from Moscow to Siberia in 1941. Shklovsky lent him Heitler's *Quantum Theory of Radiation* overnight. When asked if he had finished it, Sakharov replied, "Yes, why not?"

As a scientist, Shklovsky was expert in applying new ideas in physics to unusual situations in astronomy. His single most influential contribution was his 1953 explanation of the continuum radiation of the Crab Nebula (a supernova remnant) as the synchrotron radiation from high-energy electrons (1 to 100 GeV) spiraling in a magnetic field. He extrapolated its radio frequency spectrum to the optical region; he required in the Crab both that such electrons exist and that, since they lose energy rapidly, they must be replenished. (Protons at cosmic-ray energies are poor radiators.) The existence of an electron component at cosmic-ray energies had many important results; presumably they arise from the spinning pulsar in the Crab. From 1936 to 1955 I had vainly tried to explain radio frequency noise as thermal in origin; the revolution started by Shklovsky began the rush of high-energy physics into astrophysics. Magnetized plasmas, hot gases in rapid motion, seem now omnipresent.

He also became a force in the space program. Another novel contribution lent respectability to the search for extraterrestrial life and intelligence. For a symposium he organized in 1961 he wrote an imaginative account of the problem, although he admits weakness in molecular biology. He was the only participant to submit a manuscript on time, which he published in 1962 as a book that "sold out a printing of 50,000 copies in a few hours. . . five editions. . . many foreign languages. . . and in Braille." Its American translation as *Intelligent Life in the Universe,* with extensive additions by Carl Sagan, became a phenomenal success. Shklovsky's mind was fertile, freely roving; lacking the self-critical facility of the less gifted, he also made many mistakes. Herb Friedman's introduction is a warm picture of his personality and scientific contribution. Please read the book.

Jesse L. Greenstein
Lee A. DuBridge Professor of Astrophysics, Emeritus

Letters

Editor: In your fall edition on page 39 at the top you show a photograph which includes Dr. Millikan with Mrs. Balch on his right. During those years Mrs. Balch was a trustee of Scripps College. I was a junior there and in the spring of 1934 I was involved in a student protest which turned out to be both serious and important in the growth of the college. Mrs. Balch came out to interview us. For two hours she sat opposite me in probably the same dress as in the photograph and certainly the same hat. I feel you have identified her correctly.

Carlotta Welles
Member, The Caltech Associates

Editor: Not being a man of science, I very rarely am capable of enjoying articles in *Engineering & Science*. However the fall issue did contain two articles which I enjoyed reading, one on Shakespeare and the other on Sidney Weinbaum.

The latter article made me even prouder to be associated with Caltech. I think printing the article about Weinbaum and the difficult times of the late forties and early fifties, which I remember so well and need to be reminded of from time to time, in such an objective manner without editorializing about his guilt or innocence of an inconsequential "crime" peculiar to that era, speaks very well about an institution of science.

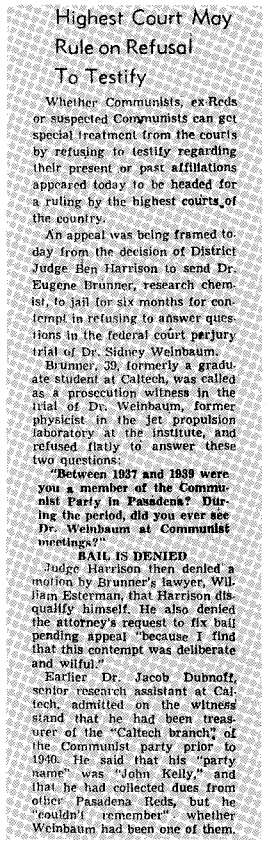
Arthur Rock
Caltech Board of Trustees

Editor: Your oral history excerpt from Sidney Weinbaum was both sobering and inspiring. Whatever his political affiliations during the Depression, three years in prison was an extraordinary price. It is hard for someone my age to fully understand the climate of that era, but I found the yellowed clippings from our local papers chilling.

Thanks for illuminating a dark chapter of our history. Perhaps with the cold war over at last, we can dismantle the vast security apparatus that has been so costly to our economy, our liberties, and our sense of decency.

Rick Cole
Vice Mayor, City of Pasadena

Editor: Your account of the Sidney Weinbaum trial includes a reference to



Highest Court May Rule on Refusal To Testify

Whether Communists, ex-Reds or suspected Communists can get special treatment from the courts by refusing to testify regarding their present or past affiliations appeared today to be headed for a ruling by the highest courts of the country.

An appeal was being framed today from the decision of District Judge Ben Harrison to send Dr. Eugene Brunner, research chemist, to jail for six months for contempt in refusing to answer questions in the federal court perjury trial of Dr. Sidney Weinbaum.

Brunner, 39, formerly a graduate student at Caltech, was called as a prosecution witness in the trial of Dr. Weinbaum, former physicist in the jet propulsion laboratory at the institute, and refused flatly to answer these two questions:

"Between 1937 and 1939 were you a member of the Communist Party in Pasadena? During the period, did you ever see Dr. Weinbaum at Communist meetings?"

