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Magazine

SPECIAL MILLENNIUM ISSUE / SCIENCE & TECHNOLOGY

one big think tank

Southern California Innovators Are Brainstorming Us Into the 21st Century

SoCal's Top 20 Sci-Tech All-Stars • Four Frontiers
In Praise of Our Technopolis • Gizmos and Glitches

SCIENCE FAIR 1999 • SOPHISTICA

SCIENTIST TRADING CARDS • ASTRONOMY AND ASTROLOGY • GLAMOROUS GLENN

Southern California's All-Stars

Some of the Century's Most Brilliant Innovators Were at the Top of Their Game on Southern California's Science and Technology Playing Fields. Here's Our List of the Top 20—and Some Major Contenders.

List-making by any measure is an imperfect art, not even remotely akin to science. Times editors and science writers compiled the brain trust before you from an initial tally of 100 key innovators who had done a substantial part of their work in Southern California—and not even winning a Nobel prize guaranteed making this A-list of 20 of the century's most influential scientists and engineers. • *Freelance writer-researcher* ***Joel Grossman*** *diligently compiled these mini-biographies of people who, by general consensus, had the greatest impact on their fields and our world. No doubt the prominent omissions will evoke gasps. Like science itself, this list is the product of an argument about the essence of the world we inhabit, which is continually revised as new information leads to new insights.* • *It must be noted that we faced a dilemma in presenting this list—essentially a dilemma of the century itself. It is one that also confronted planners at the California Science Center, where you will not find any tribute to the state's 51 Nobel-winning scientists. If their portraits were on display, the faces—like those that follow—would be almost exclusively male and overwhelmingly white—not the most inclusive signal that a center seeking to inspire careers in science should send to the diverse thousands of youngsters who throng its halls every school day.* • *The face of 21st century science will be dramatically different. It is a transformation already well underway—to everyone's benefit. One measure of this century's social journey is that today's concerns over race and gender have largely set aside the divisions of nationality, religion, class and political belief that formed such formidable barriers for many of these earlier immigrants, refugees and outsiders.* • *If California can be considered a state of mind, the pioneers before you deserve the highest place of honor in its meritocracy. These researchers and engineers have done as much as any group anywhere to create the world we will inhabit in the 21st century.*

—Robert Lee Hotz, Times Science Writer

CHEMISTRY

DONALD CRAM

Born April 22, 1919, Chester, Vt.

Grew up poor, swapping 50 hours of lawn mowing for an hour of dentistry after his father died. Progressed from one-room schools to biscuit salesman making rounds in Harlem and New York's tough East Side before pursuing chemical research.

Shortly after obtaining Harvard PhD in 1947, settled into current niche as UCLA chemistry professor. After two decades studying carbon reactions important to living organisms, got bored and started new field he called "host-guest chemistry." Basically, he became a designer of new molecules that fit targets so perfectly [like lock-and-key fit of enzymes] that they function as highly sensitive sensors, electrodes and molecular traps. Called supermolecules by some, Cram's crown-shaped ethers were singled out in 1987 Nobel award for being sensitive enough to distinguish mirror-image amino acid molecules.

Along with career came two marriages, lots of surfing and much self-searching. When not at the lab bench, Crambo, as he is known to his surfing buddies, is just another guitar-playing dude on San Onofre's Old Man's Beach.

GEORGE OLAH

Born May 22, 1927, Budapest, Hungary.

After 1956 Hungarian revolt, he fled homeland with most of research group and two cardboard boxes of worldly possessions. First stop London, where wife had relatives. Then Canada, where mother-in-law lived. Found job improving Dow Chemical's plastic-making processes.

