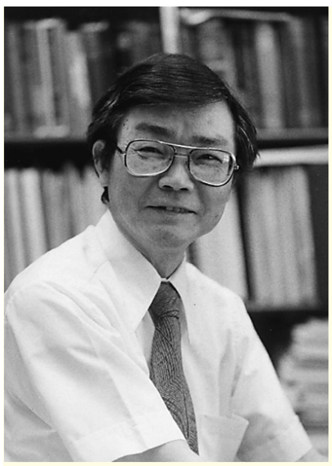
tightly wedged under a bridge. That tied up traffic for hours. . . .” The final mishap occurred during a run from Seattle to Long Beach, when the *Aquillo* encountered a storm that sent various unsecured items, including a piano and a propane tank, banging loose around the ship. The propane tank set the engine room on fire, and when the Coast Guard responded to save the *Aquillo* for the third time, “they kept right on pouring water until at last, to their great relief and John’s disappointment, they sank both the fire and *Aquillo*. That put a real damper on the hoped-for semester at sea in 1963.”

Despite the collapse of his entrepreneurial educational efforts, Campbell continued to teach engineering design at Art Center College of Design in Pasadena until a few months before his death. And, undefeated, he persevered at his extracurricular activities as well.

“John was also an inventor,” wrote Chamberlin. “In about 1925 he was awarded a patent for the inverse feedback circuit, a vital part of all modern electronic systems. Unfortunately, that patent expired long before it was recognized by industry. Also, about that time he invented the metal detector. Neither of these inventions gained him anything.” More recently, he invented a mechanism that could create a force without a reaction, which he thought would make fixed-wing aircraft and helicopters obsolete. The final crucial test failed last summer, according to Chamberlin. “As you can imagine, John’s heart was broken. That failure, along with a serious heart condition, sent his health in a downward spin and hastened his demise.”



Toshi Kubota, professor emeritus of aeronautics, died February 1, 1999, at the age of 72.

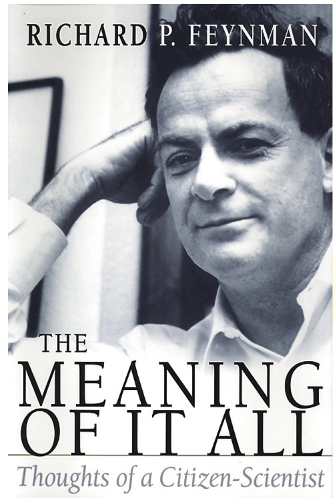
A native of Westmorland, California, Kubota received his bachelor of engineering degree in 1947 from the University of Tokyo. Returning home from Japan for graduate studies at Caltech, he earned his MS in 1952 and his PhD in 1957. Kubota remained at Caltech as a research fellow for two years before becoming an assistant professor in 1959. He was named associate professor in 1963 and full professor in 1971.

When he retired in 1990, he was honored with the establishment of the Toshi Kubota SURF Aeronautics Fellowship to “perpetuate the spirit and tradition of outstanding teaching, mentoring, and interest in undergraduate students demonstrated by Toshi.” The SURF (Summer Undergraduate Research Fellowship) fund “will ensure that Toshi’s legacy of commitment to the education . . . of young people continues.”

During his 43 years at Caltech, Kubota did much research in the field of fluid mechanics, focusing on topics such as hypersonic wake flows, supersonic turbulent shear flows, and supersonic boundary layer separation. He also served as a consultant to several engineering companies ranging from TRW to Lockheed.

In addition, Kubota held positions in the Society of Sigma Xi, the Physical Society of Japan, the American Physical Society, and the American Institute of Aeronautics and Astronautics.

He is survived by his wife, Yoshiko Phebe Nihira, and his three children, Misa Sophia, Miya Eliza, and Yuri Susan.
—DT



FEYNMAN’S MEANING

“Look at the ideas themselves and judge them directly. . .” (p. 61). Do not accept them on the basis of authority. Question, question, question, especially, your own ideas. Look at problems from all angles. Try to determine what is wrong with your solution (before someone else does).

If there was one admonition Richard Feynman tried to convey to everyone, this was it. Regrettably, until *The Meaning of It All* came along, this message was imparted only indirectly, as in Feynman’s contribution to the *Challenger* investigation.

