American Society for Microbiology

CONFERENCE FOR UNDERGRADUATE EDUCATORS

University of Central Florida
Orlando, Florida
May 19-21, 2006

Final Program

An Educational Program of

University of Central Florida
**ASMCUE 2006 Program-at-a-Glance**

### Friday, May 19th

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<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Location</th>
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<tr>
<td>6:30 – 8:30 am</td>
<td>Breakfast</td>
<td>HI: Grand Ballroom</td>
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<tr>
<td>7:00 – 7:30 am</td>
<td>Pre-Conference Workshop Check-In: Badge &amp; Program Pick-Up</td>
<td>HI: Grand Ballroom</td>
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<tr>
<td>7:00 am – 3:00 pm</td>
<td>Shuttle Bus Service</td>
<td>HI=HPA</td>
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<td>8:00 – 11:30 am</td>
<td>Pre-Conference Workshops</td>
<td>UCF: HPA &amp; HPA2</td>
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<tr>
<td>10:00 am – 6:00 pm</td>
<td>ASMCUE Registration Check-In: Badge &amp; Program Pick-Up</td>
<td>10 am-2:30 pm - LOEC</td>
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<tr>
<td>11:30 am – 1:00 pm</td>
<td>Lunch</td>
<td>HI=LOEC</td>
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<tr>
<td>12:00 – 1:30 pm</td>
<td>Lunch, Munch Talk and Plan a Bunch: Branching Out 2010</td>
<td>BA</td>
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<tr>
<td>1:30 – 2:15 pm</td>
<td>Learn Something New Concurrent Sessions II of II</td>
<td>HPA</td>
</tr>
<tr>
<td>2:30 – 3:15 pm</td>
<td>MicrobeLibrary.org Concurrent Sessions</td>
<td>HPA</td>
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<tr>
<td>3:00 – 7:00 pm</td>
<td>Exhibit Showcase</td>
<td>HPA and HPA2</td>
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<tr>
<td>3:30 – 4:30 pm</td>
<td>Author Book Corners: Sponsored by ASM Press</td>
<td>HPA2</td>
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<tr>
<td>4:20 – 7:10 pm</td>
<td>Poster Sessions</td>
<td>HPA and HPA2</td>
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<tr>
<td>5:00 – 6:00 pm</td>
<td>Author Book Corner and Refreshment Break: Sponsored by Benjamin Cummings</td>
<td>HPA2</td>
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<td>6:00 – 10:00 pm</td>
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<tr>
<td>7:30 – 8:30 pm</td>
<td>Dinner</td>
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<tr>
<td>9:00 – 10:00 pm</td>
<td>Reception</td>
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**Saturday, May 20th**

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<tr>
<td>8:30 – 9:30 am</td>
<td>Plenary Session: Edward DeLong</td>
<td>BA</td>
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<tr>
<td>9:30 – 10:30 am</td>
<td>Author Book Corner and Refreshment Break: Sponsored by McGraw-Hill Higher Education</td>
<td>HPA</td>
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<tr>
<td>10:30 am – 12:00 pm</td>
<td>Try Something New Concurrent Sessions II of III</td>
<td>HPA</td>
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<tr>
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<td>Lunch, Munch Talk and Plan a Bunch: Branching Out 2010</td>
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<tr>
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<td>MicrobeLibrary.org Online Submission Beta Testing</td>
<td>HPA</td>
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**Sunday, May 21st**

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<td>HI=HPA</td>
</tr>
<tr>
<td>8:30 – 9:30 am</td>
<td>Plenary Session: Terrence Tumpey</td>
<td>BA</td>
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<tr>
<td>9:30 – 10:00 am</td>
<td>Conference Wrap-Up and Evaluation</td>
<td>BA</td>
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<tr>
<td>10:00 – 11:30 am</td>
<td>Try Something New Concurrent Sessions III of III</td>
<td>HPA</td>
</tr>
<tr>
<td>12:30 pm</td>
<td>Bus #1 Departs to ASM General Meeting</td>
<td>HI</td>
</tr>
<tr>
<td>1:00 pm</td>
<td>Bus #2 Departs to ASM General Meeting</td>
<td>HI</td>
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UCF CAMPUS LOCATIONS: BA = Business Administration Building  HPA = Health and Public Affairs Building  HPA2 = Health and Public Affairs Building II  LOEC = Live Oak Event Center  HI = Holiday Inn-UCF  ⇆ = Continuous shuttle bus service between buildings during hours listed
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Welcome to the 2006 ASM Conference for Undergraduate Educators!

This year's theme is "Recombination of Ideas in Teaching Microbiology." The ASM staff and many volunteers have worked hard over the last year to develop a program that will allow you to draw from each other's strengths and experiences and recombine them to improve your teaching of microbiology. One of the strengths of ASMCUE is sharing favorite ideas and picking up some good tips for better teaching. Every year we look forward to connecting with old friends, and meeting new ones. Once in a while, we hear something that changes our whole perspective. We encourage you to take advantage of all the venues for sharing and learning.

To add your knowledge of current topics in microbiology, we are very excited about our outstanding plenary lectures. Each lecturer has made substantial contributions to the field of microbiology. We are also continuing the successful “Learn Something New, Try Something New” concurrent sessions for which there is a diverse array of topics and approaches to teaching and learning. We hope that you will put faces to names at the Saturday Lunch. The program also includes approximately 63 poster presentations. We invite you to provide encouragement and feedback to the poster presenters. We also welcome the exhibitors and several textbook authors to the conference. This year our corporate sponsors include Benjamin Cummings (co-sponsoring the Lunch, Munch, Talk and Plan a Bunch: Branching Out 2010 and a refreshment break) and McGraw-Hill Higher Education (sponsoring a refreshment break Saturday morning.)

We would like to thank our abstract reviewers for the time they have spent - their efforts have certainly contributed to the quality of this conference.

We greatly appreciate all the help given to us by our host institution, The University of Central Florida. Particularly, we thank Bob Gennaro, who has coordinated scheduling of facilities at UCF.

Please take time to welcome our "first-timers" who make up nearly 50% of the attendees this year. This is one of the few places that microbiology educators gather together to find kindred spirits. Where else would you find such a tremendous collection of dedicated educators? New people inspire and are inspired by us, so be sure to reach out to those you don't already know. We look forward to your active participation and hope you can share, transform, and recombine your ideas of teaching microbiology.

Respectfully,

DONALD BREAKWELL
Brigham Young University
Provo, Utah

JACKIE REYNOLDS
Richland College
Dallas, Texas
Conference Planning Committee

"Recombination of Ideas in Teaching Microbiology"
13th ASM Conference for Undergraduate Educators
May 19 - 21, 2006 • University of Central Florida, Orlando, FL

Committee Co-Chairs

DONALD BREAKWELL
Brigham Young University
Provo, UT

JACKIE REYNOLDS
Richland College
Dallas, TX

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Morehead, KY

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University of North Texas
Denton, TX

DON LEHMAN
University of Delaware
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SUE MERKEL
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GAIL GOODMAN SNITKOFF
Albany College of Pharmacy
Albany, NY

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Orlando, FL

PAPPACHAN E. KOLATTUKUDY
Dean
Burnett College of Biomedical Sciences
Orlando, FL

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About our Hosts

Excerpted from The Helix, Burnett College of Biomedical Sciences Newsletter, August 2005, Volume 1

From Our Dean, Pappachan E. Kolattukudy

This is an exciting time for the Department of Molecular Biology and Microbiology and Biomolecular Science Center, both organized into the newly established Burnett College of Biomedical Sciences aided by the generous support from Al and Nancy Burnett. The College has set its sights on building a nationally recognized biomedical education and research enterprise. The College is in the process of hiring 34 new faculty members within a five year period and five new faculty joined this year.

With over 1340 majors in Molecular Biology and Microbiology, a 53% increase during the past two years we are on our way to making significant contributions to the production of college graduates and health professionals. To help provide the skilled workforce required for the emerging biotechnology industry in Florida we are in the process of starting new BS, MS and an accelerated BS/MS degree programs in biotechnology. We are also planning to start an MS/MBA program in collaboration with the College of Business Administration. Our current MS program has 32 students with several receiving MS each year.

Our interdisciplinary PhD program in Biomolecular Science currently has 27 faculty members including faculty from Chemistry, Biology and Nanoscience and Technology Center as well as our college faculty. We currently have 51 PhD students.

Our Medical Laboratory Sciences Program is expanding with a plan to graduate 20 medical technologists per year in collaboration with the major health care providers in Orlando, the Florida Hospitals and Orlando Regional Medical Center. The prehealth advising office that serves all of the UCF students who wish to pursue health professions is making real strides with its new Director.

In our quest to find cures for major diseases, research programs funded by National Institutes of Health and other Federal agencies are making nationally recognized progress. Last year, the successful use of stem cells and drugs to recover memory lost by neurodegenerative diseases was covered by Wall Street Journal. The experimental evidence that the painful Crohn’s disease is caused by a bacterial agent was published in the world-renowned medical journal, The Lancet and this finding was covered by news media around the world. The successful treatment of patients based on this finding was covered by a feature article in Saturday Evening Post. The results of research conducted in the College on cancer, neurodegenerative diseases, cardiovascular diseases and infectious diseases are being published in top journals in the field.