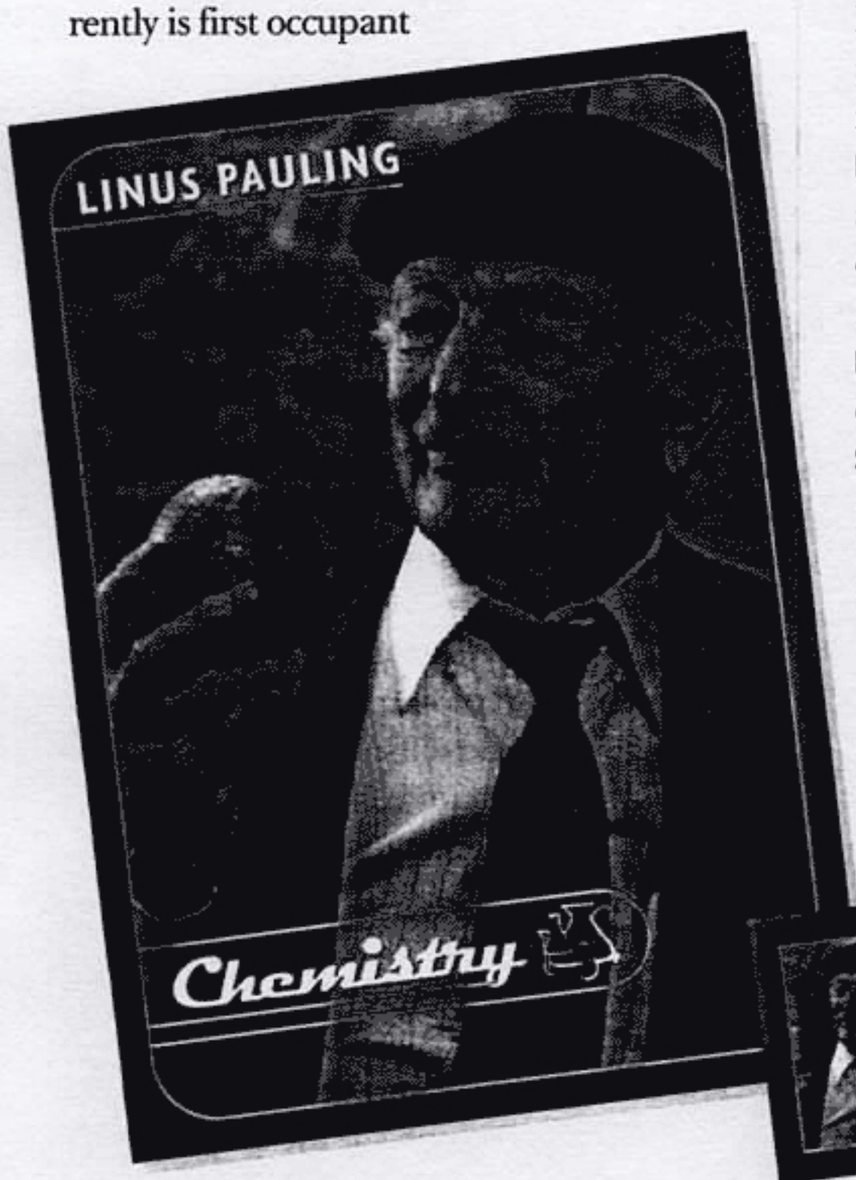
A 12-year professorial stint in Cleveland, Ohio, led him and 15 research group members to USC in 1977. USC built the Loker Hydrocarbon Research Institute so Olah could create stable carbocations [positively charged hydrocarbons] using "superacids" zillions of times stronger than 100% sulfuric and hydrochloric acids. Previously, carbocations existed only in theory as ephemeral transition states, disappearing in micro- or nanoseconds without a trace.

Olah won 1994 Nobel for creating the first carbocations stable enough to study, a breakthrough leading to practical benefits like higher-octane gasoline and a zero-emission methanol fuel cell. Has two sons and wife, Judy, who knew him from childhood and studied chemistry to work alongside him. In his autobiography, Olah admits that his wife sometimes laments his apparent belief that

"there is little in life outside chemistry."

AHMED ZEWAIL
Born Feb. 26, 1946, Alexandria, Egypt.

Graduated from Egypt's Alexandria University, earned PhD at University of Pennsylvania, then two-year UC Berkeley fellowship before 1976 acceptance of professorship at Caltech, where he currently is first occupant



of the Linus Pauling chemical physics chair. Pioneered field known as femtochemistry, using lasers as strobes to see molecular behavior at super-fast femtosecond time scale of atomic vibration. Femtochemistry is like having a camera film a million frames every billionth of a second, or 100 trillion frames in the blink of an eye.

In 1987, Zewail's team was first to directly observe what are known as transition states, the fleeting femtosecond conformations of molecules rotating and vibrating as atomic bonds break and form. Besides helping understand basic biological processes like photosynthesis, femtochemistry has the potential to make the chemical industry more efficient by allowing precise control of product yields. Zewail, a naturalized American citizen living in San Marino with his wife, a UCLA physician, and four children, is perhaps better known in Egypt, where presentation of the Order of Merit was a national television event.

MAJOR CONTENDERS

PAUL BOYER: UCLA enzyme specialist who won Nobel for unraveling formation of ATP, the universal cellular energy carrier.

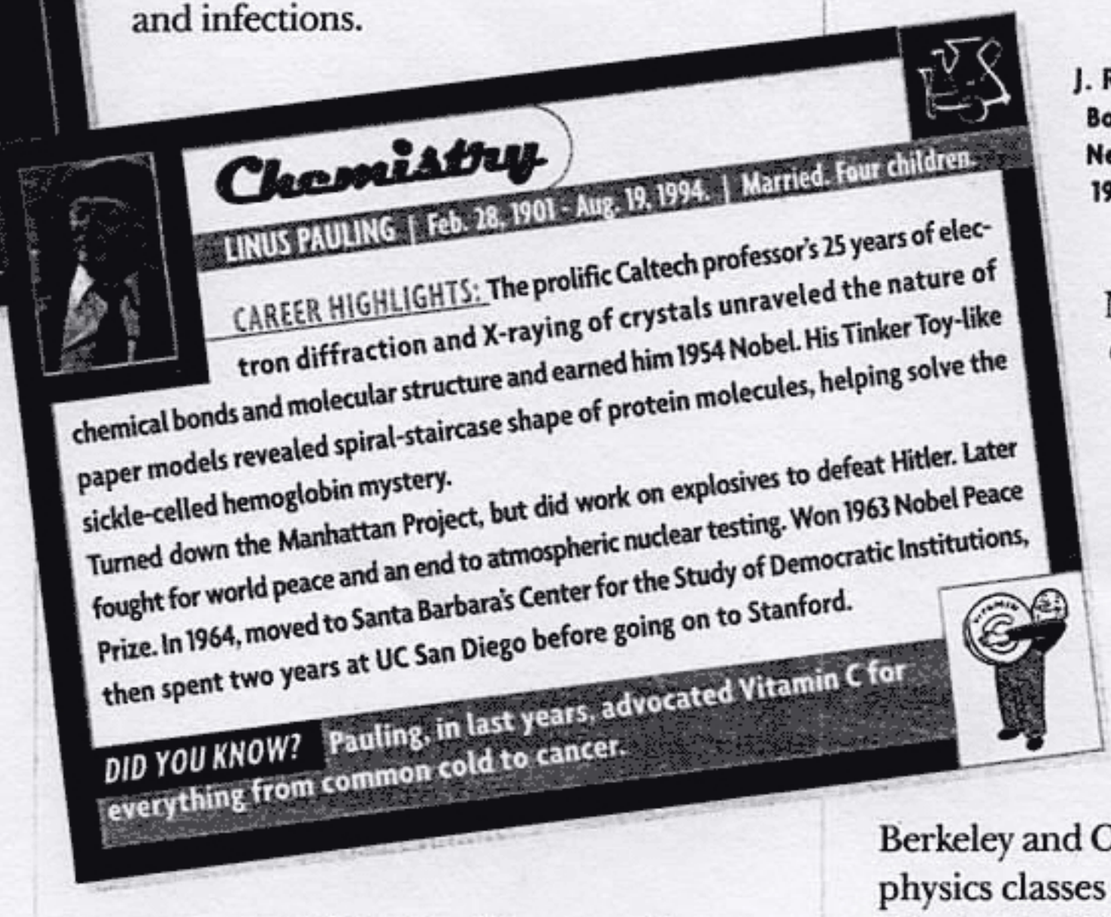
WALTER KOHN: UC San Diego and UC Santa Barbara professor who won Nobel for simplifying atomic bonding math for studying very large molecules.