At long last this material is available to those who did not have the memorable opportunity to witness the occasional, impromptu gatherings where R. P. would expand on these, and somewhat more technical matters, at some length and in considerable detail. These were not “off-the-cuff” meanderings, but carefully thought-through analyses, delivered straight and seasoned with his special touch of humor. Despite the intervening years, Feynman’s voice rings in every word of the text, and his playful, adventuresome spirit of discovery is unmistakable.

While it is Chapter III, “This Unscientific Age,” in which Feynman goes to considerable lengths to advise us on how to judge the validity of an idea, it is in Chapter I, “The Uncertainty of Science,” and Chapter II, “The Uncertainty of Values,” where he

Karvel Thornber heard Feynman speak on innumerable occasions during his undergraduate and graduate years at Caltech and worked closely with him in 1965–66 solving a problem suggested by Carver Mead. He says that "in May 1966, Feynman stated that he enjoyed the problem because for so long we had had no idea how (or even if) it would eventually turn out. Many of the questions raised in The Meaning of It All *were still on his mind during this period.*

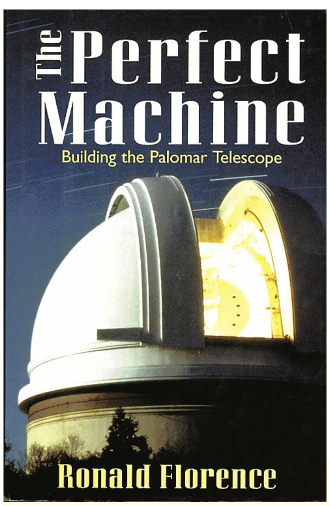
lays the foundations of his philosophy. He does this most adroitly by first motivating the nature, especially the excitement, of science, in layman's terms, and based on this as preparation, directly focusing on the meaning of life. He then briefly calls attention to the most intriguing problem of self-reference, "this thing [man] that looks at itself and wonders why it wonders," followed by an objective outline of the complementary roles of religion and science. Regarding the pursuit of science, Feynman writes, "The imagination of nature is far, far greater than the imagination of man" (p.10), and, "If you look closely enough at anything, you will see that there is nothing more exciting than the truth, the pay dirt of the scientist, discovered by his painstaking efforts."

Having transmitted the excitement of the adventure of science to the reader, along with the caveat that "all scientific knowledge is uncertain" (p. 26), he applies his experience with doubt and uncertainty to the question of the meaning of it all. And, in a manner so characteristic of the novelty of his insight, concludes "that we do not know. But I think that in admitting this we have probably found the open channel" (p. 33). By keeping our options open, he feels we will find what we want even if we do not know what that may be. "It is in the admission of ignorance and the admission of uncertainty that there is hope for the continuous motion of human beings in some direction that does not get confined, permanently blocked, as it has so many times before in various periods in the history of man" (p. 34). The second lecture concludes with his case for complete intellectual freedom.

I have carefully read this book and found it to be quite authentic. In sharp contrast to the concluding paragraphs of David Goodstein's review *(American Scientist 86* (4), pp. 374–7, July–August, 1998, and *Engineering & Science 61* (2), pp. 38–40, 1998), I feel it is an important addition to Feynman's writings. Readily accessible to a broad audience, it provides a rare insight into his assessment of a variety of issues of interest during the '50s and early '60s, his important post-QED but pre–Nobel Prize period. By all means buy a copy of this book before it goes out of print.

Finally, although I very much admire Goodstein for his raising of the issues, I do not agree that this book honors neither Feynman's wishes nor his memory. Were Feynman alive, this book would, of course, be regarded as a publication summarizing his philosophy regarding the issues he raises, and he would be held duly responsible for any apparent lack of scholarship. But clearly this is not the case. First, Feynman himself provides the disclaimer (p. 61). Second, and more to the point, this book is a historical document (pp. vii, ix). It expresses how one very introspective and imaginative person thought in 1963 on issues still largely unresolved 35 years later. It is to his credit that he attempted to grasp problems beyond our reach. All of us leave behind unfinished works; often these concern problems we believe to be important. Alive, they are our responsibility; after our life, they become everyone's responsibility.

Karvel Thornber, BS '63, MS '64, PhD '66



The previous issue of *Engineering & Science* (1998, No. 3) carried a brief story commemorating the 50th anniversary of the dedication of the Hale 200-inch telescope on Palomar Mountain. Anyone desiring to learn the whole story of the Hale Telescope from its conception should read Ronald Florence's book *The Perfect Machine* (HarperCollins, 1994), which provided background material for the article.