The College faculty is also involved in technology transfer to commercialize their findings. The research conducted by the College faculty formed the technical basis for three biotechnology companies. One of them, Chlorogen, received 6 million dollar venture capital to produce pharmaceutically important proteins in plants. Topogen is producing reagents used in cancer research and NewNeural seeks ways to treat neurodegenerative diseases.

The planning of the Burnett College of Biomedical Sciences building has been completed. We expect the plans to be converted into architectural design and construction drawings in the immediate future with an expected occupancy of the new facility within three years. Such a facility will allow all of our college researchers to be in one facility to promote scientific collaboration and shared use of expensive equipment.

We are working with the two major health care providers Orlando Regional Medical Center and Florida Hospitals to establish collaborations in biomedical research that will create a win-win situation for all partners and help convert laboratory
discoveries to patient care products. All of these efforts of the Burnett College of Biomedical Sciences are expected to help pave the way to establishing a much needed College of Medicine in UCF. Such a research based Medical school will greatly enhance the quality of medical care in the greater metropolitan area and contribute to the economy of the region and the state by helping to establish a biomedical industry.

Achieving this goal will require the support of the entire community and we are actively seeking such support with the help of many supporters within UCF and in the community. Visit our web site to get more information at http://www.bmsc.ucf.edu/ or contact the college at 407-823-1312.

Professor Robert Gennaro, Founding Chairman of the Department of Molecular Biology & Microbiology

After more than 35 years of service at UCF, Robert Gennaro retired in October 2004. Dr. Gennaro received his Ph.D. from the Texas A & M University in 1969. Soon after, he joined the faculty of the Department of Biology, UCF. Bob played a major role in the development of the new Department of Molecular Biology and Microbiology since its inception in Fall 1990. Through his efforts and under his direction as the Chair, the department grew from an initial group of 30 microbiology majors in 1990 to over 500 molecular biology and microbiology majors in just 10 years. He also played a vital role in recruitment of a talented core of new faculty that increased the research capabilities and reputation of the department. As Associate Dean of the College of Health and Public Affairs, he directed the graduate programs of the college for a number of years while also serving as the Chair of Molecular Biology and Microbiology. He also assumed the responsibility for the construction of the new Biomolecular Science Building for the Department and the Biomolecular Science Center. Bob’s commitment to our college did not end with his retirement, for he continues to serve our students and faculty in many different capacities as Professor Emeritus. The Burnett College of Biomedical Sciences is fortunate to have his valuable service continue.

The Fourteenth Annual ASM Conference for Undergraduate Educators
May 19 – 21, 2007
Toronto, Ontario, Canada

Visit www.asmcue.org in November for further information.

Note: The conference will fall on different days next year. The conference will begin Saturday and end Monday. The ASM General Meeting will begin Monday evening.
General Information

Meeting Statistics
There are 269 participants, compared to 247 in 2005. Of those registered, there are:

- 254 conference attendees and 15 exhibitors
- 232 ASM Members and 22 non-members (among the faculty participants)
- Nearly 50% first-time attendees
- 14 international attendees representing 9 countries
- 90 attendees registered for pre-conference workshops

Travel Awards
Thirteen Early-Career travel grant applications were funded. Recipients received a travel subsidy to present posters at the meeting.

Five Faculty Enhancement Program travel grant applications were funded. This Program supports non-ASM members who teach microbiology at institutions serving minority and underserved populations to attend the Conference and receive a one-year introductory ASM membership.

Check-in and Name Badges
Below are the locations for the central ASMCUE 2006 information desk:

Friday, May 19:
7:00 am – 7:30 am: Grand Ballroom, Holiday Inn (Pre-conference Workshops Only)
10:00 am – 2:30 pm: Live Oak Event Center (LOEC), UCF
3:00 pm – 6:00 pm: Atrium, Health and Public Affairs Building (HPA), UCF

Saturday, May 20:
7:30 am – 7:00 pm: Atrium, Health and Public Affairs Building (HPA), UCF

Sunday, May 21:
7:30 am – 11:30 am: Atrium, Health and Public Affairs Building (HPA), UCF

Please visit the information desk to direct any questions you may have to ASM staff.

Name badges permit attendees’ entrance into all sessions, conference meals and bus transportation. Please wear your name badge to all conference functions.

Meals
A continental breakfast will be available at the Holiday Inn Friday through Sunday. All other meals, except Saturday Lunch, will be served in the UCF, Live Oak Event Center. Lunch Saturday will be served as boxed lunches in the HPA Atrium. The registration fee covers all meals through noon Sunday. Guests are not permitted at meals unless they have paid the guest fee and present the guest badges provided to them.

Vegetarian meals will be provided at each meal for those who requested them. If you need vegetarian meals and did not request them prior to the conference, please make the request at the ASM information desk.
Shuttle Bus Service from the Holiday Inn Orlando - University of Central Florida
Shuttle buses will run continuously ONLY during the hours below between the Holiday Inn and the UCF campus. For exact pick-up and drop-off locations, see the ASMCUE 2006 Conference Program (pp. 13-19).

**Friday, May 19**
7:00 am – 3:00 pm  
6:00 pm – 10:00 pm

**Saturday, May 20**
7:00 am – 11:00 am  
6:00 pm – 10:00 pm

**Sunday, May 21**
7:30 am – 12:00 pm

Shuttle Bus Service to the ASM General Meeting
Shuttle service to the ASM General Meeting will be provided at the conclusion of the conference to participants who registered in advance. Attendees who have paid for shuttle bus service to the ASM General Meeting will receive a ticket in the meeting packets. The ticket must be presented upon boarding the bus. The bus will drop off at the West Concourse of the Orange County Convention Center. Buses will load at the Holiday Inn-UCF on Sunday, May 21. **Buses will depart at 12:30 pm and 1:00 pm.**

Holiday Inn Orlando- University of Central Florida

*Hotel check-in*: 3:00 pm  
*Sunday check-out*: 11:00 am

Poster Presentations
Poster sessions will be held Saturday, May 20 from 3:00 pm – 7:10 pm in UCF. Authors may set up their posters beginning noon, Saturday, May 20. All poster presentations should be ready by 3:00 pm. Authors must remove their posters Saturday evening between 7:10 pm – 9:00 pm.

Exhibits
The Exhibit Showcase will be held Saturday, May 20 from 4:20 pm – 7:00 pm in the HPA Buildings. Exhibitors may set up from 12:00 pm – 3:00 pm on Saturday. All exhibits must be dismantled between 7:00 pm – 9:00 pm.

Reminder!
**Fill out your ASMCUE 2006 Meeting Evaluation!**

A conference evaluation will be sent via email to attendees immediately following the conference. Please take time to fill out the survey so that we may serve your future needs.

We look forward to welcoming you to 
Toronto, Ontario, Canada, May 19 – 21, 2007!
Sponsors and Exhibitors

The American Society for Microbiology would like to thank the following sponsors and exhibitors for their generosity:

**Co-Sponsor for Saturday Lunch:**
**BENJAMIN CUMMINGS**

**Sponsor of the Saturday Morning Refreshment Break:**
**MCGRaw-HiLL HiGHER EDUCATION**

**Sponsor of the Saturday Afternoon Refreshment Break:**
**PEArSON EDUCATION - BENJAMIN CUMMINGS**

**Sponsors of the Meet the Author Book Corners:**
**ASM PRESS**
**PEArSON EDUCATION - BENJAMIN CUMMINGS**
**MCGRaw-HiLL HiGHER EDUCATION**
**W.W. NORTON & COMPANY**

**Exhibit Showcase**
Saturday, May 20 - 3:00 pm – 7:00 pm
HPA and HPA2

- **AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE**
  Washington, DC
  www.biosciednet.org

- **PEArSON EDUCATION - BENJAMIN CUMMINGS**
  San Francisco, CA
  www.aw-bc.com

- **ASM PRESS**
  Washington, D.C.
  www.asm.org

- **EAGLE VISION EDITIONS**
  Vista, CA
  http://members.cox.net/galderson/

- **EDVOTEK**
  Bethesda, MD
  www.edvotek.com

- **JONES AND BARTLETT PUBLISHERS**
  Sudbury, MA
  www.jbpub.com

- **MCGRaw-HiLL HiGHER EDUCATION**
  New York, NY
  www.mhhe.com

- **NATIONAL CENTER FOR BIOTECHNOLOGY INFORMATION**
  Bethesda, MD

- **PEArSON EDUCATION-PRENTICE HALL**
  Upper Saddle River, NJ
  www.prenhall.com

- **W.W. NORTON & COMPANY**
  New York, NY
  www.wwnton.com

- **WILEY**
  Hoboken, NJ
  www.wiley.com
Meet the Author Book Corners

The following publishers have sponsored Author Book Corners in which feature authors will be present to meet and greet ASMCUE 2006 Attendees.

Joan Slonczewski
Sponsored by W. W. Norton & Company
Friday, May 19, 3:30 pm: HPA Atrium

*Microbiology: An Evolving Science*
by Joan Slonczewski and John Foster
(Coming soon)

Authored by Joan L. Slonczewski and John W. Foster, this text is intended for courses enrolling biology and microbiology majors and was written to present the core topics of microbiology within the context of the new challenges that are shaping the field. All of the chapters feature strong coverage of the process of science and of current research, as well as “Thought Questions” designed to stimulate inquiry. The text gives equal emphasis to microbial ecology and medical microbiology, features strong coverage of viruses, and incorporates strong coverage of how genomics, bioinformatics, and other tools are changing how microbiologists work and what they know.