RICHARD LERNER: Pioneered using immune system to generate useful new enzyme-like catalytic antibodies while at Scripps Research Institute in San Diego.

RUDOLPH MARCUS: Caltech Nobelist for electron transfer theory.

STANLEY MILLER: Pioneering work on primordial chemistry that led to early life on Earth. Now at UC San Diego.

K. C. NICOLAOU: Scripps Research Institute organic chemist leads in synthesizing "molecular mountains," complex natural molecules useful against cancer, cholesterol and infections.



HAROLD UREY: Nobelist discovered heavy hydrogen; later, at UC San Diego, he studied origins of life.

PHYSICS

MURRAY GELL-MANN
Born Sept. 15, 1929, New York City.

Child prodigy. Learned to read at 3, entered Yale at 15, earned MIT PhD at 21. During three-year University of Chicago stint, formulated famous "strangeness" concept, explained odd subatomic particle behavior and predicted new subatomic particles.

At 26, married and headed west to Caltech. Between birth of daughter and son developed new algebraic methods to structure burgeoning subatomic "particle zoo," and whimsically named system the "Eightfold Way," after Buddha's path. Joyce's "Finnegans Wake" inspired his "quarks" moniker for ultimate building blocks of matter. Quark-related quantum chromodynamics theory followed. Won Nobel in 1969.

Remarried in 1992 and moved to New Mexico's Santa Fe Institute. In a 1996 speech, he said he is "part of an ongoing effort by a number of theoretical physicists to construct a modern interpretation of quantum mechanics, one that is compatible with quantum cosmology and that explains, in a convincing way, how the quasi-classical world of familiar experience emerges from the underlying quantum universe."

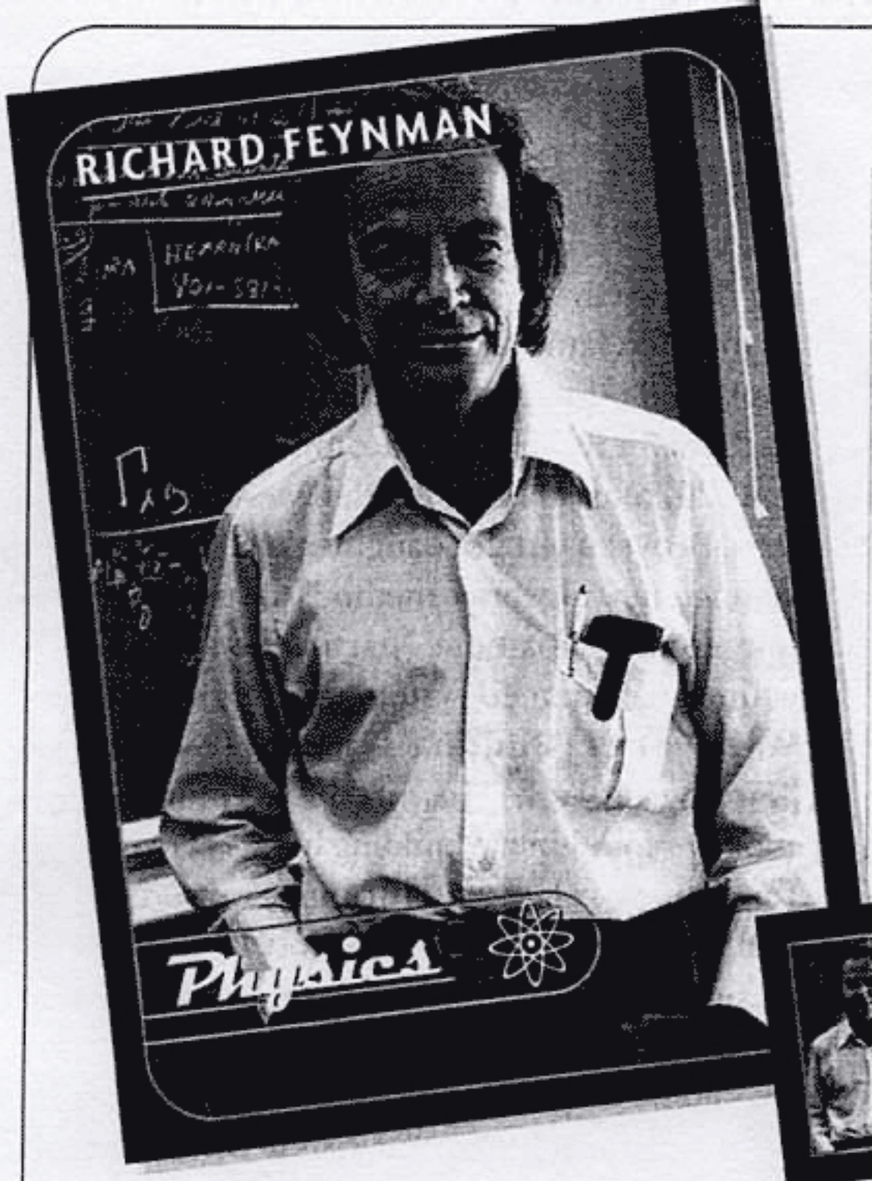
J. ROBERT OPPENHEIMER
Born April 22, 1904, New York City; died Feb. 18, 1967, Princeton, N.J.

