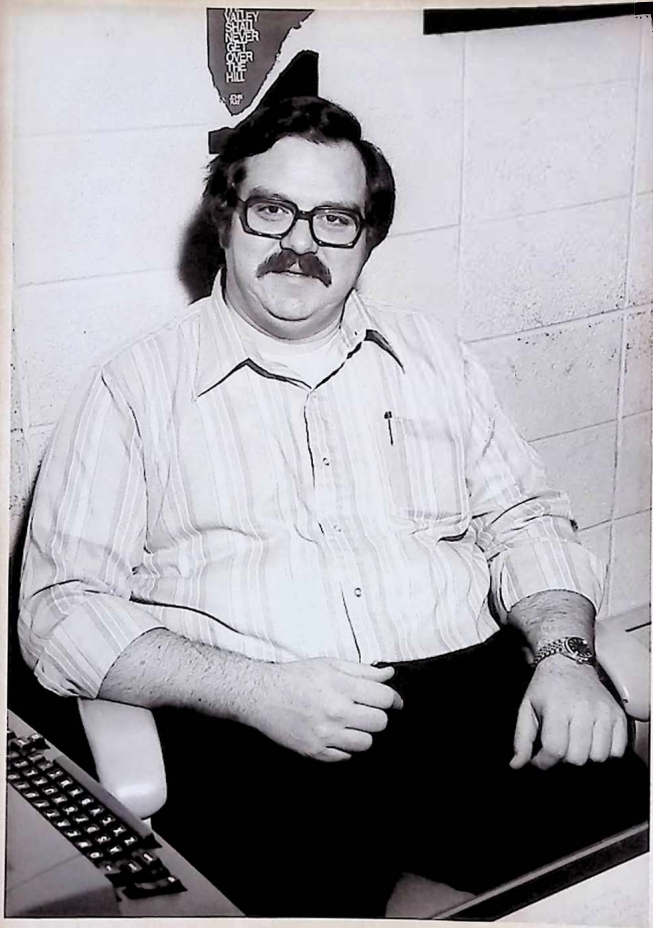
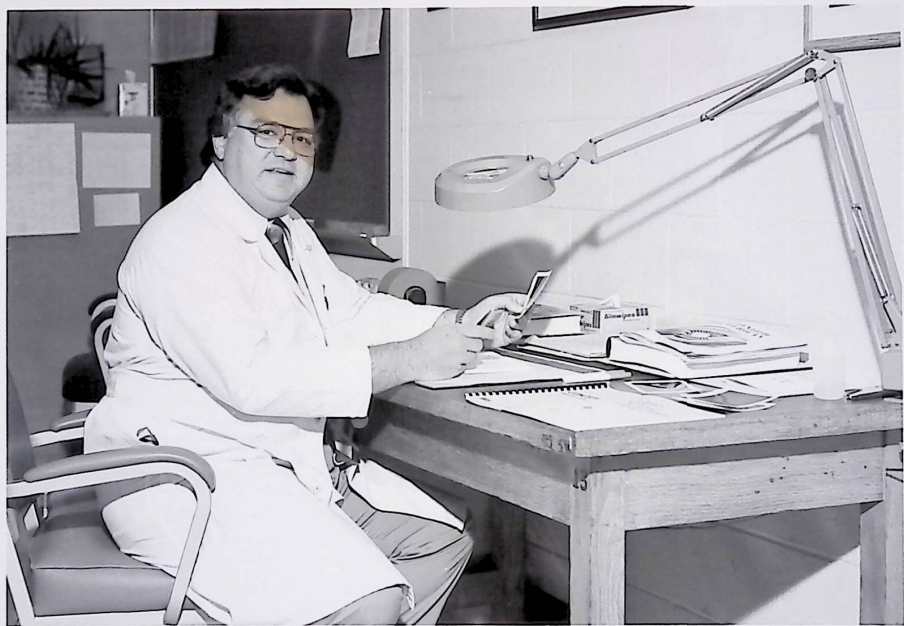




















Wilkes University

News

University Relations Office
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New Department Chairs Appointed at Wilkes University

Wilkes-Barre- Wilkes University president Dr. Christopher N. Breiseth recently announced the appointment of seven new chairpersons to the school's consolidated program units, effective January 1, 1999.

Chairing the departments of Education and Psychology is Dr. Diane Polachek, associate professor of Education. Polachek is also host of the children's educational program, "WOW!," a cooperative effort between Wilkes and WBRE-TV. Polachek received bachelor of arts degrees in elementary education, French, and psychology and teaching certifications for elementary education and secondary French at Wilkes in 1978. Polachek completed two master's degrees, one in French from the University of California at Santa Barbara and one in elementary education from Wilkes. She obtained a doctorate in education from Lehigh University.

The new chairperson for the departments of Economics, Communications, Political Science, Sociology/Anthropology, and International Studies is Dr. Thomas J. Baldino.

-MORE-

1st Add: New Department Chairs Appointed at Wilkes University

Baldino has been teaching at Wilkes since 1991 and serves as co-director of its Survey Research Center. He received a bachelor of arts degree in political science with minors in history and German from La Salle College. He earned a master's degree from The University of Illinois and a doctorate degree from The University of Pennsylvania.

Dr. Roger L. Maxwell, chairperson for the departments of Engineering and Physics, has been a member of the Physics department faculty for fifteen years. He received a bachelor of arts in physics from the University of Buffalo and his doctoral degree in physics from Syracuse University.

Dr. Darin E. Fields will head the departments of English, History, Philosophy, and Foreign Languages. He is currently the advisor of *Amnicola*, the University's yearbook, along with sitting on the Faculty Development Committee and the Graduate Studies Committee. Fields acquired a bachelor of arts degree in English from the University of Arizona and a master's and doctorate in English from the University of Delaware.

Mr. James L. Harrington, chairperson of the Music, Dance, Art, and Theatre departments, was the only American guest artist to perform at the Tenth International Festival of Organ Music held at Cambridge University, England. Harrington received a bachelor of arts degree in music education from Oberlin College Conservatory of Music and a master's degree of organ performance from Yale University.

-MORE-

2nd Add: New Department Chairs Appointed at Wilkes University

Dr. Jeffrey R. Alves was selected new chairperson for the departments of Accounting and Business Administration. Dr. Alves is director of the Allan P. Kirby Center for Free Enterprise and Entrepreneurship. He earned a bachelor of science degree in general studies from the U.S. Air Force Academy and a master's degree in Finance from Southern Illinois University. Alves completed a doctorate degree in Business Administration with a concentration in Finance at The University of Massachusetts, Amherst.

Dr. Lester J. Turoczi, chair for the departments of Chemistry, Biology, and Health Science, has been with Wilkes since 1972 and has served as assistant, associate, and full professor during his tenure. Turoczi received a bachelor of arts degree in biology, a master's degree in Zoological Science, and a doctoral degree in Genetics all from Rutgers University.

An additional six members of the Wilkes faculty were re-confirmed as chairpersons for their departments. They are: Dr. Stephen Tillman, Math and Computer Science; Dr. Anne Y. F. Lin, Pharmacy Practice; Dr. Arthur H. Kibbe, Pharmaceutical Sciences; Dr. Dale Bruns, Geo-Environmental Sciences and Engineering; Dr. Mary Ann T. Merrigan, Nursing; and Lt. Col. Scott R. Papp, Aerospace Studies.

#####

Photo:

Front Row: Dr. Stephen Tillman, Shavertown, Pa.; Dr. Bonnie Bedford, dean, College of Arts, Sciences and Professional Studies/associate professor, English, Wilkes-Barre; Dr. Diane M. Polachek, Drums, Pa.; Dr. Christopher N. Breiseth, Wilkes president; Dr. Anne Y.F. Lin

Second Row: Dr. Thomas J. Baldino, Mountaintop, Pa.; Dr. Arthur H. Kibbe, Clarks Summit, Pa.; Dr. Dale Bruns, Dallas, Pa.; Dr. Roger L. Maxwell, Wilkes-Barre; Dr. Mary Ann T. Merrigan, Hazleton, Pa.; Dr. Darin E. Fields, Wyoming, Pa.

Third Row: Mr. James Harrington, Wilkes-Barre; Dr. J. Michael Lennon, vice president for Academic Affairs, Shavertown, Pa.; Lt. Col. Scott R. Papp; Dr. Jeffrey Alves, Wilkes-Barre

Absent From Photo: Dr. Lester J. Turoczi, Wilkes-Barre







Team looking for way to reduce need for radical surgery

Wilkes, Mercy Hospital, doctor taking part in prostatic cancer research project

A new research team from Wilkes University and Mercy Hospital, Wilkes-Barre, and a local physician are attempting to develop a test to predict androgen dependent tumors in prostate cancer patients, ultimately reducing the need for radical surgery.

Kingston urologist Dr. Charles M. Burns Sr., Mercy Hospital; Dr. J. Steinmetz, chairman of Mercy's Pathology Department; Dr. Lester Turoczy, chairman, Wilkes Biology Department and project coordinator, and Todd Vinovski, a senior bio-chemistry major and premedical scholar at Wilkes, began the collaborative research project this summer.

The team has been analyzing prostate cancers from some of Dr. Burns' local patients for the presence of androgen receptors. Prostatic cancer cells have these receptors for male sex hormones called androgens. In a certain number of men, they can be treated with anti-androgen drug therapy.

Tumors that express androgen receptor and whose growth is subdued by anti-androgen therapy are considered to be androgen depen-

dent. These abnormalities may be reduced and almost eradicated without having to resort to radical surgery, if the androgen status is easily and clearly ascertained.

Some prostatic cancer tumors do not respond to androgen therapy and are called androgen independent. Surgical removal is more likely to prevent tumor progression in these patients.

At the time, no test has been developed that can predict androgen dependence; therefore, physicians have had to be prognosticators in their use of these hormone therapies versus surgery.

This new test would accurately identify whether the tumor is androgen dependent or independent, eliminating the guesswork of the doctor and providing for the appropriate therapy, thus perhaps sparing the need for radical surgery for the patient.

Prostate cancer is currently the most frequently occurring cancer type in men and is the second leading cause of death in men over 40.

From the left, are Dr. Turoczy, chairman, Dr. Burns, and Vinovski.

Wilkes University News

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Wilkes University and Mercy Hospital Conduct New Prostate Cancer Research Project

Wilkes-Barre -- A new research team from Wilkes University, Mercy Hospital, Wilkes-Barre, and a local physician, is attempting to develop a test to predict androgen dependent tumors in prostate cancer patients, ultimately reducing the need for radical surgery.

Well-respected Kingston urologist Dr. Charles M. Burns, Sr., M.D., '35, Mercy Hospital; Dr. J. Steinmetz, M.D., Chairman of the Pathology Department at Mercy; Dr. Lester Turoczi, Chairman, Wilkes Biology Department and Project Coordinator; and Todd Vinovrski, a senior bio-chemistry major and premedical scholar at Wilkes, began the collaborative research project this summer.

The team has been analyzing prostate cancers from some of Dr. Burns's local patients for the presence of androgen receptors. Prostatic cancer cells have these receptors for male sex hormones called androgens. In a certain number of men, they can be treated with anti-androgen drug therapy.

-MORE-

1st Add: Wilkes and Mercy Conduct New Prostate Cancer Research Project

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Some prostatic cancer tumors do not respond to androgen therapy and are called androgen independent. Surgical removal is more likely to prevent tumor progression in these patients.

At the present time, there has not been a test developed which can predict androgen dependence and as such, physicians have had to be prognosticators in their use of these hormone therapies versus surgery.

This new test would accurately identify whether the tumor is androgen dependent or independent, eliminating the guesswork of the doctor and providing for the appropriate therapy, thus perhaps sparing the need for radical surgery for the patient.

Prostate cancer is currently the most frequently occurring cancer type in men and is the second leading cause of death in men over forty years of age.

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Photo:

Dr. Lester Turoczi, Chairman, Wilkes biology department and Project Coordinator; Dr. Charles M. Burns, Sr., M.D., '35, Kingston, Pa.; and Todd Vinovrski, senior biochemistry major and premedical scholar at Wilkes University

Dr. J. Steinmetz, Chairman of the Pathology Department at Mercy Hospital, Wilkes-Barre, is also taking part in the project, but was unable to be in the photo.





Wilkes will host Pre-Med Day 1996

Area high school students and their parents are invited to Wilkes University's annual Pre-Med Day scheduled Friday, Nov. 8, in the Dorothy Dickson Darte Center for the Performing Arts, South and River Streets. Pre-Med Day 1996 is a chance for juniors and seniors to meet with doctors, discuss pertinent medical issues and ask questions concerning careers in medicine. Highlighting the program will be a keynote address by Wilkes University graduate Dr. Robert Brown, '68, chief of infectious diseases at Wilkes-Barre General Hospital. Other Wilkes pre-med graduates and friends of the University will also be on hand to serve as panelists for a question and answer period. For more information on Pre-Med Day 1996 or the Health Sciences programs at Wilkes, contact the Admissions Office at 1-800 WILKESU, extension 4400, or 831-4400. From left are: David Reel, Pre-Med Day 1996 student speaker; Dr. Lester Turoczi, professor and chairperson of Biology; Dr. Dan Kopen; Dr. Umid Nejib, dean, School of Science & Engineering; and Bernard Vinovski, dean, Enrollment Services.



WILKES HOLDS ANNUAL PRE-MED DAY — Area high school students and their parents attended Wilkes University's annual Pre-Med Day, in the Arnaud C. Marts Center. Pictured, from left, are: Dr. Lester J. Turoczi, professor/chairperson; Dr. Dan Kopen, Northeastern Surgical Specialty Group Inc., and member, Wilkes University Board of Trustees; and Dr. Robert Brown, chief of infectious diseases, Wilkes-Barre General Hospital. *TL 12/1/95*



Wilkes holds pre-med day ^{25 11/27/93}

Area high school students and their parents attended Wilkes University's annual pre-med day in the Arnaud C. Marts Center.

The event provided an opportunity for juniors and seniors to meet with doctors, discuss pertinent medical issues and ask questions concerning careers in medicine.

The event included a keynote address, "A Physician's Report on AIDS," by Wilkes graduate Dr. Robert Brown, '68, chief of infectious diseases, Wilkes-Barre General Hospital.

Other Wilkes pre-med graduates and friends of the university were on hand to serve as panelists for a question and answer period.

Wilkes University has a strong tradition of educating students for the medical profession, with more than 500 students being placed in doctoral professional schools.

From the left, are Dr. Lester J. Turoczi, professor/chairperson, biology department, Wilkes University; Dr. Dan Kopen, Northeastern Surgical Specialty Group Inc. and Wilkes trustees, and Dr. Brown.



From left are: Dr. Charles Reif, professor emeritus of biology; Robin Christopher Minielly, Michael Bruno, Gregory Dobash, Carrie A. Williams; and Dr. Lester Turoczl, professor of biology at Wilkes University.

HAZ TL 11/17/95

Wilkes announces Reif Scholarship recipients

Wilkes University has announced four recipients of the Charles B. Reif Scholarship for the Biological Sciences for the 1995-1996 school year.

Recipients of the prestigious award are Robin Christopher Minielly of Sayre, Carrie A. Williams of Wilkes-Barre, Gregory Dobash of Harveys Lake and Michael Bruno of West Pittston.

The scholarship was established to recognize Dr. Charles B. Reif for his many years of service

as a professor of biology and chairman of the biology department at Wilkes.

Dr. Reif's former students established the scholarship which is provided annually for students who wish to pursue the study of the biological sciences.

Minielly, who is also a Guthrie Scholar, was awarded the sophomore biology award and is a member of the Wilkes Pre-Med Society. Williams, a University and

Guthrie Scholar, is a member of the Wilkes Pre-Med Society, WCLH radio station and Alpha Chi Honor Society.

Dobash, a Guthrie Scholar, is a member of the WCLH radio station, the AIDS Awareness Committee and the Alpha Chi Honor Society.

Bruno is a Guthrie Scholar and a member of the Scholars Society.

All four students are planning careers as physicians.

TIMES

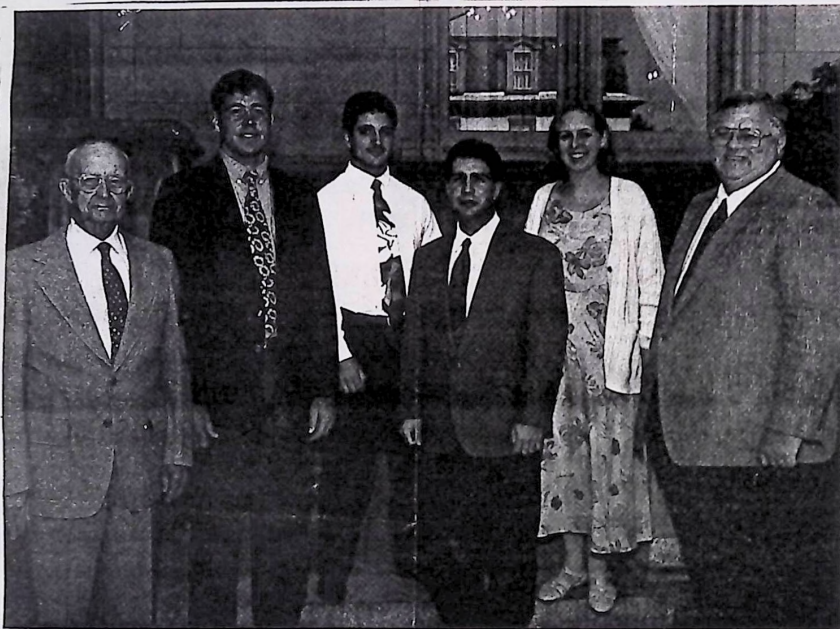
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Scholarship recipients

Rob Minlely (second from left) of Sayre was recently named by Wilkes University as one of four recipients of the Charles B. Reif Scholarship for the Biological Sciences for 1995-96. Minlely, who is also a Guthrie Scholar, was selected to receive the sophomore biology award and is a member of the Wilkes Pre-Med Society. His future plans include becoming a physician. The scholarship

was established to recognize Dr. Charles B. Reif for his many years of service as a professor of biology and chairman of the biology department at Wilkes. Former students established the fund. Left to right in photo are Reif; Minlely; scholarship recipients Michael Bruno of West Pittston, Gregory Dodash of Harvey's Lake and Carrie Williams of Wilkes-Barre; and Dr. Lester Turoczl, professor of biology at Wilkes.

SUNDAY DISPATCH

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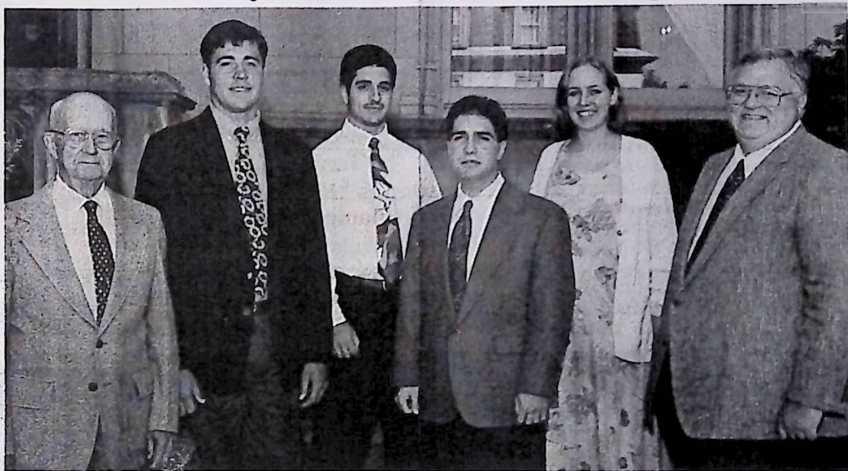
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Wilkes University Announces Reif Scholarship Recipients



Four students including one from West Pittston will receive the Reif Scholarships for the Biological Sciences for the 1995-96 school year.