Marjorie Kelly Cowan
Sponsored by McGraw-Hill Higher Education
Saturday, May 20, 9:30 am: HPA Atrium

*Microbiology: A Systems Approach, 1st Edition*
by Marjorie Kelly Cowan and Kathleen Park Talaro
(Hardcover – January 2005)

*Microbiology: A Systems Approach* is an exciting new textbook written with the non-major/allied health student in mind. Offering an engaging writing style through the use of tools such as case studies and analogies, the text thoroughly explains difficult microbiology concepts in an accessible manner. Utilizing an organ systems approach, the unique in-chapter organization of the disease/clinical chapters provides students a realistic viewpoint of the clinical experiences they will encounter in the future.

Support our Exhibitors and Sponsors!

Visit the Exhibit Showcase
Saturday, May 20
3:00 pm – 7:00 pm
HPA and HPA2
Moselio Schaechter, John L. Ingraham, Fred C. Neidhardt

Sponsored by ASM Press
Saturday, May 20, 3:30 pm: HPA Atrium

Microbe
by Moselio Schaechter, John L. Ingraham, and Frederick C. Neidhardt
(Paperback – November 2005)

Microbe, a brand new, general microbiology textbook intended for upper-division undergraduate courses, is an exciting introduction to the world of microbes. With a distinct ecological and evolutionary orientation, Microbe invites readers to partake of the most current advances in the field. Written by prominent scientists with practical teaching, textbook writing, and research experience, this new textbook will engage students in the learning process with its clear, reader-friendly style and unique perspective of the field.

Microbe is paradigm-driven rather than fact-driven. Key concepts are illustrated by inspiring examples that convey the excitement of the field. This is not a compendium of facts, but rather a textbook in the older, traditional sense: a book that can be used for studying rather than for looking up factual information.

Purchase of the Microbe textbook grants instructors and students access to two Web resources. The first is the Microbe website which is designed to amplify material covered in the book by providing quick links to additional information and animation and video clips. The second is the BrainX E-Learning System study guide which enhances learning and allows students to make more productive use of their study time.

Rodney Anderson

Sponsored by ASM Press
Saturday, May 20, 3:30 pm: HPA Atrium

Outbreak: Cases in Real World Microbiology
by Rodney P. Anderson
(Paperback – May 2006)

Outbreak: Cases in Real-World Microbiology is a fascinating new textbook targeting introductory microbiology instructors and students. Generously illustrated with color photographs, the book integrates headline-making disease outbreaks into the microbiology coursework and is the first work of its kind to utilize material that directly impacts college-age students. Unique in its presentation, Outbreak is designed to offer instructors the flexibility to use the book effectively in a number of ways, while providing students with the critical content they need.

A total of 96 classroom-tested case studies cover the topics of microbiology, including basic microbiology concepts, medical microbiology, bioterrorism, environmental microbiology, and industrial microbiology. At the end of each case study are questions for students to think about and answer. Appendices direct students to specific reference material relevant to the study questions and provide handy information about antimicrobial agents in table format. At the end of each section, following the case studies, are detailed descriptions of the diseases involved in the outbreak case studies. These descriptions offer concise information on the cause, transmission, pathogenesis, clinical features, diagnosis, treatment, and prevention of these diseases.
Key Features
- Presents case studies covering a wide variety of subject areas, including general, medical, environmental, and industrial microbiology
- Integrates current outbreaks that are featured in news headlines into the classroom for added relevance
- Features a discovery-oriented answer key that directs students to appropriate reference material rather than providing complete answers to the study questions
- Introduces students to the relevance of diverse social, economic, political, and religious issues that exist in various parts of the world
- Provides case studies of varying levels of difficulty
- Presents complete information about each disease and microbe covered

**Invisible ABCs**
by Rodney P. Anderson
(Hardcover – September 2006)

*Invisible ABCs*, due to publish in September, makes creative use of microbe photomicrographs to teach school-age children about the microbial world. Featuring over 100 vivid micrographs, this book teaches readers that microorganisms are fascinating life forms that carry out essential activities in our ecosystems to sustain life on Earth.

Key Features
- Features over 100 superb illustrations of algae, molds, bacteria, and viruses
- Emphasizes the beneficial roles of microorganisms children encounter in their daily activities, from eating bread and cheese to taking medicines
- Presents scientifically accurate information in an age-appropriate format that is both colorful and captivating
- Communicates the size of microorganisms by relating them to items children are familiar with from everyday experiences

**Robert W. Bauman**
*Sponsored by Benjamin Cummings*
Saturday, May 20, 5:00 pm: HPA Atrium

**Microbiology with Diseases by Taxonomy, 2nd Edition**
By Robert W. Bauman
(Hardcover – January 2006)

Filled with lively vignettes and cutting-edge research that highlight the intrinsic appeal of microbiology, Bauman’s Second Edition retains the book’s groundbreaking art program, includes a handy new “Microbe-at-a-Glance” feature, offers new options for the Microbiology Place website/CD-Rom, and provides instructors with a new Media Manager presentation package with 30 multi-step animations.
Faculty Enhancement and Travel Grant Awardees

Faculty Enhancement Program Awardees:

- **Cliff K. Grimsley**  
  Gaston College, Dallas, NC

- **Saron Z. Henry**  
  Milwaukee Area Technical College, Milwaukee, WI

- **Johana Melendez**  
  Hillsborough County Community College, Plant City, FL

- **Madhura M. Pradhan**  
  The Ohio State University, Dublin, OH

- **T.G. Thomas**  
  Bakersfield College, Bakersfield, CA

Early-Career Travel Grant Awardees:

- **Mary N. Boyle**  
  Vermont Technical College, Randolf Center, VT

- **Jennifer Renee Brigati**  
  University of Tennessee, Knoxville, TN

- **Paul Dean Brown**  
  University of the West Indies, Kingston, JAMAICA

- **Naowarat Cheeptham**  
  Thompson Rivers University, Kamloops, BC, Canada

- **Ciraj Ali Mohammed**  
  Melaka Manipal Medical College, Manipal, Karnataka, India

- **Jennifer Ann Herzog**  
  Herkimer County Community College, Herkimer, NY

- **Himgauri K. Kulkarni**  
  MiraCosta Community College, Oceanside, CA

- **Jennifer Kraft Leavey**  
  Georgia Institute of Technology, Atlanta, GA

- **Emily L. Lilly**  
  University of Massachusetts Dartmouth, North Dartmouth, MA

- **Tracey Meilander**  
  Kent State University, Kent, OH

- **Stephanie S. Strand**  
  Washington University School of Medicine, St. Louis, MO

- **Anh-Hue Thi Tu**  
  Georgia Southwestern State University, Americus, GA

- **Debra Lynn VanHouten**  
  Chemeketa Community College, Salem, OR
Conference Program

FRIDAY, MAY 19th

6:30 am – 8:30 am  BREAKFAST  Holiday Inn Grand Ballroom

7:00 am – 7:30 am  PRE-CONFERENCE WORKSHOP CHECK-IN  Badge and Program Pick-up  Holiday Inn Grand Ballroom

7:00 am – 3:00 pm  SHUTTLE BUS SERVICE  Continuous service between buildings during hours listed

8:00 am – 11:30 am  Pre-Conference Workshops

Applications of Molecular Biology to the Clinical Sciences and Medicine Sponsored by Edvotek, Inc.
Jack G. Chirikjian, Edvotek, Inc. and Vasna Nontanovan, Georgetown University Medical Center

Bringing Real Life to the Classroom: Using Case Studies in Microbiology Teaching
Mary Allen, Hartwick College and Mary Dominiecki, Complete Healthcare Communications, Inc.

Case-Based Learning Using Protein and DNA Simulations to Analyze Cases Based on Infectious Diseases
Karen Klyczek and Mark Bergland, University of Wisconsin, River Falls

Incorporating Genomics and Bioinformatics into Your Courses
Brad Goodner, Hiram College

Writing Successful Grant Proposals for Microbiology
Jeanne Rudzki Small, National Science Foundation

HPA = Health and Public Affairs Building
HPA2 = Health and Public Affairs Building II
LOEC = Live Oak Event Center
BA = Business Administration Building

13th ASM Conference for Undergraduate Educators  Orlando, Florida

13
ASMCUE 2006

10:00 am – 6:00 pm
**ASMCUE REGISTRATION CHECK-IN:**  
**BADGE AND PROGRAM PICK-UP**  
10:00 am – 2:30 pm – LOEC  
3:00 pm – 6:00 pm – HPA, Atrium

11:30 am – 1:00 pm
**LUNCH**

1:00 pm – 2:00 pm
**WELCOME REMARKS AND OPENING PLENAiry LECTURE**
Molds and Mycotoxins, Genes and Genomes  
Joan W. Bennett, Tulane University

2:00 pm – 2:30 pm
**ASM GLOSSARY, TOOLS & WHAT’S NEW**
Amy Chang, ASM Education Department

2:45 pm – 3:30 pm
**LEARN SOMETHING NEW**
**CONCURRENT SESSIONS I OF II**  
(8 Sessions)