Graduated from New York's Ethical Culture School and Harvard University, then co-developed "Born-Oppenheimer method" of molecular quantum mechanics and earned PhD in Germany.

In 1929 began 13-year professorship alternating semesters between UC Berkeley and Caltech, where his theoretical physics classes attracted cultlike following. Married in 1940 and had a son and daughter. Warm relationships with world's top physicists and acclaimed high energy atomic research made him the man for top government wartime bomb job.

Assembled all-star cast of physicists for Manhattan Project, then headed new Los Alamos lab near family ranch. On July 16,

Card illustrations by A.J. Garces



1945, 21 days before Hiroshima, first atomic bomb detonated at Alamogordo. When cheers of success stopped, amid awesome silence and "radiance of a thousand suns," Bhagavad Gita line flashed through Oppenheimer's mind: "I am become Death/The shatterer of worlds." In part because of wife and brother's left-leaning interests, he was drummed out of government work in 1953, at height of anti-Communist hysteria, for not enthusiastically embracing the H-bomb.

MAJOR CONTENDERS

CARL ANDERSON: Caltech Nobelist discovered first antimatter and muon, an unstable particle that exists in cosmic radiation in both negative and positive forms.

MARIA GOEPPERT-MAYER: As a woman, she usually worked unpaid, but while at UC San Diego won Nobel for nuclear shell structure theory.

THEODORE MAIMAN: L.A. resident best known for building first laser at Hughes.

ROBERT MILLIKAN: Physics Nobelist who, as Caltech president, helped create JPL and turn school into world-class science institution.

FREDERICK REINES: UC Irvine Nobelist who confirmed neutrino existence.

KIP THORNE: Caltech theoretical physicist known for gravitational theory and black holes.

EARTH SCIENCES

JACOB BJERKNES
Born Nov. 2, 1897, Stockholm, Sweden; died July 7, 1975, Los Angeles.

Son of Vilhelm Bjerknes, Norwegian theoretical physicist and meteorologist with whom he collaborated as part of "Bergen School" studying weather in Norway during World War I. Helped develop modern idea of air masses, the cold and warm fronts and "squall lines" now a staple of newspaper and TV weather maps. Named fronts after wartime battle lines, with clashing polar and tropical air masses giving rise to instabilities and low pressure centers producing storms. Work was mathematical and gave rise to modern storm theory and weather forecasting.

Bjerknes was on 1939-40 U.S. lecture tour with wife during World War II when Germans overran Norway. Accepted UCLA offer to stay and start meteorology department, which helped aviators deal with upper air masses and trained military weather forecasters. In 1944, finalized cyclone theory showing relationship of upper and lower air masses, which in 1950s became basis for first accurate computer-assisted weather forecast. Also among first to use rocket data and space satellite photos to forecast weather. In 1960s, discovered how Pacific Ocean temperatures along equator influence global winds and change climate, what we now call El Niño.

ARIE HAAGEN-SMIT
Born Dec. 22, 1900, Utrecht, Holland; died March 18, 1977, Pasadena.

Grew up in Holland rowing the canals and playing hide-and-seek among gold and silver bars at the Royal Mint, where father was chief chemist. Champion boxer, excelled in natural products chemistry, isolated plant growth hormone auxin and discovered synthetic growth regulators popular in agriculture.

Lured to Caltech in 1937 as expert in then-new field of biochemistry to work on traumatic acid, a plant wound hormone. Research on turpentine helped paint industry, and studying desert plant oils provided excuse for camping trips with wife and three daughters. Also liked long Sierra Club river trips, nature photography and growing orchids.