Recipients of the prestigious awards are Michael Bruno, West Pittston; Robin Christopher Minnielly, Sayre; Carrie A. Williams, Wilkes-Barre and Gregory Dobash, Harveys Lake.

The scholarship was established to recognize Dr. Charles B. Reif for his many years of service as a professor of biology and chairman of the biology department at Wilkes. Dr. Reif's former students established the scholarship which is provided annually for students who wish to pursue the study of the biological sciences.

Bruno is a Guthrie Scholar and a member of the Scholars Society. He plans a future career as a physician.

Williams, a University and Guthrie Scholar, is a member of the Wilkes Pre-Med Society, WCLH radio station and Alpha Chi Honor Society.

Dobash, a Guthrie Scholar, is a member of WCLH radio station, the AIDS Awareness Committee and the Alpha Chi Honor Society. He plans to eventually become a physician.

Shown above are the Charles B. Reif Scholars for the 1995-96 school year. From left, Dr. Reif, professor emeritus of biology; Robin Minnielly, Michael Bruno, Gregory Dobash, Carrie Williams and Dr. Lester Turocz, professor of biology at Wilkes.

Wilkes University News

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Wilkes University Holds Annual Pre-Med Day

Wilkes-Barre -- Area high school students and their parents attended Wilkes University's annual Pre-Med Day, in the Arnaud C. Marts Center.

Pre-Med Day is an opportunity for juniors and seniors to meet with doctors, discuss pertinent medical issues and ask questions concerning careers in medicine.

The event included a keynote address titled "A Physician's Report on AIDS" by Wilkes graduate Dr. Robert Brown, '68, chief of infectious diseases at Wilkes-Barre General Hospital.

Other Wilkes pre-med graduates and friends of the University were on hand to serve as panelists for a question and answer period.

Wilkes University has a strong tradition of educating students for the medical profession, with more than 500 students being placed in doctoral professional schools.

-MORE-

1ST ADD - WILKES HOLDS ANNUAL PRE-MED DAY

PHOTO:

From left to right: Dr. Lester J. Turoczi, professor/chairperson, Biology Department, Wilkes University; Dr. Dan Kopen, Northeastern Surgical Specialty Group, Inc. and member, Wilkes University Board of Trustees; and Dr. Robert Brown, chief of infectious diseases, Wilkes- Barre General Hospital.

STANDARD-SPEAKER

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Pre-Med Day at Wilkes

Area high school students and their parents are invited to Wilkes University's annual Pre-Med Day on Friday in the Dorothy Dickson Darte Center for the Performing Arts, South and River streets, Wilkes-Barre.

Pre-Med Day 1995 is a chance for juniors and seniors to meet with doctors, discuss medical issues and ask questions concerning careers in medicine. Registration will be held from 9:30 to 10 a.m. and the day continues through a noon luncheon.

Highlighting the morning's activities will be a keynote address by Wilkes University graduate Dr. Robert Brown, '68, chief of infectious diseases at Wilkes-Barre General Hospital. His address is titled "A Physician's Report on AIDS."

Other Wilkes pre-med graduates and friends of the university will be on hand to serve as panelists for a question-and-answer period. They include Dr. Maureen Litchman, '78, center director of the Wyoming Valley Family Practice Residency Program, Kingston; Dr. Dan Kopen, '70, Northeastern Surgical

Specialty Group Inc., Kingston, and a Wilkes University Trustee; Dr. Henry Novroski, family practitioner, and Dr. David Greenwald, '66, oncologist.

In addition, Dr. Ralph Rozelle, dean of health sciences, will discuss health sciences programs at Wilkes, and Bernard Vinovrski, dean of enrollment services, will provide information on admission to Wilkes University and financial aid opportunities.

Wilkes University senior Dan Smith will also talk to participants about his experiences as a pre-med student at Wilkes.

Wilkes has a strong tradition of educating students for the medical profession, with more than 500 students being placed in doctoral professional schools.

For more information on Pre-Med Day 1995 or the health sciences programs at Wilkes, contact the admissions office at 1-800-WILKES-U, extension 4400, or 831-4400.

Wilkes University News

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The scholarship was established to recognize Dr. Charles B. Reif for his many years of service as a professor of biology and chairman of the biology department at Wilkes. Dr. Reif's former students established the scholarship which is provided annually for students who wish to pursue the study of the biological sciences.

Minnielly, who is also a Guthrie Scholar, was awarded the sophomore biology award and is a member of the Wilkes Pre-Med Society. His future plans include becoming a physician.

Williams, a University and Guthrie Scholar, is a member of the Wilkes Pre-Med Society, WCLH radio station and Alpha Chi Honor Society. Her future

-MORE-

1ST ADD WILKES UNIVERSITY ANNOUNCES REIF SCHOLARSHIP WINNERS

aspiration is to become a family practice physician.

Dobash, a Guthrie Scholar, is a member of the WCLH radio station, the AIDS Awareness Committee and the Alpha Chi Honor Society. Dobash plans to eventually become a physician.

Bruno is a Guthrie Scholar and a member of the Scholars Society. He plans a future career as a physician.

Photo: Shown are the Charles B. Reif Scholars for the 1995-1996 school year. From left to right: Dr. Charles Reif, professor emeritus of biology; Robin Christopher Minielly; Michael Bruno; Gregory Dobash; Carrie A. Williams; and Dr. Lester Turoczi, professor of biology at Wilkes University.

Sexual harassment at LCCC a textbook case that officials must rewrite

Editor:

Sexual harassment in the workplace is a form of discrimination. It clearly violates Title VII of the Civil Rights Act of 1964, which protects employees from discrimination on the basis of race, color, religion, national origin, and sex. All organizations, including educational institutions, are covered by this law.

Although any person can be a victim of sexual harassment, the vast majority of instances involve women as victims and men as perpetrators of the harassment.

That's because sexual harassment is about power — the sheer power of being able to control, intimidate, embarrass, or demean another human being, and get away with it. And in most organizations, men hold positions of power, and women are subordinates. Harassment and all of its ugliness, flows down the organizational hierarchy. Bosses are harassers, subordinates are victims.

Besides the human and organizational costs, employers are paying dear-

ly, as well they should, for allowing this behavior to exist. Organizations that fail to take seriously the issue of sexual harassment will continue to dig deeply into their pockets.

The same fate befalls schools and colleges, for the law clearly holds the institution responsible for failing to provide a safe and harassment-free environment for employees and students.

Over the past few months, our community has watched the sexual harassment case unfold at the Luzerne County Community College. To our great sadness, the details, as reported in the press, provide a textbook case of sexual harassment.

We urge all decision makers involved in this situation — trustees, college officials, and county commissioners — to work to transform an apparently oppressive environment into one of fairness and civility.

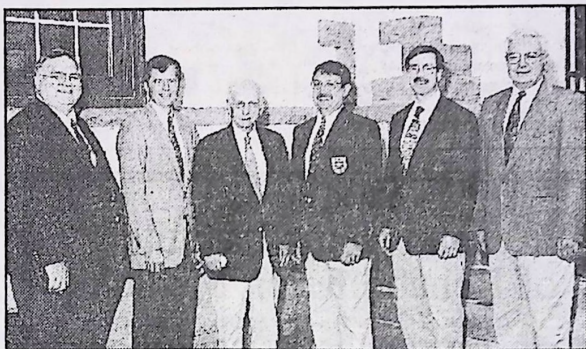
We specifically urge that you work toward gender equity by appointing qualified and progressive women to the

board of trustees and to other leadership positions within the college. In addition, you must conduct a national search for the next president, and include as a selection criterion a demonstrated commitment to fair treatment.

As a public institution, your actions both reflect and shape the community. You have the moral imperative to set appropriate examples of gender equity in a non-discriminatory work environment. As women in the academy, and as citizens of this community, we demand that you do so.

Jan W. Kelly
University of Scranton
Executive Chairperson
Northeastern Pennsylvania
Women in Higher Education
(NEPAWHE)
Jennifer Turney
Wilkes University
Secretary, NEPAWHE
Lynda Goldstein
Penn State, Wilkes-Barre
Acting Treasurer, NEPAWHE

TL
5/11/95



WILKES TO HOST PRE-MED DAY — Area high school students and their parents are invited to Wilkes University's annual Pre-Med Day, on Friday, Nov. 4 in the Dorothy Dickson Dart Center, South and River Streets. Registration begins at 9 a.m. and continues through a noon luncheon. Juniors and seniors will have the opportunity to discuss medical careers and issues with area doctors. For further information, contact the admissions office at 1-800-WILKES-U or 831-4400. Shown, from left, are members of the Pre-Med Day planning committee: Dr. Lester Turoczi, professor and chairperson of Biology; Bernie Vinovski, dean of Enrollment Services; John Chwalek, assistant dean of Admissions; Emory Guffrovich, Jr., dean of Admissions; Dr. Dan Kopen, Wilkes alumnus and president of NE Surgical Specialty Group, Inc.; and Dr. Ralph B. Rozelle, dean of Health Sciences.

TL 10/24/94

Wilkes University News

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WILKES UNIVERSITY TO HOST AREA HIGH SCHOOL STUDENTS AT ANNUAL PRE-MED DAY NOVEMBER 4

WILKES-BARRE -- Area high school students and their parents are invited to Wilkes University's annual Pre-Med Day, being held Friday, November 4, in the Dorothy Dickson Dart Center, South and River streets.

Pre-Med Day 1994 is a chance for juniors and seniors to meet with doctors, discuss pertinent medical issues and ask questions concerning careers in medicine. Registration begins at 9 a.m. and the day continues through a noon luncheon.

Highlighting the morning's activities will be the keynote address given by Wilkes University graduate, Dr. Robert Brown, '68, chief of Infectious Diseases at Wilkes-Barre General Hospital. His address is entitled "A Physician's Report on AIDS."

Other Wilkes pre-med graduates and friends of the University will be on hand to serve as panelists for a question and answer period. They include Dr. Maureen Litchman, '78, center director of the Wyoming Valley

-MORE-

1ST ADD - WILKES UNIVERSITY TO HOLD PRE-MED DAY

Family Practice Residency Program, Kingston; Dr. Dan Kopen, '70, Northeastern Surgical Specialty Group Inc., Kingston, and a Wilkes University trustee; Dr. Henry Novroski, family practitioner; Dr. David Greenwald, '66, oncologist; and Dr. John Ellis, '79, oncologist.

In addition, Dr. Ralph Rozelle, dean of health sciences, will discuss various health sciences programs at Wilkes, and Emory Guffrovich Jr., dean of admissions, will provide information on admission to Wilkes University and financial aide opportunities.

Wilkes University has a strong tradition of educating students for the medical profession, with more than 500 students being placed in doctoral professional schools.

For more information on Pre-Med Day 1994 or the health sciences programs at Wilkes, contact the admissions office at 1-800-WILKES-U, or 831-4400.

PHOTO:

The Pre-Med Day Planning Committee, from left: Dr. Lester Turoczi, professor and chairperson of biology, of Wilkes-Barre; Bernie Vinovrski, dean of enrollment services, of Courtdale; John Chwalek, assistant dean of admissions, of Forty Fort; Emory Guffrovich Jr., dean of admissions, of Pittston; Dr. Dan Kopen, Wilkes University alumnus and trustee and president of Northeastern Surgical Specialty Group Inc., of Kingston; Dr. Ralph B. Rozelle, dean of health sciences, of Forty Fort.



AUG 10, 1994

DALLAS POST
DALLAS, PA

WKLY - 4,310

Steelman wins biology award from Wilkes Univ.

Wilkes University senior Scott Steelman recently received the biology department's Biology Research Award for discovering a way to estimate the genetic damage caused by the chromium.

With Scott's new twist on this kind of research, scientists can better estimate the impact of this substance on mice, and perhaps one day, humans, according to Dr. Lester Turoczl, his research supervisor.

Heavy metals such as lead and chrome, found in junk yards across the country, may be just as deadly Turoczl said. As the chrome bumpers and wheels decompose over time, chromium enters the water table. Scientists must learn how this affects the safety of water supplies.

Steelman's interest in this research was fueled by his experience with sophisticated laboratory techniques at Thomas Jefferson University in Philadelphia last summer. He will return to the University to begin graduate studies this fall.



SCOTT STEELMAN

Wilkes University News

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Wilkes University Biology Faculty Choose Two Students to Receive Research Award

Editors: Note connection to your coverage area.

WILKES-BARRE -- Wilkes University's biology professors had a tough decision to make. Each year they get together and vote for one student to receive the Outstanding Biology Research Award. That student is traditionally a graduating senior.

This year the award went to Leila Hadj-Chikh of Campbell, New York, a junior and senior Scott Steelman of Dallas. "We had two excellent candidates," said Biology Department Chair, Dr. Lester Turoczi. "Both students have conducted innovative and thorough research projects and deserve this honor."

Hadj-Chikh has studied the feeding behaviors of grey squirrels since her sophomore year at Wilkes. Her most recent research has focused on the squirrels ability to interpret the quality of the seeds and decide whether to eat them immediately or store them for later use.

Under the supervision of Wilkes University Associate Professor of Biology, Dr. Michael Steele, Hadj-Chikh's research has met with favorable response when presented at the Pennsylvania Academy of the Sciences during a spring meeting in the Poconos and at a conference of the American Society of Mammologists held in Washington, D.C. in June.

MORE

1ST ADD TWO WILKES STUDENTS RECEIVE OUTSTANDING RESEARCH AWARD

"This study will help us to understand how seed consumers, like grey squirrels, disperse seeds and help replant our oak forests," said Steele.

Steelman studied the genotoxic effects of chromium on the spleen cells of mice. Some forms of chromium are found in water. Modifying existing studies, he discovered a way to estimate the genetic damaged caused by the chromium.

"With Scott's new twist on this kind of research, we can better estimate the impact of this substance on mice, and perhaps one day, humans," said Turoczi who served as Steelman's research supervisor.

"People worry about heavy metals, such as lead, but chrome, found in junk yards across the country may be just as deadly," he continued. "As the chrome bumpers and wheels decompose over time, chromium enters the water table. We need to learn how this affects the safety of our water supplies."

Steelman's interest in this research was fueled by his experience with sophisticated laboratory techniques at Thomas Jefferson University in Philadelphia last summer. He will return to the University to begin graduate studies this fall.

PHOTO: From left: Scott Steelman, Leila Hadj-Chikh, and Dr. Lester Turoczi, chairman of the Wilkes University Department of Biology.



REIF SCHOLARS — Wilkes University has announced four recipients of the Charles B. Reif Scholarship for the Biological Sciences for 1992-93. Eric Feese of Catawissa, Kristine Maxwell of Wilkes-Barre, Rima Saad of Mountaintop and Kimberly Thompson of Dallas were recently named as winners of the prestigious scholarship. A senior, Feese is a Presidential Scholar and was named GTE Academic All-American at Wilkes University. A graduate of Southern Columbia, he plans to become a physician. Feese is the son of James and Gail Feese of Catawissa. In addition to the Reif Scholarship, Maxwell received a Grant Barlow Scholarship, Luzerne County Medical Society Ladies Auxiliary Scholarship and the Presidential Scholarship. A senior at Wilkes, she is on the dean's list and is the daughter of Thomas and Barbara Maxwell of

Wilkes-Barre. Upon graduation, Saad hopes to obtain a medical degree or a graduate degree in psychology. While at Wilkes, she received the John Henry Ellis III Scholarship, the Outstanding Freshman Chemistry Award, and the Sophomore Achievement Award. She is the daughter of Dr. Antoine and Helen Saad of Mountaintop. A graduate of Dallas Senior High School, Thompson plans to become a physician. A recipient of the Presidential Scholarship, she has also received the Grace Kimball Scholarship, the Memorial Scholarship and was a Guthrie Scholar in Wilkes-Hahnemann program. She is the daughter of Edward and Theresa Thompson of Dallas. From the left: Dr. Lester Turoczl, chairman of the biology department; Maxwell, Saad, Feese, Thompson, Dr. Charles B. Reif, professor emeritus of biology.

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MOUNTAINTOP EAGLE
MOUNTAINTOP, PA

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REIF SCHOLARS NAMED- Rima Saad of Mountaintop is among the four recipients of the Charles B. Reif Scholarship for the Biological Sciences for 1992-93. Rima hopes to obtain a medical degree or a graduate degree in Psychology. While at Wilkes, she received the John Henry Ellis III Scholarship, the Outstanding Freshman Chemistry Award and the Sophomore Achievement Award. Rima is the daughter of Dr. Antoine and Helen Saad of Mountaintop. Shown, from left, are Dr. Lester Turoczi, chairman of the biology department; Kristine Maxwell, scholarship winner, Rima Saad, Eric Feese, scholarship winner, Kim Thompson, scholarship winner; and Dr. Charles Reif, Professor Emeritus of Biology.

Wilkes University News

Stephanie Simmons
Assistant Director of University Relations
Wilkes-Barre, Pennsylvania 18766
(717) 831-4772/FAX (717) 824-2934

WILKES UNIVERSITY BIOLOGY STUDENTS COMPLETE SUMMER RESEARCH

WILKES-BARRE -- Three Wilkes University biology students spent their summer conducting professional research. Leila Hadj-Chikh, Campbell, N.Y., Darren Michael, Dallas, and Scott Steelman, Dallas, were far from home preparing for their chosen careers.

Leila Hadj-Chikh, a junior biology major, spent part of her summer examining the life history patterns of the eastern mosquito fish in South Carolina at the Savannah River Ecology Laboratory in Aiken. This undergraduate summer research program pairs students interested in ecology with professional researchers. Under the supervision of these advisors, she, along with other students, conducted summer research projects which were part of larger, long-term projects. When her research was complete, she presented her findings in seminars before other students and faculty. She comments, "It was an incredible learning experience, one I'll never forget."

Scott Steelman, a senior biology major, spent part of his summer at Thomas Jefferson University in the molecular biology department in Philadelphia. There, he studied the relationship between bacterial protein with human T cells. He examined how

-MORE-

1ST ADD WILKES UNIVERSITY BIOLOGY STUDENTS

surface proteins of Shigella bacteria interact with human blood cells in causing a severe form of arthritis. Steelman said, "I would classify my summer experience at Jefferson as an invaluable experience that was a great help in advancing my skills as a researcher and as a biology student in general. Personally, I feel that I have gained a greater confidence in myself as a scientist as well as reaffirm my future goals."

Darren Michael, a senior biology major, spent part of his summer working in the Chemistry Department at the University of North Carolina at Chapel Hill. As a participant in the Summer Undergraduate Research Experience (SURE) program, he chose to work with Dr. Gary Pielak's research team. Composed of seven graduate students, a few undergraduates, and Gary, the group's primary interest was the relationship between a protein's amino acid sequence and its relative stability. In the long run, research such as this may allow treatment of various illnesses at the molecular level. He states, "My summer in North Carolina was one of the most enjoyable experiences of my life. As a result of this experience, I have a new appreciation for the tremendous effort which scientific research demands."

"We are pleased to have the caliber of student capable of successfully participating in these prestigious summer undergraduate research positions," said Dr. Lester Turoczi, a professor of biology at Wilkes University. "Each student interacted directly with research scientists at institutions and experienced shared learning with other undergraduate students from other colleges and universities from across the United States."