1 **Biology Curriculum**  
Graham Walker, Massachusetts Institute of Technology

2 **Giving Your Course the Genomics Touch**  
Brad Goodner, Hiram College

3 **Going for the Gold: Using the Enrichment Culture in an Introductory Microbiology Course**  
Mark Martin, University of Puget Sound

4 **Identification of Microorganisms in a Clinical Setting Based on Molecular and Genetics Testing—PCR, DNA Probes, RNA Analysis, etc.**  
David R. Hillyard, ARUP Laboratories

5 **Microbiology NSF Funding Updates**  
Jeanne Rudzki Small, National Science Foundation

6 **Scientific Underpinning for Professional Practice: The Essentials of Baccalaureate Education for Professional Nursing Practice**  
Jean D. Leuner, University of Central Florida
7 Teaching Microbiology Without Teaching Microbiology: The Dual Use Debate
Chris J. Woolverton, Kent State University
HPA 246

8 Using History to Teach Microbiology
Joan W. Bennett, Tulane University
HPA 117

3:30 pm – 4:30 pm
MEET THE AUTHOR BOOK CORNER:
JOAN SLONCZEWSKI
Sponsored by W.W. Norton Company
Microbiology: An Evolving Science
by Joan Slonczewski and John Foster
HPA Atrium

4:30 pm – 6:00 pm
TRY SOMETHING NEW
CONCURRENT SESSIONS I OF II
(5 Sessions)

1 Case-Based Learning Using Protein and DNA Simulations to Analyze Cases Based on Infectious Diseases
Karen Klyczek and Mark Bergland, University of Wisconsin, River Falls
HPA 104

2 Is It Possible to Teach Metabolism Interactively?
Amy Cheng Vollmer, Swarthmore College
HPA 246

3 Pathways to Scientific Teaching: Active Learning and Assessment
Diane Ebert-May, Michigan State University
HPA 119

4 Using Clickers Wisely
Erica Suchman, Colorado State University, Ft. Collins
HPA 126

5 Using Concept Maps as a Creative Tool for Teaching and Assessment of Learning
Clarissa Dirks, University of Washington
HPA 272

6:00 pm – 7:30 pm
DINNER
LOEC
Live Oak Room

6:00 pm – 10:00 pm
SHUTTLE BUS SERVICE
HI⇔LOEC

7:30 pm – 8:30 pm
PLENARY SESSION
LOEC
Live Oak Room

The Microbe Electric: Microbial Nanowires, Fuel Cells, and Electron Transfer onto Materials with Geobacter
Derek Lovley, University of Massachusetts, Amherst

9:00 pm – 10:00 pm
RECEPTION
Holiday Inn
SATURDAY, MAY 20th

7:00 am – 8:30 am  
**BREAKFAST**  
Holiday Inn  
Grand Ballroom

7:00 am – 11:00 am  
**SHUTTLE BUS SERVICE**  
HI⇒HPA

7:30 am – 7:00 pm  
**ASMCUE REGISTRATION CHECK-IN: BADGE AND PROGRAM PICK-UP**  
HPA Atrium

8:30 am – 9:30 am  
**PLENARY SESSION**  
BA 107

*Exploring the Microbial World: From Genomes to Biomes*  
Edward DeLong, Massachusetts Institute of Technology

9:30 am – 10:30 am  
**MEET THE AUTHOR BOOK CORNER AND REFRESHMENT BREAK:**  
**MARJORIE KELLY COWAN**  
Sponsored by McGraw-Hill Higher Education

*Microbiology: An Evolving Science*  
by Marjorie Kelly Cowan and John Foster

10:30 am – 12:00 pm  
**TRY SOMETHING NEW**  
**CONCURRENT SESSIONS II OF III**  
(6 Sessions)

1. **Applying the Scholarship of Teaching and Learning: Research on Students’ Concept Mastery, Attitudes, Beliefs, and Interest**  
Steven Pollock, University of Colorado, Boulder  
HPA 272

2. **Case-Based Learning Using Protein and DNA Simulations to Analyze Cases Based on Infectious Diseases**  
Karen Klyczek and Mark Bergland, University of Wisconsin, River Falls  
HPA 104

3. **Mathematical Modules in Biology**  
Meghan Burke, Kennesaw State University  
HPA 246

4. **Pathways to Scientific Teaching: Active Learning and Assessment**  
Diane Ebert-May, Michigan State University  
HPA 116

5. **Searches on DNA Sequences: Another Tool in the Active Learning Tool Kit**  
Marcia Cordts, University of Iowa  
HPA 126

6. **Using Concept Maps as a Creative Tool for Teaching and Assessment of Learning**  
Clarissa Dirks, University of Washington  
HPA 117
12:00 pm – 1:30 pm

**LUNCH, MUNCH, TALK AND PLAN A BUNCH: BRANCHING OUT 2010**

*Co-Sponsored by Benjamin Cummings*

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<td>VII: HPA 117</td>
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1:30 pm – 2:15 pm

**LEARN SOMETHING NEW**

**CONCURRENT SESSIONS II OF II**

(8 Sessions)

1. **Biology Curriculum**
   Graham Walker, Massachusetts Institute of Technology
   HPA 116

2. **Giving Your Course the Genomics Touch**
   Brad Goodner, Hiram College
   HPA 125

3. **Going for the Gold: Using the Enrichment Culture in an Introductory Microbiology Course**
   Mark Martin, University of Puget Sound
   HPA 126

4. **Identification of Microorganisms in a Clinical Setting Based on Molecular and Genetics Testing—PCR, DNA Probes, RNA Analysis, etc.**
   David R. Hillyard, ARUP Laboratories
   HPA 107

5. **Microbiology NSF Funding Updates**
   Jeanne Rudzki Small, National Science Foundation
   HPA 272

6. **Scientific Underpinning for Professional Practice: The Essentials of Baccalaureate Education for Professional Nursing Practice**
   Jean D. Leuner, University of Central Florida
   HPA 119

7. **Teaching Microbiology Without Teaching Microbiology: The Dual Use Debate**
   Chris J. Woolverton, Kent State University
   HPA 246

8. **Using History to Teach Microbiology**
   Joan W. Bennett, Tulane University
   HPA 117
2:30 pm – 3:15 pm  **MICROBELIBRARY.ORG CONCURRENT SESSIONS**

**Atlas-Protocol Project**
Ann Smith, University of Maryland, College Park

Starts in HPA 119
Breakout Rooms:
HPA 116, HPA117, HPA 119, HPA 125, HPA 126, HPA 246, HPA 272

**Curriculum Activity Development**
Jean Cardinale, Alfred University

3:00 pm – 7:00 pm  **EXHIBIT SHOWCASE**

HPA and HPA2

3:30 pm – 4:30 pm  **MEET THE AUTHOR BOOK CORNERS:**
MOSELIO SCHAECHTER, JOHN L. INGRAHAM, FRED C. NEIDHARDT AND RODNEY ANDERSON

Sponsored by ASM Press

**Microbe**
by Moselio Schaechter, John L. Ingraham, and Fred C. Neidhardt

**Outbreak: Cases in Real World Microbiology and Invisible ABCs**
by Rodney Anderson

3:30 pm – 4:30 pm and 5:00 pm – 6:00 pm  **MICROBELIBRARY.ORG AUTHOR INTERFACE BETA TESTING**

HPA 104

4:20 pm – 7:10 pm  **POSTERS PRESENTATIONS**

4:20 – 5:00 pm: Poster Session A
5:00 – 6:30 pm: Poster Session B
6:30 – 7:10 pm: Poster Session C

HPA Atrium
HPA2 Atrium

5:00 pm – 6:00 pm  **MEET THE AUTHOR BOOK CORNER AND REFRESHMENT BREAK:**
ROBERT W. BAUMAN

Sponsored by Benjamin Cummings

**Microbiology with Diseases by Taxonomy, 2nd Edition**
by Robert W. Bauman

6:00 pm – 10:00 pm  **SHUTTLE BUS SERVICE**

HI⇔LOEC

7:30 pm – 9:00 pm  **DINNER**

LOEC Live Oak Room

9:30 pm – 10:30 pm  **RECEPTION**

Holiday Inn
SUNDAY, MAY 21st

7:00 am – 8:30 am  BREAKFAST  Holiday Inn
                  Grand Ballroom

7:30 am – 12:00 pm SHUTTLE BUS SERVICE  HI⇔HPA

8:30 am – 9:30 am  PLENARY SESSION  BA 107
                    Differential Virulence in Mammals of
                    Influenza A H5N1 Viruses Isolate in Asia
                    Terrence Tumpey, Centers for Disease Control
                    and Prevention, Atlanta, GA

9:30 am – 10:00 am CONFERENCE WRAP-UP AND EVALUATION  BA 107

10:00 am – 11:30 am TRY SOMETHING NEW
                     CONCURRENT SESSIONS III OF III
                     (5 Sessions)

1  Applying the Scholarship of Teaching and Learning:
   Research on Students’ Concept Mastery, Attitudes,
   Beliefs, and Interest
   Steven Pollock, University of Colorado, Boulder
   HPA 125

2  Is It Possible to Teach Metabolism Interactively?
   Amy Cheng Vollmer, Swarthmore College
   HPA 126

3  Mathematical Modules in Biology
   Meghan Burke, Kennesaw State University
   HPA 117

4  Searches on DNA Sequences: Another Tool in the Active
   Learning Tool Kit
   Marcia Cordts, University of Iowa
   HPA 116

5  Using Clickers Wisely
   Erica Suchman, Colorado State University, Ft. Collins
   HPA 119

12:30 pm  BUS #1
          DEPARTS TO ASM GENERAL MEETING  Holiday Inn

1:00 pm  BUS #2
         DEPARTS TO ASM GENERAL MEETING  Holiday Inn
2006 ASM KADNER INSTITUTE

(FORMERLY ASM GRADUATE AND POSTDOCTORAL SUMMER INSTITUTE IN PREPARATION FOR CAREERS IN MICROBIOLOGY)

July 29 - August 2, 2006
University of Connecticut, Storrs

One-week, intensive, hands-on training in grantsmanship, scientific presentations, and teaching. Sessions also address career opportunities in the microbiological sciences and scientific ethics.