When postwar Los Angeles complained of burning eyes and difficult breathing during haze, he used equipment developed to analyze pineapple flavors to liquefy smog chemicals in air. Oil and automobile industries fought his conclusions about smog origins, but eventually gave in to persistent scientific crusade and began to clean up their act. In 1968, he left the lab to take up smog-busting when Gov. Reagan appointed him the first chairman of state Air Resources Board. Died of lung cancer.

F. SHERWOOD ROWLAND
Born June 28, 1927, Delaware, Ohio.

Upon 1946 Navy discharge, hitchhiked from San Pedro to Ohio via Yosemite and Yellowstone to finish college and play semipro baseball. In 1952 married wife Joan and earned PhD in chemistry by studying radioactive isotopes at University of Chicago under Nobelist Willard Libby. Son and daughter born during four years teaching at Princeton, then eight years of University of Kansas "hot atom" tracer chemistry.

Became chemistry department chairman at new UC Irvine campus in 1964. Intrigued

by atmospheric buildup of manmade chlorofluorocarbons [CFCs] on 1970s scientific cruise to Antarctica, investigated atmospheric chemistry with postgrad student Mario Molina, who shared 1995 Nobel. They quickly calculated that the million annual tons of CFC production could destroy the stratospheric ozone layer, allowing unhealthful ultraviolet light levels to reach Earth's surface. With kids grown and wife Joan along, embarked on two-decade crusade of heavy travel to get word out on ozone hole and remove CFCs from aerosol cans, air conditioners and refrigerators. One result is U.N.'s Montreal Protocol phaseouts, which should lead to 100-year ozone layer healing period.

MAJOR CONTENDERS

WILLARD LIBBY: Nobelist developed carbon-14 method for dating relics, then taught at UCLA.

MARTIN KAMEN: Libby's former student, he determined carbon-14's half-life; now emeritus professor at USC.

J. WILLIAM SCHOPF: UCLA pioneer in study of early life, finding 3.5-billion-year-old fossilized microbes.

AEROSPACE

KELLY JOHNSON
Born Feb. 27, 1910, Ishpeming, Mich.; died Dec. 21, 1990, Burbank.

Lockheed career man began designing aviation tools in 1933, quickly becoming chief research engineer. Solved Electra instability problem with signature twin-tail arrangement. Created super-secret Skunk Works, a big-top tent that trapped nearby plastics factory stink and turned out fastest, highest flying planes in military history. Intuitively created total quality control, with engineers, designers and machinists mingling on factory floor to solve problems, coming in under budget, ahead of time and returning government contract money.

A gruff man able to trouble-shoot almost any aeronautical problem. Widowed twice and married three times, he turned out F-80 Shooting Star for Korean War, Mach 2 [twice the speed of sound] F-104 Starfighter and Mach 3 Blackbird, to name a few. Suffered stress headaches on difficult projects like high-flying U-2 spy plane, but always knew whom to tap for solutions. A remarkable salesman, he could sell Air Force on a plane before they knew they needed it.

THEODORE VON KÁRMÁN
Born May 11, 1881, Budapest, Hungary; died May 7, 1963, Aachen, Germany.

Career launched in 1912 as director of new Aeronautical Institute at Germany's University of Aachen. During World War I, helped Austro-Hungarian Air Corps synchronize machine-gun fire with propeller rotation, but better known for 1911 discovery of Kármán vortices, the forces later determined to have caused the 1940 Tacoma Narrows bridge collapse.

Lured to Caltech for first time in 1926 as wind tunnel consultant, but did not leave Aachen permanently until 1930 to direct Caltech's Guggenheim Aeronautical Laboratory. A bachelor who lived with mother and sister, he introduced many new aeronautical concepts, including theories of structural buckling and isotropic turbulence. Helped found JPL and was its first director. Big in military consulting, particularly helping Air Force with long-term planning, and in 1942 founded Aerojet-General Corp. to develop rocketry. Also helped develop first supersonic airplane, the X-1. Besides role in making U.S. world aerospace leader, was known for warmth, wit, easy approachability and encouraging students, who were welcome in his home.

MAJOR CONTENDERS

DONALD DOUGLAS: Aircraft engineer and designer who founded company with his name.

HOWARD HUGHES: Eccentric designer of Spruce Goose "flying boat" and other one-of-a-kind aircraft who pioneered SoCal aircraft industry.

JACK NORTHROP: Known for wing designs and company bearing his name.

