David Kritchevsky (1920–2006)1,2

Jon A. Story3* and David M. Klurfeld4

3Department of Foods and Nutrition, Purdue University, West Lafayette, IN and 4USDA Agricultural Research Service, Beltsville, MD

David Kritchevsky, one of the most influential researchers on diet and health of the 20th century and former president of the AIN, died of multiple organ failure on 20 November, 2006. He was born on 25 January, 1920 in Kharkov, Russia, immigrated with his parents, Jacob and Leah, to the United States in 1923, and settled in Chicago where Dave grew up. He received B.S. and M.S. degrees from the University of Chicago in 1939 and 1942, respectively, in chemistry and organic chemistry. In Dave’s typical fashion, he described his need to get a job as a homozygous genetic problem; his father was poor and his mother was poor. He worked as a chemist at Ninol Laboratories in Chicago from 1940 to 1946. Subsequently, he earned his Ph.D. in organic chemistry from Northwestern University in 1948. Dave and his wife, Evelyn, went to Zurich, Switzerland, where he had obtained a postdoctoral fellowship with Leopold Ruzicka, Nobel laureate in chemistry, at the Federal Institute of Technology. Melvin Calvin, another Nobel laureate in chemistry, hired him into the Radiation Laboratory at the University of California, Berkeley, where he worked from 1950 to 1952. He joined Lederle Laboratories in Pearl River, New York where he met Hilary Koprowski, who would be named Director of the Wistar Institute in 1957. Dave joined the Wistar staff that same year and held many positions of increasing seniority, including Associate Director, and was Institute Professor and Caspar Wistar Scholar at the time of his death.

Dave held many positions at the University of Pennsylvania in addition to his position at Wistar. He was Professor of Biochemistry in the School of Veterinary Medicine, Professor of Biochemistry in Surgery in the School of Medicine, and a member of the Graduate Group in Biochemistry in the Graduate School of Arts and Sciences. His 5-y term as Chairman of the latter lasted from 1972 to 1984. Early in his career, Dave was called before the Dean of Medicine for teaching the citric acid cycle to the tune of “Tiptoe through the Tulips” and using other “teaching aids.” Dave’s response was that you can do your job and present the facts dryly or you can present the facts and enjoy it, while having students remember even more of what was taught. If someone had taught us the Krebs cycle with music, we would probably not need to look it up today. Dave was frequently invited to play the piano and sing songs he had written to the music of popular tunes. These included the “Cholesterol Biosynthesis Song,” sung to the tune of “Jingle Bells” and “If I Had a Big Grant” to the tune of “If I Were a Rich Man” from the musical, “Fiddler on the Roof.” All the more remarkable was that he did not read music and played by ear.

Eating Lipid
by David Kritchevsky
Tune: Making Whoopee

You eat some eggs
You eat some ham
You take some butter
Then brother – wham!
You get those chest pains
Eternal rest pains
From eating lipid.

You see the doc,
He shakes his head,
"With blood like this
You’ll soon be dead
The fats are way up
They’re gonna stay up
If you eat lipids."

He puts you on a diet
Five hundred calories
You think you’d like to try it
If there were enough to see.

You lose some weight
In fact you think
You’re in great shape
For the shape you’re in.

Your new condition
Called malnutrition
Is not from lipids.

Dave was a member of many professional societies, served on numerous committees, and was recognized as a fellow of the ASN, the American Oil Chemists Society, and the American Association for the Advancement of Science. He was elected president of the AIN for 1979–80 and the Society for Experimental Biology and Medicine for 1984–86. Dave served on many study sections and committees for the NIH, the Food and Nutrition Board of the National Academy of Sciences (1976–80), and the Dietary Guidelines Advisory Committee (1983–85).
He was very active on editorial boards of journals and book series. Some of the more notable book series include Advances in Experimental Medicine and Biology, Advances in Lipid Research, The Bile Acids, and Monographs in Atherosclerosis.

He served as Western Hemisphere Editor of Atherosclerosis (1977–89) for which he was Consulting Editor at the time of his death along with service on 9 other editorial boards during 2006.

An abbreviated list of awards Dave received include: the St. Ambrose Medal (1968) from the City of Milan, Italy, the Borden Award (1974) from the AIN, the Philadelphia Award (1977) from the ACS, the Outstanding Achievement Award (1978) from the American College of Nutrition, a Professional Achievement Award (1979) from the University of Chicago, the Robert H. Herman Memorial Award (1992) from the American Society for Clinical Nutrition, the Auenbrugger Medal (1994) from the University of Graz, Austria, the Supelco-AOCS Research Award (1996) from the American Oil Chemists Society, a Special Recognition Award (1999) from the International Soybean Symposium, an honorary D.Sc. (2001) from Purdue University, the Lifetime Achievement Award (2005) from the International Whole Grains Symposium, the Alton E. Bailey Award (2006) from the American Oil Chemists Society, and he was the inaugural recipient of the David Kritchevsky Career Achievement Award (2006) from the ASN, which will be awarded annually. Dave enjoyed receiving these honors but was actually uncomfortable being in the spotlight. He was always modest and gave full credit to those who worked with him.