Presentation topics will focus on:

- Writing a Successful Grant Proposal
- Presentation Techniques
- Mentoring and Networking
- Case Studies in Ethics
- Preparing your Curriculum Vitae or Resume
- Time Management
- Teaching Strategies
- Obtaining a Postdoctoral Position
- Pathways to the Professoriate: Laboratory Management Skills
- Balancing Professional and Personal Life

ELIGIBILITY
- Senior level graduate student or early career postdoctoral scientist,
  - Established research in the microbiological sciences, and
- ASM member

IMPORTANT DATES

Application Deadline:
June 15, 2006

Notification Date:
July 1, 2006

Website: www.asmgap.org

Email: fellowships-careerinformation@asmusa.org

SPONSORED BY COMMITTEE ON GRADUATE AND POSTDOCTORAL EDUCATION OF THE ASM EDUCATION BOARD.
Plenary Sessions

Opening Plenary Lecture

Molds and Mycotoxins, Genes and Genomes

Friday, May 19, 1:00 pm
Live Oak Room, Live Oak Event Center, UCF

Joan W. Bennett
Department of Cell and Molecular Biology
Tulane University
New Orleans, LA

Mycotoxins are poisons produced by microscopic fungi called molds. These toxins are a major problem in agriculture. When foods and feeds are contaminated by mycotoxins and then consumed by unwary people or animals, the outcome can be illness or death. Some mycotoxins are present in mold spores. When people are exposed to high concentrations of aerosolized spores, the result can be respiratory infection and allergy. The flooding caused by Hurricane Katrina in New Orleans provided an ideal environment for the growth of both toxic and nontoxic molds. Molecular techniques based on the genes that encode the ability to make mycotoxins can be used to detect toxigenic molds and insights from genomics (the entire genetic content of an organism) tell us something about the evolution of these fungal poisons.

Joan W. Bennett did her graduate work at the Univ. of Chicago and joined the faculty of Tulane University (New Orleans, LA) in 1971 where she has taught genetics and bioethics. Her research has focused on the genetics and biosynthesis of aflatoxin, a highly carcinogenic metabolite made by several species of molds in the genus Aspergillus. Recently, she has turned her attention to fungal genomics and is hoping to develop an interdisciplinary initiative on fungal systems biology. Like many residents of New Orleans, Hurricane Katrina has caused a major change in her life. On July 1, 2006, she will move to Rutgers University (New Brunswick, NJ) where she will be a professor of Plant Biology and Pathology, and an associate vice president working to enhance the status of women in science. She is a past president of the American Society of Microbiology and a current vice president of the International Union of Microbiological Societies. In 2005, she was elected to the National Academy of Sciences.
Friday Evening Plenary Lecture

The Microbe Electric: Microbial Nanowires, Fuel Cells, and Electron Transfer onto Materials with Geobacter

Friday, May 19, 7:30 pm
Live Oak Room, Live Oak Event Center, UCF

Derek Lovley
Department of Microbiology
Director, Environmental Biotechnology Center
University of Massachusetts
Amherst, MA

Geobacter species have the novel capability of transferring electrons, derived from central metabolism, outside the cell onto insoluble, extracellular electron acceptors. In subsurface environments and aquatic sediments Geobacter species grow by coupling the oxidation of organic compounds to the reduction of Fe(III) and Mn(IV) oxides. This plays an important role in the natural cycling of organic matter and metals, but Geobacter are also key agents in the removal of organic contaminants in polluted groundwater. Geobacter species can also use electrodes as an electron acceptor. Thus, electricity can be generated in sediment batteries extracting energy from the environment or in microbial fuel cells converting a diversity of organic wastes or renewable biomass to electricity. Practical applications under investigation range from powering small electronic devices to vehicles and self-feeding robots. Investigations into the mechanisms by which Geobacter species transfer electrons outside the cell demonstrated that Geobacter produces fine (< 5 nm) but relatively long (10-20 µm) pili, localized on one side of the cell, that are electrically conductive. These microbial nanowires represent a novel mechanism for electron transfer in microorganisms and may have practical applications for nanoelectronics.

Derek Lovley is Distinguished University Professor in the Department of Microbiology and Director of the Environmental Biotechnology Center at the University of Massachusetts-Amherst. Dr. Lovley received his Ph.D. in Microbiology from Michigan State University and was a postdoctoral researcher at the Anaerobe Laboratory at Virginia Tech prior to joining the U. S. Geological Survey as a Project Chief in their National Basic Research Program in 1984. He moved his laboratory to the University of Massachusetts in 1995. He has over 200 publications, including 26 in Science or Nature journals, and has been recognized as an Institute for Scientific Information "Highly Cited Researcher". Dr. Lovley has received many awards including Popular Science’s ‘Best of What’s New in Environmental Technology’, as well as the Proctor and Gamble Award in Applied and Environmental Microbiology, and was recently featured in Time magazine’s profile of top innovators in environmental science. His research, which focuses on genomic approaches to novel environmental biotechnologies, is supported by the Department of Energy, the Office of Naval Research, the National Science Foundation, and industry.
Saturday Morning Plenary Lecture

Exploring the Microbial World: From Genomes to Biomes

Saturday, May 20, 8:30 am
Business Administration Building, Room 104, UCF

Edward DeLong
Department of Civil and Environmental Engineering
and Division of Biological Engineering
Massachusetts Institute of Technology
Cambridge, MA

Past views on the details of prokaryotic inhabitants of the sea, and the details of geochemical cycling in the ocean, have been fairly simplistic and not entirely comprehensive. For instance, until only very recently photosynthesis in the sea was presumed to be dominated by relatively large protists (diatoms, dinoflagellates and the like), that controlled upper ocean productivity. Application of flow cytometry ocean science led to the discovery of Prochlorococcus species, and the realization that oxygenic photosynthetic prokaryotes actually account for a large proportion of the global ocean photosynthesis and primary productivity. In another example, the microbial loop model represents the bulk of bacterioplankton processes as entirely heterotrophic, consuming and channeling dissolved organic matter through bacterioplankton, to protists, larvae and larger metazoa. Application of genomic techniques have led to the discovery that a significant fraction of heterotrophic bacterioplankton also harvest light energy via several potential mechanisms, activities that could significantly alter how energy and matter flux through the upper ocean. It may even be that most of the picoplankton in the surface ocean, (including both Bacteria and Archaea), can harvest light energy to do biochemical work, a hypothesis that remains to be fully tested. In another example, the conversion of ammonia to nitrate, a central process that in part regulates surface productivity, was presumed to be solely catalyzed by bacteria. New data now suggest that planktonic archaea, related to hyperthmophiles, may very well be the predominant nitrifiers in worlds the oceans. The take home lesson of these new discoveries and realizations is that our understanding of microbial biology and biogeochemistry is changing rapidly, largely due to the application of new technologies, like genomics, to the study of naturally occurring microbial populations. These emerging ideas and hypothesis, derived from recent technological breakthroughs, still need to be thoroughly tested, verified, and integrated into a larger, more holistic picture of the living ocean ecosystem.

Edward DeLong is currently a Professor at the Massachusetts Institute of Technology. He holds a joint appointment in the Division of Biological Engineering and the Department of Civil and Environmental Engineering at MIT. His scientific interests focus primarily on questions in microbial genomics, biology, ecology, and evolution. A large part of DeLong’s efforts have been devoted to the study of microbes and microbial processes in the ocean, combining laboratory and field-based approaches.

A significant research focus in DeLong’s group has centered on the discovery and characterization of marine picoplankton belonging to the Domain Archaea. . Archaea comprise one of the three major evolutionary lineages of extant life. Previously known and cultured Archaea have been viewed as prokaryotic specialists, thriving exclusively in
habitats of elevated temperature, low pH, high salinity, or strict anoxia. Unexpectedly, cultivation-independent surveys in the ocean led to the recognition of several new types of Archaea. These planktonic Archaea are ubiquitous in the world’s oceans, and it has now been demonstrated that archaeal numbers can rival those of bacteria in the ocean’s cold, aerobic interior. Currently efforts aim to better understand the natural history of these microbes, using a variety of genomic, biochemical, microbiological, and geochemical approaches.