BAIL IS DENIED

Judge Harrison then denied a motion by Brunner's lawyer, William Esterman, that Harrison disqualify himself. He also denied the attorney's request to fix bail pending appeal "because I find that this contempt was deliberate and wilful."

Earlier Dr. Jacob Dubnoff, senior research assistant at Caltech, admitted on the witness stand that he had been treasurer of the "Caltech branch" of the Communist party prior to 1940. He said that his "party name" was "John Kelly," and that he had collected dues from other Pasadena Reds, but he "couldn't remember" whether Weinbaum had been one of them.

Eugene Brunner in the reproduced news clipping on page 37. The combination of partial truths and omissions here can produce some bad implications. I hope I can contribute a little to help balance the history of our fellow alumnus (BS '33, PhD '38) and my fellow classmate.

I remember Eugene from our first day of freshman classes in 1929. Professor Luther Wear was laying out the plan of his mathematics course to our mixed section of the brilliant and not-so-brilliant, still to be sorted out. In his practiced way, he abruptly broke off the review to toss out a question about an equation. I had barely started to think when we heard a quick, conclusive answer. A trout had snatched the fly. I looked around to the source, a round-faced young man with thick glasses, who till this moment had looked half asleep: Eugene Brunner.

A little later in our freshman English section, Professor George MacMinn was fingering our first themes. He had been looking for some gleam of imagination out of the pile. He was largely disappointed except for one jewel, which he lifted out to read to us. It was "The Laboratory" by Eugene Brunner, a prose poem celebrating the scientist's career. We were beginning to get acquainted with our gifted classmate, who eventually went on through the difficult theoretical physics option to graduate with honors.

I left Caltech after graduating, but years after, a little before World War II, I encountered Eugene once more. He had just been hired as a hydrodynamics physicist by the Shell Development Company in Emeryville, where I was already working. He was given office space in the room I occupied. For a time we were also both members of a technical and professional employees' union. Like other unions of that time, this one had its share of Stalinists, but I never saw anything that identified Eugene with the Stalinist faction.

It was a different story with another union local member, George Eltenton. George was later alleged to be an intermediary for contacts between Robert Oppenheimer and Soviet agents. He was an English physicist who had been imported to Shell to help Otto Beeck by building one of America's first mass spectrometers. I rode in a car pool with George and had many opportunities to talk with him. Scarcely the stealthy conspirator imagined by some people, he was tirelessly forthright in advocating the Soviet system and criticizing America for withholding technical information from its glorious ally. The point is that in those times of the United Front, Communist influences had penetrated significantly into areas of American life. They had brushed closely against some of us.

In 1948 I left Shell and had no further contact with Eugene for about 30 years. Then one year I made a routine solicitation call to him on behalf of the Alumni Fund. He was living in Oregon and urged me to visit him and Mrs. Brunner whenever convenient. My wife and I were able to make this visit while touring Oregon in 1985. We spent the afternoon at the Brunner home and inevitably we talked about the court hearings. Eugene filled in my knowledge of the later history.

The threatening tone of his interrogation had affronted Eugene, and he had

steadily refused to answer. (It is useful to recall that membership in the Communist Party broke no law. And the implied acts or associations dated from more than 10 years before the hearings.) But the threat was real; his refusal to answer devastated his career. He quickly became both unemployed and unemployable in industry. Cut off from his profession, he made a living for the next 10 years as a television repairman.

The history did take one further twist, and even brightened a little bit. During his banishment, Eugene was gradually teaching himself to read Russian, not with any career plans but simply for personal interest. In some way the American Physical Society took notice of him and asked him to translate some papers from the Russian journals. His submissions were welcomed; he received more commissions and eventually found a new career of translating, abstracting, and reviewing the extensive literature of Russian physics.

I had to wonder how he could recover a mastery of contemporary physics after the long layoff. But Eugene disparaged the difficulty. Anyway, monitoring other people's achievements was less demanding than creative research of his own. The thought did cross my mind that he would have preferred the latter. But of course it was no longer an option.

Lee Carleton, BS '33

Editor: I read with much interest the interview with Sidney Weinbaum in the fall issue of *Engineering & Science*. My recollection of the events is somewhat different, and while I was not close to Dr. Weinbaum—I was not an ardent chess player—I knew Malina and Tsien very well indeed, and in particular Clark Millikan. The one statement in the interview that is plainly incorrect and unfair is the quotation about Clark Millikan "gleefully" relating the story about the Communist cell at Caltech. There was certainly no hard feeling between Millikan and Malina, and, more than that, Clark was one of the most decent, honest, and straightforward men I have known. Indeed, the only remark Clark made to me about the Weinbaum case—for which I can vouch—expressed his complete mystification as to the reason for Weinbaum's insistence on a clearance, which to him was akin to a Freudian death urge.