Dave became interested in the physiologic and pathologic roles of cholesterol while studying its synthesis early in his career. He conducted the first large-scale biosynthesis of radioactively labeled cholesterol by feeding $^{14}$C-acetate to hens, collecting the eggs, and isolating high specific-activity cholesterol from the yolks (1). The labeled cholesterol was subsequently fed to animals and humans to trace the metabolic fate and estimate absorption and plasma half-life in work with Max Biggs, a physician working for John Gofman, who had developed the ultracentrifugation technique of separating serum lipoproteins.

Dave published the first observation that diets with fats rich in unsaturated fatty acids were less atherogenic for rabbits than those rich in saturated fatty acids in 1954 (2); this observation increased the number of digits on automobile license plates from 6 to 7, Dave got a personalized tag that read C27H46O, the chemical formula for cholesterol. Dave was interested in how triglyceride structure affects atherogenesis and produced many articles in this area. In recent years, he became a leader in the study of conjugated linoleic acid with articles on its inhibition of both cancer and atherosclerosis. Dave coauthored the first book on $\beta$-sitosterol with O. J. Pollak in 1981 (3).

In the early 1960s, based on the work of Professor Haqvin Malmros of University Hospital, Lund, Sweden, Dave demonstrated that a purified diet, rich in saturated fatty acids, was atherogenic for rabbits, whereas a standard, alfalfa- and grain-based diet with similar lipids added was not (4). This and subsequent exploitation of this observation caused Malmros to remark that it was Dave who deserved most of the credit for the diet's utility. These early observations set the stage for additional work, published in 1968, of the cholesterol-lowering property of dietary fiber (5) and marked the beginning of Dave's life-long emphasis on nutrient interactions, which many nutrition researchers are only now realizing may be as important as individual nutrient differences. Publication of the work on dietary fiber, known then as roughage, he said, was the most difficult in his career, in part because it challenged the dogma that fiber was inert, indigestible material. This led to his ascendency in the dietary fiber field for decades and friendships with the other leaders in this area. In 1988, he and Denis Burkitt were featured on the cover of Cancer Research for their advancement of the study of dietary fiber and colon cancer. Denis was well known for his discovery of Burkitt's lymphoma but in later years drew considerable medical and popular attention to the lack of fiber in Western diets as a cause of various illnesses. Denis visited Dave whenever he was in the U.S. At their first meeting, Denis, a very proper gentleman who spent 20 years as a medical missionary in Africa, said he had read so many of Dave's articles that he asked if he could address him by his Christian name. Dave's response was, “It's my Jewish name, but go ahead.” Dave was co-organizer with George Vahouny, of George Washington University, of a series of dietary fiber meetings that became the premier gatherings for the field and were published as a series of books on fiber (6). Work done by one of us (J.A.S.) with Dave on bile acid binding by dietary fiber expanded on the work of Martin Eastwood and led to new areas of research, relating the observations to cholesterol lowering and colon cancer, including conception of the ratio of primary to secondary bile acids being a risk factor for colon cancer.

As a part of these studies with purified diets, Dave was one of the earliest investigators to study the role of soy protein in experimental atherosclerosis as well as gallstone formation. After a 1979 article on inhibition of cholelithiasis in hamsters appeared in the American Journal of Clinical Nutrition with one of us (D.M.K.), he got a phone call from an irate individual who had read an article in the National Enquirer that stated doctors had the secret to curing gallstones but were keeping it to themselves to keep the medical business lucrative. Dave's response to the caller, “for a hamster, you speak English very well,” put an abrupt end to their conversation.

Dave published >1000 articles, chapters, and books during his career; his 420 research articles have been cited over 10,000 times. His first article was in 1943 on the synthesis of a new compound, diethyl acetal of 3-methylbuten-3-al-1 (7). He is listed as one of the 250 most highly cited authors in the field of agricultural sciences by the Institute for Scientific Information. His first article in The Journal of Nutrition appeared in 1962 on the compositional effects of heating fats (8) and his last in this journal in 2003 called on scientists to avoid a reductionist approach in the field of diet and cancer (9). He continued actively contributing to science even though he no longer ran a laboratory in the last several years. By sharing ideas with colleagues, he was coauthor on 4 original research articles that appeared in 2006.