One of the more surprising developments in Delong’s application of genomic approaches to microbial ecology and biology, was the discovery of a new and widespread type of phototrophic energy generation in the sea. In brief, via analyses of large genome fragments harbored on Bacterial Artificial Chromosomes, Delong and his group identified a new type of bacterial photoprotein of the retinylidene variety, never before found in bacteria. That new photoprotein, dubbed proteorhodopsin by DeLong’s group, was shown to be a light driven proton pump. Via heterologous expression and biochemical characterization DeLong’s lab showed that this ubiquitous marine bacterial photoprotein is capable of generating significant amounts of biologically useful energy from light. DeLong’s group later verified the presence of significant amounts of the photoprotein in seawater, and documented the occurrence of many similar genetic variants of the photoprotein in the sea. This study showed the great potential of “metagenomics” for discovering and characterizing hitherto unknown and globally significant microbial processes in natural systems.

Over the past decade, the major research interest of DeLong has centered on the development and application of similar genomic technologies and metagenomics, to answer fundamental questions in microbial ecology and evolution. Much of biological complexity of microbial ecosystems is encoded within the collective genomes of the community. Just as individual macromolecules can serve as documents of evolutionary history, naturally occurring genomes can provide unprecedented perspective on environmental, evolutionary and ecological history. Recent applications in the marine environment demonstrate that our understanding of the functional attributes, population biology, and natural history of extant microbes can now be significantly advanced using these new approaches. Systems science can in theory be extended from genomes to ecosystems, and DeLong’s current interests focus on traversing that path.
**Sunday Morning Plenary Lecture**

**Differential Virulence in Mammals of Influenza A H5N1 Viruses Isolate in Asia**

Sunday, May 21, 8:30 am  
Business Administration Building, Room 104, UCF

**Terrence Tumpey**  
*Influenza Branch*  
*Centers for Disease Control and Prevention*  
*Atlanta, GA*

The spread of highly pathogenic avian influenza H5N1 viruses across Asia in 2003-2005 devastated domestic poultry populations and resulted in the largest and most lethal H5N1 virus outbreak in humans to date. To better understand the potential of H5N1 viruses isolated during this epizootic event to cause disease in mammals, we have used the mouse and ferret models to evaluate the relative virulence of selected 2003-2005 H5N1 viruses representing multiple genetic and geographical groups and compared them to earlier H5N1 strains isolated from humans. Our results demonstrate that, in general, the levels of virulence of H5N1 viruses in these two models are comparable. Furthermore, the ferret model demonstrates an increase in virulence of the 2004-2005 human H5N1 isolates compared with the 1997 human isolates and with the 2003-2005 avian isolates studied.

**Terrence Tumpey’s** interests lie in elucidating the molecular determinants of virulence of influenza viruses, including pandemic influenza strains. Two main avenues of research are being pursued.

1. Since 1997, there has been great interest in highly pathogenic avian H5N1 viruses that have jumped the species barrier to infect humans. More recently, an unprecedented spread of H5N1 viruses across Asia have devastated domestic poultry and resulted in the largest and most lethal H5N1 outbreak in humans to date. These events have raised worldwide concern about the imminent emergence of another pandemic influenza strain. My research emphasis is to understand the pathogenesis of potential pandemic strains of influenza viruses and develop new approaches for more effective control of influenza through the use of novel vaccine strategies.

2. The research group seeks, in collaboration with several other labs, to elucidate the molecular determinants of virulence of the 1918 pandemic influenza virus. The 1918 influenza virus is estimated to have caused more than 20 million deaths worldwide, but the reasons for this high mortality are poorly understood. Working in the high-containment BSL3+ laboratory at the Centers for Disease Control, they successfully reconstructed the influenza virus strain responsible for the 1918 pandemic.

The research group is currently studying the function of their individual gene products and analyzing the function of these genes. These studies should ultimately shed light not only on the 1918 influenza virus, but also provide new insight into the pathogenesis of all human influenza viruses. Furthermore, this research should provide the basis for design of better treatment strategies and development of antiviral and other preventive measures against pandemic influenza.
I have been engaged in series of educational initiatives made possible by the award of a four-year HHMI Professorship. My original idea had been to form an “Education Group,” analogous to a “Research Group,” that would enable me to train young Scientist-Educators while simultaneously carrying out educational research/development focused on improving the teaching of Introductory Biology in a large class format. The number of people who participated and our collective accomplishments far surpassed my original expectations. Our website not only describes our accomplishments and freely available educational material, but also documents our experiment of founding an Education Group modeled after a Research Group (http://www.cfkeep.org/html/snapshot.php?id=79434230). In my talk, I will summarize some highlights, stressing materials that I hope may be useful to other educators. A major accomplishment that has had far reaching consequences was our effort to confront the “SO MANY CONCEPTS” problem of teaching Introductory Biology by ordering these concepts into a hierarchical, cross-referenced “Biology Concept Framework (BCF).” Intended as a process to aid teaching rather than a unique solution, this project critically influenced our group’s subsequent activities, from within MIT to assisting with the National Biology Olympiad. The two papers listed describe the formulation of our BCF and our application of its principles to a voluntary lab accompanying MIT Introductory Biology courses. I will also discuss our ongoing collaborative effort together with Charles Shubert of MIT Information Services & Technology and John Belcher of MIT Physics to build a freely available 3D protein viewer with professional level graphics, but an education-friendly interface, within the TEALsim computing environment.


Graham Walker grew up in Ottawa Ontario and attended Carleton University. After becoming fascinated by DNA in a freshman biology course, he focused his budding chemistry career on organic chemistry in the hopes being able to synthesize DNA. He then went to the University of Illinois for graduate school to work on nucleic acid synthesis and biochemistry. Interested in learning genetics, he then moved to UC Berkeley for his postdoctoral research. Since 1976, Graham has been a member of the faculty of the Department of Biology at MIT, where his lab has carried out basic research on DNA repair and mutagenesis in E. coli. Several of the DNA repair genes Graham has worked on have turned out to have human homologs that play roles in cancer prevention. His lab also studies the symbiosis between legumes and the nitrogen-fixing bacterium Rhizobium and recently has uncovered commonalities between this symbiosis and the chronic intracellular infections caused by the human pathogen Brucella. Since being named an American Cancer Society Research
Professor in 2001, Graham has used the funds provided by the award to initiate a new project on DNA repair and mutagenesis in yeast and mammals. Graham has been deeply involved in teaching throughout his career and in 2002 was awarded a four-year HHMI Professorship to support his efforts in undergraduate education (http://www.cfkeep.org/html/snapshot.php?id=79434230). He used those funds to establish an Education Group analogous to his Research Group but working on curriculum development. Graham ran the MIT undergraduate program in Biology for 15 years, served as Housemaster of the all-women’s undergraduate dormitory for 6 years, and has directed MIT’s HHMI-funded program in undergraduate education in the biological sciences since its inception in 1989. He co-authored the major textbook on DNA Repair and Mutagenesis and has finished his work on the 2nd edition, which was published by ASM Press in November 2005. Graham served as an Editor of J. Bacteriol. for 16 years, finishing his 10-year term as Editor-in-chief in 2001. He was recently elected to the American Academy of Arts and Sciences. He is married to Jan, a computer scientist/cognitive psychologist recently turned artist, photographer and sailor, and has an 18-year-old son, Gordon, who is a sophomore at UC Santa Cruz. Graham is an enthusiastic gardener and cook, is no longer running marathons, and enjoys songwriting and playing music.

Giving Your Course the Genomics Touch
Brad Goodner, Hiram College

Friday, May 19, 2:45 pm – 3:30 pm: HPA 125
Saturday, May 20, 1:30 pm – 2:15 pm: HPA 125

How does E. coli O157:H7 differ from nonpathogenic E. coli strains? What do all members of the gamma-Proteobacteria have in common, even though they inhabit different niches? How do different bacteria accomplish central metabolism? If you want your students to consider such questions, then you may wish to include some genomics information in your courses. I will go over several easy-to-use Web resources where you can access genomic data as well as tools you can use to ask questions involving one or more genomes.

Brad Goodner: I was born and raised in north-central Texas, but I don’t wear boots, a ten-gallon hat, or a belt with a big buckle. My academic history has included stints as an Aggie, a Boilermaker, a Tar Heel, a Spider, and now as a Terrier (extra points if you can name all the schools). I am currently Associate Professor of Biology and Director of the Hiram Genomics Initiative at Hiram College. I teach molecular and cellular biology, genetics, microbiology, bioinformatics, and immunology. My students and I use a variety of molecular tools to understand how “simple” bacteria do their thing. Specifically, we are interested in how bacteria organize their genomic and metabolic space, and how they interact with their environment and with other organisms. There are two parallel tracks and one overarching umbrella to this work. One track involves the physiological, ecological, and evolutionary analysis of one bacterial genus, the soil saprophyte/plant pathogen/opportunistic human pathogen Agrobacterium. The second track is comparative analysis of many bacterial species using genomic mapping and sequencing as the major tools. The umbrella covering these tracks is incorporation of research as part of courses at Hiram College and through outreach to area high schools. These efforts in courses lead many more students into subsequent independent research projects.
**Going for the Gold: Using Enrichment Culture in an Introductory Microbiology Course**

*Mark Martin, University of Puget Sound, Tacoma, Washington*

**Friday, May 19, 2:45 pm – 3:30 pm: HPA 116**  
**Saturday, May 20, 1:30 pm – 2:15 pm: HPA 126**

Is it possible to mix "hands on" laboratory exercises with standard microbiology curricula in a way that improves and reinforces both---but without costing too much money? In my experience, the answer is an emphatic "yes!" The key is using enrichment culture to illustrate and underline not only the breadth of the microbial world but the specific environmental and biochemical adaptations possessed by particular microbes.

