DEPARTMENT OF BIOCHEMISTRY & MICROBIOLOGY COOK COLLEGE

Lipman Log

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News from the Chair

by Alan Antoine

I would like to take this opportunity to thank all of the contributors and supporters of the Department of Biochemistry and Microbiology. We receive contributions from 31 of you, and your support is greatly appreciated. This support is used in multiple ways, but primarily for student support, and special needs in research and teaching, particularly for our junior faculty. The total amount of Rutgers Foundation donor support is listed as $7,615 for fiscal year 2004. Included in this donor support are additional funds linked to matching funds from Bristol-Myers Squibb Company ExxonMobil Corporation, Merck & Company Incorporated, and The Millipore Foundation. Two important academic areas supported by these funds include the Bosnian Student Project administrated by Dr. Peter Kahn and the new Robert S. and Eileen A. Robison Scholarship Award for Excellence in Graduate Studies administered by myself (see picture). In addition, there are other resources that have been established as endowments for departmental use. These include the Dennis and Linda Fenton Endowed Chair in Microbiology, the first of its kind at Cook College, named for and administered by Dr. Douglas Eveleigh. The H. Boyd and Jeanette I. Woodruff Graduate Fellowship in Soil and Environmental Microbiology provides full academic support to one new graduate student annually in this field of study. I am fortunate to administrate this fellowship program.

The department seeks your continued support to improve our academic programs and to help us expand into research areas that are new and unique to our departmental missions in biochemistry, biotechnology, environmental toxicology, and microbiology. We are continually seeking support to help with our five-year plan to renovate several research laboratories and furnish them with modern, state-of-the-art equipment. Finally, the department faculty administer three undergraduate majors for Cook College, Biochemistry, Microbiology, Biological Sciences, and our student enrollments are increasing. We seek more support for these students in the form of scholarships and internships.

We hope that you will keep us in mind in the future. In addition, you are most welcome to visit here and learn more about our progress and plans for the future. Best wishes to everyone and I hope that you enjoy the soon to arrive springtime season.

Robison Scholarship Award 2005
***L-R*: H. Fisher, M.Häggblom, L.Wickman (Awardee) D. Robison, R. Robison, D. Pramer, A. Antoine, H. Robison, E. Robison**

The Department designated as a Historic Landmark for the Discovery of the Actinomycete Antibiotics

Doug Eveleigh

The Discovery of the Actinomycete Antibiotics in the Department has recently been recognized by the American Chemical Society in their National Historic Chemical Landmark Program. Selman Waksman began his studies of microbial antagonism in 1937, leading to Boyd Woodruff's discovery of the first Rutgers' actinomycete antibiotic, actinomycin in 1940. Actinomycin was active towards Gram-positive and Gram-negative bacteria and also *Mycobacterium tuberculosis*, but toxic to animals. In 1942, Woodruff discovered the more promising streptothricin, but it was also toxic towards animals. However in 1943, dramatic success came with Albert Schatz's discovery of streptomycin, the first practical broad spectrum antibiotic capable of vanquishing cholera, bubonic plague and typhoid and also tuberculosis. Waksman's screening program continued to yield new antibiotics, the most notable being neomycin (1949) and the antifungal candicidin (1953) by Hubert Lechevalier. Selman Waksman, a graduate of the Department (B.S. 1915, M.S. 1916) received the Nobel Prize for Physiology or Medicine, 1952 for his "ingenious, systematic and successful studies of soil microbes that have led to the discovery of streptomycin" (Noble citation). One of Soil Microbiology's gifts to Rutgers was the antibiotic patent royalties which mounted to $12 million. It facilitated the building of the Waksman Institute of Microbiology.

The impact of the Rutgers Actinomycete Antibiotics was that for the first time, there was global hope to cure disease. The conceptual leap that soil bacteria were both a medical and pharmaceutical resource, turned the medical world topsy-turvy. **The recognition of the Discovery of the Actinomycete Antibiotics will be through presentation of the ACS plaque by William Carroll, President ACS, at the Waksman Room, Martin Hall, Tuesday 2.00 pm, May 24th, 2005.** The Department was formerly in Martin Hall, the Administration Building. Following the presentation will be a reception and a session of oral histories. Come tell tall stories! **An Actinomycete Antibiotic Symposium, "SOIL BACTERIA'S GIFT TO MEDICINE"** considers historical perspectives through to the search for new antibiotics - Wednesday 9:15 am, May 25th.

