reluctant journal referees. Referees are scientists who advise editors whether or not a proposed article has scientific merit and should appear in print; if the thumbs go

down, the article will not appear. These review boards usually have their own prejudices. Members of these boards may have staked their careers on positions challenged by the very pieces they review.

McConnell publishes his own journal, *The Worm Runner's Digest*. (A "runner" is an experimenter who runs an animal through a maze; a psychologist who puts rats through a maze is a rat runner. McConnell and his associates are worm runners.) Half of the journal contains serious articles about worm training; the other half is composed of spoofs and cartoons about planarians and science in general. One sketch shows a male and a female worm. She says: "I'm sorry, Irving, but it would never work out. I'm trained and you're not."

Science and humor don't mix well. Howls of protest went up when some readers couldn't distinguish between the serious pieces and the lampoons, so McConnell began printing the serious pieces right side up and the humor upside down. Some scientists refuse to contribute to a journal with a funny name. Editors of other journals have sometimes requested that their contributors delete references to articles published in the *Digest*. McConnell says that there are librarians who don't place the magazine on their science shelves, because they distrust journals with odd names. So the *Digest* has now been renamed—it's *The Journal of Biological Psychology*. McConnell has even added referees. But if you turn the magazine upside down and open the back cover, Irving is still there, under the banner of *The Worm Runner's Digest*.

• • •

Even impeccable scientific credentials are no guarantee against trouble if the new ideas run counter to the accepted theories of the day. Dr. Albert Schatz was trained as a soil biologist and soil chemist and, with his colleagues at Rutgers University, discovered the antibiotic streptomycin. At the University of Chile, he was a professor on the faculties of chemistry, pharmacy, medicine and agronomy; he is currently a professor at Washington University. He has received honorary degrees from three universities. A list of his published scientific articles covers 12 pages.

With a co-author, Joseph Martin, D. D. S., Schatz presented a theory about the way cavities form in teeth. Most dentists believe that cavities ("caries" in the professional jargon) form when acid in the mouth attacks tooth enamel. This theory dates from 1880. Fledgling dentists, drilling intently on their first molar, still memorize it; the toothpaste industry is based on it.

The Schatz-Martin theory goes by the imposing name of "proteolysis-chelation." Schatz and Martin contend that bacteria, acting on the protein in tooth enamel through a process known as proteolysis, produce not only acids but many other compounds as well, including a group of chemicals known as chelates. The word "chelate" comes from the Greek *chēlē*, which means a crablike claw. Chelating agents act on a molecular level—they grab metal atoms into their structure. In its chemical definition, calcium is a metal, and chelating agents in the mouth go after the calcium in tooth enamel to fill in holes in its molecular structure. It is the chelaters, not the acids, say Schatz and Martin, that initiate the attack on the enamel.

Why all the fuss? The theories sound almost the same. But acid inhibits chelation; if the advocates of the chelation theory are right, when acid is removed from the mouth in an effort to stop cavities, chelation is aided and cavities may actually be promoted.

Schatz and Martin have met nothing but hostile opposition to their suggestion. First, they have found it difficult to publish in the big-name American dental journals. The editors of these journals are known authorities on caries, from the acid point of view. For this reason, Schatz and Martin had to publish in small dental journals, such as the *Pakistan Dental Review* and the *New York State Dental Journal*, where—as Schatz says—"the editors are in a position to be open-minded."

One of the main criticisms of Schatz and Martin is that they have failed to offer experimental proof of their theories. In his early work on caries, Schatz obtained research funding from the U. S. Public Health Service and the New York Academy of Dentistry. He did not oppose the acid theory at the time. When his antiacid views became clearer, he was asked to change his approach, then threatened with removal of funding. When he did not back down, funding disappeared. That was in 1956. In the same year, 40 consultant specialists in proteolysis and chelation, outside of the dental profession, were asked to complete a questionnaire about the Schatz-Martin theory. The great majority indicated that the proposed process was possible and theoretically valid. Funding remained unavailable. Some young researchers have attempted to obtain money to probe the proteolysis-chelation theory but have been consistently turned down. Schatz advises them to stay out of the fight. Young careers can be withered by lining up on the wrong side of a controversy.