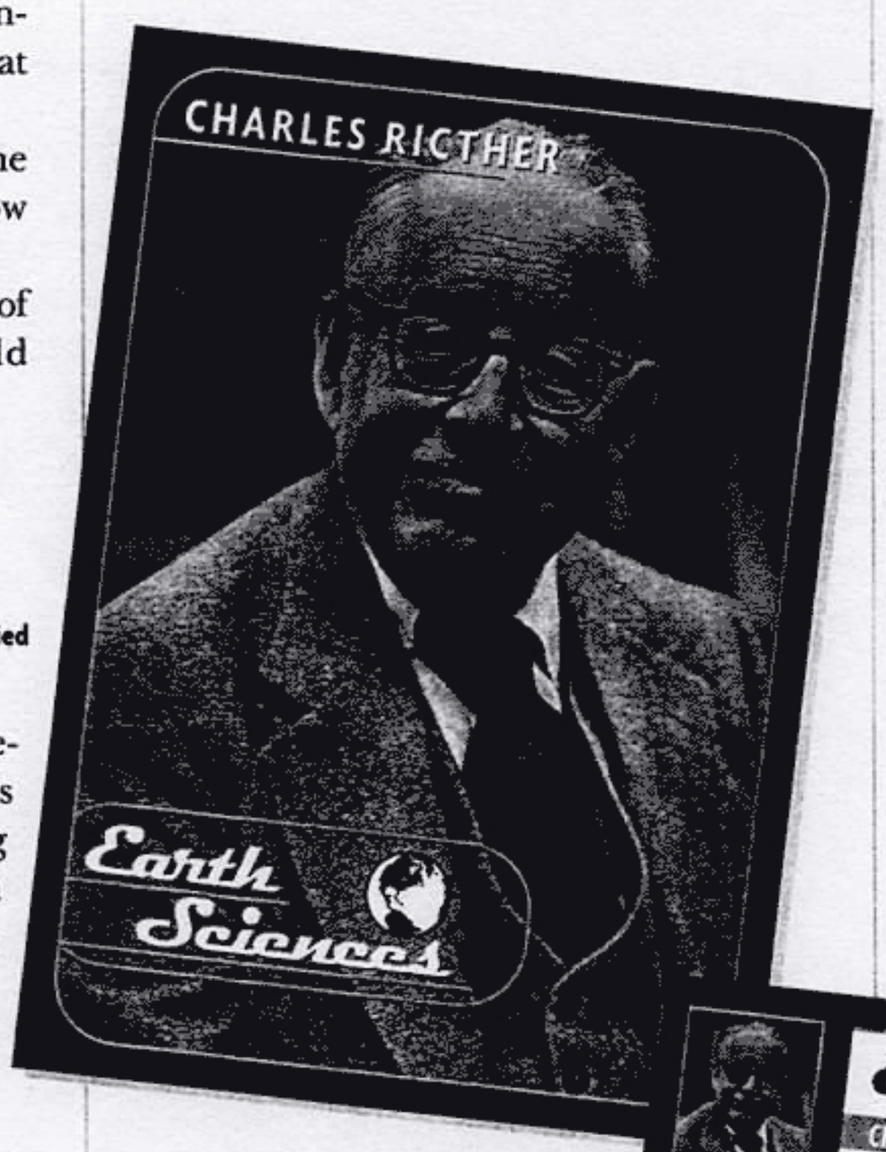
SIMON RAMO: The R in TRW, he helped make U.S. a missile power.

BURT RUTAN: Talented designer's work found in aircraft and spacecraft large and small.

MEDICINE

JONAS SALK
Born Oct. 28, 1914, East Harlem, N.Y.; died June 23, 1995, La Jolla.

Day after becoming MD in 1939, married first wife, with whom he had three sons, then helped develop flu vaccine for U.S. Army. In 1947, headed to University of Pittsburgh, where National Foundation for In-