PHOTO: From left: Dr. Lester Turoczi, chairman of the Wilkes University Biology Department; Leila Hadj-Chikh, Campbell, N.Y.; Scott Steelman, Dallas; and Darren Michael, Dallas.

Wilkes University News

Stephanie Simmons
Assistant Director of University Relations
Wilkes-Barre, Pennsylvania 18766
(717) 831-4772/FAX (717) 824-2934

CHARLES B. REIF SCHOLARS NAMED AT WILKES UNIVERSITY

WILKES-BARRE -- Wilkes University has announced four recipients of the Charles B. Reif Scholarship for the Biological Sciences for 1993-1994. John Dorunda of Taylor, David Hutz of Mountaintop, Darren Michael of Dallas, Karen Pastula of Swoyersville, and James Tricarico of Old Forge were recently named as winners of the prestigious scholarship.

The Charles B. Reif Scholarship in Biological Sciences was established by former students of Dr. Reif, many of whom are physicians, dentists, researchers and teachers. The establishment of the fund recognizes Dr. Reif for his many years of service as a professor of biology and chairman of the Biology Department. Scholarships are provided annually for students who wish to pursue the study of the biological sciences.

Senior John Dorunda, who also received the Sarah D. Moyer Scholarship, was named Outstanding Freshman Chemistry Student, and is the president of the Pre-Med Society. He plans on attending Penn State College of Medicine or Medical College of PA. He is the son of Paul and Barbara Dorunda of Taylor, PA.

-MORE-

1ST ADD REIF SCHOLARS NAMED AT WILKES UNIVERSITY

In addition to the Reif Scholarship, David Hutz received the Outstanding Sophomore Biology Major Award, Mildred Gitten's Memorial Scholarship, and the Wilkes University Presidential Scholarship. He is the son of Mary and Paul Hutz of Mountaintop, PA.

Upon graduation, Darren Michael plans on attending graduate school to study Biochemistry or Molecular Biology. He is a trustee scholar, in the chemistry club, and is on the Dean's List. Darren is the son of Clarence and Morag Michael.

Senior Karen Pastula is involved in the Pre-Med Society, is on the Dean's List, is the Senior Class Treasurer, and is on the women's soccer team. Upon graduation, she plans to attend medical school or graduate school to pursue a career in public health. She is the daughter of Elaine and Andrew Pastula of Swoyersville, PA.

Upon graduation, senior James Tricarico plans on attending medical school to become a physician. He is a member of the Pre-Med Society and was awarded the Outstanding Academic Achievement Award in 1992. He is the son of James and Andrea Tricarico.

Photo: Shown at a recent meeting announcing the Cahrls B. Reif Scholars for 1993-1994 are seated from left: John Dorunda and James Tricarico. Standing from left are: Karen Pastula, David Hutz, Darren Michael, Dr. Lester Turoczi, professor of Biology at Wilkes University, and Dr. Charles Reif, Professor Emeritus of Biology.

Schools & Colleges

Wilkes University's Guthrie Scholars doing clinical research at Robert Packer Hospital

The Guthrie Scholars of the Hahnemann/Wilkes University Program have begun the clinical research phase of their education at the Robert Packer Hospital in Sayre.

The students are attending medical lectures, studying medical ethics and participating in a cooperative education experience with an occupational medicine specialist.

IN PHOTO AT RIGHT, from left, are Dr. Les Turoczi, chairman of the biology department at Wilkes; Kristine Maxwell, Wilkes-Barre; Harry Rose, Exeter, and Kimberly Thompson, Dallas, three of the Guthrie Scholars, and Dr. Ralph Rozelle, dean of health sciences at Wilkes.

The Guthrie Scholars of the Hahnemann/Wilkes Program is a cooperative effort motivated by the regional need for physicians interested in serving rural and semi-rural health care delivery. Each institution is also interested in attracting students and staff members of superior ability and accomplishments.

Established in 1991, the program gives outstanding Wilkes students assurance of early admission to



the Hahnemann University School of Medicine. This allows them to focus their attention on academic excellence rather than the admissions process.

As Guthrie Scholars, the students were simultaneously admitted to Wilkes University and the Hahnemann Medical School, contingent on an interview at Hahnemann and their maintenance of a B+, or higher, average in their pre-medical science courses at Wilkes. There will be significant financial aid for the Guthrie Scholars in their senior year at Wilkes.

Hahnemann University, located

in the center of Philadelphia, is an academic health center with four primary missions: patient care, education, research and community service.

It includes the School of Medicine, the Graduate School and the School of Health Sciences and Humanities, with a total of more than 2,000 students, as well as Hahnemann University Hospital, a 616-bed tertiary care facility.

The Guthrie Healthcare system is a premier health care provider in the northern tier of Pennsylvania and the southern tier of New York. Guthrie's primary missions are patient care, medical education and research.

Wilkes University News

Stephanie Simmons
Assistant Director of University Relations
Wilkes-Barre, Pennsylvania 18766
(717) 831-4772

WILKES BIOLOGY DEPARTMENT HOSTS LECTURER FROM ACADEMY OF NATURAL SCIENCES

PHOTO: WILKES-BARRE--The Wilkes University biology department recently hosted a lecture featuring Robert W. Sanders, a member of the division of environmental research at the Philadelphia Academy of Natural Sciences. Sanders lecture was titled "Microscopic Mixotrophs in Lakes and Oceans: Are They Plants or Animals or Both?" From left: Dr. Lester Turoczi, chairman of the biology department at Wilkes University ; Dr. Robert Sanders, Guest Speaker; Dr. Kenneth Pidcock, assistant professor of biology at Wilkes University.

FROM THE DESK OF

LESTER J. TUROCZI, Ph.D.

CHAIRMAN, DEPARTMENT OF BIOLOGY

file 6-29-92
Lester Turoczy

|||||

Mark

For use in the Quarterly.

copy made
for Nedra

You may want to cite this prestigious award of
a Howard Hughes Research Fellowship to Renee Strucke
who graduated 3 years ago from our dept. (See her
enclosed letter & my response.)

Thanks, L

99 Mason Terrace
Brookline, MA 02146
April 7, 1992

Lester Turoczi, Ph.D.
Dept. of Biology
Wilkes University
Wilkes-Barre, PA 18766

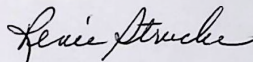
Dear Dr. Turoczi:

I am writing to inform you that I have been named a Howard Hughes Research Fellow for the year 1992-1993. I will be working in the laboratory of Dr. Paul Bleicher at the Cutaneous Biology Research Center of the Massachusetts General Hospital, which is a Harvard Medical School affiliate. My project involves the role of certain T-cells in inflammatory skin diseases. I am quite excited by this opportunity as it allows the investigation of a clinical syndrome using basic science principles, thereby integrating the two components of my training in medical school.

I would like to thank you for writing a letter in support of my application. I am sure that your recommendation as my former research mentor was very important in my selection from a group of highly qualified applicants. For your information, 60 students were awarded fellowships this year, and eleven of these were from Harvard.

I will be in touch as I begin my research and I will keep you informed of my progress. Please pass on my good news and best wishes to everyone in the department. Please let me know of any new developments at Wilkes.

Sincerely,

A handwritten signature in cursive script, reading "Rence Strucke".

Rence Strucke



WILKES UNIVERSITY

School of Science and Engineering • Biology Department

June 19, 1992

Dr. Renee Strucke
99 Mason Terrace
Brookline, MA 02146

Dear Renee,

I have been away this past semester on sabbatical leave so your letter of April 7 was only recently opened.

Congratulations on the Howard Hughes Fellowship!!

You should find that research experience to be a real plus for your personal growth and scientific maturation. I know you'll do it justice.

I take note that you are the first of my former independent research students to become a Hughes Fellow, and I share in your joy along with some pride as well.

All appears to be going well on campus. I am currently teaching my summer course in Biology of Cancer, and it seems to be going smoothly and well. The University has survived my time away quite nicely. Incidentally, I was at Merck Research Labs in Rahway, N. J., learning new techniques in cell culture at Dr. Greg Hollis's Molecular Biology Lab. It went really well, and I hope to bring those new techniques on-board in my own lab here soon.

In closing, congratulations and best wishes on the fellowship. Please keep me posted on your progress and don't hesitate to stop by if you are in the area.

Warmest regards,

Lester J. Turoczi, Ph.D.
Professor and Chairman





Howard Hughes Medical Institute

Joseph G. Perpich, M.D., J.D.
Vice President
Grants and Special Programs

6701 Rockledge Drive
Bethesda, Maryland 20817
(301) 571-0335

June 1992

TO: Deans, Directors, Department Chairs

FROM: Joseph G. Perpich *Joseph G. Perpich*

SUBJECT: 1992 Fellowship Awards
Predoctoral Fellowships in Biological Sciences
Research Training Fellowships for Medical Students

The attached press release announces the names of the 70 students selected for predoctoral fellowships and the 76 students selected for new or continuing awards under the medical student fellowship program, in the 1992 competitions.

See Next To Last Page

Program announcements and applications for the 1993 competitions will be available in September for these fellowships and the Postdoctoral Research Fellowships for Physicians. We especially ask that you bring these programs to the attention of your colleagues and students.

To request further information on these programs and other programs of the Institute, contact the following:

Predoectoral Fellowships in Biological Sciences

Hughes Predoectoral Fellowships
Fellowship Office
National Research Council
2101 Constitution Avenue
Washington, DC 20418
(202) 334-2872

All other programs

Howard Hughes Medical Institute
Office of Grants and Special Programs/DDC92
6701 Rockledge Drive
Bethesda, MD 20817
(301) 571-8412

Contact: Frank Blanchard
(301) 571-0574

6701 Rockledge Drive
Bethesda, MD 20817

**Howard Hughes Medical Institute
awards 146 fellowships
for graduate education, medical student training**

BETHESDA, Md., June 3, 1992 — The Howard Hughes Medical Institute today announced the award of 146 fellowships supporting graduate education in the biological sciences and training of medical students in basic biomedical research.

The awards include 70 five-year fellowships for study toward Ph.D. degrees in the biological sciences and 76 fellowships to medical students.

"Once again we are pleased with the exceptional quality of these talented and committed awardees," said HHMI President Purnell W. Choppin, M.D. "We are beginning to see the early outcomes of these programs, as predoctoral fellows from prior years complete their Ph.D. degrees and the medical student fellows present their research at a conference we convene annually in Bethesda. They have just begun to fulfill their great promise for significant contributions to biomedical research."

Joseph G. Perpich, M.D., J.D., vice president for grants and special programs, said, "The Institute now supports almost 400 students at more than 50 academic institutions through the predoctoral and medical student fellowship programs. We are especially pleased that in both programs 10 to 15 percent of the awards have gone to outstanding students from minority groups underrepresented in the sciences, including blacks, Hispanics, Native Americans, and Native Pacific Islanders."

(over)

Howard Hughes Medical Institute Office of Grants and Special Programs

PREDOCTORAL FELLOWSHIPS IN BIOLOGICAL SCIENCES 1992 FELLOWS

<u>Name</u>	<u>Undergraduate Institution, Year of Graduation</u>	<u>Fellowship Institution</u>
Biochemistry and Structural Biology		
David Min Chao	Harvard University, 1989	Massachusetts Institute of Technology
Melinda Bonnie Fagan	Williams College, 1992	Stanford University
David Henry Hackos	Johns Hopkins University, 1991	University of California - San Francisco
Stuart Spencer Licht	Princeton University, 1992	Massachusetts Institute of Technology
I-Fan Theodore Mau	Harvard University, 1992	University of California - San Francisco
Kayvan Roayaie	Rutgers the State University of New Jersey - New Brunswick, 1991	University of California - San Francisco
Jennifer Ellen Schmidt	University of Washington, 1992	University of Washington
Kyle John Vogan	McGill University, Canada, 1992	McGill University, Canada
Edgar Chong Young	University of Toronto, Canada, 1991	Brandeis University
Karen Marie Zito	Indiana University - Bloomington, 1991	University of California - Berkeley
Biostatistics, Epidemiology, and Mathematical Biology		
Anne M. Bronikowski	Marquette University, 1987	University of Chicago
Michael Joseph Daniels	Brown University, 1991	Harvard University
Cell Biology and Immunology		
Jose Antonio Alcantara	Pennsylvania State University, 1988	University of Pennsylvania
Lara Jane Ausubel	Harvard University, 1989	Harvard University
Michelle Leigh Boytim	University of Miami, 1992	Stanford University
Bradley Brian Brasher	Colorado State University, 1990	Harvard University
George Yen-Hsi Liu	California Institute of Technology, 1990	University of Cambridge, England
Ellen Annette Lumpkin	Texas Tech University, 1991	University of Texas Southwestern Medical Center
Thomas Nicholas Moreno	University of California - Davis, 1992	University of California - San Diego
Helen Chun-Hui Su	Brown University, 1990	Brown University
Jennifer Jo Wernegreen	Earlham College, 1992	Yale University
Carol Norris White	University of Connecticut, 1974	University of Connecticut

Howard Hughes Medical Institute Office of Grants and Special Programs

PREDOCTORAL FELLOWSHIPS IN BIOLOGICAL SCIENCES 1992 FELLOWS

<u>Name</u>	<u>Undergraduate Institution, Year of Graduation</u>	<u>Fellowship Institution</u>
Biochemistry and Structural Biology		
David Min Chao	Harvard University, 1989	Massachusetts Institute of Technology
Melinda Bonnie Fagan	Williams College, 1992	Stanford University
David Henry Hackos	Johns Hopkins University, 1991	University of California - San Francisco
Stuart Spencer Licht	Princeton University, 1992	Massachusetts Institute of Technology
I-Fan Theodore Mau	Harvard University, 1992	University of California - San Francisco
Kayvan Roayaie	Rutgers the State University of New Jersey - New Brunswick, 1991	University of California - San Francisco
Jennifer Ellen Schmidt	University of Washington, 1992	University of Washington
Kyle John Vogan	McGill University, Canada, 1992	McGill University, Canada
Edgar Chong Young	University of Toronto, Canada, 1991	Brandels University
Karen Marie Zito	Indiana University - Bloomington, 1991	University of California - Berkeley

Biostatistics, Epidemiology, and Mathematical Biology

Anne M. Bronikowski	Marquette University, 1987	University of Chicago
Michael Joseph Daniels	Brown University, 1991	Harvard University

Cell Biology and Immunology

Jose Antonio Alcantara	Pennsylvania State University, 1988	University of Pennsylvania
Lara Jane Ausubel	Harvard University, 1989	Harvard University
Michelle Leigh Boytln	University of Miami, 1992	Stanford University
Bradley Brian Brasher	Colorado State University, 1990	Harvard University
George Yen-Hsi Liu	California Institute of Technology, 1990	University of Cambridge, England
Ellen Annette Lumpkin	Texas Tech University, 1991	University of Texas Southwestern Medical Center
Thomas Nicholas Moreno	University of California - Davis, 1992	University of California - San Diego
Helen Chun-Hui Su	Brown University, 1990	Brown University
Jennifer Jo Wernegreen	Earlham College, 1992	Yale University
Carol Norris White	University of Connecticut, 1974	University of Connecticut

Howard Hughes Medical Institute Office of Grants and Special Programs

PREDOCTORAL FELLOWSHIPS IN BIOLOGICAL SCIENCES 1992 FELLOWS

<u>Name</u>	<u>Undergraduate Institution, Year of Graduation</u>	<u>Fellowship Institution</u>
Neuroscience and Physiology		
Michael Stephen Beauchamp	Harvard University, 1992	University of California - San Diego
Mark Christopher Bieda	Harvard University, 1990	Stanford University
Solange Pezon Brown	Princeton University, 1990	Harvard University
Jennifer Arwen Cummings	University of Texas - Austin, 1992	University of California - San Francisco
Hannah Alice Dvorak	Queen's University, Canada, 1992	California Institute of Technology
Eva Marie Finney	University of Florida, 1992	University of California - Berkeley
Joanne Fraher	Rutgers the State University of New Jersey - New Brunswick, 1992	University of Pennsylvania
Yuval Gazit	Tel Aviv University, Israel, 1991	Massachusetts Institute of Technology
Takao Kurt Hensch	Harvard University, 1988	University of California - San Francisco
Anton Edward Krukowski	Yale University, 1991	University of California - San Francisco
Matthew Swan Lawrence	Harvard University, 1991	Stanford University
Jennifer Fran Linden*	Harvard University, 1991	California Institute of Technology
Henry Wiltshire Mahncke	Rice University, 1992	University of California - San Francisco
Jennifer Ann Martino	College of Saint Elizabeth, 1991	Rutgers the State University of New Jersey - New Brunswick
Mireya Nadal-Vicens	Harvard University, 1991	Stanford University
Rhett Valino Pascual	University of California - Berkeley, 1990	University of California - Berkeley
Deborah Melissa Redish	Stanford University, 1992	Massachusetts Institute of Technology
Naomi Leah Ruff	University of Maryland College Park, 1989	University of California - San Diego
Chris Schafmeister	Simon Fraser University, Canada, 1990	University of California - San Francisco
Christine Theresia Schulteis	University of California - Los Angeles, 1990	University of California - Los Angeles
Martin Bernard Stemmler	Johns Hopkins University, 1991	California Institute of Technology
Ramon Kenneth Tabtiang	University of Cambridge, England, 1991	University of California - San Francisco
Jennifer Wahlsten	University of Minnesota - Twin Cities, 1991	University of Minnesota - Twin Cities

* Award deferred from 1991

**Howard Hughes Medical Institute
Office of Grants and Special Programs**

**RESEARCH TRAINING FELLOWSHIPS FOR MEDICAL STUDENTS
1992 FELLOWS**

Initial Awards -- First Year of Research

<u>Name</u>	<u>Fellowship Institution</u>	<u>Research Mentor</u>	<u>Department</u>
Biochemistry and Structural Biology			
Andrew C. Hecht	Harvard University	Benjamin V. Treadwell	Orthopaedic Surgery
Michael George Jacoby IV	Washington University	David P. Cistola	Biochemistry
Cindy Levine	Cornell University Medical Center	David Hajjar	Biochemistry
Melinda Aileen Maggard	Harvard University	Patricia K. Donahoe	Pediatric Surgery
Biostatistics, Epidemiology, and Mathematical Biology			
Kenneth Charles Goldberg	Medical College of Wisconsin	Arthur Hartz	Biostatistics
Cell Biology and Immunology			
Peter Alan Barton	University of Michigan - Ann Arbor	Jeffrey S. Warren	Pathology
Tamara Nathan Bloch	University of Chicago	Kevan C. Herold	Endocrinology
Judson Michael Brandeis	Harvard University (Vanderbilt University)*	Charles B. Carpenter	Immunogenetics
Brian Eugene Brigman	University of North Carolina - Chapel Hill	Albert Baner	Surgery
Christopher Hayden Cabell	Duke University	Perry J. Blackshear	Medicine
John Dwight Chen	Stanford University	David T. Woodley	Dermatology
Briggs Edward Cook	Johns Hopkins University	Ruben Adler	Ophthalmology/Neuroscience
Michael Jay Fisher	Harvard University	Alan D. D'Andrea	Pediatric Oncology
Tony Friedman	Duke University	Mary Louise Markert	Pediatrics
Tejal Kanti Gandhi	Harvard University	Bruce Zetter	Surgery
Robert Ronald Hergan, Jr.	University of Pennsylvania	William Ming Fu Lee	Medicine
Jennifer Lynn Hunter	Duke University	James Dirk Iglehart	Surgery
Rainu Kaushal	Harvard University	Bernardo Nadal-Ginard	Cardiology
Sunjay Kaushal	Harvard University (Johns Hopkins University)*	Vijak Mahdavi	Cardiology/Genetics
Daniel Lewis Kraft	Stanford University	Irving L. Weissman	Pathology

* A medical school affiliation other than the fellowship institution is indicated in parentheses.