Reflecting Dave's interest in free exchange of scientific ideas, he was willing to share his thoughts with anyone in the field and was not worried about being preempted. He gave advice freely to people in academics, government, and industry, often stating his philosophy on this subject as, “No sooner done than said.” He had far more ideas than any set of scientists could pursue and most were worth further exploration. He was disappointed that most large meetings had become places to present work that was already published.

Dave was awarded many grants to support his research over the years from the government, nonprofit organizations, and the food and pharmaceutical industries. He was adamant that
industry support would not color his opinion of whatever was being studied and is to be admired for providing an example of how an ethical approach to science can coexist with private funding. Dave was the recipient of an NIH Research Career Award that began in 1961 and was still active 45 y later at his death.

After one of us (D.M.K.) and Dave published the first study demonstrating a benefit against atherosclerosis from consumption of red wine in rabbits, that not only opened a wider field of scientific inquiry by others but proved to be fodder for his wit. Because the only modalities for raising HDL-cholesterol at the time were alcohol ingestion and exercise, Dave often recommended running from bar to bar.

During Dave’s service on the Food and Nutrition Board of the National Academy of Sciences, he was part of a panel that authored a short report entitled “Toward Healthful Diets,” which evoked tremendous controversy among scientists, the news media, and the general public (10). The panel found no conclusive evidence that dietary modification could decrease both blood cholesterol and heart disease; it pointed out that almost all the data were circumstantial, there was an absence of long-term safety information on low-fat, low-cholesterol diets, and a lack of evidence relating diet with cancer in 1980. The report concluded that “Good food that provides appropriate proportions of nutrients should not be regarded as a poison, a medicine or a talisman. It should be eaten and enjoyed.” The panel recommended eating a variety of foods, adjusting energy intake and expenditure to avoid obesity, reducing intake of nutrient-poor foods if energy requirements are low, and moderating intake of sodium. The panel was excoriated for these conclusions by many. In the last few years, Dave had intended to revisit the recommendations of this report and write a review summarizing the current state of the science, which still supports the original conclusions.

When Dave served on a National Academy of Sciences committee that wrote the first report on Diet, Nutrition and Cancer in 1982 (11), he described the process as deliberate regarding all nutrients except when it came to fat; he said at that point the committee became a lynch mob. When literature from the 1940s was reviewed that demonstrated reduced food intake inhibited cancer growth in rodents, most of the committee dismissed those studies, because they believed fat explained the observations and because not all required nutrients had been supplied in the diets of the time. In response, he and one of us (D.M.K.) conducted a series of studies using carefully crafted diets that reawakened interest in caloric restriction as a cancer preventive and dissociated the effect of dietary energy from fat, which are highly correlated in human diets. We were also the first, to our knowledge, to implicate insulin-like growth factor I as a tumor growth factor responsive to chronic caloric deprivation to show body fat was not driving the dietary fat effect and to determine the degree of caloric restriction needed to inhibit tumorigenesis. We also proposed that the calorie-restricted animal was closer to normal than an ad libitum-fed, sedentary control that should be viewed as the equivalent of a morbidity obese human.

Examination of Dave’s 10 most highly cited papers reveals his ability to make significant contributions in a variety of areas over an extended period of time (HistCite, http://www.garfield.library.upenn.edu/histcomp/kritchevsky-d_auth-citing/index-1cs. html, 22 December, 2006). Each paper was cited >158 times. Publication dates ranged from 1952 to 1997, with the earliest a method for detecting steroids in paper chromatography and the latest on inhibition of atherosclerosis by conjugated linoleic acid being cited in excess of 500 times. Other topics in Dave’s top 10 include in vitro binding of bile acids by dietary fiber, effects of soy protein on serum lipids and atherosclerosis, and the inhibition of tumors by caloric restriction. But this list is just a sample of the different contributions Dave made to science. He was well known for research on a variety of factors affecting atherosclerosis: thyroid hormone, mitochondrial oxidation, and the lysine:arginine ratio of the diet. He tested many pharmaceutical agents for inhibition of atherosclerosis and published early studies that d-thyroxine, probucol, lovastatin, and other commonly used drugs were efficacious against atherogenesis. With George Rothblat, he conducted early studies of cholesterol metabolism in cell culture that characterized cholesterol influx and efflux. Dave was a major figure in early studies of cholesterol metabolism and atherosclerosis in nonhuman primates; this work was carried out primarily in Africa over 20 y with NIH support.