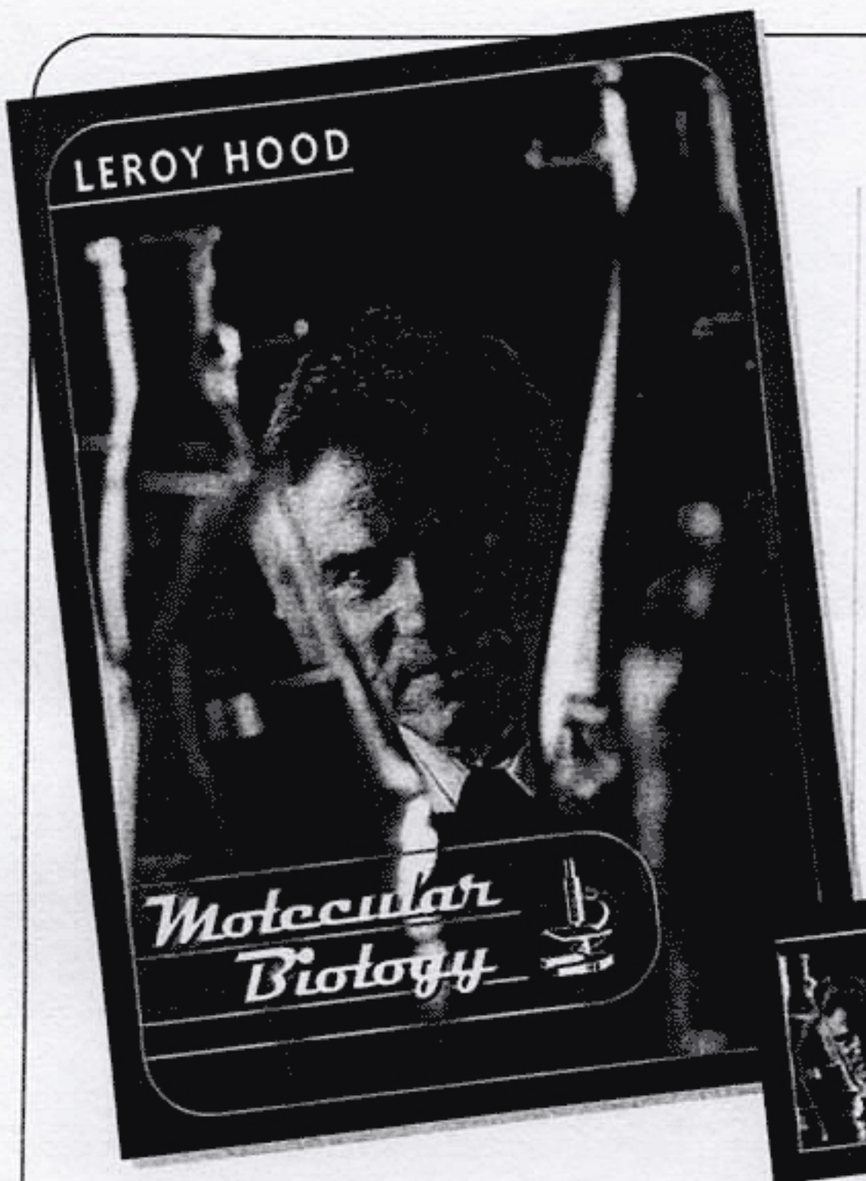


Earth Sciences

CHARLES RICHTER | April 26, 1900-Sept. 30, 1985 | Married. No children.

CAREER HIGHLIGHTS: A theoretical physicist best known for working with Beno Gutenberg in 1935 to develop the Richter scale, prior to which there was no absolute measure for studying earthquake intensities. An obsessive student of earthquakes, he kept a seismograph in his living room and learned Russian, Italian, Japanese and other languages to read about quakes. He is credited with saving many lives in L.A. by suggesting building code changes. He spurred the tracking of quake activity by helping create the Southern California Seismic Array. His Caltech catalog of California earthquakes is considered the most extensive history of the state's shakers ever completed.

DID YOU KNOW? Richter was a nudist and a Trekkie who enjoyed solo hikes and camping in the local mountains.



fantile Paralysis [March of Dimes] funded development of a vaccine reducing polio by a miraculous 95%. Scientific establishment, particularly lifelong vaccine rival Albert Sabin, savaged Salk, even denying him membership in the National Academy of Sciences.

Though a Rodney Dangerfield among scientists for doing applied work rather than discovering new things, March of Dimes financial support and voters' land gift led to 1963 opening of La Jolla's Salk Institute, which many call foundation stone of San Diego's thriving biotech economy. Divorced in 1968, Salk met artist and Picasso-companion Françoise Gilot in Paris in 1970, and was remarried within days. Enjoyed private moments walking on the beach and continued lab work, including research on an AIDS vaccine. Last idea was combining 10 childhood disease vaccinations into one injection for use in Third World countries.

MAJOR CONTENDERS

W. FRENCH ANDERSON: Gene therapy pioneer, now at USC.

DAVID BALTIMORE: Nobelist discovered how viruses cause cancer tumors; new Caltech president.

GERALD EDELMAN: Nobelist best known for immune system antibody work; at Scripps Institute since 1992.

FRED GAGE: Neural regeneration research at UC San Diego and Salk Institute aimed at spinal cord injuries, Alzheimer's, Parkinson's.

ROGER GUILLEMIN: Pioneering Nobelist in brain hormone research; still active at Salk Institute.

LOUIS IGNARRO: UCLA Nobelist uncovered role of nitric oxide in body, which has many medical spinoffs.

ROGER SPERRY: Caltech Nobelist for split-brain research emphasized importance of nonverbal right brain thinking.

INDER VERMA: Salk Institute gene therapy leader.

Molecular Biology

LEROY HOOD | Oct. 10, 1938 – | Married. Two children

CAREER HIGHLIGHTS: In a creative burst at Caltech in the 1970s, Hood helped create revolutionary machines that decode protein amino acid sequences and build customized protein and DNA segments. In the '80s Hood helped found Applied Biosystems Inc. to churn out machines for fellow scientists leading the biotech revolution. He turned down offer to head Human Genome project, then moved to University of Washington in 1992 to head new interdisciplinary Department of Molecular Biotechnology, funded partially by Bill Gates. Ultimate goals: Understanding biological complexity and creating a more preventive medicine with DNA-based knowledge.

DID YOU KNOW? Hood is a devoted mountain climber who sometimes helicopters to remote base camps to save time.

MOLECULAR BIOLOGY

FRANCIS CRICK
Born June 8, 1916, Northampton, England.

World War II English weapons designer specializing in mines to destroy ships. Postwar divorcé with son, in 1949 married current wife, artist Odile Speed, with whom he has two daughters. Met James Watson at Cambridge University in 1951. The two shared what Crick termed "a certain youthful arrogance, a ruthlessness, and an impatience with sloppy thinking." Collaborating, they discovered DNA double helix structure—a seminal event in modern biology that won 1962 Nobel. According to Watson's book on the breakthrough, Crick celebrated by loudly announcing to a local pub that the two had just discovered "the secret of life."

Other collaborations led to working out how DNA information is translated into protein amino acid sequences. Proposed "Central Dogma" of molecular biology: that information cannot flow backward from proteins into DNA.

At La Jolla's Salk Institute since 1976, mostly working as theoretician to unravel mysteries of human brain and consciousness, including dreams and vision, but has said it will take another generation to solve the puzzle. Interest in origins of life resulted in brief flirtation with idea that microbes drifting through space seeded Earth.

MAX DELBRÜCK
Born Sept. 4, 1906, Berlin, Germany; died March 10, 1981, Pasadena.

A theoretical physicist, he began studying biology after lecture by quantum mechanics guru Niels Bohr noted paradox that life exists at once as whole organisms and collections of molecules. Left Germany in 1937 for Caltech and study of bacteriophages—rapidly replicating bacteria-attacking viruses. Fundamental life processes were revealed. But grant money ran out in 1940, and seven-year sojourn at Tennessee's Vanderbilt University began, during which time he married and had first of four children.