**Howard Hughes Medical Institute
Office of Grants and Special Programs**

**RESEARCH TRAINING FELLOWSHIPS FOR MEDICAL STUDENTS
1992 FELLOWS**

Initial Awards -- First Year of Research

<u>Name</u>	<u>Fellowship Institution</u>	<u>Research Mentor</u>	<u>Department</u>
Cell Biology and Immunology (continued)			
Phillip R. Kravetz	Harvard University (University of Michigan - Ann Arbor)*	Arthur B. Pardee	Molecular Pharmacology
Katherine Paige Lemon	Harvard University	John Blenis	Molecular Physiology
Steven P. Leon	Harvard University	Peter McL. Black	Neurosurgery
James M. Malone III	University of Nebraska Medical Center	Peter Kolbeck	Pathology
Ryland Melford III	Washington University	Edwin McCleskey	Cell Biology and Physiology
Michael E. Mitchell	Harvard University	James Cunningham	Hematology
John Edwin Monks	Duke University	Dani P. Bolognesi	Surgery/Microbiology
Sam Peyvand Mostafapour	Stanford University	Brian Kobilka	Molecular and Cell Physiology
George Braxton Payne	Duke University	Mariano Garcia-Blanco	Medicine
Amy Estelle Pickar	Duke University	Hilliard F. Seigler	Microbiology and Immunology
Barbara Ann Pippin	University of Pittsburgh	Michael T. Lotze	Surgery/Molecular Genetics
Stacy Lynne Smith	Harvard University	Judah Folkman	Surgery
Kimberly Crapo Stone	Duke University	Michael P. Sheetz	Cell Biology
Renee J. Strucke	Harvard University	Paul Bleicher	Dermatology
William Hudson Sweatt	Johns Hopkins University	James E.K. Hildreth	Pharmacology
Alison Patricia Toth	Duke University	Sean P. Scully	Orthopaedic Surgery

<u>Name</u>	<u>Fellowship Institution</u>	<u>Research Mentor</u>	<u>Department</u>
Genetics and Molecular Biology			
Hugh B. Carey	Yale University (University of Connecticut)*	Michael Kashgarian	Pathology
Rohan Hazra	Johns Hopkins University	Garry R. Cutting	Pediatrics
Catherine Marshall Hurt	University of California - San Francisco	Mary L. Williams	Dermatology/Pediatrics
Jennifer Ellen Lawrence	Johns Hopkins University	Arthur Feldman	Medicine

Ethics Institute planning science, technology parley

The Ethics Institute of Northeast Pennsylvania will host a science and technology conference March 25 from 7 to 9:15 p.m. at Ramada Hotel, Public Square, Wilkes-Barre. It is sponsored by Wilkes University and College Misericordia. Educators, students, public officials and professionals are encouraged to attend.

Seated, from the left, are Siena Finley, RSM, director, Ethics Institute of Northeast Pennsylvania, and Dr. Ashim Basu; standing, Dr. Hal Baillie, Sister Patricia Lapczynski, moderator, ethics in science and technology workshop; Dr. Lester Turoczi and Dr. Michael Garr.

A registration fee is required. For more information, contact the Institute at 674-6201 ext. 201.

Dr. Baillie, a University of Scranton philosophy professor, will lead a discussion on ethical decision making in the issues of science and technology. Dr. Turoczi, chairman of the Wilkes biology department, will address ethical issues of high-tech science areas such as genetic engineering and gene therapy. The relationship between science and society and the dilemmas of power and control will be discussed by Dr. Garr, Wilkes associate professor of sociology. Dr. Basu, professor of health service administration and public policy at Wilkes, will focus on the role of policy makers in the regulation of technology for public interest.





Science and technology conference slated 2/13_{7L}

The Ethics Institute of Northeast Pennsylvania will host a Science and Technology Conference on March 25 from 7 p.m. to 9:15 p.m. at the Ramada Inn on Public Square in Wilkes-Barre. Some of the issues that will be discussed at the conference are: ethical decision making, genetic engineering and gene therapy, the relationship between science and society and the role of public policy makers in the regulation of technology. Registration fee is \$10 for the general public and

\$3 for students. For more information, contact the institute at 674-6201, ext. 201. Shown, seated from left: Siena Finley, RSM, institute director; Ashim Basu, professor of health science administration, Wilkes University. Standing, from left: Hal Baillie, professor of philosophy, University of Scranton; Sister Patricia Lapczynski, workshop moderator; Lester Turoczy, professor of biology at Wilkes University; Michael Garr, associate professor of sociology and anthropology at Wilkes.

MOUNTAINTOP EAGLE

MOUNTAINTOP, PA
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REIF SCHOLARS NAMED AT WILKES- Kimberly Gavel of Mountaintop is among the four recipients of the Charles B. Reif Scholarship for the Biological Sciences for 1991-92 at Wilkes University. Kimberly plans to attend graduate school to pursue a masters degree in environmental toxology. A senior at Wilkes, Kimberly received the presidential Scholarship and is on the Dean's List. Shown, from left, are Dr. Lester Turóczi, Chairman of the Biology Department; Kathleen Flaim, Charlotte Hoffman, Robert Midgett, Kimberly Gavel and Dr. Charles B. Reif, Professor Emeritus of Biology.

RECEIVED

CURRICULUM VITAE

SEP 7 1989

PUBLIC RELATIONS
OFFICE

9-27-89

NAME: Lester J. Turoczi

TITLE: Professor of Biology, and
Chairman, Department of Biology

BIRTHDATE: November 13, 1942

PLACE OF BIRTH: Jersey City, New Jersey

ADDRESS: (Home) 114 Reliance Drive
Wilkes-Barre, PA 18702 (Office)
Wilkes College
Department of Biology
Wilkes-Barre, PA 18766

TELEPHONE: (Home) 717/824-6753 (Office)
717/824-4651, Ext. 4754

HEALTH: Fine

MARITAL STATUS: Single

SOCIAL SECURITY NUMBER: 137-34-6129

EDUCATION:

<u>Institution and Location</u>	<u>Degree</u>	<u>Year Conferred</u>
Rutgers University Newark, New Jersey	B.A.	1965
Rutgers University New Brunswick, New Jersey	M.S.	1967
Rutgers University New Brunswick, New Jersey	Ph.D.	1972

Dissertation Title: Aspects of Aging in Drosophila melanogaster:
Significance of Time-Related Modifications.

POSITIONS:

1984 - Present	Wilkes College, Professor and Chairman, Department of Biology
1976 - 1984	Wilkes College, Associate Professor and Chairman, Department of Biology
1975	Pennsylvania State University, Visiting Lecturer
1972 - 1975	Wilkes College, Assistant Professor of Biology
1968 - 1972	Rutgers University, Instructor of Biology
1966 - 1968	Rutgers University, Teaching Assistant in Biology
1965 - 1966	Rutgers University, Research Assistant in Genetics

PUBLICATIONS AND RESEARCH ENDEAVORS:

1. The effects of Erythorbic Acid Treatments on Melanin Synthesis and on the Adult Lifespan in *Drosophila melanogaster*. Proc. Nat'l Acad. Sci., USA, 56: 1743-1745 (1966) with K. C. Sondhi
2. A Motorized Brush for Small Laboratory Cleaning Needs. Drosophila Information Service (DIS), 43: 190 (1968)
3. Studies in Mutagenesis and Anti-Mutagenesis. I. Analysis of Chromium, Selenium, Vitamin B-15 (Pangamic Acid), and Ginseng (Panax). Proc. Pa. Acad. Sci., 57: 181-184 (1983) with Janis Fegley and Laura Fedak
4. Studies in Mutagenesis and Anti-Mutagenesis. II. A Modified Micronucleus Test as a Genotoxic Screen Using Vitamin C. Proc. Pa. Acad. Sci., 57 : 185-189 (1983) with Christopher J. Woolverton
5. Studies in Mutagenesis and Anti-Mutagenesis. III. A Modified Micronucleus Test as a Genotoxic Screen Using Vitamin A. Proc. Pa. Acad. Sci., 58 : 118 (1984) with Janis Fegley (Abstract)
6. A Genetic Toxicology Study of L-Canavanine Utilizing the Salmonella/Microsomal Mutagenicity Assay and the Micronucleus Test. Abstract to Pennsylvania Academy of Sciences for Spring 1985 Meetings, with Anthony Morollo, and, presented in an enlarged version to the Environmental Mutagen Society Conference, April 1986, Baltimore, MD
7. Cobaltous Acetate: A Genotoxic Analysis. Presented in April 1987 at Environmental Mutagen Society Conference, San Francisco, California.
8. Dithiothreitol: A Genotoxic Analysis. Presented at Genetic Toxicology Association Meeting, Princeton, New Jersey, November 1987.
9. Identification of Three New Immunoglobulin Lambda-Like Genes in Man. J. Exper. Med., 163: 425-435 (1986). Coauthored with H. Chang et al. of the National Cancer Institute.
10. The Expectations and Boundaries of Human Gene Therapy: A Commentary. J. PA. Acad. Sci. 62: 164-166 (1988).
11. Bookreview for Bioscience, The A.I.B.S. Journal, 39 :267 (1989) with K. Klemow on Tootill's, "The Facts on File Dictionary of Biology".
12. The Effect of Music Modality on Immunoglobulin A, accepted for publication in J. PA. Acad. Sci. 63: 1989 with coauthors C. Charnetski, G. Strand, M. Olexa, and J. Rinehart.

Following is a list of research projects which were performed in conjunction with undergraduate biology majors and reported at the annual Eastern Colleges Science Conference between 1973 and 1989:

- Drosophila Aging and Fecundity Analysis--with E. Marban
- Acrylamide Gel Electrophoresis Apparatus Development--with G. Hollis
- Drosophila Age Pigment Biophotography--with R. Clompus
- Drosophila Eye Pigment Chromatography--with A. Falkowski
- Biochemical Characterization of Drosophila eye pigments--with J. Wallace
- Human Chromosome Karyotyping and Micronucleus Determination in the Presence of Ascorbic Acid--with J. Metzger and L. Caputo
- Age-related Human Micronucleus Analysis--with S. Rogers and S. Silver
- Influence of Microwave Radiation on Mouse and Drosophila Behavior and Genetics--with G. Edwards, D. Palanzo, L. Vekkos, D. Harcharik
- Ames Testing of Susquehanna River Samples for Potential Mutagens--J. Andrade and D. Blumfield
- Ames Testing of Vitamins C and E in High Dosages--with M. Clifford and G. Dugan
- Micronucleus Testing of Synthesized Hadacidin Derivatives in the Mouse--with D. Kuzminski
- The influence of temperature on the storage and stability of Ames Test Salmonella Tester Strains--with Donna Nitka and Laura Fedak
- A mutagenicity assay of Selenium compounds utilizing the Ames Test--with John Wartella
- Genotoxic Studies of Cobaltous Acetate Utilizing the Ames Test and the Mouse Micronucleus Test--with Melissa Bauzon and Lori Kocur
- Genotoxic Studies of L-Canavanine and its Nitrosated Derivatives--with Anthony Morollo
- Genotoxic studies of dl-Dithiothreitol--with C. Dougherty and L. Mikulis
- The influence of aged cryoprotectant on storage of Ames Test Salmonella strains--with John Jankowski
- An Ames Mutagenicity Assay for Pyrrolizidine alkaloids in Echium vulgare --with Mary Elizabeth Montaldi
- A Dose Dependent Mutagenicity Assay of Echium vulgare Leaf Infusions Utilizing the Mouse Micronucleus Test--with Renee Strucke
- Determination of the Mutagenic Potential of the Medicinal Herb Echium vulgare in Acute and Sub Chronic Toxicity Studies Utilizing the Mouse Micronucleus Test--with David Garber

SPECIAL PROJECTS AND COLLEGE SERVICE:

- Reviewer of two grant proposals in Biotechnology made to the Ben Franklin Technology Partnership, Bethlehem, Pa., Dec., 1988
- Reviewed two papers for the "Journal of the Pennsylvania Academy of Science, May and Oct., 1988
- Reappointed as Biology Chairman, Fall 1988 by college administration
- Selected by graduating class of 1987 to present "Charge to the Graduates" at commencement
- Visiting Scientist, Summer 1983 and 1984, National Cancer Institute, NIH, Bethesda, MD. Molecular Biology and Gene Mapping
- Visiting Scientist, Sabbatical Academic Year 1981, Loma Linda Univ. Medical School - Dept. of Microbiology, Loma Linda, California. Gene Regulation in the virus phi X174
- Visiting Scientist, Summer 1980, University of Texas, Houston, Graduate School of Biomedical Science, Research in Genetic Toxicology

- Freshman College Program Development, Wilkes College
- Weekly Radio Program on College FM Station called "Biological Perspectives", 1974-78.
- Coordinator of Science Expo Programs for visiting high school seniors-- six years at Wilkes College
- Institutional Coordinator for annual Eastern College Science Conference, 1974-1985
- Escorted students on field course to Galapagos Islands in 1976
- Chairman of Student Life Committee for Middle State Accrediation Review
- College Committee Memberships on:

Curriculum Committee	Concert and Lecture Series Committee
Faculty Policy Committee	Academic Dean Search Committee
Student Life Committee	Mission Task Force
Middle States Evaluation- Self-Study Committee	Health Sciences Committee

SELECTED CONFERENCE/WORKSHOP PARTICIPATION:

- 1989 Hastings Center Bioethics Conference, June 1989 in New York City on "Ethics-Human Nature-Medical Progress".
- 1988 Workshop in Tissue Culture - Techniques for Life Scientists in January 1988 at Catholic University of America, Wash., D.C.
- 1987a Representative at Second International Congress on Ethics in Medicine, New York City, Beth Israel Medical Center
- 1987b Participant at Association of Biology Laboratory Educators (ABLE) Meeting at University of Minnesota
- 1985a Shortcourse in Electron Microscopy and X-ray Microanalysis, Lehigh University, Bethlehem, PA
- 1985b Workshop on Methods in Scanning Electron Microscopy for Biologists, SUNY - New Paltz, NY
- 1984 Symposium on Molecular Biology, Pennsylvania State Univ.
- 1983 Hastings Center Workshop on Bioethics of Fetal Research, Hastings-on-Hudson, NY
- 1982 Gordon Conference on Genetic Toxicology, Colby College, New Hampshire
- 1980 Eucaryotic Gene Expression and Cancer Biology-Given Institute, Aspen, Colorado
- 1979 High Resolution Chromosome Analysis-Given Institute
- 1978 Human Ecology Seminar-American University, Washington, D.C.
- 1977 Biomedical Issues in a Medical Context Conference-Stanford Univ.
- 1977 Biomedical Ethics and Fetal Research Seminar-Hastings Center, NY

CAMPUS ADVISORSHIP:

Faculty Advisor to:

Human Services Committee; Biological Society (AIBS); Photography Club; Class of 1980; Inter-dormitory Council Football team

Invited Speaker to:

Wilkes College Student Body May 1986 to present a philosophical lecture as part of the Student Government Activities Center Board "Last Lecture" Series

PROFESSIONAL MEMBERSHIPS:

The Society of the Sigma Xi
 American Association for the Advancement of Science
 American Association for Cancer Education
 American Society of Zoologists
 Pennsylvania Academy of Sciences
 New York Academy of Science
 Environmental Mutagen Society
 Genetic Toxicology Association
 Hastings Center-Institute for Society, Ethics and the Life Sciences
 Biological Photographers Association
 Wilkes-Barre/Scranton Medical Ethics Group
 College Misericordia Institute of Gerontology
 Newly Appointed to -
 1. Membership Chairman for Eastern Pennsylvania of the Pennsylvania Academy of Sciences
 2. Board of Directors of the Eastern Colleges Science Conference, April 1986, based at Providence College, Providence, Rhode Island

MAJOR PROFESSIONAL INTERESTS:

Developmental Genetics; Genetic Toxicology and Mutagenesis; Molecular Biology; Gerontology; Regulatory Biology; Bioethics.

GENERAL INTERESTS:

Music; Photography; Travel; Reading.

SPECIAL HONORS:

- 1985 Carpenter Outstanding Teacher Award for 1985 - Wilkes College
- 1975-1988 Research Grants for Annual and Summer Research Projects.
Typical grant per year of \$600.-\$900.
- 1987 Wilkes College Nominee as Outstanding College Professor in Pennsylvania to Council for the Advancement and Support of Education (C.A.S.E.), Washington, D.C.

Faculty Resume Information Sheet

OCT 21 1983

Full Name TUROCZI, LESTER
Last First M.I. M. I. TURCOTTE
FOR ACADEMIC TRAINING

School or College and Department College of Arts & Sciences, Biology Dept.

Age as of September 1, 1988, Date of Birth 45 years - 11-13-42

Academic Rank Professor

Full-Time ☒ Part-Time ☐

Non-Wilkes College Teaching, If Part-Time _____

Earned Degrees	Name of Institution	Location	Area, Field or Major	Degree Received	Date Conferred
	Rutgers University	Newark, N.J.	Biology	B.A.	1965
	" "	" "	Zoological Sci.	M.S.	1967
	" "	New Brunswick	Genetics	Ph.D.	1972

Teaching Experience Incl. Wilkes	Name of Institution	Location	Subjects/ Fields Taught	Full or Part-Time Rank	Dates of Service From - To
	Wilkes College	W-B, PA	Biological	Full-Time	1972-Pres.
	Penn State University	Lehman, PA	Genetics	Part-Time	1975-76

Non-Teaching Experience

Full-Time	Firm or Organization or Self-Employed	Duties	Title	Dates of Service From - To
Part-Time				

List Major Consulting Activities

Wilkes College Quarterly Magazine - Consulting Editor

Bibliographic Citation of Principal Publications - Last Five Years

Proc. Pa. Acad. Sci. - "Human Gene Therapy Bioethics" - 1989 Vol. 62
" " " " - "Studies in Mutagenesis I" - 1983
" " " " - "Studies in Mutagenesis II" - 1983
Human Genetics - Identification of three new Lambda-Like Genes in Man - 1987

Memberships in Professional and Scientific Societies

Scope:

Organization Name	Local, State, Regional, National		Offices Held
	Local	State	
A.A.A.S.		National	-
Penna. Acad. Sci.		State	-
N.Y. Acad. Sci.		National	-
Environ. Mutagenesis Soc.		International	-
Eastern Colleges Science Conf.		Regional	Vice-President

Teaching at Wilkes 1988-89 (including teaching overloads)

Course Title	Hrs. of Lecture per Week	Hrs. of Recitation per Week	Contact Hrs. of Laboratory per Week	# of Day Sections; Enrollment	# of Evening or Weekend Sections; Enrollment
Fall '88 Bio. Sci. I	2	-	-	1:70	
Total of Genetics	2	-	3	1:17	
Students Taught					
86 Various Labs	-	-	3	1:20	
Spring '89 Anticipated					
Bio. 224 - Cell & Molecular Bio.	4	-	-	1:60	
Total of Students Projected					
Bio. 315 - Molecular Bio.	3	-	-	1:20	
Various Labs.	-	-	3	1:25	

Other Duties Performed for Base Salary, 1988-89 (Full-Time Faculty)

Duty/Activity	Hours per Week	# of Advisees: 30
Advising	6	
Research/Scholarship	10	
Committee Work	3	
Department Chairperson	10	

Other Duties for Extra Compensation, 1988-89 (Full-Time Faculty)

Duty/Activity	Hours per Week

esc

9-26-88

Bacterial Tests for Potential Carcinogens

New short-term tests can identify environmental agents that cause damage to DNA, the primary event in chemical carcinogenesis. The tests are also valuable for clarifying the mechanism of DNA damage

by Raymond Devoret

The fact that physical and chemical agents in the environment enhance the incidence of cancer has become of great concern. It is clear that an adequate limitation of human exposure to carcinogens would save lives. To identify potential carcinogens in the environment is therefore an urgent task. In the case of chemical carcinogens that is no easy matter. It is estimated that more than 50,000 different man-made chemicals are currently in commercial and industrial use; between 500 and 1,000 new chemicals are put on the market every year. The standard animal tests for potential carcinogenicity take a long time and cost a great deal of money.