One of Dave’s central characteristics was skepticism about scientific ideas. He wanted data to back up suppositions, which was often the problem with dietary recommendations to prevent chronic disease. He quoted the late playwright, Wilson Mizner, as saying “I respect faith, but it is doubt that gets you an education.” Another of Dave’s characteristics was immense energy. He said that if hyperactivity had been a recognized condition when he was a child, he probably would have been labeled that way. Fortunately for those of us in science, he was not diagnosed or treated for Attention Deficit Hyperactivity Disorder but directed his energy and intellect into research. He was more interested in getting the facts correct than proving a hypothesis. Dave was fond of quoting the 19th-century biologist, Thomas Huxley, who said, “The tragedy of science is the slaying of a beautiful hypothesis by an ugly fact.” This attitude explains in part why Dave did not prefer taking a problem and exploring it in greater and greater depth (which he likened to going down rabbit trails) and why he was more interested in understanding the big picture of nutrition and disease prevention.

An annual highlight in the lipid field was the December arrival of Dave’s Christmas poem. For decades, he incorporated the names of many dozens of the best-known scientists into rhyming verse that ran for several typed pages. Michael Brown, Nobel laureate in physiology or medicine, said “You really know you’ve arrived when you make it into Dave’s Christmas poem.” From his 1988 edition:

“...Hirsch and Hegsted – best of days To Holmes and Hashim, Hill and Hayes. This year’s brass ring may they catch Holman, Heaton, Havel, Hatch Howards – Alan, Barb and Jim Hodges, Hornings (her and him)...”

Despite Dave’s seeming ease in putting all those names into verse, he said he had repeated trouble with only 1 name even using a rhyming dictionary: Kritchevsky. As a result, he ended each edition by finding a name that rhymed, ranging from obscure Russian poets to former University of Iowa football coach Forest Evashevski and providing a footnote identifying the person. The poems always ended with, “Good luck, good health from Dave Kritchevsky.”

Irving Berlin said, “Life is 10 percent of what you make it and 90 percent of how you take it.” We could quibble with the percent distribution, but it captures a spirit reflected in Dave’s personality. He was always optimistic. Scientific disagreements never became personal; he respected colleagues even when he disagreed with them. Throughout this article, we have referred
to Dr. Kritchevsky as Dave in part because that’s what we called him and out of our fondness for him. This reflects another lesson he taught us by his actions. In the 1970s it was quite unusual for students to call their mentor by first name. It was even rarer for staff such as secretaries or janitors to do that. Dave never minded when this happened; he said it didn’t bother him, didn’t cost anything, and made relations at work better. It also reflects Dave’s sense of informality. We are confident he is the only scientist who was ever told in preparation for meeting the Dutch royal family that the prince was to be addressed as Your Royal Highness and not as Claus, Baby. He treated everyone with respect and tried to put them at ease. Dave was a mentor for many scientists, not just those who worked directly with him as we were privileged to do. We were lucky enough to get his wisdom and advice in more concentrated doses than most. He acted as a mentor to us, long before that word came into fashion, and both of us owe him much gratitude for his enduring advice and friendship. Together, we published >100 research articles with Dave but also spent countless hours discussing science, sending each other picture postcards from our travels, and maintaining the utmost respect for an exceptional person and scientist.

Dave was an extraordinary teller of stories and jokes. We have both had the experience of telling him a joke and months later hearing a better version, barely recognizing it until he got to the same punch line. Some of our fondest memories are of Dave trading jokes and stories with colleagues in a hotel lobby or bar after a long day of scientific meetings. In the mid-1980s, Dave was featured by a columnist in the Philadelphia Inquirer newspaper who referred to him as a “scientist and stand-up comic.” When Dave received a phone call from a professional joke writer a few days later, he squashed the potential partnership by telling the man that he wrote his own material. We are better scientists for having known him and, more importantly, better people for having had him as our friend. Dave would often write letters with ideas or instructions back to the laboratory when he was away. In one letter, he appended a poem about friendship he had written:

Corporeal reality
Is bound in many ways

It being circumscribed by clocks
And calendars and days.
The psyche knows no boundary
With age ’twill not contend
It grows and soars, past time’s set ends
On wings it’s lent by words of friends.

David Kritchevsky is survived by his wife of 58 years, Evelyn, their 3 children [Barbara, Associate Dean and Cecil C. Humphreys Professor of Law, University of Memphis School of Law; Janice (Sojka), Associate Professor of Large Animal Medicine, Purdue University; and Stephen, Professor of Internal Medicine, Gerontology and Geriatrics and Director, J. Paul Sticht Center on Aging and Rehabilitation, Wake Forest University], and 6 grandchildren.

**Literature Cited**