INSIDE THIS ISSUE:

OUR FACULTY

Faculty - Grants

Dr. Tamar Barkay - National Science Foundation. Biogeoscience Program. "Collaborative research: Mercury isotope fractionation during microbial and abiotic redox transformations". This project is a collaboration with Dr. Joel Blum from the Geology Department at the University Michigan and Dr. John Reinfelder from the Environmental Science at Rutgers. The objective of this project is to examine the fractionation of mercury stable isotopes during various biological and chemical transformations of mercury.

Dr. Tamar Barkay—Department of Energy. NABIR Program. "Microbial pathways for the reduction of mercury in saturated subsurface sediments". This project is a collaboration with the laboratories of Lily Young and Gerben Zylstra in the Biotech Center. It will examine the molecular ecology of anaerobic microbial communities that reduce ionic mercury to the volatile elemental form under various respiratory pathways.

New in print

Schaefer, J.K., J. Yagi, J. Reinfelder, T. Cardona, K. Ellickson, S. Tel-Or, and **T. Barkay**. 2004. The role of the bacterial organomercury lyase in controlling methylmercury accumulation in mercury contaminated natural waters. Env. Sci. Technol. 38:4304-4311.

Poulain, A., M. Amyot, D. Findlay, S. Telor, **T. Barkay**, and H. Hintelmann 2004. Biological and photochemical production of dissolved gaseous mercury in a boreal lake. Limnol. Oceanog. 49: 2265-2275.

Somsamak P, Richnow HH, **Häggblom MM** (2005) Carbon Isotopic fractionation during anaerobic biotransformation of methyl tert-butyl ether and tert-amyl methyl ether. Environ. Sci. Technol 33:103-109.

Ruess L, Tiunov A, Haubert D, Richnow HH, **Häggblom MM,** Scheu S (2005) Carbon stable isotope fractionation and trophic transfer of fatty acids in fungal based soil food chains. Soil Biol. Biochem., in press.

Ravit B, **Häggblom MM**, Ehrenfeld JG (2005) Salt marsh rhizosphere effects microbial biotransformation of the widespread halogenated contaminant tetrabromobisphenol A (TBBPA). Soil Biol. Biochem., in press.

Heikkinen MSA, Hjelmroos-Koski M, **Häggblom MM**, Macher J (2004) Bioaerosols. In: Ruzer L, Harley NH (eds) Aerosols Handbook: Measurement, Dosimetry, and Health Effects. CRC Press, pp. 291-342.

Tchernov D, Gorbunov MY, de Vargas C, Yadav SN, Milligan AJ, **Häggblom M M**, Falkowski PG (2004) Membrane lipids of symbiotic algae are diagnostic of sensitivity to thermal bleaching in corals. Proc. Natl. Acad. Sci. USA 101:13531-13535.

Jääskeläinen EL, **Häggblom MM**, Andersson MA, Salkinoja-Salonen MS (2004) Atmospheric oxygen and other conditions affecting the production of cereulide by *Bacillus cereus* in food. Int. J. Food Microbiol. 96:75-83

Vetriani, C., Y.S., Chew, S.M. Miller, J. Yagi, R.A. Lutz, and **T. Barkay.** 2005. Microbially mediated mercury reduction in deep-sea hydrothermal vents. Appl. Environ. Microbiol. 71:220-226.

Voordeckers, J.W., Starovoytov, V., and **Vetriani, C**. (2005). *Caminibacter mediatlanticus* sp. nov., a thermophilic, chemolithoautotrophic, nitrate ammonifying bacterium isolated from a deep-sea hydrothermal vent on the Mid-Atlantic Ridge. Intl. J. Syst. Evol. Microbiol. 55:773-779.

Vetriani, C., Chew, Y.S., Miller, S.M., Yagi, J., Coombs, J., Lutz, R.A., and Barkay, T. (2005) Mercury adaptations among bacteria from a deep-sea hydrothermal vent. Appl. Environ. Microbiol. 71:220-226.