Fortunately there is an alternative to the classical animal tests. One can take advantage of the profound unity of living matter and resort to bacteria as the test organisms. A bacterial assay for carcinogenicity takes a few hours or days rather than the two or three years required for an animal test, and it costs far less. An effective bacterial test has been developed by Bruce N. Ames of the University of California at Berkeley, based on the ability of a chemical to cause mutations in bacteria. More recently my colleagues and I at the Centre National de la Recherche Scientifique in Gif-sur-Yvette have devised a group of tests based on a chemical's ability to induce the development of a dormant virus in bacteria. The Ames test and our tests not only provide means of identifying dangerous chemicals but also are powerful new tools for learning to understand the primary events of the carcinogenic process initiated by chemicals.

Cancer is a disease of highly evolved multicellular organisms such as human

beings, whereas bacteria are minute single cells at the opposite end of the evolutionary scale. It may therefore seem paradoxical that bacteria can serve to identify substances that cause cancer. Actually, however, there is no paradox.

One tends to think of a cancer as a tumor that can spread through the body to form multiple tumor colonies (metastases). That is a clinical, macroscopic view of cancer at a multicellular stage, since just one gram of malignant tumor already contains a million cancer cells. Cancer begins at the level of the single cell. A cell in an adult tissue evolves in such a way that it departs from conformity with the strict physiological rules governing the set of identical cells that constitute a tissue; it becomes a unique and distinguishable defect in an otherwise monotonous structure. The cell begins to divide and a tumor grows. Some of the daughter cells may break the tissue barrier, invading adjacent tissues and usually metastasizing to distant sites. Cancer cells have a great selective advantage, since they escape the programmed fate of most normal cells: to age and die. For cancer cells the entire body is a culture medium in which they thrive, ultimately to die with the body they kill.

Physical and chemical agents in the environment cause cancer by damaging DNA, the cell's hereditary material. DNA damage initiates a complex cellular process that in mammalian cells can eventually lead to transformation into a cancerous state. Agents that damage DNA are therefore potential carcinogens. DNA is the hereditary material of all living cells, and both DNA lesions

and the cellular processes that repair them are remarkably similar in bacteria and in human cells; what is detrimental to bacterial DNA is likely to harm human DNA. That is the theoretical justification for substituting bacteria for mammalian cells in tests to detect damage to DNA.

The theoretical justification is supported by experimental and practical results: bacterial tests distinguish with more than 90 percent reliability between known carcinogens and known noncarcinogens, and they have identified as potential carcinogens new chemicals that have subsequently been shown to be carcinogenic in animal tests. Of course, the manifestations of DNA damage are very different in bacteria from the transformation to the cancerous state that is observed in mammalian cells. In compensation the bacterial tests are so much faster and less expensive as to finally make comprehensive screening for potential carcinogens a feasible objective.

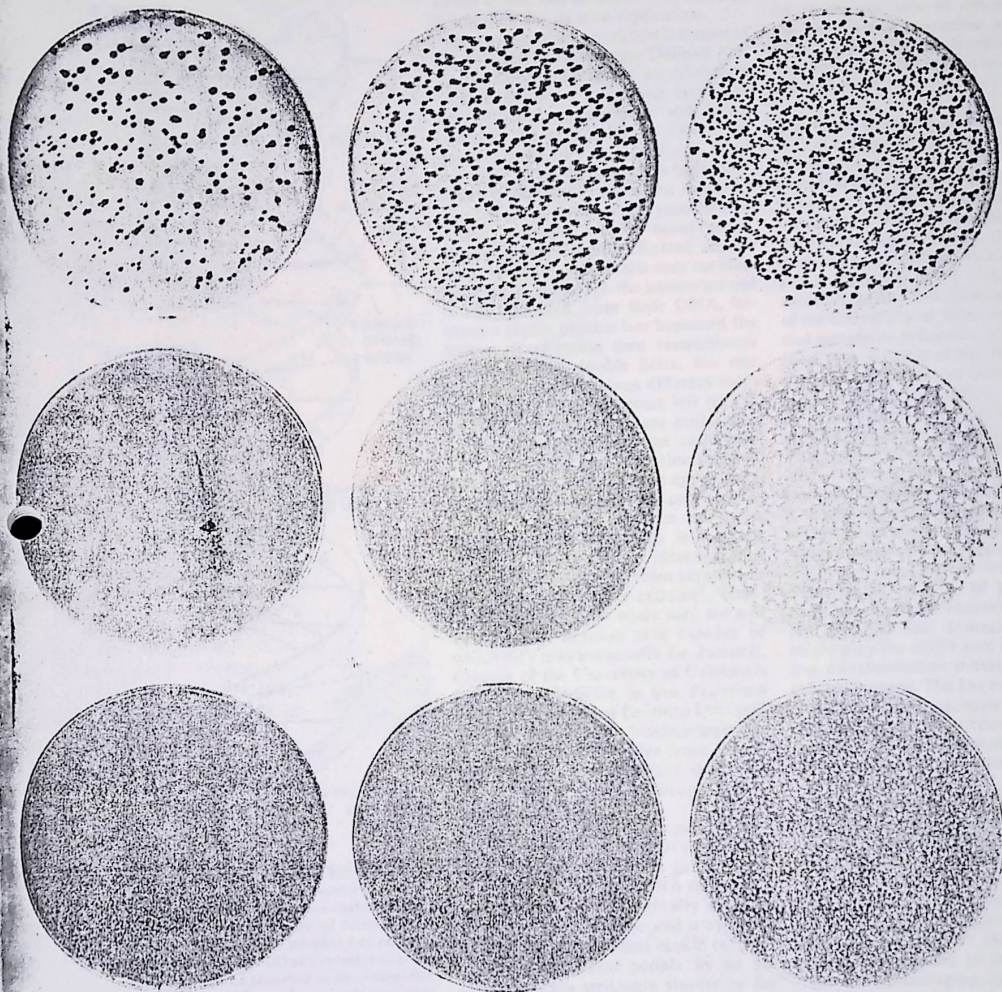
The carcinogenic potential of physical agents, and notably of ionizing radiations, is much better understood than that of chemical agents. Broad popular awareness that radiations can cause cancer has come only in the era of nuclear weapons and reactors, but the danger actually became apparent soon after the discovery of X rays by Wilhelm Konrad Röntgen in 1895. Only four years later it was reported that a technician who checked newly manufactured X-ray tubes by fluoroscopying his own hand was afflicted with a skin cancer; he eventually died of it. The warning was ignored, and most of the first generation of radiation therapists died of cancer. The carcinogenic effect of the ultraviolet

radiation in sunlight has also been shown for some time. As long ago as 1905 a French physician named DUBREUILH observed that skin cancers of the back of the neck were particularly prevalent among workers who were exposed to the sun as they tended the vineyards harvested grapes in the Bordeaux region.

Although X rays, gamma rays and other radiations hit all the components of cells in a random manner, it was recognized quite early that the genetic material must be the most radiation-sensitive cellular target. DNA constitutes only a minor fraction of the chemical components of a cell, but direct or indirect damage to it has great impact on the

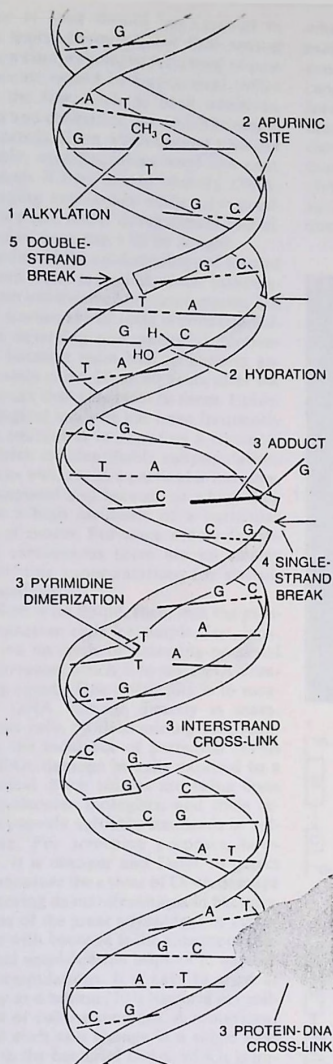
cell's future, whereas damage to proteins and other cellular components has much less effect. That is because DNA is the memory of the cell. DNA replicates to beget DNA, and so errors in DNA are transmitted from cell generation to cell generation.

The double helix of DNA consists of two chains of sugar (deoxyribose) and



THREE BACTERIAL TESTS for potential carcinogens reveal DNA damage: the Ames test (top), the inducible (middle) and the lambda mutagen test (bottom). In each case the culture plate at the left is an untreated control; tester bacteria on the center plate were treated with a moderate dose and those at the right with a higher dose. The Ames test shows the extent of reverse mutations in histidine-deficient *Salmonella typhimurium* that enable the revertant bacteria to proliferate. A background of spontaneous mutant colonies (red stain) is seen at the left. Many more colonies grow when tester bacteria are exposed to 250 nanograms (center) and 750 nanograms (right) of the potent mutagen (and carcinogen) nitrosoguanidine. In the inducible (middle)

DNA damage is revealed by the induction of a prophage, a dormant bacterial virus integrated in the DNA of "lysogenic" *Escherichia coli*; mature phage particles burst out of the tester bacteria and create plaques on a lawn of indicator bacteria of strain A (red stain). Here the DNA damage was caused by the antitumor drug mitomycin C, 10 nanograms of it on the center plate, 200 nanograms at the right. In the mutagen test (bottom) a modified form of the prophage makes plaques on a lawn of *E. coli* of strain B (on which nonmutated phage cannot form plaques) when it undergoes mutation in its "operator" regions and can no longer remain dormant. Again the treatment was 10 nanograms of mitomycin C (center) and 200 nanograms (right).



STRUCTURAL ALTERATIONS are imposed by radiations or by chemical agents on the double helix of DNA, two chains of sugar and phosphate groups (*helical bands*) linked by paired bases: either adenine (A) and thymine (T), or guanine (G) and cytosine (C). The alterations can be classified in five categories, examples of which are illustrated: negligible helix distortions (1), as by alkylation of one of the bases; minor distortions (2) caused by hydration or the absence of a base; major distortions (3) caused by insertion of an "adduct," linking of two bases to form a dimer, or cross-linking between the two strands or between a strand and a protein; breaks in a single strand (4) or in both strands (5). Any structural alteration affects DNA's function as a template for replication, but some negligible alterations are not sensed by a cell as damage to DNA.

phosphate group, linked, as by the rung, of a twisted ladder, by paired nitrogenous bases: two purines (adenine and guanine) and two pyrimidines (thymine and cytosine). Adenine always pairs with thymine and guanine with cytosine, but the sequence of the bases along a strand of DNA is variable and carries a particular coded message. Any alteration, even a slight one, in the structure of the double helix affects the functions of the DNA, one of which is to serve as a template for its own replication.

Not every DNA alteration is sensed in the cell as DNA damage. Defined precisely, DNA damage is an alteration that constitutes a stumbling block for the replication machinery and hence hampers the replication of DNA, endangering the survival of the cell. Once incurred, DNA damage calls for repair, which is accomplished by the interplay of at least a score of enzymes whose action is governed by as many genes. Repair is never totally efficient, and so many cells die. Some cells may survive, however, even though the lesions are not totally removed from their DNA, because a repair process has bypassed the lesions. Replication then reconstitutes an undamaged double helix, but one bearing a coded message different from the original one. The scars left on the DNA by such a process are mutations.

The correlation between radiation-induced cancer and radiation-induced DNA damage has long been apparent to radiation biologists, but it is only recently that molecular evidence has been found that DNA damage is a direct cause of cancer. The evidence comes from patients suffering from xeroderma pigmentosum, who are extremely sensitive to sunlight and, while they are still very young, develop skin cancers of which they may eventually die. James E. Cleaver of the University of California School of Medicine in San Francisco and Dirk Bootsma of Erasmus University in Rotterdam have demonstrated that xeroderma patients suffer from a well-characterized genetic defect: their cells cannot carry out a particular DNA-repairing process.

At noontime on a sunny day the flow of ultraviolet radiation that reaches the earth is strong enough to generate pyrimidine dimers in the DNA of exposed cells by linking two laterally adjacent thymines or a thymine and a cytosine. Most such DNA lesions in skin cells are repaired in normal people by an excision process strikingly similar to the "cut and patch" repair process in bacteria exposed to the same radiation. In xeroderma patients, however, the lesions go unrepaired, and their accumulation appears to bring on cell transformation: DNA damage breeds cancer.

Appreciation of the carcinogenic role of chemicals in the environment has come slowly, even though instances of cancer caused by occupational exposure

have long been observed. As early as 1775 the British physician Sir Percival Pott correlated the incidence of cancer of the scrotum in men who had once been chimney sweeps with the accumulation of soot in their groin area many years before. Experimental findings on chemical carcinogens date back at least to 1918, when two Japanese investigators, K. Yamagiwa and K. Ichikawa, showed that skin cancers could be induced by repeated applications of coal tar to the ear skin of rabbits. One of the chemicals responsible for causing such cancers is benzo[a]pyrene, which is also present in soot, cigarette smoke and charred meat.

Progress toward understanding chemical carcinogenesis has been slow for at least three reasons. First of all, most chemical carcinogens are not biologically active in their original form, so that testing them in that form does not reveal their carcinogenic nature. Only about a decade ago did it become clear, as a result in particular of the investigations of James A. Miller and Elizabeth C. Miller of the University of Wisconsin, that normal metabolic processes, which convert food into substances the body can absorb and eliminate and convert harmful compounds into harmless ones, transform environmental chemicals into metabolites capable of inducing cancer. Those metabolites had to be characterized in order to show just how their parent substances are threats.

A second delaying factor was that the actively carcinogenic metabolites react with various cell components, including RNA and proteins as well as DNA. Since there are a lot of proteins, performing important functions, it was often assumed that damage to proteins might play the major role in the cancerous transformation initiated by chemical carcinogens. The key role of damage to DNA in carcinogenesis by chemicals was recognized only recently, and the results of the bacterial tests have provided strong (although indirect) evidence for such a mechanism.

Finally, the understanding of chemical carcinogenesis has been obscured by the fact that DNA damage, although it is the essential event in the initiation of carcinogenesis, does not usually in itself lead to cancerous transformation; additional factors are apparently required to promote the complex chain of cellular events culminating in the transformation. DNA-damaging agents in themselves are therefore only potential carcinogens.

As I pointed out at the beginning of this article, only a small fraction of the flood of chemicals reaching the market every year can be tested accurately by means of the standard animal assays. In order to obtain results with statistical significance a great many animals must

or at least should be exposed to each tested chemical; for that reason alone a comprehensive screening of new chemicals would be impractical (other than the few, such as food additives, drugs and cosmetics, for which testing is mandated). Even when animal tests are feasible, manufacturers need low-cost, fast tests if they are to identify DNA-damaging substances while new products are still under development and alternative ones can still be sought.

Studies of the epidemiology of human cancers have provided much information on environmental carcinogens, but such studies are of little immediate value in detecting new potential carcinogens because most human cancers appear only some 20 or 30 years after the exposure that gives rise to them. Epidemiological analysis has most frequently been successful in detecting a chemical to which an identifiable subpopulation, such as workers in a particular industry, are exposed and because of which they show a high incidence of a particular type of cancer. For some widely distributed carcinogens there are no clearly identifiable subpopulations for statistical analysis.

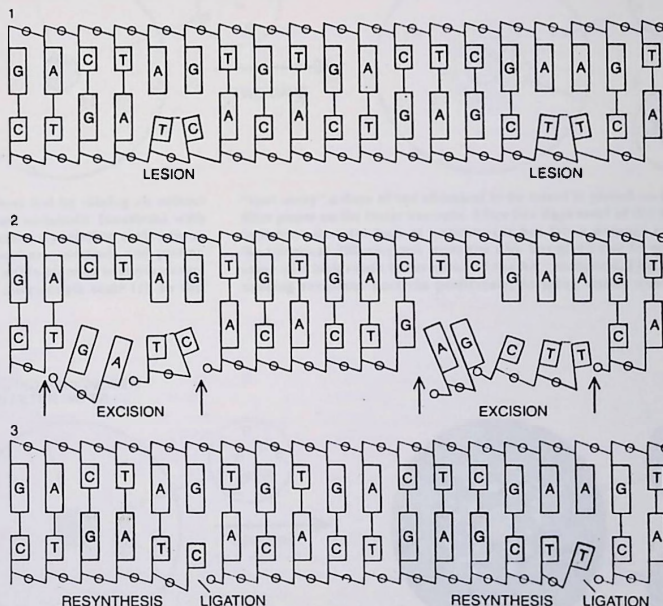
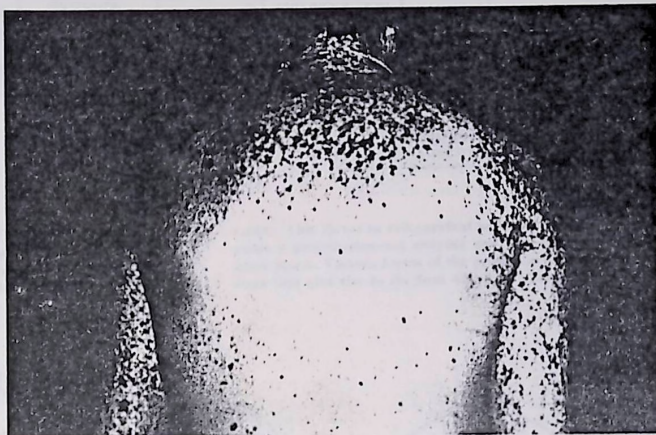
There is no doubt, then, that the present situation calls for simple, fast, inexpensive methods of detecting potential carcinogens, which is to say DNA-damaging agents. One possibility is to measure DNA damage directly in mammalian cells by determining biochemically the incidence of particular forms of DNA damage in cells exposed to a chemical. Such studies are being done by molecular biologists, and their results provide valuable standards of reference. For screening purposes, however, it is cheaper and faster to detect and measure the extent of DNA damage by scoring its manifestations in bacteria.

One of the great advantages of assays done with bacteria is the enormous biological amplification implicit in bacterial manipulations. It is easy to grow as many as a billion (10^9) bacteria per milliliter of culture medium. A mutational event such as a change in a single base pair in the bacterial DNA, which is impossible to detect by standard biochemical methods, will be revealed as a mutant bacterium. That single bacterium can be selected from among 10^9 cells because its daughter cells, and only they, will proliferate and form a colony visible to the unaided eye on an agar nutrient plate. Since a colony consists of about a million (10^6) bacteria, a rare single mutational event with a probability of, say, one in 100 million (a probability of 10^{-6}) would thus be amplified by a factor of 100 trillion (10^{14}).