Lab Notes

Prof. Kevles (*E&S*, No. 3, 1998) would attribute the prominence and longevity of the "Baltimore case" to congressional thirst for publicity coupled with media ignorance, arising within a climate of suspicion and fear of biological science. This climate in turn presumably originated with the debut of genetic engineering, the recombinant DNA debate, the prospect of cloning, et al. Concurrent issues of corruption and fraud elsewhere in public life also tainted the general atmosphere.

Likely all true. But the Baltimore case had another singular component that confused and prolonged the issue. This controversy centered around a novel and quite surprising scientific result, which was certain to draw careful scrutiny of the evidence presented. And as the issue proceeded, it developed that that evidence relied upon records maintained in such a slovenly fashion that it was not necessarily unreasonable to question their validity.

The principals were—in my view, appropriately—ultimately exonerated of fraud. But—also in my view—the longevity and intensity of conflict in this case derived in no small part from the revelation of the disorderly and seemingly capricious handling of the underlying research records.

Robert L. Sinsheimer
Professor Emeritus
Department of Molecular, Cellular and Developmental Biology, University of California, Santa Barbara

Dan Kevles replies:

Yes, Imanishi-Kari was something of a sloppy record keeper, but her habits in this regard had nothing to do with prolonging the case for the (unconscionably) long period of a decade. What had everything to do with it was the search for evidence of fraud by a congressional subcommittee and an investigative agency of government that began in 1989 and that through the next six years denied Imanishi-Kari elementary rights of due process, including the right to see the evidence against her and to confront and cross-examine the witnesses against her.

Faculty File

John Brady

Ken Farley

Honors and Awards

Associate Professor of Political Science R. Michael Alvarez and Associate Professor of History William Deverell have been selected to receive 1999 Haynes Foundation Faculty Fellowships.

Harry Atwater, associate professor of applied physics, has been elected by the Materials Research Society to serve on its executive committee and council for three years—one year each as vice president (1999), president (2000), and past president (2001). His term commenced on January 1.

Professor of Chemistry Jesse Beauchamp (BS '64) has been selected as the 1999 recipient of the American Chemical Society's Peter Debye Award in Physical Chemistry, which is sponsored by DuPont.

John Bercaw, Centennial Professor of Chemistry, will be the recipient of the American Chemical Society's 1999 George A. Olah Award in Hydrocarbon or Petroleum Chemistry.

Seymour Benzer, Boswell Professor of Neuroscience, Emeritus, and Crafoord laureate, has been named a 1998 Ellison Medical Foundation Senior Scholar as part of the Ellison Medical Foundation Senior Scholars in Aging Program. Benzer's current research centers around the "Methuselah" gene, which, when mutated in fruit flies, increases the fly's life span by one-third. It is not yet known whether humans carry an analogous gene.

John Brady, Chevron Professor of Chemical Engineering and executive officer for chemical engineering, has received the Professional Progress Award for Outstanding Progress in Chemical Engineering from the American Institute of Chemical Engineers. Given to a person under the age of 45 who has made a significant contribution to the science of chemical engineering, the award is sponsored by Air Products and Chemicals, Inc.

Peter Dervan, Bren Professor of Chemistry and chair of the Division of Chemistry and Chemical Engineering, will receive the American Chemical Society's 1999 Alfred Bader Award in Bioinorganic or Bioorganic Chemistry.

Associate Professor of Geochemistry Kenneth Farley has been selected to receive the James B. Macelwane Medal of the American Geophysical Union, "which is awarded for significant contributions to the geophysical sciences by a young scientist of outstanding ability."

Petr Horava, Sherman Fairchild Senior Research Fellow in Physics, has been awarded a Junior Prize of the Learned Society of the Czech Republic for outstanding research in theoretical physics.

Hans Hornung, Johnson Professor of Aeronautics and director of the Graduate Aeronautical Laboraories, will be awarded the 1999 Ludwig-Prandtl ring at the annual congress of the DGLR (the Geman Society for Aeronautics and Astronautics) in Berlin in September. The award is given to one person per year in academia or industry for his or her contributions to aeronautics and astronautics. Previous Caltech recipients include Theodore von Kármán, who got the first one in 1957, and Hans Liepmann.

Norman Horowitz (PhD '39), professor of biology, emeritus, has received the 1998 Thomas Hunt Morgan Medal, which "recognizes a lifetime contribution to genetics," from the Genetics Society of America, which cited not only his impact on genetics and evolutionary