Wawrik, B., L. Kerkhof, **G. J. Zylstra**, and J. J. Kukor. 2005. Identification of unique type II polyketide synthase genes in soil. Appl. Env. Microbiol. (in press)

Cho, O., K. Y. Choi, **G. J. Zylstra**, Y.-S. Kim, S.-K. Kim, J. H. Lee, H.-Y. Sohn, G.-S. Kwon, Y. M. Kim, and E. Kim. 2005. Catabolic role of a three-component salicylate oxygenase from *Sphingomonas yanoikuyae* B1 in polycyclic aromatic hydrocarbon degradation. Biochem. Biophys. Res. Commun. (in press)

Kim, D., J.-C. Chae, J. Y. Jang, **G. J. Zylstra,** Y. M. Kim, B. S. Kang, and E. Kim. 2005. Functional characterization and molecular modeling of methylcatechol 2,3-dioxygenase from *o*-xylene-degrading *Rhodococcus* sp. strain DK17. Biochem. Biophys. Res. Commun. (in press)

Caballero, A., A. Esteve-Núñez, **G. J. Zylstra,** and J. L. Ramos. 2005. Assimilation of nitrogen from nitrite and trinitrotoluene in *Pseudomonas putida* JLR11. J. Bacteriol. (in press)

Seminar

Dennis Fenton and Doug Eveleigh

DENNIS FENTON, Executive Vice President, Amgen Corporation visits the Department.
Dennis Fenton, who with his wife Linda, donated the first Professorial Endowed Chair to Cook College, visited the Department last fall. He toured and had discussions with faculty and students. He was impressed with the innovation in the teaching laboratories, that there was a Hi-throughput and DNA Sequencing facility for undergraduate training, and in addition a sophisticated Protein Computing Structural Facility. His comments were made within the framework of considerations of the development of Microbiology in the College. He was most pleased to hear that an Undergraduate Curriculum in Microbiology had become a reality, and also wished us well in developing a graduate Applied Microbiology Curriculum.

Dennis reflected on his career in his seminar given on September 29, 2004:

"Rutgers' Microbiology's Contribution to Operations Management" - Operational excellence as a competitive advantage). The lecture was to a standing room audience and attracted a diverse spectrum of *Cookies*. Dennis reflected in up beat manner on his background at the Ag School and how it helped him face the vicissitudes of running a large corporation.

Visiting scientists

From Chulalongkorn University, Thailand: Pongtharin Lotakul (working with Drs. Doug Eveleigh and Brad Hillman - Plant Biology Pathology) and Sehanat Prasongsuk (his third visit) graduate student (Eveleigh)

Andrew Marinucci a Visiting Scientist from the DEP in Trenton, New Jersey working with the Barkay Lab.

Gunnar Oregaard, a graduate student at the University of Copenhagen, visited the Barkay Lab from Oct. through Dec. working with Jonna Coombs on functional DNA arrays and with other members of the lab on various projects.

Katri on skies

Katri Mattila from the Artic Microbiology Research Consortium, Rovaniemi, Finland working in the Häggblom Laboratory in January 2005.

Conferences - Seminars -Symposium

Max Häggblom was an invited speaker at a special symposium on MTBE biodegradation at the International Petroleum Environmental Conference held in Albuquerque, NM in October 2004.

Max Häggblom gave a seminar in a session on microbial dehalogenation at the Society for Industrial Microbiology Annual Meeting, in Anaheim, Calif, July 2004.

Ward PL, Donnelly, M. Franklin A., Hong J, and **S Katz**. Antibiotic and antibmicrobial resistance and efficiency disruption by teas and nutraceuticals. Ehrlich Conference 2004, Nurnberg, Germany.

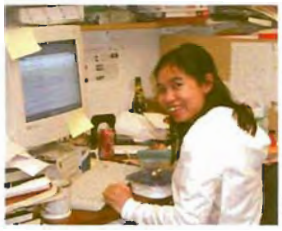
Kleiner, D. K., **Katz, S.E.** and **PL Ward.** *In vitro* antimicrobial resistance in an indicator bacterium exposed to residue level exposures to antimicrobial drugs, pesticides and veterinary drugs. Ehrlich Conference 2004, Nurnberg, Germany.

Elisabetta Bini was selected to participate in the Rutgers New Faculty Traveling Seminar from May 23 to 27, 2005. For more info: http://travelseminar.rutgers.edu/

Our Graduate Students

Gavin Swiatek (Ph.D. 2004 - Eveleigh Lab) is a Post Doctoral Associate in the Bill Ward Laboratory. He is cloning and expressing ctenophorin and cnidarian fluorescent probes.

Ph.D.



Piyapawn Somsamak defended her Ph.D. thesis "Anaerobic Biotransformation of Methyl tert-Butyl Ether (MTBE) and Related Fuel Oxygenates Under Different Anoxic Conditions" in the Environmental Sciences Graduate Program on Dec 17th 2004.