Along with physician Salvador Luria and chemist Alfred Hershey, spent summers at Long Island's Cold Spring Harbor as part of informal "phage group" that coordinated research and shared 1969 Nobel for viral genetic insights. The prize-givers said that their work "set the solid foundations on which modern molecular biology rests."

Back at Caltech in 1947, studied how light affects fungi, taking time out only to set up a molecular genetics institution at the University of Cologne. Known for brusque manner and tough critiques, yet had charm and won people over by inviting them camping with his family.

MAJOR CONTENDERS

GEORGE BEADLE: Nobelist linked single genes to single enzymes, shifting genetics into bio-

Hood and Hubble photographs from Associated Press

chemical realm and DNA; worked at Caltech.
SEYMOUR BENZER: Created field of molecular neurogenetics at Caltech to study how genes influence behavior.
THEODOSIUS DOBZHANSKY: Caltech pioneer in modern evolutionary genetics and how species form in the wild.
RENATO DULBECCO: Nobelist's animal virus research led to vaccines and cancer tumor mechanisms; he worked in Italy and at Caltech, then as president of Salk Institute.
EDWARD LEWIS: Caltech Nobelist discovered embryonic genetic similarities in fruit flies and humans.
THOMAS HUNT MORGAN: Genetics Nobelist established world-renowned Caltech biology department.
KARY MULLIS: La Jolla independent consultant, was Nobelist for widely used DNA polymerase chain reaction [PCR].
SUSUMU OHNO: City of Hope's genetics researcher illuminated inactive female X chromosome and evolution by gene duplication.

ASTRONOMY

MAJOR CONTENDERS

WILLIAM FOWLER: Caltech Nobelist described how stars and elements form from nuclear reactions.
GEORGE HALE: Noted solar scientist founded Mt. Wilson Observatory and helped mastermind Caltech's rise to world fame.

INFORMATION TECHNOLOGY

LEONARD KLEINROCK
Born June 13, 1934, New York City.

Karate black belt who studied electrical engineering at City College of New York night school. UCLA computer science professor since 1963. MIT graduate work on data networks and 1961 packet switching theory [breaking messages into small pieces for best use of communication channels] inspired Internet [ARPANET], with UCLA as first node in 1969. First Internet message typed to node 2 at Stanford crashed system at 'g' of 'login.' But things have gotten better, and two marriages and four children later the former marathon runner formed startup Nomadix Inc., and is stumping for nomadic computing, a multiplicity of communication devices keeping people connected wherever they wander.

Between exotic nature trips published first book on how to make information flow across large communication networks and classic "queueing theory" text for analyzing Internet. Has said he does best creative thinking alone at home. Perhaps his mind wanders back to engineering roots: a Bronx kid inspired by comic books to build radios.

CARVER MEAD
Born May 1, 1934, Bakersfield.

Likened to a "silicon Salvador Dali" with his Fu Manchu mustache, he pioneered silicon compilers to design microchips and Very Large Scale Integrated (VLSI) circuits that squeeze millions of transistors onto the Pentium and other chips, making low-cost computing a reality. At Caltech since an undergraduate, metamorphosed from creating purely mathematical designs to sculpting silicon into wire and transistor proxies for the neurons and synapses of nervous systems, eyes and ears. His work is behind such devices as digital hearing aids and "seeing devices," including artificial retinas.

Commutes weekly between Caltech and hand-built Woodside home to be near Santa Clara digital camera business venture, Foveon Inc. Likes wild animals and hanging out in nature and refers to science as "a form of channeling . . . [where] you also have to go work the equations." A restless soul, every 10 to 15 years he seeks out a new field to explore.

MAJOR CONTENDERS

LEONARD ADLEMAN: USC researcher dabbles in DNA computing, mathematical AIDS T-cell therapy and is the A in RSA computer security code.
SOLOMON GOLOMB: Pioneered shift register sequence work used in radar, cryptography, cell phones. Worked at JPL and is now at USC.
IRWIN JACOBS: Former UC San Diego professor who, with partner Viterbi, spun equations into satellite decoding and Qualcomm cell phone systems.

Astronomy

EDWIN HUBBLE | Nov. 20, 1889-Sept. 28, 1953 | Married. No children.

CAREER HIGHLIGHTS: After many freezing nights at the Mt. Wilson Observatory, the tweedy, pipe-chomping astronomer set off controversy with evidence of galaxies beyond our own Milky Way and developed an improved system of classifying galaxies based on spiral and elliptical shapes. "Hubble's Law," formulated in 1929, states that the most distant galaxies are moving away from us at the fastest speeds, and utilizes "Hubble's constant" to calculate the size of the "knowable" universe.
A former Rhodes Scholar who had once studied law, he provided the first proof, in the 1930s, of an expanding universe.

DID YOU KNOW? Hubble was an amateur heavyweight boxer, collected science history books and loved dry fly-fishing.

JON POSTEL: Major Internet shaper at UCLA and USC.
IRVING REED: Reed-Solomon error correcting codes used in CDs, computers; is now at USC.
ANDREW VITERBI: Wireless pioneer noted for CDMA spread spectrum multiple access communications technology; Qualcomm co-founder, former UCLA professor. ▬