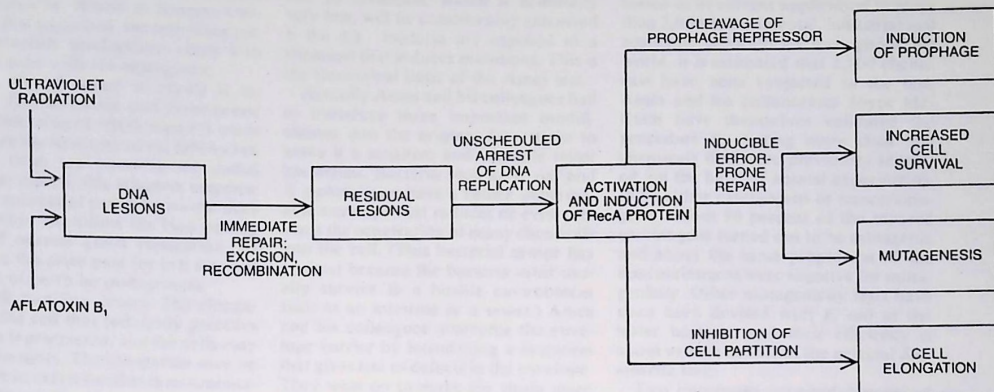
The series of cellular events that leads to mutation, and to several other manifestations of DNA damage in bacteria, has recently been somewhat clarified. The bacterium *Escherichia coli*,

which inhabits the colon of a number of mammals including human beings, is genetically programmed to divide and (under optimal conditions for growth) form two daughter bacteria in 30 minutes. When the DNA of a bacterium is damaged, the bacterium may need more than two hours to resume its cycle of division (if it is not killed by the damage). During that time there is a sequence of cellular events.

Immediately after the primary DNA lesions are incurred a first round of repair is effected: an excision repair, in which the damaged segment is cut out of the DNA and replaced by an undamaged DNA sequence. Some residual lesions will remain, however. If they are bulky or clustered, the residual lesions hamper the DNA-replication machinery, and replication stops abruptly. Unless the arrest of replication is transitory

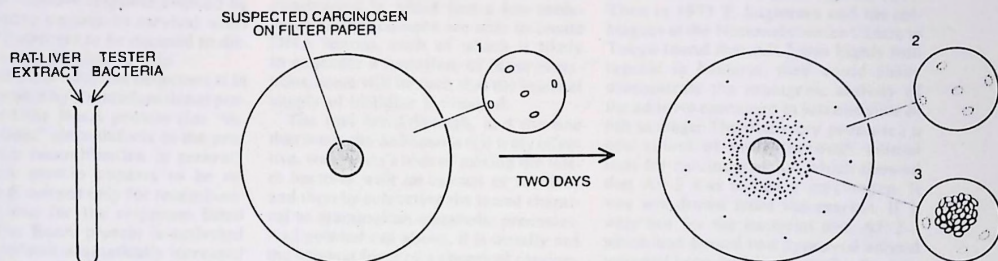


XERODERMA PIGMENTOSUM is a genetic disease whose victims develop skin cancer as a result of normal exposure to sunlight, typically on uncovered parts of the body, as is shown in the photograph at the top. These patients lack a DNA-repair process that in normal individuals removes thymine dimers, the lesions created by the ultraviolet radiation present in sunlight (1). In the normal repair process the bases in the lesion areas are first excised (2). Then the excised stretches of DNA are resynthesized and the new segments are ligated to undamaged stretches (3).



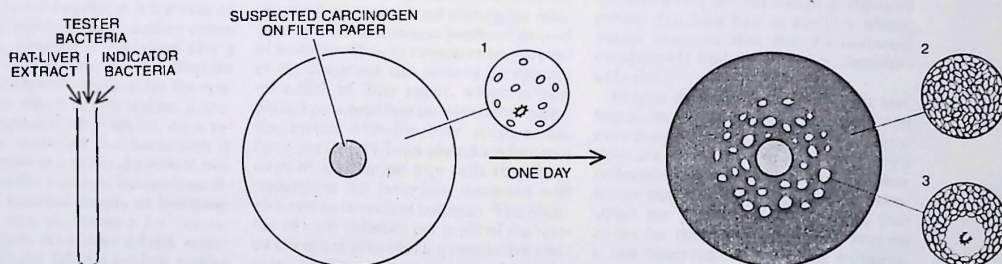
SEQUENCE OF CELLULAR EVENTS follows DNA damage imposed on *E. coli* by ultraviolet radiation or by the carcinogen aflatoxin B₁. Immediate repair processes mend most of the lesions but leave residual damage, causing an unscheduled arrest of DNA repli-

cation. This threat to cell survival activates the RecA protein to become a protein-cleaving enzyme and also induces the synthesis of more RecA. Various forms of the protein are involved in three processes that give rise to the four observed phenomena shown at right.



MUTAGENESIS is detected in the Ames test by mixing an extract of rat liver (which supplies mammalian metabolic functions) with tester bacteria (which cannot grow because a mutation makes them unable to manufacture histidine, a necessary nutrient) and plating the mixture on an agar medium so that a thin layer of bacteria covers the medium evenly, as is shown on a microscopic scale (1). In this

"spot assay" a dose of the chemical to be tested is placed on a disk of filter paper on the tester bacteria. After two days most of the *his*⁺ bacteria have died for lack of histidine (2), but DNA damage caused by the chemical diffusing out from the disk has given rise to mutations, some of which result in reversion of the *his*⁺ mutation. The histidine-making revertant bacteria proliferate, forming visible colonies (3).



INDUCTION of a dormant bacterial virus, prophage lambda, is detected in the inducetest. Lysogenic tester bacteria are mixed with rat-liver extract and then with indicator bacteria. The mixture is plated; the medium is covered with a thin layer of indicator bacteria interspersed with a few lysogenic bacteria (1). After a day most of the plate

is covered by a thick lawn of indicator bacteria (2). Where the chemical that is being tested has diffused from the filter-paper disk the DNA damage it causes leads to the induction of mature lambda phage. The phage particles burst out of the lysogenic cells and kill indicator bacteria in the vicinity, making visible plaques on the lawn (3).

the cell's survival is at risk. As Miroslav Radman of the University of Brussels and Evelyn M. Witkin of Rutgers University first suggested, the following cellular adaptive mechanisms come into play to cope with the emergency:

1. A second round of repair is induced. This inducible and error-prone repair (nicknamed "SOS repair") tends to restore the structure of the DNA even though there are errors in the coded message; indeed, this adaptive response may be successful partly because it does not "bother" to follow the base-pairing rules of normal DNA replication. At any rate, the price paid for cell survival appears often to be mutagenesis.

2. Cell partition ceases. The elongation of the cell that ordinarily precedes division is protracted, and the cells may form filaments. The elongation may be adaptive in that it facilitates recombination between the two sets of damaged chromosomes in the cell, the intact segments of each combining to yield an intact chromosome.

3. If a prophage, or dormant bacterial virus, is present in the cell, it is induced to develop into a large number of mature progeny phage that burst out of the cell. This adaptive response evolved by the prophage ensures its survival when a host cell appears to be doomed to die: the rats leave the sinking ship.

Each of these adaptive responses is in part promoted by a multifunctional protein called the RecA protein (for "recombination," since defects in the protein impair recombination in general). The RecA protein appears to be required in *E. coli* not only for recombination but also for the responses listed above. The RecA protein is activated and its synthesis dramatically increased when DNA replication is blocked.

Of the various bacterial manifestations of DNA damage, Ames chose mutagenesis as the basis of his pioneering work to develop a test for potential carcinogens. His *Salmonella*-mammalian-liver assay, known generally as the Ames test, is currently the standard test and by far the most widely used. The tester organism is a strain of *Salmonella typhimurium*, another colon bacterium, bearing a mutation (*his*⁻) that renders it unable to manufacture one of the enzymes required for the synthesis of the amino acid histidine, a necessary component of proteins. As a result of the mutation the bacterium is unable to grow in a minimal nutrient medium unless the medium is supplemented with an external supply of histidine.

On very rare occasions a *his*⁻ mutation undergoes reversion: a back mutation restores the DNA's normal coding sequence for the needed enzyme and thereby restores the internal supply of histidine. The reversion can be scored because only the revertant bacteria form colonies on a medium that lacks

histidine. Obviously the spontaneous rate of reversion, which is ordinarily very low, will be considerably enhanced if the *his*⁻ bacteria are exposed to a chemical that induces mutations. This is the theoretical basis of the Ames test.

Actually Ames and his colleagues had to introduce three important modifications into the original *his*⁻ strain to make it a sensitive and versatile tester bacterium. Bacteria such as *E. coli* and *S. typhimurium* have a rather impermeable envelope that reduces or even prevents the penetration of many chemicals into the cell. (This bacterial armor has evolved because the bacteria must usually survive in a hostile environment such as an intestine or a sewer.) Ames and his colleagues overcame the envelope barrier by introducing a mutation that gives rise to defects in the envelope. They went on to make the strain more sensitive to DNA-damaging agents by eliminating its capacity for excision repair, so that most of the primary lesions remain unhealed. And they introduced into the bacterium a plasmid, a foreign genetic element that makes DNA replication more error-prone. By means of these three modifications a strain was constructed in which just a few molecules of a carcinogen are able to create DNA lesions, each of which is likely to engender a mutation; of those mutations, some will be such that the internal supply of histidine is restored.

The real breakthrough, and the one that made the *Salmonella* test truly effective, was Ames's idea of mixing the tester bacteria with an extract of rat liver and thereby subjecting the tested chemical to mammalian metabolic processes. As I pointed out above, it is usually not the original form of a chemical carcinogen that is active but rather one of its metabolites. Because the liver is the body's major metabolic factory the enzymes of a rat-liver extract should convert the chemical being tested into metabolites that react with DNA—if there are any.

In practice the Ames test is usually done by adding the chemical to be examined to *his*⁻ tester bacteria immersed in a rat-liver extract and plating the mixture on a solid nutrient medium devoid of histidine. (For demonstration purposes the chemical can instead be spotted on a disk of filter paper, which is then placed on a medium on which the bacteria, mixed with the liver preparation, have previously been plated.) After two days of incubation any cells that have undergone the reversion mutation will give rise to revertant colonies. The number of such colonies per mole of the tested chemical provides a quantitative estimate of the mutagenic potency of the chemical.

The simplicity, sensitivity and accuracy of the *Salmonella* test for screening large numbers of environmental

sources of potential carcinogens has resulted in its current application in more than 2,000 governmental, industrial and academic laboratories throughout the world; it is estimated that 2,600 chemicals have been subjected to the test. Ames and his collaborator Joyce McCann have themselves validated the procedure by testing more than 300 chemicals that were previously reported, on the basis of animal experiments, to be either carcinogens or noncarcinogens. About 90 percent of the reputed carcinogens turned out to be mutagenic and about the same proportion of the noncarcinogens were negative for mutagenicity. Other mutagenicity tests have since been devised with *E. coli* as the tester bacteria, and their efficiency is about as high as that of the original *Salmonella* test.

Two impressive accomplishments of mutagenicity tests can be mentioned to give an idea of their value. In Japan the chemical feryl furamide, known as AF-2, was added to a broad range of common food products for some years as an antibacterial agent. It had not shown any carcinogenic activity in standard tests on rats in 1962 or on mice in 1971. Then in 1973 T. Sugimura and his colleagues at the National Cancer Centre in Tokyo found that AF-2 was highly mutagenic in bacteria; they could easily demonstrate the mutagenic activity of the additive contained in just one slice of fish sausage! The discovery prompted a new round of more thorough animal tests for carcinogenicity, which showed that AF-2 was indeed a carcinogen. It was withdrawn from the market. If it were not for the bacterial test, AF-2—which had passed two approved animal tests and been declared negative for carcinogenicity—would presumably still be a component of fish sausage and other Japanese food products.

In 1975 Ames and his colleagues reported that 89 percent of the major class of hair dyes sold on the U.S. market contained mutagenic compounds. Since then the cosmetic industry has modified the composition of most hair dyes. It is estimated that several tens of millions of people dye their hair in the U.S. alone, which suggests that the discontinued components had presented a considerable risk.

In spite of all their advantages the mutagenicity tests have some technical and even theoretical limitations. Since mutations are revealed in the Ames assay by a restoration of enzyme activity, any mutation that does not happen to reconstruct the precise DNA sequence that codes for the histidine-making enzyme is not observed. To take one example, the antitumor drug bleomycin, which does its therapeutic work by damaging the DNA of tumor cells (as do about half of all antitumor agents), fails to induce the mutation that is scored in the *Salmonella* test. A false-negative re-

sponse of this kind is a technical problem that can be remedied by substituting other tester bacteria or a complementary short-term test.

False-positive responses are more significant from a theoretical point of view because they may raise some doubts about the validity of mutagenicity tests for identifying potential carcinogens. The point is that some chemical reactions with DNA are highly mutagenic in bacterial and mammalian cells without, as far as one can tell, being carcinogenic. Among these are the incorporation of an analogue of one of the nitrogenous bases and the methylation of certain sites on the bases. Such reactions cause negligible alterations in DNA structure that are not sensed in the cell as DNA damage; DNA replication proceeds on schedule and the new DNA carries a readable—although wrong—coded message. This process is termed direct mutagenesis, and in scoring for mutations it should be clearly distinguished from the more frequent indirect mutagenesis. In the latter process, described above, DNA damage brings about a transient arrest in replication; replication is resumed with the help of the RecA protein on a template that carries lesions, causing mutagenesis of the newly formed strand.

Since it is DNA damage that appears to initiate the cancerous transformation of a mammalian cell, a chemical is a potential carcinogen if it is a DNA-damaging agent, not simply because it causes

mutations. A mutagen can have strong genetic effects on a biological population by altering the information encoded in the DNA of individuals' germ cells but nonetheless fail to cause cancer because it does no real DNA damage to the somatic cells: the cells of the rest of the body. Not all genetic toxic substances (chemicals that affect DNA) are potential carcinogens, whereas chemical carcinogens—because they damage DNA—are all indirect mutagens. In other words, mutagenic activity in bacteria is correlated with carcinogenesis in mammals primarily through indirect mutagenesis, which results from DNA damage.

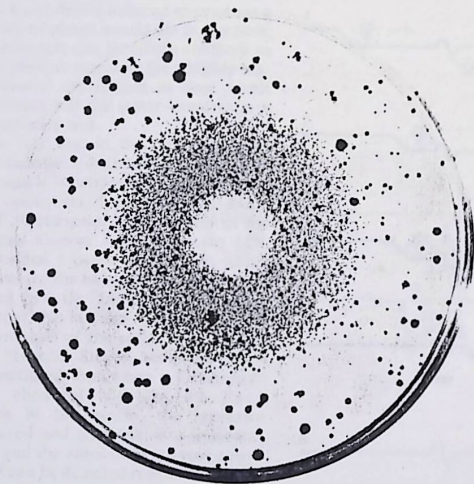
In 1953, before the structure of DNA had even been established, André Lwoff of the Pasteur Institute in Paris anticipated that "inducible lysogenic bacteria might become a good test for carcinogenic and perhaps anticarcinogenic activity." A bacterium is said to be lysogenic when it carries, in a dormant state, the DNA of a "temperate" bacterial virus, which in this dormant state is called a prophage. One such temperate virus is phage lambda, which becomes a prophage when it is integrated into the DNA of certain lysogenic strains of *E. coli*.

When lysogenic *E. coli* bacteria are subjected to any treatment that halts DNA replication, the prophage is induced: its DNA loops out of the bacterial DNA and also directs the synthesis of

proteins forming the virus particle, and a progeny of mature phage develops, bursting out of the host cell. The process is called lysogenic induction. Under normal conditions the dormant state of prophage lambda is maintained by a repressor, a protein that lies on the DNA's "operator" regions and blocks the operation of the lambda genes (except the gene that directs the synthesis of repressor to keep the prophage dormant). Jeffrey W. Roberts and Christine W. Roberts of Cornell University discovered that the induction of prophage lambda results from the cleavage of the lambda repressor; together with Nancy Craig they have recently shown that relatively pure repressor can be cleaved when it is mixed with an activated form of the RecA protein.

By triggering the activation of the RecA protein into the form that can cleave a viral repressor, DNA damage results in the induction of a dormant virus. The induction of prophage lambda can therefore serve as a test for DNA damage. Even before the mechanism of prophage development was understood at a molecular level, lysogenic induction was applied in the pharmaceutical industry to identify prospective antibiotics and antitumor drugs. When induction tests were done with ordinary strains of lysogenic *E. coli*, however, they did not give a positive response for such known carcinogens as benzo[a]pyrene.

Patrice Moreau, Adriana Bailone and



SPOT ASSAYS visualize the efficacy of bacterial tests qualitatively, although quantitative assays are preferable (see illustration on page 41). In the Ames test (left) the tested chemical was ethyl methane sulfonate, an alkylating agent and potent mutagen. A dense halo of revertant *S. typhimurium* colonies is seen around the disk from which the mutagen diffused. (Close to the disk there is a zone in which a toxic concentration of the chemical killed all bacteria.) The larger colonies

are mutant bacteria that arose spontaneously without exposure to the chemical. In the inductest (right) the tested chemical was aflatoxin B₁, a potent carcinogen of the liver. The aflatoxin doses placed on the four test disks were (clockwise from top right) 0, 20, 200 and 2,000 nanograms. In the background a few of the lysogenic *E. coli* tester bacteria have spontaneously produced mature phage that have killed the nearby indicator bacteria, producing plaques at random locations.

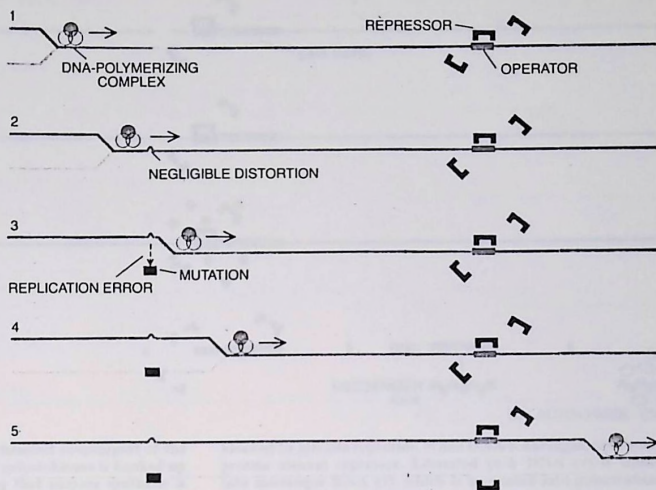
I therefore set out five years ago to renovate the lambda-induction test to make it capable of identifying all kinds of DNA-damaging agents. We reasoned that because the molecular mechanism of lysogenic induction was understood better than that of mutagenesis, a prophage-induction test should provide more insights than mutagenicity tests could into the precise effect of chemical carcinogens on DNA and should provide a supplementary tool for screening as well.

Following Ames's lead, we constructed new tester bacteria that are permeable to chemicals and deficient in excision-repair enzymes, and we assayed potential carcinogens in the presence of a rat-liver metabolizing mixture. The prophage-induction test, or inductest, has turned out to discriminate effectively between carcinogens and noncarcinogens in our laboratory and in several others.