The fuel oxygenate methyl *tert*-butyl ether (MTBE) has been frequently detected in groundwater and surface water. Since contaminated sites are often subsurface, anaerobic degradation of MTBE will likely be significant for remediation. In this study the anaerobic biotransformation of the fuel oxygenates methyl *tert*-butyl ether (MTBE), ethyl *tert*-butyl ether (ETBE), and methyl *tert*-amyl ether (TAME) under different anoxic electron accepting conditionswas evaluated. After extended incubation stable microbial cultures were erniched that utilize MTBE and/or TAME under methanogenic or sulfidogenic conditions. No biotic loss of ETBE has been observed. Anaerobic degradation of fuel oxygenates was observed in sediment microcosms from four different locations. MTBE and TAME utilization as sole substrates was sustained upon refeeding and subculturing over several years. Stoichiometric amounts of *tert*-butyl alcohol (TBA) and *tert*-amyl alcohol (TAA) accumulated indicating that cleavage of the methyl group was the initial step in MTBE and TAME biotransformation. Anaerobic utilization of the methyl group was coupled to sulfidogenesis or methanogenesis. When methanogenesis or sulfate reduction was inhibited, the cultures continued to degrade MTBE, but a retardation of MTBE degradation was observed. The observation suggests that anaerobic MTBE degradation was not coupled directly to methanogenesis or sulfate reduction and the interactions among members of the MTBE-utilizing microbial community must be important for the overall degradation process. Significant carbon isotope fractionation during anaerobic biotransformation MTBE and TAME was observed under both sulfate-reducing and methanogenic conditions. This is one of the first studies to determine the isotopic enrichment factors during anaerobic degradation. The findings clearly demonstrate that carbon isotope fractionation has potential to be used as a tool to monitor *in situ* anaerobic MTBE and TAME biodegradation. As anaerobic degradation is likely to control the fate of MTBE and related fuel oxygenates, this study provides crucial information to understand the process as well as to appropriately manage MTBE-contaminated sites.

Piyapawn was supported in her studies by a Royal Thai Government Graduate Fellowship and also by grant support from the NJ Water Resources Research Institute. She is a Lecturer in the Department of Environmental Sciences, Kasetsart University, Bangkok, and returned to this position in January 2005.

Alumni Connection

Pasquale V. Scarpino (Ph.D. 1961) pasqualescarpino@uc.edu

We received a letter from **Dr. Pasquale V. Scarpino**, (Ph.D. 1961) who has been teaching since 1963! He received his Ph.D under Drs. David Pramer and Robert Starkey. In his letter he says, "*Both Drs. Pramer and Starkey were very important in my education, and I would have not done as well at Cincinnati if it had not been for them.*" He wishes us much success with our LIPMAN LOG , says he enjoys reading about what we are doing, and about our Alumni. He especially was pleased to read about one of his classmates Dolph Klein! We hope his recovery went well with his knee surgery.

What's Shaking

by Kathy Maguire

Wedding Bells for Margie Wintermyer (Ph.D Cooper Lab) to Ted Takas took place in October, 2004.

Wedding bells for **Kritee** to Imtiaz Rangwala (Imtiaz is a Ph.D. student in Environmental Science) the last week of July 2004.

Edward

It's a boy! **Edward Earl Hunter** weighing in at 9 lbs. 12 oz arrived at 12:04 p.m. on January 18, 2005. Parents Jonna Coombs (Postdoc Barkay Lab) and John Hunter (Ph.D. Cooper Lab).

Dr. and Mrs. Ted Chase, Jr. became grandparents on November. 25, 2004. Jane Elizabeth Lilly, daughter of Vanessa Chase Lilly and John Lilly. Weight: 8 lb 3 oz (3709 g), length 20 3/4" (52.7 cm).

Lance Corporal Jakob Knospler, son of **Patricia Christensen-Wood** a part-time Ph.D. student of Stan Katz, appeared in *Time Magazine* (Person of the Year 2004) with President George Bush. Jakob was severely wounded in Iraq while clearing a building in Fallujah, but will be fine after several reconstructive surgeries to his face. Please keep him and Patricia in your thoughts.

New faces:

Riqing Yu a new graduate student in Environmental Sciences has joined the **Barkay Lab** in January. Riqing moved to Rutgers from LSU where he was awarded a Masters degree last fall in marine ecotoxicology. Prior to his arrival in the USA, Riqing earned two other Masters degrees, one at the Chinese Academy of Sciences, Institute of Hydrology in Wuhan on the toxicity of acid rain to fish, and the other from the Dept. of Biology, Hong Kong University of Technology on metal bioaccumulation by unicellular eukaryotes.