In this session, I will go over several specific examples of how I use laboratory exercises involving enrichment culture to improve student outcomes with lecture material, and vice versa. I will also present some possible ideas and resources describing how to create this lab/lecture synergism in different academic environments, ranging from small liberal arts Biology majors to nursing programs to advanced microbiology majors. Finally, I will go over a few ideas describing how to "fold in" independent student designed projects as part of this "microbiological mixture."

**Mark O. Martin** has long been an enthusiastic observer of the microbial diversity all around us. The incredible prokaryotic diversity in a pinch of soil---and attending the electrifying Microbial Diversity course at Woods Hole a few years ago---inspired his presentation at ASMCUE. He earned his BA degree at UCLA in Biology, and a PhD from Stanford University in Biological Sciences. After two postdocs and a lengthy stint in the San Diego biotechnology industry, Mark returned to his first love, teaching microbiology and genetics in a small liberal arts setting. Mark has a long history of working with relatively "undomesticated" bacteria, including *Sinorhizobium meliloti*, *Pseudomonas mendocina*, *Sphingomonas elodea*, *Xanthomonas campestris*, and *Vibrio harveyi*. He is now a very happy Assistant Professor of Biology at the University of Puget Sound in Tacoma, Washington, where he teaches microbiology and carries out undergraduate-centered research with the bacterial predators *Bdellovibrio bacteriovorus* and *Ensifer adhaerens*. Mark urges all of us who know the microbial world to show our "prokaryotic pride" in the classroom, at conferences, in the laboratory, but---from bitter experience---not necessarily at cocktail parties.

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**Identification of Microorganisms in a Clinical Setting Based on Molecular Genetics Testing—PCR, DNA Probes, RNA Analysis, etc.**

*David Hillyard, ARUP Laboratories*

**Friday, May 19, 2:45 pm – 3:30 pm: HPA 107**  
**Saturday, May 20, 1:30 pm – 2:15 pm: HPA 107**

Molecular methods have enhanced the speed and accuracy of microbial identification and are now an integral part of clinical diagnostics. Although Polymerase Chain Reaction (PCR) in basic or “real-time” formats dominates clinical testing several new methods for nucleic acid detection, quantitation and sequence interrogation extend the potential of the molecular approach. Tests employing isothermal amplification, fluorescent and electric chip-based detection, mass spectroscopy, high throughput sequencing and a variety of other technologies will offer powerful new tools for the diagnosis and management of microbial disease.
Dr. Hillyard is the Medical Director of Molecular Infectious Disease Testing, of Research & Development for Infectious Diseases, Co-Director of the Core Nucleic Acid Sequencing Laboratory, and Associate Director of the Infectious Diseases Laboratories at ARUP Laboratories, Salt Lake City, Utah. Among his professional memberships are The Academy of Clinical Laboratory Physicians and Scientists, The American Association for the Advancement of Science, The American Society for Microbiology, and the Association for Molecular Pathology. He is an Associate Professor of Pathology at the University of Utah School of Medicine, and Co-Director of the Molecular Genetic Pathology Fellowship Training Program. He is editing the first edition of the Handbook of Molecular Pathology, to be published in 2007. Dr. Hillyard received his M.D. degree from the Columbia University College of Physicians and Surgeons.

Microbiology NSF Funding Updates  
Jeanne Rudzki Small, National Science Foundation

Friday, May 19, 2:45 pm – 3:30 pm: HPA 272  
Saturday, May 20, 1:30 pm – 2:15 pm: HPA 272

What is NSF funding these days in microbiology education--and why? At this session, you'll learn what NSF has funded in the past three years, why these projects support NSF's mission for undergraduate education, and how you can use the products of these projects in your own work. You'll see a demonstration of how to get a listing of these projects through the Internet, including detailed project reports and contact information for the project personnel. Finally, you'll learn how to connect what others have done into your own future grant proposals to NSF.

Jeanne Rudzki Small joined NSF in August 2004 as a biology program director in the Division of Undergraduate Education. She is on leave from Eastern Washington University in Cheney, Washington, where she is Professor of Chemistry & Biochemistry. As a biophysicist, Jeanne has specialized in laser-based biophotonic instrumentation design and applications to environmental monitoring. At Eastern Washington University, Jeanne has served as Assistant to the Provost for Undergraduate Research. Her teaching passion is chemistry for non-science majors.

Jeanne received her B.S. in Chemistry from Trinity University in San Antonio, TX. Her A.M. and PhD degrees are in Chemistry from Harvard University. She did postdoctoral work in the Department of Biology at the Johns Hopkins University. Her industrial experience includes work for Quantum Northwest, Inc., an instrumentation company in Spokane, WA.

Scientific Underpinning for Professional Practice: The Essentials of Baccalaureate Ed for Professional Nursing Practice  
Jean D'Meza Leuner, School of Nursing, University of Central Florida

Friday, May 19, 2:45 pm – 3:30 pm: HPA 119  
Saturday, May 20, 1:30 pm – 2:15 pm: HPA 119

The American Association of Colleges of Nursing has long established standards for the education of entry level professionals in nursing who receive their preparation in senior colleges and universities. The Essentials of Baccalaureate Education for Professional Nursing Practice provide clear guidelines for the full spectrum of competencies to be achieved through this pathway to nursing practice. Core to the preparation of professional nurses is the
Expectation that the learner will be exposed to a strong base of science and general studies as a foundation for the practice. The scientific base of biology, microbiology, anatomy and physiology, and chemistry serve not only as key elements of the foundation for the nursing science course work but also provide the learner with important skills in critical thinking, reasoning, and analysis which are critical to professional nursing practice. This session will discuss the important of this scientific underpinning to the practice of nursing and common threads in baccalaureate nursing education regarding the sciences.

Jean D’Meza Leuner is the Director of the School of Nursing at the University of Central Florida, Orlando, Florida. She received a Diploma in Nursing from St. Luke’s Hospital School of Nursing, NYC, NY, and her B.S.N. from Seton Hall University, So. Orange N.J. Dr. Leuner received her M.S.N. and Ph.D. from Boston College, Chestnut Hill, MA. Dr. Leuner has extensive experience in nursing education and higher education administration and she has teaching experience in nursing at the baccalaureate, masters and doctoral level. She has been the recipient of several grants to support nursing education and practice. Dr. Leuner served as the Co-PI for a DHHS Grant to develop a school-based health clinic network in S.C., and most recently she is the PI on a SUCCEED Florida grant from the Department of Education to increase the number of nurse faculty for the state. She is the President elect for Sigma Theta Tau Int., Theta Epsilon Chapter, the professional honor society at the University of Central Florida and the Chair elect for the Florida Association of Colleges of Nursing.

Teaching Microbiology Without Teaching Microbiology: The Dual Use Debate
Christopher J. Woolverton, Kent State University

Friday, May 19, 2:45 pm – 3:30 pm: HPA 246
Saturday, May 20, 1:30 pm – 2:15 pm: HPA 246

The anthrax attacks of 2001, the narrowly averted SARS epidemic and the feared avian influenza pandemic have made microbiology a household word. Yet, few people understand the depth of training and acquisition of skills required to do microbiology. The theoretical constructs that define microbiology include cell biology and physiology, genetics, biochemistry, molecular biology, and others. The practical aspects of microbiology include solid problem-solving skills, strong communication skills and manual dexterity. To achieve the rigor and diversity in microbiology education, the microbiology tradition is to use viable organisms to teach the theoretical and practical aspects of the discipline. However, the use of viable, and potentially disease-causing, microbes has been hotly debated in light of their misuse as bioweapons. Does the restricted use of some microbes prevent the training of microbiologists who recognize and know how to control those organisms? Are BSL-2 organisms necessary to teach microbiology principles to undergraduates? Should microbiology teaching strategies and methods be regulated similarly to research methods and publication? How will the training of future microbiologists change as policy makers focus on the potential misuse of microorganism? These and other questions will be addressed in this session.

Christopher J. Woolverton is currently associate professor of Biological Sciences and a full member of the graduate faculty in Biological Sciences and in the School of Biomedical Sciences at Kent State University. Woolverton also serves as the director of the CDC-funded, Kent State University Center for Public Health Preparedness and its BSL-3 training facility. Woolverton received his B.S. with honors in Biology from Wilkes University, Wilkes-Barre, PA, and his M.S. and Ph.D. in Medical Microbiology from West Virginia University's College of Medicine. He spent two years as a post doctoral scientist, studying cellular immunology, at the University of North Carolina at Chapel Hill.
Woolverton’s research interests are focused on the detection and control of bacterial pathogens. He is the author of numerous publications and patents detailing the creation and mechanisms of a novel liquid crystal biosensor. He also publishes on and patented a polymer controlled antibiotic delivery system. Woolverton serves as an ad hoc reviewer for microbiology-related journals and funding agencies. He is an international lecturer on the interface of biological systems and liquid crystalline soft matter, as well as, polymer-controlled drug delivery. Woolverton’s pedagogical research is focused on development and assessment of curricula for the training of public health professionals in their bioterrorism preparedness efforts.