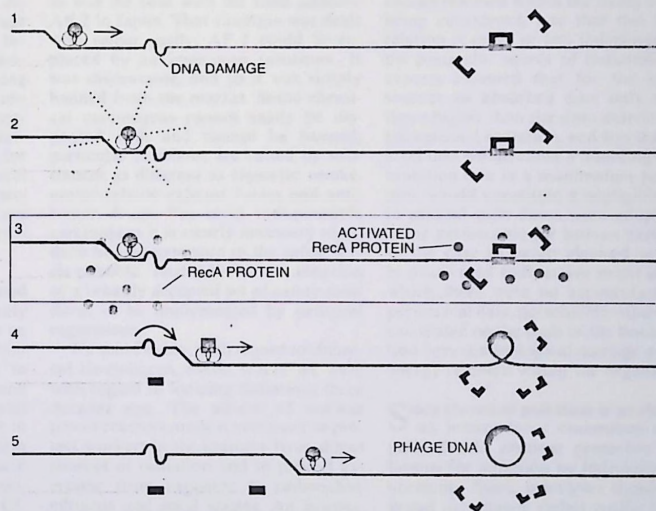
The inductest has certain advantages over mutagenicity tests. Mutations can be scored only in bacteria that survive exposure to a chemical treatment that is often toxic as well as mutagenic, and no more than one bacterium out of 1,000 is likely to be detected as a histidine revertant. In contrast, lysogenic induction can be observed, when it takes place, in the bulk of a cell population. Prophage induction is a mass effect, largely independent of whether or not cells would survive the chemical treatment; a cell that is induced to produce a progeny of phage would die in any case. The inductest can therefore continue to give a positive response for a highly toxic potential carcinogen at dose levels that would kill the tester bacteria in a mutagenicity test.

The fact that in the inductest most cells undergo a dramatic change led us to design a biochemical assay of lysogenic induction. Sankar Adhya, Maxwell E. Gottesman and Asis Das of the National Cancer Institute in the U.S. constructed a bacterial strain in which the gene for the enzyme galactokinase is hooked up to the lambda DNA in such a way that the lambda repressor blocks the synthesis of the enzyme. Alain Levine, Moreau, Steven Sedgwick and I demonstrated that when a DNA-damaging chemical activates the RecA protein in this strain, the repressor is cleaved and galactokinase is synthesized, and the amount of enzyme activity that can be detected reveals the extent of DNA damage. This biochemical assay may be the shortest of the short-term tests; it takes only half a day to test for a potential carcinogen.

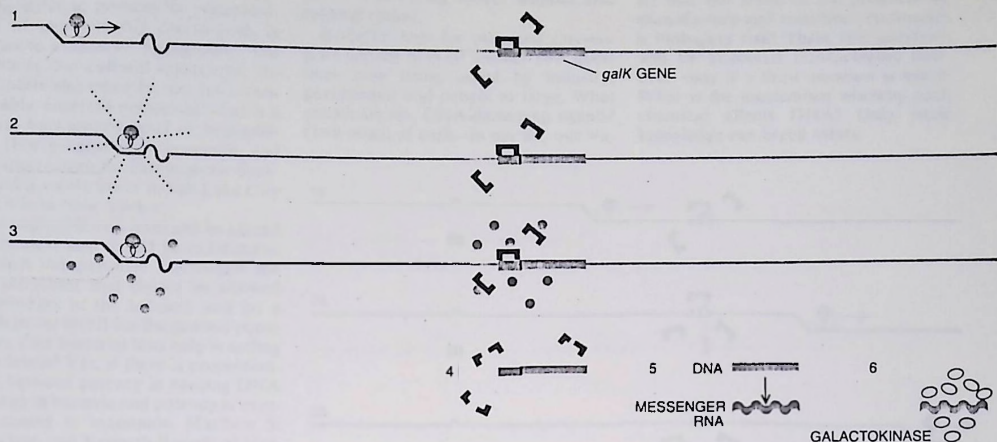
Moreau and I have also constructed strains, containing a new form of prophage lambda, in which one can identify chemicals that induce mutagenesis without damaging DNA. This lambda mu-



DIRECT MUTATION is a result of DNA replication on a minor distortion of a DNA strand. This diagram and the one below show the replication of only one strand of bacterial DNA (blue) carrying a piece of viral DNA, prophage lambda (*red*), which is kept in a dormant state by a repressor protein that blocks an operator region. The DNA strand is replicated by a polymerizing complex (1). A negligible distortion of the bacterial DNA (2) does not obstruct replication, but it does give rise to an error in replication, so that the newly formed DNA strand (light blue) carries a mutation (3). The negligible distortion is not sensed as DNA damage, RecA protein is not induced, repressor stays in place and prophage is replicated in dormant state (4, 5).



INDIRECT MUTATION results from the events that follow DNA damage (1), which blocks DNA replication and produces an "SOS" signal (2). A large amount of RecA protein (orange) is synthesized (3). The RecA somehow facilitates DNA replication on a damaged template, apparently by temporarily modifying the polymerizing complex (4). This replication is highly mutagenic not only at the lesion site but also elsewhere (5). Activated RecA cleaves the repressor (4, right), freeing the operator region of the prophage DNA. The prophage is thereby induced to form phage DNA (5), which in turn forms virus particles that burst out of bacterium.



ENZYME-INDUCTION TEST is a biochemical counterpart of the inductest. The gene, *galK*, for synthesis of galactokinase is hooked up to prophage-lambda DNA in such a way that enzyme synthesis is

blocked by lambda repressor. When DNA is damaged, activated RecA protein cleaves repressor. Liberated *galK* DNA (4) is transcribed into messenger RNA (5), which is translated into galactokinase (6).

tatest, as we call it, reveals whether a chemical gives rise to mutations directly (that is, without causing DNA damage and therefore without inducing prophage) or indirectly (by damaging the DNA and producing active virus).

Although neither the inductest nor the lambda mutatest has yet been validated as extensively as the Ames mutagenicity test, the two appear to be valuable complementary assays, in particular for determining the nature of DNA damage and for establishing a correlation between potency in producing DNA damage in bacteria and potency in causing cancer in mammals. Perhaps more important in the long run, a biological system comprising both a cell and a dormant virus should be a valuable tool for analyzing the pathway of biochemical changes, genetic or nongenetic (cleavage of repressor, for example), that are triggered when cells are exposed to carcinogens.

Given that man is exposed to a flood of chemicals, some of which surely increase the risk of cancer, there is an urgent need to identify potential carcinogens and lower human exposure to them to a level of negligible risk and keep it there. In such an effort bacterial tests can play a major role. In order to ensure broad acceptance of uniform standards, some investigators have strongly favored the adoption of a single, standardized mutagenicity test. Often, however, it is advisable to adapt a screening effort to the particular physical and chemical properties of the substance that is under study. It would therefore seem to be sensible to subject each chemical to a battery of tests. Any test has its foibles, which give rise to false-negative or false-positive respon-

ses. Several independent and complementary determinations of a chemical's DNA-damaging capacity can provide a balanced and hence more compelling assessment of carcinogenic risk.

The pronouncement that a particular chemical is a potential carcinogen has obvious social, economic and even political implications. The chemical may present a risk to a very large population, as was the case with the food additive AF-2 in Japan. That situation was dealt with rather easily: AF-2 could be replaced by an innocuous substitute. It was dispensable, and so it was simply banned from the market. Some chemical carcinogens cannot easily be dispensed with and cannot be banned; particular problems are raised by substances as different as cigarette smoke, motor-vehicle exhaust fumes and anti-tumor drugs. For most indispensable carcinogens it is clearly necessary to reduce human exposure to the safest levels possible. That calls for the adoption of a broadly accepted set of safety standards to be implemented by stringent regulations.

We stand today, with regard to chemical carcinogens, about where we were with regard to ionizing radiations three decades ago. The advent of nuclear power reactors made it necessary to protect workers in the industry from direct sources of radiation and to protect everyone from exposure to radioactive effluents and solid wastes. An international agency sponsored by the United Nations worked out a set of standards and regulations designed to minimize human exposure to various sources of radiation. The regulations were broadly accepted and implemented, and they have stood the test of time. They should provide a valuable reference for evolu-

ing standards for chemical carcinogens.

The experts who set the standards for radiation safety have proceeded from two basic facts. One is that mankind is exposed to a natural background of radiations whose biological effect is not perceptible (even though in principle there is no threshold for the effects of ionizing radiations). The other is that biological damage is proportional to the energy released within the living system being considered, and that this linear relation is more or less independent of the particular source of radiation. The experts assumed that for the known sources an absorbed dose only a few times higher than the dose delivered by background radiation, and less than the level that would cause a doubling of the mutation rate in a mammalian population, would constitute a negligible risk; in general such doses were adopted as being permissible for human exposure. In the case of newly devised or newly discovered radioactive materials for which there were no accumulated experimental data, permissible values were calculated on the basis of the linear relation between biological damage and the energy released within the organism.

Since chemical pollution is worldwide, an international committee of experts should propose protective regulations for adoption by individual governments. Some principles should gain broad acceptance rather easily: for example, all unnecessary potential carcinogens should be banned. A list of carcinogens that cannot be dispensed with but to which exposure should be strictly limited will also have to be drawn up. It may be difficult, however, to reach a consensus on such a list and on the permissible environmental concentrations

each chemical. One would like to begin by defining permissible concentrations of indispensable carcinogens in relation to a "natural" background. The trouble is that cultural differences, social habits and other factors have considerably distorted notions of what is a natural background level of negligible risk. (For geographical, economic and religious reasons the carcinogenic background is surely lower in Salt Lake City than it is in New York.)

If a negligible-risk level can be agreed on, the next step would be to estimate, for each indispensable carcinogen, the concentrations that should be allowed for workers in the industry and (at a much lower level) for the general population. Can bacterial tests help in setting such levels? Yes, if there is proportionality between potency in causing DNA damage in bacteria and potency in causing cancer in mammals. Matthew S. Meselson and Kenneth Russell of Harvard University have attempted to demonstrate a direct relation between mutagenic potency in the *Salmonella* test and carcinogenic potency in laboratory animals. For 10 of the 14 known chemical carcinogens they considered there was a correlation.

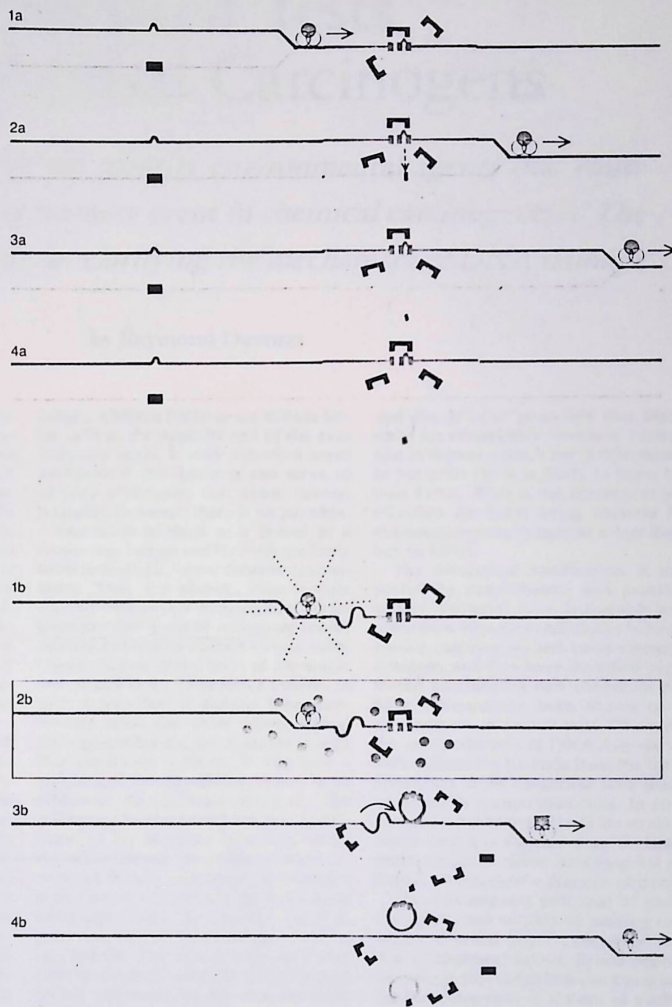
The many exceptions to the rule of correlation were to be expected because in a mammal the extent of DNA damage in a target cell depends on factors (which may be different in bacteria) such as the specific metabolism of carcinogens in the organ involved, the cells' permeability to particular metabolites and tendency to accumulate them and the extent of residual DNA damage after the cellular repair mechanisms have had their effect. Each of these variables must be determined for each individual carcinogen if one is to set valid levels for human exposure. Each chemical—in contrast to individual sources of radiation—requires a thorough specific study to determine its carcinogenic potency. Bacterial tests have good indicative value.

Even though establishing regulations will be much more difficult for chemical carcinogens than it was for radiations, the regulations should be established soon. It is wiser and safer to have safety regulations than not to have them. A large part of the human population contracts cancer; one person in five dies of it. It is important to determine the precise mechanism by which each DNA-damaging agent acts on DNA, not only to prevent cancer but also to develop better ways of curing it. About half of all the drugs administered in an effort to arrest cancer are DNA-damaging agents, and so a significant number of people are being regularly exposed, for therapeutic purposes, to such agents. By establishing, through studies in bacteria, the mechanism whereby antitumor agents affect DNA, investigators may be able to help design more drugs that are

effective in curing cancer without also causing cancer.

Bacterial tests for potential carcinogens should help to answer two questions now being asked by industry, government and people at large. What chemicals are DNA-damaging agents? How much of each—in our air, our wa-

ter and our food, in the products we manufacture and consume—constitutes a biological risk? These two questions will be answered satisfactorily, however, only if a third question is asked: What is the mechanism whereby each chemical affects DNA? Only basic knowledge can breed safety.



DIRECT AND INDIRECT MUTAGENESIS can be distinguished from each other by the mutatest, based on mechanisms diagrammed here. The repressor binds to a slightly modified operator (1a, 1b). A negligible alteration of operator DNA (1a) results, in a mutation (2a) that prevents further binding of the repressor (3a). The prophage develops into active phage particles (4a) that are selectively revealed by strain-B indicator bacteria, which are not sensitive to nonmutated phage; phage development independent of RecA-protein activation reveals direct mutagenesis. DNA damage (1b), on the other hand, leads on replication (2b, 3b) to RecA-dependent indirect mutagenesis, which is detected with strain-B indicator bacteria. The concomitant event, prophage induction (1b, 4b) resulting from activation of RecA, is detected with indicator bacteria of strain A, not with strain-B bacteria. Mutagenesis can be diagnosed as indirect when it occurs along with prophage induction: both are dependent on RecA.

Wilkes College

PRE-MEDICAL EDUCATION PROGRAM

*An Outstanding
Educational Experience*



Stark Learning Center
Wilkes College, Wilkes-Barre, PA

Pre-Medical Program at Wilkes College

Wilkes College pre-medical students are a special group of students

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- **Special because** they are very closely counselled by both the professorial staff and clinical psychologists.
- **Special because** they have a number of exceptional alternative programs offered to them and open to them if they choose to take advantage of them.
- **Special because** they are known to health science advisors from their freshman year on. The fact that they are known and counselled early in their college career allows them to choose the pathway to a health profession which is most suited to them.

Programs of Study

The pre-medical program students at Wilkes not only major in academic disciplines of their choice but also are exposed to a broad-based liberal arts curriculum which prepares them for an intelligent, caring approach to their chosen profession. Students are required to complete the following courses at Wilkes as *minimum* requirements for medical school.

- 2 courses in biology
- 4 courses in chemistry
- 2 courses in physics
- 2 courses in calculus
- 2 courses in psychology

In addition, upper-level courses in sciences and independent scientific research are available to pre-medical students.

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The Faculty at Wilkes College feels that all students in the health professions should have some first-hand experience in their chosen field and be exposed to a variety of health professions.

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- Spend some time in a hospital or health professional office setting to observe health care delivery.
- Do personal research and are counselled on variations in professions such as differences in health care delivery, life styles, etc.

Alternative Pathways

Wilkes College has ongoing joint degree programs with universities and professional schools in dentistry, optometry, podiatric medicine, physical therapy, occupational therapy, pharmacy, and health records administration. These provide a wide variety of different career pathways if students for one reason or another opt out of the pre-medical program.

The following aspects of the undergraduate pre-medical education program at Wilkes College are distinctive

- In a 2-year period (1983-1984) over 100 students entered doctoral-granting health professional schools (medical, podiatric medicine, dentistry, optometry)
- About 90% of those applying have been placed
- Smaller classes
- Outstanding science facilities
- Excellent teaching
- Strong academic preparation
- An atmosphere rich in cultural and ethnic heritage
- Personal counselling
- Help with standardized test taking (MCAT, DAT, OCAT, etc.)
- Assistance in taking interviews



Wilkes College is an equal opportunity institution and prohibits and rejects any discrimination in admissions or hiring practices based on race, age, sex, color, national origin, handicap, or religion.

Health Sciences Office

Wilkes College

Wilkes-Barre, PA 18766

Phone (717) 825-6744

Please send information and application form for the pre-medical program.

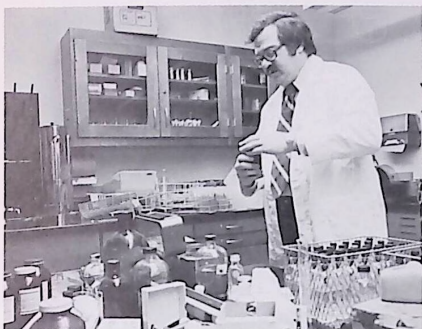
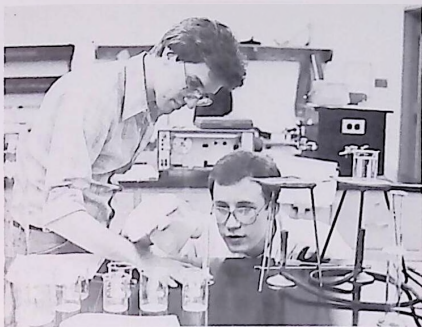
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County_____

High School_____

Year in High School_____





New America, Bldg. 1, Rt. 130, P.O. Box 1029, East Windsor, NJ 08520

Tel: 609/443-4402

GENETIC TOXICOLOGY TESTING

INTRODUCTION:

For a considerable period of time, man has been interacting with an increasingly chemical environment. The continued technological advances which, in themselves, attest to man's achievements and increased affluence, has in the meantime transformed the environment we live in, into an increasingly hazardous one with a tremendous potential for harm to mankind. Although the change in the environment comes as a byproduct of the modern societies' way of living, the environmental challenges have reached a level to which we must react. The increased incidence of Cancer is only one among many diseases which have, directly or indirectly, been related to the changes in our environment. There are thousands of natural substances to which man is exposed, in addition to the thousands of man-made chemicals which have become an integral part of our lives. It is this challenge which brought scientists such as Bruce Ames (1975) to address the question of a qualitative test for carcinogenicity, and Demerec (1958) before him to address the question of bacterial mutability under the stress of a chemical mutagen.

Mutagenicity and Carcinogenicity, terms which are becoming synonymous in their loose interpretation, only reflect the wide concern over the continued exposure to the chemical environment in which we live. Due to the increased incidence of genetic aberration and inborn errors, it is suddenly realized that mutagens are not only harmful to man's health vis-a-vis Cancer, but also have a long lasting and deleterious genetic effect from which we should protect future generations.

It is in this light that mutagenicity testing has become the societies' arm in protecting itself against hazardous chemicals with a potential of causing genetic damage to humans. It is no longer a question of a cancer causing agent that genetic toxicologists test for, rather, the detection of an agent that shows a potential, however small, of causing point mutations and/or chromosomal aberration.

Mutagenicity testing involves a whole array of tests (see appendix I), each of which addresses a specific level of DNA change, all of which are directed at the primary question of mutagenicity and carcinogenicity. While some of these tests address only the question of the

mutagenic potential of a chemical agent (short-term tests), others are directed towards the actual demonstration of a cancer causing agent (long-term tests). While the link between the mutagenic and carcinogenic potential of chemical agents is debatable, it is clearly indicated that a kind of relationship, in itself not clearly understood, must exist between the two activities. For this reason, primarily, short-term tests have been proposed by the major Federal Regulatory Agencies for incorporation, along with the more definitive long term test batteries as parts of the package of chronic toxicology tests required for new chemical products.