Three new undergraduate students have joined the **Barkay Lab**. **Chris Dipasquale** who is a junior majoring in Biotech and Biochem is working with Jeffra Schaefer, **Justin Crane** who is a Biochem and Biology double major working with Sharron, and **Richard Pescatore**, a Rutgers College freshman who is a Fellow at the Rutgers Undergraduate Research Center is conducting research with Kritee.

The **Ward Laboratory** welcomes three new members: **Gloria Kierniesky** a full time Program Coordinator II. **Jennifer Louden** working as a full time technician, having graduated from Cook in January and **Ms. Haleema Janjua** as a visiting scientist. Haleema earned her BS in Biochemistry from Douglass College in 2000 and has worked 3 years at Enzon doing protein biochemistry, HPLC, and assay development.

L-R: Gloria, Jennifer and Haleema

In Memory of Dr. Albert Schatz

ALBERT ISRAEL SCHATZ, CO-DISCOVERER OF STREPTOMYCIN, EDUCATOR AND HOLISTIC MEDICINE PIONEER, DIES AT 84

Albert Schatz, co-discoverer of streptomycin, died peacefully at home in Philadelphia, January 17, 2005. He was 84. As a graduate student working with Selman Waksman in the world's first antibiotic screening program, he discovered streptomycin in 1943. His later research interests elucidated the significance of chelation in soil formation and in plant nutrition, concepts which he extended as a basis for the development of dental caries. As a Professor of Education at Washington University and Temple University, he developed outreach programs to communicate science to the lay person. Dr. Schatz was a pioneer of alternative health care medicine.

Albert Schatz was born of Russian immigrants in Norwich, CT, and grew up in Passaic, NJ. His academic training at the Rutgers College of Agriculture was with an undergraduate degree in Soil Chemistry (1942), and a doctoral degree in Soil Microbiology (1945). He broadened his research interests while working at the NY State Department of Health, the Sloan Kettering Institute, at Brooklyn College and the National Agricultural College, and in more medical environments at the Philadelphia General Hospital and in the University of Chile. He was keenly interested in outreach teaching of science to the lay person. He was appointed Professor of Education at Washington University (1965-1969) and then moved to Temple University where he taught until his retirement in 1981. As professor emeritus, he remained active in science education and holistic medicine.

It was while Dr. Schatz was searching for antibiotics in Professor Selman Waksman's program that focused on the screening of actinomycetes, that they discovered streptomycin. Waksman's prior two antibiotics actinomycin and streptothricin were active against gram-negative pathogens, the former also inhibiting the tubercule bacillus in *in vitro* tests. Both proved too toxic for use in man. However, in 1943, Albert Schatz isolated two streptomycin producing strains of *Streptomyces griseus*, one from soil and the other from a plate swabbed from the throat of a healthy chicken prepared by fellow student Doris Jones. Courageously, he showed streptomycin to be active against the virulent human *Mycobacterium tuberculosis*, var. *hominis* H37 strain. This discovery occurred in the basement Soil Microbiology laboratory in Martin Hall. Successful *in vivo* trials against *M. tuberculosis*, first in a guinea pig model and then in humans at the Mayo clinic, soon led to the rapid large scale production of streptomycin. However, the first purified streptomycin used in the animal trials was hard won through extraction from flask cultures by Albert Schatz.

The 1948 Waksman-Schatz streptomycin patent became lucrative, the net royalties having risen to $2,360,000 by 1950. It then took Schatz's litigation against Rutgers to gain an equitable the distribution of these monies, and that he be accorded full recognition as a co-discoverer of streptomycin. In an out-of-court settlement it was agreed that twenty percent of the royalties would be distributed amongst the Waksman research team: 10% to the program leader Selman Waksman for the discovery and for his thirty years development of soil microbiology that led to streptomycin, 3% to Albert Schatz plus $125,000 *in lieu* of foreign patent rights, while 26 workers shared in royalties or cash benefits. Patent 2,449,866 was later cited as one of the top ten patents of the 20th century.

Albert Schatz's subsequent major studies unraveled the positive action of chelation in rich soil formation and in plant nutrition. An outgrowth was his intriguing theory of proteolysis-chelation as a cause of dental decay, which promoted much debate. He was a committed environmentalist, and in his central Philadelphia community he led recycling campaigns and composting projects. He was always ready to take on unpopular causes and as such actively campaigned against fluoridation of public drinking waters. In similar vein as a humanitarian, he campaigned for the underdog being an active member of the International Workers of the World.