• • •

Dr. Bartholomew Nagy of the University of California at San Diego has looked into the interior of certain meteorites and found microscopic bodies that appear to be fossils of once-living animals. Nobody knows the origin of these meteorites—or of any meteorites, for that matter—but wherever these came from, Nagy and his colleagues said, there must have been life.

The opposition finds the whole idea absurd. "There's no indication that those meteorites were under water for long periods of time, and everybody knows there must be water for life. Nagy must be looking at museum-shelf dust, or his own fingerprints, or spores that came into the meteorite when it passed through our atmosphere."

The leader of the opposition is Professor Edward Anders of the Enrico Fermi Institute for Nuclear Studies at the University of Chicago. He and his associate, Dr. Frank W. Fitch of the department of pathology, tried to duplicate the microscopic forms detected by Nagy and his associates, using only terrestrial organisms. They did prove fairly conclusively that one of the forms found by Nagy was nothing more than stained ragweed pollen. The implication: If one of the molecules can be of terrestrial origin, why not all?

Prior to their ragweed explanation, Anders and Fitch favored the view that the shapes detected by Nagy and his co-workers were produced by some inorganic process. Said Anders, "In my op'nion, at least, the only connection between meteorites and life is that an article on meteorites appeared in a magazine called *Life*."

Papers and sharp rebuttals, addenda and debate have ricocheted between the group led by Nagy and the group led by Anders. One writer called this dialog "a strange game of surrealistic tennis." Within the papers, sometimes hidden in the technical jargon, are innuendoes about carelessness, insufficient research, inadequate attention to detail and lack of objectivity.

The suggestion of poor laboratory procedures is as damaging to a scientist as the claim of dirty instruments would be to a surgeon. Unless experimental procedures are beyond criticism and laboratory results unequivocal (a fortunate combination that seldom occurs), traditionalists can always decry a new hypothesis.

Nagy and his co-workers knew they were sticking their necks out. One biochemist said, in a popular-magazine article, "Unless they're pretty darn sure of their results, they can ruin their careers with something as sensational as this."

The meteorite research was carried in another direction by Dr. Fredrick Sisler, a microbiologist with the U. S. Geological Survey, and by Dr. Walter Newton, chief of the germ-free laboratory at the National Institutes of Health. They sterilized the surface of a stone that had fallen in Murray, Kentucky, in 1950. Then, in the germ-free tanks at Bethesda,

Maryland, they pulverized a few grams of the meteorite's core material and placed it in a culture media. Within several months, Dr. Sisler found small particles the size and shape of bacteria but unlike terrestrial organisms. Many scientists do not believe that inert bacteria could survive after millions of years in space. Even though Sisler's approach has been a model of experimental caution, Nagy told me how the scientific community responded to Sisler's work: "He was battered."

• • •

Dr. Joseph B. Rhine and his wife joined the psychology faculty of Duke University shortly after Rhine received his degree from the University of Chicago in 1925. He was fascinated by the possibilities of clairvoyance, telepathy and precognition, and resolved to devise experiments that would prove or disprove their existence. The first tests showed that strict precautions and sophisticated statistical analysis would be required. In the fall of 1933, the researchers felt they had something important. One of their subjects, after a specified trial of 300 card-reading clairvoyance tests, produced a score of twice the number of hits expected by pure chance. The mathematical probability of such a score being due solely to chance was absurdly remote. These tests were the subject of the first paper published by the group. "Extra-Sensory Perception" was published in 1934 by the Boston Society for Psychical Research.

The New York Times printed the story and Rhine was an overnight sensation. He notes, "A few men . . . boiled up for a time in a towering rage of denunciation of the national craze they thought must have been deliberately generated and whipped up by irresponsible sensationalism. It was an atmosphere so acrid and clouded by the smoke of dissension as not to permit a calm judgment of the real merits of the findings presented. Criticisms were overdone, phrased in intemperate language and published far too easily and incautiously." Rhine has since become exceedingly conservative about popularized reports of his work. He now permits reports on previously published data only.