SHORT - TERM MUTAGENICITY TESTS PERFORMED AT:

MAS LABORATORIES:

The purpose of the following short term tests is to evaluate the mutagenic activity of the test chemical in a microbial system using E.coli and Salmonella typhimurium. The test results can only be interpreted in a relative manner to two types of control tests. In one set of controls, the positive control test, a set of active mutagens are used with the different bacterial strains. These positive acting mutagens are: 2-Anthramine, 9-Amino acridine, dimethyl nitrosamine, methyl methane sulfonate, methyl nitrosoguanidine, 2-nitrofluorene and sodium azide. In the second control set, the spontaneous mutability of each strain is tested for in the absence of chemical mutagens.

General Features of MAS Short-term tests:

- * Tests are performed in triplicate with a five dose response for each chemical tested.
- * The level of toxicity of each chemical is determined prior to the evaluation of its mutagenicity (except when supplied).
- * Concentrations of the chemicals tested are determined in accordance with their solubility and/or, their toxicity limits to the bacterial strains used.
- * In the case of weak mutagens, the test is repeated using 2-4 S.9 concentrations to decidedly determine the test chemicals' mutagenicity potential.
- * Test results are reported by phone within three days of receipt of material. (When toxicity tests are performed by MAS Laboratories, results are reported within one week).
- * Written reports, accompanied by statistical analysis and raw data, are submitted within four weeks of test.
- * Inconclusive results, i.e. no clear demarkation as to positive or negative Ames; may be clarified using any one of the four tests available at MAS Labs at a reduced cost.
- * Consultation with MAS Labs during and after test performance is welcomed at all times.

TEST PROTOCOLS
=====

AMES TEST: (Abstract)

Objective: Evaluate the mutagenic potential of the test material using Salmonella typhimurium as indicator organisms.

Test Strains:

Salmonella typhimurium strains TA98, TA100, TA1535, TA1357, and TA1358.

Sample required:

One to two grams.

Test Procedure:

Performed as described by Ames et al (1975), with and without metabolic activation with liver microsome homogenates in a:

- 1 - Qualitative assay: Direct contact of raw material with the test organism directly in agar plates.
- 2 - Quantitative assay: Using five concentrations of a solution (aqueous or DMSO) of the test material without metabolic activation.
- 3 - Quantitative assay: Same as in 2 with one or more concentrations of S.9 extract.

Results:

For qualitative assay, results are recorded as (+) or (-) relative to the positive* and negative** control tests.

For quantitative assays, results are tabulated in numbers of his⁺ revertants obtained with the test material along with the number of his⁺ revertants obtained with the positive and negative controls.

Duration of test:

Three days for verbal result, and four weeks for written report.

Report:

Final report will include raw data in tabular form for all tests performed and the experimental design used. A discussion and interpretation, based on the statistical analysis will be provided as basis for our conclusion as to the mutagenic potential of the test material.

All procedures are certified as to performance under the Good Laboratory Practice regulations.

AMES TEST (continued)

FOOTNOTES

* Positive Controls: For positive control test in the absence of metabolic activation; Sodium azide, 9-Amino acridine and 2-Nitrofluorene are used.
For positive control test in the presence of S.9 activation, 2-Anthramine is used.

** Negative Controls: Determines the spontaneous mutability of each strain used with and without metabolic activation.

Ames, B.N., J. McCann and E. Yamasaki. Methods for detecting carcinogens and mutagens with the *Salmonella*/mammalian microsome mutagenicity test. *Mutation Res.* 31 (1975) 347-364.

Ames, B.N., J. McCann and E. Yamasaki. Mutagenicity and DNA-modifying activity: a comparison of two microbial assays. *Mutation Res.* 31 (1975) 41-70.

DNA REPAIR TEST USING PolA⁺ and PolA⁻ STRAINS OF E.coli:

Objective: Evaluate the potential of a test material to cause damage to bacterial DNA, hence inhibition of bacterial growth in the absence of DNA repair processes.

Test Strains:
E.coli Strains W3110(PolA⁺) and P3078(PolA⁻).

Sample required:
One to two grams.

Test Procedure:
Procedure is performed as described by Rosenkranz et. al. (1976). The bacterial test strains are exposed to varying concentrations of the test material, placed in stainless steel cylinders, directly on a bacterial lawn in a top agar overlay method. After 24 hour incubation, the zone(s) of inhibition of the PolA⁻ strain is recorded as well as that of PolA⁺. Activation assays are performed in a parallel fashion to the nonactivation test, after an appropriate preincubation of test material with the S.9 extract.

Results:
Zones of inhibition are recorded in mm. diameters. For each concentration of test material used, an average of three zones is determined. Positive control test results (using Dimethyl nitrosamine and MMS) are recorded as averages of triplicate assays.

Duration of Test:
Three days for verbal result, and four weeks for final written report.

Report:
Final report will include raw data in tabular form for all tests performed, and the experimental design used. A discussion and interpretation, based on the statistical analysis of the data will be provided as basis for our conclusion as to the mutagenic potential of the test material.

All procedures are certified as to performance under the Good Laboratory Practice regulations.

Rosenkranz, H.S., B. Gutter and W.T. Speck. Mutagenicity and DNA-modifying activity: a comparison of two microbial assays, Mutation Res. 41 (1976) 61-70.

RECOMBINATION ASSAY WITH E.coli rec^+ / rec^- SYSTEM:

Objective: Evaluate the potential of test material to cause DNA damage to the test strains, hence inhibition of the growth of the rec^- E. coli strain ($recB^-recC^-$).

Test Strain: E. coli JC5519 ($recB^-recC^-$).

Sample Required:
One to two grams.

Test Procedure:
The bacterial strains are exposed to varying concentrations of the test material, placed in stainless steel cylinders, directly on a bacterial lawn in a top agar overlay method. After 24 hour incubation, the zone(s) of inhibition of the rec^- strain is recorded as well as that of the rec^+ strain.

Activation assays are performed in a parallel fashion to the nonactivation test, after an appropriate preincubation of the test material with the S.9 extract.

Results:
Zones of inhibition are recorded in mm diameters. For each concentration of test material used, an average of three zones of inhibition is determined. Positive control test results using dimethylnitrosamine and MMS are recorded as averages of triplicate assays.

Duration of Test:
Three days for verbal result, and four weeks for final written report.

Report:
Final report shall include raw data in tabular form, and the experimental design used. A discussion and interpretation, based on the statistical analysis of the data will be provided as basis for our conclusion as to the mutagenic potential of the test material.

All procedures are certified as to performance under the Good Laboratory Practice regulations.

FORWARD MUTATION TEST USING E.coli:

Objective: Evaluate the mutagenic potential of a test material as determined through the induction of 5-methyl-tryptophane (5-MTR) resistance and to galactose utilization (gal^+) phenotypes.

Test Strains: E.coli gal^- and 5-MTR sensitive strains.

Sample Required:
One to two grams.

Test Procedure:
Bacterial cultures are exposed, in liquid medium, to varying concentrations of the test material, at sublethal doses, in the presence and absence of S.9 extract. The number of gal^+ and 5-MTR resistant colonies are determined on the appropriate selective media, at three growth intervals. The viable count is also determined, at each concentration, at the same time intervals, on complete medium.
The mutation rate is calculated using the appropriate mutation rate formula as gal^+ or 5-MTR resistance mutants per cell per generation.
Positive and negative controls, in the presence and absence of metabolic activation, using dimethyl nitrosamine and MTG, are performed in a parallel fashion to the test material.

Results:
The number of gal^+ and 5-MTR resistant colonies are recorded for each concentration of the test material. Results obtained with the positive and negative control tests are also recorded for comparison.
The mutation rate is calculated for each concentration of test material as an average of three sets of data obtained from triplicate assays. In each assay, the mutation rate is calculated on the basis of three values of mutant number and viable count obtained at the three growth intervals in the test.

Duration of Test:
Five days for verbal result, and four weeks for written report.

Report:
Final report will include raw data in tabular form for all tests performed and the experimental design used. A discussion and interpretation, based on the statistical analysis of the data will be provided as basis for our conclusion as to the mutagenic potential of the test material.

All procedures are certified as to performance under the Good Laboratory Practice regulations.

MAS LABORATORIES STANDARD OPERATING PROCEDURES

General Outline

In compliance with the Good Laboratory Practices regulations, MAS Laboratories standard operating procedures are designed to maintain an accurate record of all the operations through which a test material is processed from the time of its receipt to the writing of the final report. In all cases, bound, page numbered log books are used. All entries are dated and each page is authenticated by the signature of the operator and the section head. Alterations in entries shall be initialed by the section head and documented as to reason of alteration. Personnel safety as well as that of the immediate environment outside MAS Laboratories is dealt with with utmost care by maintaining rigorous adherence to the guidelines described by OSHA and EPA.

MAS Labs Standard Operating Procedures

1. Upon receipt of test compound, it is logged in Entry Log Book, and given an MAS number. Entry shall include a complete identification of sponsor, a physical description of the compound as received, lot number and name or number, as requested by sponsor and weight received. All entries are dated and signed by log book operator.
2. Test compounds are immediately stored in a central receiving rack maintained at 4°C, unless otherwise specified by sponsor, until it is used in the test.
3. Prior to opening the sample (test compound) container for manipulation and use in test, the container is transferred to a safety cabinet (Lab-Con-Co., Bio-hazard negative air pressure hood) for weighing and transfer to dilution tubes.
4. After sample weighing all manipulations with the sample are performed in a Class II biohazard cabinet equipped with Hepa filtration and activated charcoal systems (Labmark).
5. Operator handling of test material shall be dealt with in the appropriate laboratory procedure using gloves (and filter masks if necessary).
6. All microbiological operations are performed under aseptic conditions.
7. Raw test data are recorded in ink in a bound, page numbered data book. Each page is dated and signed by test operator.
8. Observations during the test and/or comments may be written on the raw data pages and initialed by the test operator.
9. At the completion of a study, the section head shall authenticate all data obtained and shall sign accordingly.
10. The white copy of the raw data book may be sent to sponsor upon request, while the yellow copy is maintained by MAS for a permanent record. Routinely, however, the raw data shall be forwarded to sponsor on special forms in the final report, maintaining both white and yellow copies of test result as a permanent record available for inspection on location.

1. The final report shall have, identified on the front sheet, the names of personnel who were involved in the processing of the sample and performance of the test.
12. Curriculum vitae of all personnel shall be available for inspection by the sponsor if so requested.

Equipment

All equipment used at MAS Laboratories are certified by licensed inspectors. Complete log books are kept for each instrument. Records, in the form of daily/weekly entries or charts, specifying the operational conditions of each instrument shall be made available for inspection as needed and will be kept in MAS permanent files. This shall include autoclaves, ovens, incubators, balances, hoods, water distillation apparatus, etc.

Laboratory Environment

The laboratory environment is maintained at a constant temperature and humidity level, through central heating and air conditioning units and is equipped with an exhaust system maintaining a continuous air circulation with the outside environment. No air re-circulation is allowed under the East Windsor Township regulation.

Waste Disposal

Disposal of plates containing bacterial cultures, test chemicals and carcinogens is under contract with a major New Jersey hazardous waste disposal firm.

Laboratory Safety Procedures

Test compounds and mutagens are clearly labeled upon their receipt as "hazardous chemicals," and are kept in a well-labeled refrigerator with a biohazard sign on it.

Eating, drinking, smoking, storage of food or drinks are prohibited from all specified test and chemical storage areas.

Mechanical pipetting aids are used in handling test compounds.

Proper laboratory attire is adhered to at all times. Protective gloves and filter masks are used when appropriate.

APPENDIX

Gene Mutations:

Ames/Salmonella

E. coli: WP₂uvrA

E. coli: K12

Quantitative suspension

Host-mediated assay

Urine analysis

Yeast: S288Ca, S138,
S211

Mouse lymphoma:

TK+/-locus

Drosophila: sex-linked
recessive lethal

Mouse: somatic mutation
test

Primary DNA Damage:

E. coli: polA⁺/polA⁻

B. subtilis: rec⁺/rec⁻

Yeast: D4

Yeast: D3, D5 or D7

Mouse lymphoma: SCE

Human WI-38 cells: UDS

CHO cells: SCE

Rat primary hepatocytes: UDS

Human lymphocytes: SCE

Chromosome Aberrations:

Mouse lymphoma

CHO cells

Mouse bone marrow

Rat bone marrow

Hamster bone marrow

Mouse micronucleus

Drosophila: X and Y loss

Drosophila: dominant lethal

Drosophila: heritable trans-
location

Mouse: dominant lethal

Rat: dominant lethal

Mouse: heritable trans-
location

Other:

BALB/3T3: malignant transformation

Rodent cells: cytotoxicity

RAM cells: cytotoxicity

Mouse: spermhead abnormalities

CRYOGENIC STORAGE EFFECTS ON SALMONELLA STRAINS
EMPLOYED IN THE AMES TEST FOR MUTAGENICITY.

John V. Jankowski and Lester J. Turoczi (Wilkes College)

A standard method for storing "Ames strains" of Salmonella typhimurium involves the preparation of aliquots using 0.08ml of DMSO added to 0.92ml of an overnight broth culture of the bacteria. These vials are then deep frozen at either -80° in a cryogenic freezer or stored in a liquid nitrogen storage container on canes in a canister. In our laboratory, variations in the number of spontaneous revertants for strain TA100 have been observed which appear to be dependent upon the age of the DMSO and the position of the vial in the cryo-container canister. A chemical analysis of stored, aged DMSO utilizing infra-red (I.R.) spectroscopy indicates a possible structural change in the solvent over time. We will present studies on variations in storage conditions pertaining to aged vs. fresh and sealed vs. opened bottles of DMSO combined with vial position in the liquid nitrogen container employing the standard five tester strains of Salmonella. The potential for interaction between storage position and solvent stability on revertant numbers will be discussed.

*This Abstract sent to P.A. Acad. of Sci.
for April meeting paper presentation*



United Health and Hospital Services, Inc. Wyoming Valley Family Practice Residency

Family Practice Residency

FUNCTIONS OF PRIMARY CARE

A. Clinical services on a scheduled basis

Appointments initiated by patient (or patient's family, friend, employer), or by the physician (or other health professional or health institution) at mutual convenience to provide:

1. Periodic health exam
2. Diagnosis and treatment of acute condition
3. Diagnosis and treatment of chronic condition
4. Follow-up care after hospitalization
5. Maintain continuity for patient obtaining consultative services from other physicians and health professionals to coordinate clinical care, answer patient questions and improve compliance with recommendations of the consultant
6. Crisis intervention for semi-urgent problems (i.e., appropriate for delays inherent in scheduling as opposed to drop-in or emergency visit).

B. Clinical services required by others for the patient

1. Pre-employment or school health examinations
2. Certification of sick days or readiness to return to work
3. Disability evaluation and determination
4. Insurance examinations
5. Needs assessment for community agencies (Visiting Nurse Association, Homemakers Services, half-way houses, rehabilitation programs).

C. Health Education and Disease Prevention

1. Health promoting behavior - Alameda County data from Belloc and Breslow
 - a. average 7-8 hours of sleep per night
 - b. maintain reasonable weight
 - c. regular physical exercise (Paffenbarger study suggests 2000 calories aerobic work/week equivalent to jogging 4 miles on 5 days/week)
 - d. limit alcohol to less than 5 drinks/day
 - e. no cigarettes *(Nurses having smoked is more significant)*
 - f. eat breakfast almost daily
 - g. avoid snacking between meals
2. Other risk averting behavior
 - a. seat-belts
 - b. awareness of occupational and environmental hazards (radiation, sunlight)
 - c. home safety -- falls, burns
 - d. no handguns
 - e. nutrition - avoid excess animal fats, salt and protein, problems of obesity
 - f. alcohol and drug abuse
 - g. stress control
 - h. fluoridation
3. Education of patient about benefits of secondary and tertiary prevention
 - a. hypertension
 - b. coronary artery disease
 - c. arthritis
 - d. diabetes mellitus
4. Early detection and primary prevention
 - a. routine immunizations
 - b. PAP smears
 - c. Teaching breast self-examination
 - d. Physician awareness of current communicable disease patterns necessary to provide timely advice on immunizations and information or reassurance about minor viral illnesses.

D. Counselling

1. Physician responsibility to inform patient about what is happening and why certain interventions are recommended
 - a. modified according to nature of doctor-patient relation (Szaz-Hollender)
 - b. empathic communication of interest and concern
 - c. description of problem in terms understandable by the patient
 - d. engagement of the patient in active efforts to solve the problem

2. Physician understanding of reasons patients seek medical care

a. McWhinney description of patient behavior:

- i) Some discontinuity is perceived in usual function
- ii) The discontinuity is perceived as illness
- iii) Some form of self-care is attempted
- iv) Family or friends serves as the first-line external resource
- v) Other external nonprofessional resources are tried
- vi) Professional, non-medical resources are consulted
- vii) Physician is consulted
- viii) Diagnostic assessment
- ix) Management plan
- x) Care or chronic illness or death

b. Ecology of medical care

- i) Kerr White's data suggests that about one-third of illness episodes lead to physician consultation and 1% to hospitalization

c. Physician as social contact

- i) Especially among the elderly and the depressed ambulatory visits to the physician may be the major source of social contact
- ii) Regular prophylactic visits may be cost effective in reducing ER visits, hospitalizations, or doctor-shopping with attendant duplication of laboratory tests or prescription of inappropriate drugs.

d. Psychological component to medical illness

- i) About 60% of medical visits have a major behavioral component (mid-town Manhattan study revealed 84% of general population reporting some emotional/psychiatric problem at time of study)

3. Anticipating Guidance

- a. Physician need to understand potential stress associated with diagnostic work-up or treatment of illness or with evolution of natural history of the disease.
- b. Importance of knowledge of the life cycle.

Counselling the patient in anticipation of natural changes in the life cycle:

- i) individual (D.J. Levinson, G. Vaillant)
- ii) family (B.K. Hennen)
 - Courting
 - Marriage
 - Child bearing
 - Child rearing
 - Child launching
 - Empty nest

Retirement
Death of one's spouse
Grieving

III. Implementing Ambulatory Care

A. Organization of setting

1. Scheduling

- a. Importance of time as diagnostic and therapeutic modality
- b. Establish proper pace for complete, thorough examination whether in one or multiple visits
- c. Allow adequate time for the multiple complaints often encountered in elderly patients - avoid endless pursuit of unifying diagnosis when multiple concurrent problems exist.
- d. Therapeutic trial of medication as diagnostic maneuver appropriate to ambulatory setting.

2. Medical Records

- a. use of pre-printed history forms
- b. laboratory flow sheets
- c. treatment lists
- d. working diagnoses or problem list

3. Office staff

Protocols for:

- i) telephone procedures, including canceling appointments when doctor delayed by emergency or called away
- ii) restriction of smoking to specific areas
- iii) instructions about dealing with physically unruly, abusive or intoxicated patients
- iv) handling visits by drug detail persons
- v) acute medical emergencies
- vi) billing procedures
- vii) drop-in patients
- viii) staff addressing one another

4. Hospitalizations

When elective hospitalization should be arranged
Advantages and disadvantages of hospitalization from medical, social, economic and psychological points of view

5. Knowing capabilities of Allied Health Professionals

Nurse practitioners
Physical therapists
Social workers
Nutritionists
Home health aides