Schatz was keenly interested in communicating science to the lay person, becoming an educational consultant to UNESCO and FAO, the Pennsylvania State Department of Public Education and to Rodale Press. In his appointment to Washington University as professor of education (1965-1969), as founder and president of Susan B. Anthony University (a university without walls), and from 1969 at Temple University, Dr. Schatz pioneered innovative environmental science teaching, spanning school to university levels. "Fun with garbage" was one of his themes, introduced through his texts "*Teaching Science with Garbage*" (co-authored with his wife Vivian) and "*Teaching Science with Soil*", and for which he received the National Science Teachers Association Award, and the Gold Medal Award (Thorlet Prize), Société Academie d'Éducation et d'Encouragement, France.

Curiosity beguiled him, and he forayed in diverse research directions. Initially studying microbial inhibitors active towards bacteria, fungi, animal and bacterial viruses and even human sperm, he later published on lichens, mushrooms, algae, protozoa and mosses. Physiological studies addressed autotrophy and nitrification. Chelation again came to the fore through his suggestion of the use of lichen metabolites by the Incas to aid in the dissolution of the stones to facilitate the tight fitting of their massive monuments. He even considered physiological parameters to account for the extinction of the dinosaurs.

From the early 1950s Dr. Schatz was a pioneer of alternative health care medicine, promoting holistic medicine internationally as consultant to the National Health Federation, the Foundation for Alternative Cancer Therapies, the British Royal Society of Health, and working on the Board of Directors of the International Association of Cancer Victims and Friends. Dr. Schatz was a Therapeutic Touch practitioner. His humorous approach to life was very evident in his *Therapeutic Aspects of Humor* Newsletter and was integral to his medical philosophy. Schatz's contributions to holistic medicine were recognized through a special award from the American Academy of Holistic Pioneers in 1970.

Dr. Schatz's local community best remembers him for his humanitarianism, and his interests in alternative health care and environmentalism, he was prodigious in his outreach. He wrote a weekly newspaper column, and combined with continual pieces to newspapers and magazines, he published over seven hundred articles! Internationally Albert Schatz will be best remembered for his discovery of streptomycin which was the key magic bullet that opened attack towards the world's greatest killer, tuberculosis, and also the notorious microbes that caused cholera, typhoid, bubonic plague and dysentery against which penicillin was ineffective. In these early studies he illustrated, rather incongruously, how soil microbes were to be the source of the magic bullets, the antibiotics, that have been key in vanquishing disease and enhancing world health. The discovery of streptomycin, and indeed propensity of Actinomycetes to produce diverse antibiotics, thrust medicine into the Golden Age of Antibiotics, an era in which the conquest of disease was forecast.

Albert Schatz was honored internationally receiving four honorary degrees from Brazil, Peru, Chile and the Dominican Republic, and many medals and laurels from universities and societies in Europe, Latin America and the United States. He was voted as one of America's Ten Outstanding Young Men by the US Junior Chamber of Commerce in 1954. He received the Selman A. Waksman Award from the Theobald Smith Society (NJ branch of the American Society for Microbiology), the George Hammel (Cook College Distinguished Alumnus Award), and also the Rutgers University Medal, the University's highest honor on the occasion of the 50th anniversary of the discovery of streptomycin in 1994.

Dr. Schatz is survived by his wife of 59 years (March 23, 1945), the former Vivian Rosenfeld (Douglass College, 1946). He is also survived by his sister, Elaine Davidson, two daughters, Linda Schatz and Diane Klein, and four grand-children, Geoff Klein, Valerie Klein, Nick Klein and Carl Sigmond.

Memorial donations may be made to the:

Center for Constitutional Rights
666 Broadway, 7th Floor
New York NY 10012

Dr. Schatz with the Designer Gene's Club in 1994

Thanks to individuals and organizations who provided financial support to the
Department over the year:

Edith Kunin Memorial Fund (Dr. Robert Kunin Ph.D. 1942)
Fenton/Eveleigh Chair in Applied Microbiology
Robert Robison (Ph.D. 1954) Scholarship Fund
Dr. Anthony Romano (Ph.D. 1952)

Department of Biochemistry and Microbiology
Cook College—Rutgers University
Lipman Hall
76 Lipman Drive
New Brunswick NJ 08901-8525
732.932.9763

www. cook.rutgers.edu/~dbm

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