That Weinbaum's problems began in 1949 or so, which is much later than the date for his original clearance, may well be related to the discovery at about that time of the very real spy ring in the atomic research projects in Canada and the US. To bring in anti-Semitism as one reason for his troubles is definitely uncalled for.

I remember Dr. Weinbaum as someone even a little more nutty than the rest of us on the faculty at Caltech. We both lived close to the campus—he, I believe, on Steuben Street and I on the corner of Del Mar and Wilson—and I enjoyed walking at some distance behind him to campus because at random intervals Weinbaum performed something like a jump followed by a few dancelike steps, waving his arms like a bird. I always thought he was a Communist, and I don't think he made any pretense otherwise. One has, of course, to remember that in the Depression of the thirties many liberals looked toward communism and Russia as possible alternate solutions. The purges later in the same decade and finally the Hitler–Stalin pact turned most everybody off, but there remained a rather lunatic fringe trying to explain these terrible facts with an often bizarre logic. In any case, Weinbaum was considered odd but hardly dangerous. Indeed, Bill Sears tells me that von Kármán once introduced Weinbaum at a party as his friend dealing in chemistry and communism.

Hans W. Liepmann
Theodore von Kármán Professor of Aeronautics, Emeritus

Editor: Congratulations on an exceedingly interesting issue of your magazine for fall 1991, encompassing as it did the end of an unfortunate political era in the United States, the possible end of William Shakespeare, the end of man's last vestige of privacy (his genetic structure), and the end of the universe.

I can add some fragments of information to the Sidney Weinbaum sidebar to the article on Shakespeare.

Dr. Clyde Wolfe did indeed work for a man named Arensberg, who had previously done some writing on the Shakespeare controversy and was involved in a book considering, among other things, codes and ciphers and concealed meanings of all kinds. Wolfe's job was to assess the probability of random associations in previously discovered codes (perhaps it would be better to say purported codes) and to look for strange new combinations that

Congratulations on an exceedingly interesting issue of your magazine for fall 1991, encompassing as it did the end of an unfortunate polticial era in the United States, the possible end of William Shakespeare, the end of man's last vestige of privacy (his genetic structure), and the end of the universe.

would lead to Bacon's signature of authorship. Or any other signature.

Among the courses conducted at Caltech by Dr. Wolfe was one called, I believe, "Probability Theory and Combinatorial Analysis." While awaiting the arrival of the instructor on opening day, I and five or six others in the class occupied our time by writing in large letters on the board, "This is the class in uncertainty, doubt, and indecision." Wolfe called it an excellent description of his subject, unaware that it might be peculiarly apt when working on the identity of dramatists.

Wolfe became a good friend of mine, and I recall him, as I do half a dozen other professors at Caltech, with a good deal of affection. Among them was Professor George R. MacMinn, whose course on Shakespeare I took, and whose inscribed book, *The Theater of the Golden Era in California,* honors my bookshelf.

One summer Wolfe had to be in Berkeley on some important private business and asked me if I would fill in for him on the Shakespeare job for a couple of weeks. Of course I would. He briefed me, gave me two or three days to bone up on the great controversy, and left.

The first thing I saw when I walked into Arensberg's house in the Hollywood Hills was Brancusi's famous "Bird in Flight" sculpture perched on a hall table. I had barely turned away from it before I encountered Duchamp's "Nude Descending a Staircase." It was flanked by a half dozen Picassos from one of his more incomprehensible periods.

Arensberg, as you have probably guessed, was, of course, the Walter Arensberg whose magnificent collection is now in the Philadelphia Art Museum. He had become very interested in the Shakespeare authorship and had obtained photocopies of the First Folio for Wolfe's work on codes, some of which, it was thought, might be positional, which meant, obviously, that the printer had to be in on the game.

I think it a little cavalier to sweep Arensberg into the Looney bin to which Professor La Belle discards all those who dare to question the discontinuities and contradictions in the Shakespeare of Stratford record. Also in that Looney bin one finds a good many scholarly experts, an army of lawyers who are accustomed to weighing evidence, and an amazing array of individuals of various trades, such as Mark Twain, Charles Dickens, Walt Whitman, Henry James, John Galsworthy, Sigmund Freud, and Charles Chaplin. Some of this sampling are obtained from the writing of that dreadful Charlton O. Ogburn, whom Professor La Belle stabs to death with a telephone pole. I think a fair approach would be for concerned readers to obtain a copy of Ogburn's 1974 article in *Harvard* magazine. It is mercifully short and presents the case against Stratford rather logically, I thought.

During my short stay in Clyde Wolfe's job I contributed absolutely nothing. I did not even become an expert on Shakespeare. I started out as and continue to be an impartial observer. Much of the hogwash Professor La Belle refers to is just that. So is much of the material adduced by the Stratfordites, who sometimes seem short on logic and long on emotion.

Nobody has proved Shakespeare didn't write Shakespeare. Nobody has proved beyond question that Shakespeare did write Shakespeare. Nobody has proved anyone else wrote Shakespeare.

Linton von Beroldingen, BS '29