In 1937, poorly printed parlor-game ESP cards were sold to the general public. These cards, approved by Rhine, gave heat and apparent substance to his opponents' arguments. But, as he pointed out, the ESP experiments conducted at Duke did not permit either the "receiver" or the experimenter to see the cards during the tests. In 1938, the American Psychological Association conducted a round-table discussion between supporters and opponents of belief in ESP, to probe the possibility that sensory cues were somehow involved in the tests. These debates were emotion-charged sessions that Rhine recalls as a test "of the very right of these ESP workers to continue their researches." There appeared to be general agreement that the precautions being taken were adequate; nevertheless, added safeguards were suggested. Once these safeguards were implemented, the test results were less impressive but still very much above chance levels. There was the implication that further tightening might make the results completely random, but no one could suggest further refinements. To Rhine, all of the tedious precautions removed some of the spontaneity, some of the fun from the work; but the results of the experiments, according to him, can hardly be doubted.

Over the years, the two major criticisms of Rhine's work have been that lack of clinical control permitted the correct answer to be known somehow by the subjects or allowed the experimenters, perhaps subconsciously, to alter the data, and that the mathematics used to evaluate the statistical significance was not handled properly. In December 1937, there was a meeting of the American Institute of Mathematical Science in which the mathematical techniques used in the ESP analysis were examined. Conclusion: Rhine's treatment of the numbers was proper.

Not long ago, Drs. Thomas Duane and Thomas Behrendt, of the Jefferson Medical College of Philadelphia, published an article in the prestigious journal *Science* about the apparent telepathic transfer of electroencephalographic rhythms between identical twins. A storm of criticism arose in letters to the magazine that attacked the experimental techniques employed.

Some of the criticisms were apparently well taken, but others were tinged with hysteria. One writer said that he had received a letter asking, "Ought I not to resign from the American Association for the Advancement of Science [the organization that sponsors *Science*]?" In an answering letter, Duane and Behrendt admitted some shortcomings in their procedures; nevertheless, they felt they were on the right track. "Only hard, quantitatively acceptable results will prove or refute the hypothesis. We intend to seek such data and it is our hope that others will do likewise."

Rhine is now devoting his energies to the establishment of the Foundation for Research on the Nature of Man. This private institution is dedicated to the exploration and discovery of the ultimate

"Would a hate group of twenty-five qualify?"

capabilities of man. The Duke Parapsychology Laboratory has been closed: *The Journal of Parapsychology*, once published by the Duke group, will be published by the new foundation; the Duke files will also be transferred. One of the first responsibilities of the organization will be "the bridging of the gap between the firmly established results of decades of parapsychological research and the existing professional groups of scientists to whom these findings should have significance."

• • •

There are far more would-be geniuses in the world than real ones, and the guardians of public funds and the editors of scientific journals must use some criteria to judge the relative value of papers offered for publication. But it is sometimes difficult to tell the difference between a crank and a contributor. A crank may have grand visions of himself saving the world. He may be prohibited from publishing in recognized journals and may start his own. He may even start his own research institute. Worst of all, he may take his case directly to the public instead of to his scientific peers. But so may a contributor. Clearly, anyone should be heard *before* judgment is pronounced.

Suppose that technical journals were to publish a supplement each year, in which articles were selected not for contribution while conforming but for maximum possible impact on the discipline. The more controversial an idea, the more likely its inclusion. Reputable scientists might shun this issue of the journal unless one other ingredient were added: a generous honorarium, or perhaps a promise of research funds. That would make all the difference in the world; it might even become fashionable for a scientist to publish a "special" piece.

Agencies that provide cash for research might establish an analogous "kook" fund, available to qualified applicants not on the basis of the probable success of their proposed projects but, rather, on the basis of possible impact if their ideas eventually prove successful. A single success could justify many, many miscarriages.

Our lives depend on change. Economically, we depend on demand for new products to fill our productive capacity. Our national security requires innovation to provide a technological edge that, in this Cold War world, is equivalent to political superiority. Old mores become socially unacceptable because they grow boring; new thrills are challenging, exciting. We are committed to innovation, the mother of the future. To fear and suppress the radically new idea, as the scientific establishment generally does, is childish, wasteful and ultimately dangerous.

Where-To-Buy-It? Use REACTS Card on Page 27