Over the years, Woolverton has taught Basic Microbiology (for nursing and allied health majors), General Microbiology (for science majors) and cell biology (for science majors). Additionally, he has taught Microbial Physiology and Immunology to graduate students.

Woolverton has served on the editorial boards of ASM’s Microbiology Education and Focus on Microbiology Education. He has participated in and contributed to numerous ASMCUE conferences, serving as co-chair of the 2001 conference. Woolverton resides in Kent, OH with his wife and three daughters.

Using History to Teach Microbiology
Joan W. Bennett, Tulane University, New Orleans, LA

Friday, May 19, 2:45 – 3:30 pm: HPA 117
Saturday, May 20, 1:30 – 2:15 pm: HPA 117

One way to instill interest in a scientific theory is to talk about the theorizer. Students like to hear about the scientists who made the science. Historical biography can help teachers make microbiology come alive. Examples of well-known figures from the history of microbiology include Louis Pasteur and Alexander Fleming. Why aren’t more scientists remembered as superstars? Why is it easier for a sports figure to gain fame than for a scientist? Are these questions related to the general difficulty of popularizing science? These questions will be addressed.

Joan W. Bennett did her graduate work at the Univ. of Chicago and joined the faculty of Tulane University (New Orleans, LA) in 1971 where she has taught genetics and bioethics. Her research has focused on the genetics and biosynthesis of aflatoxin, a highly carcinogenic metabolite made by several species of molds in the genus Aspergillus. Recently, she has turned her attention to fungal genomics and is hoping to develop an interdisciplinary initiative on fungal systems biology. Like many residents of New Orleans, Hurricane Katrina has caused a major change in her life. On July 1, 2006, she will move to Rutgers University (New Brunswick, NJ) where she will be a professor of Plant Biology and Pathology, and an associate vice president working to enhance the status of women in science. She is a past president of the American Society of Microbiology and a current vice president of the International Union of Microbiological Societies. In 2005, she was elected to the National Academy of Sciences.
Try Something New
Concurrent Sessions

Applying the Scholarship of Teaching and Learning:
Research on Students’ Concept Mastery, Attitudes, Beliefs, and Interest

Steven Pollock, University of Colorado, Boulder

Saturday, May 20, 10:30 am – 12:00 pm: HPA 272
Sunday, May 21, 10:00 am – 11:30 am: HPA 125

It is well documented that traditional introductory (physics) courses often fail to teach our students the basics. Indeed, these same courses often teach students things we don’t want. This interactive workshop will build some bridges from the field of Physics Education Research (providing a research base addressing such issues) to teaching in biology. Beyond the usual focus on pure content, there are extensive sets of attitudes and beliefs about science that we teach our students. Some of these messages are beneficial (e.g., that science is a coherent representation of the world) while others are detrimental (e.g., the notion that women cannot be strong physicists). While decades of physics education research have reformed classroom practices to improve conceptual mastery, these same practices often fail to improve student attitudes and beliefs about learning (physics). Our workshop will survey some broader results of Physics Education Research (perhaps of interest to biologists!), but will focus on a new instrument designed to probe students’ beliefs about science and learning science, the Colorado Learning About Science Survey[1]. We will collectively explore various dimensions of student beliefs and interest, gender differences, and correlations between beliefs and performance, while discussing how this survey might be extended to biology. [1] http://class.colorado.edu

Steven Pollock is currently Associate Professor in the Department of Physics at the University of Colorado (CU) in Boulder and an active member of the Physics Education Research group at CU. His background is in theoretical nuclear physics (PhD Stanford, 1988). He received the University of Colorado Teaching Excellence award in 1998, became a Carnegie Teaching Scholar in 2001, was an invited participant/observer in the 2003 Fermi School on Physics Education Research, and was co-recipient of the CU Boulder President's Faculty Excellence Award for Advancing Teaching and Learning through Technology in 2004. He runs annual workshops on research-based teaching practices for graduate students at CU. His physics research is now in the field of physics education, with a focus on student learning in large scale classes, and the constraints and opportunities of replicating "proven" curricular practices. He is involved closely in a science and math STEM teacher preparation grant (training undergraduate Learning Assistants), and is co-investigator in the Colorado PhysTec program, an NSF sponsored curriculum grant investigating sustainability of secondary implementation of tutorials at CU, and an NSF Teacher Professional Continuum grant to investigate the impacts of the Colorado Learning Assistant Program. Professor Pollock has presented his scholarship on teaching at numerous conferences, seminars, and colloquia. He is also the author of two multimedia texts: "Thinkwell Physics I" (2001) and "Particle Physics for Non-Scientists" (2003).
Case-Based Learning Using Protein and DNA Simulations to Analyze Cases Based on Infectious Diseases
Karen Klyczek and Mark Bergland, University of Wisconsin, River Falls

Friday, May 19, 4:30 pm – 6:00 pm: HPA 104
Saturday, May 20, 10:30 am – 12:00 pm: HPA 104

Case It! is a National Science Foundation-sponsored project to promote collaborative case-based learning in biology education, via free molecular biology computer simulations and Internet conferencing. In this hands-on session, we will demonstrate how Case It! Software can be used to enhance understanding of molecular biology techniques for analyzing cases based on genetic and infectious diseases, as well as awareness of ethical issues associated with these diseases.

Students first use the Case It! simulation to analyze DNA and protein sequences for cases involving genetic diseases or infectious diseases such as SARS, HIV, and influenza, among others. Simulated tools for case analysis include DNA and protein electrophoresis, Southern blotting, Western blotting, dot blot, PCR, and ELISA.

After analyzing the cases, students construct web-page "posters" using the Case It! Web Editor. They then play the roles of counselors, medical personnel, "family members", and others as they ask and answer questions about the case results using a custom Internet conferencing system hosted on our web site. See http://www.uwrf.edu/caseit/caseit.html for details.

Mark Bergland is a Professor in the Biology Department at the University of Wisconsin - River Falls. He has been principal investigator (PI) for four NSF grants and also grants from the University of Wisconsin System to develop educational software. His software has been disseminated via the BioQUEST Library CD-ROM and the Internet, and results of past projects have been presented at numerous professional meetings and workshops. He received the 1990 and 2003 Outstanding Faculty Member of the Year Awards and also the 2004 Scholarship Award for the College of Arts and Sciences, Science Division.

Karen Klyczek is Chair of the Biology Department at UW-River Falls. She was the PI for two NSF Teacher Enhancement Awards to provide biotechnology in-service training for secondary life science and agriculture education teachers. She has presented at numerous workshops and conferences dealing with biotechnology education, and has received NIH funding for the study of gene regulation in tumor cells. In 2000 she was named the University Distinguished Teacher at UW-River Falls, and is also a past recipient of the Outstanding Faculty Member of the Year Award for the College of Arts and Sciences, Science Division.

Is It Possible to Teach Metabolism Interactively?
Amy Cheng Vollmer, Swarthmore College

Friday, May 19, 4:30 pm – 6:00 pm: HPA 246
Sunday, May 21, 10:00 am – 11:30 am: HPA 126

Teaching metabolism is important, but not as exciting as teaching about molecular genetics or genomics. Yet, in the post-genomic era, making sense of lists of genes requires an excellent working knowledge of metabolism. I have tried some different, interactive techniques in teaching metabolism in introductory biology as well as in microbiology to students. In particular, I have found that students enjoy the 'sport' of making connections
Try Something New

between various molecules and pathways. I look forward to sharing some of these activities with participants in this session. I invite anyone who has activities, case studies, or problem sets about metabolic pathways to bring them along for discussion and sharing.

Amy Cheng Vollmer is Professor of Biology at Swarthmore College, where she has been since 1989. She teaches courses including: Introductory Cellular and Molecular Biology, Microbiology, Microbial Pathogenesis and the Immune Response, and Microbial Processes and Biotechnology. Her research interests are in the area of the regulation of bacterial stress response and its environmental applications. Her interest in promoting the scholarship of teaching and learning was enhanced by serving as chief editor of Microbiology Education for its first four years. Two recent initiatives she has engaged are in the areas of adult science literacy and reactivating interest in the teaching of metabolism. She is currently Chair of the Student Membership Committee on the ASM’s Membership Board. She is the 2006 recipient of the Carski Distinguished Undergraduate Teaching Award and will give the award lecture at this year’s ASM General Meeting.

Mathematical Modules in Biology
Meghan Burke, Kennesaw State University

Saturday, May 20, 10:30 am – 12:00 noon: HPA 246
Sunday, May 21, 10:00 am – 11:30 am: HPA 117

It is becoming increasingly clear that an understanding of mathematical concepts is essential for biology students. Not only do they need to understand the perpetually problematic topics of graphing and logarithms, but also research in biology is becoming more involved with mathematical models.

The Mathematical Modules in Biology project has developed a library of mathematical modules that address applications in the undergraduate biology curriculum. Each module centers upon a specific application and has at least four different parts, which will address that same application at the levels of precalculus, differential calculus, integral calculus, and differential equations. The modules serve as material for group project assignments in these math courses or can be used in biology courses depending on the mathematical preparation of the students to enhance students’ understanding of the mathematics while studying a biological problem. The particular module to be demonstrated in this session will focus on epidemiology.

By working on the modules, students gain teamwork experience, written communication skills, and an introduction to numerical and graphical investigations that require them to use graphing calculators or spreadsheet software.

Meghan Burke has a Bachelor of Science from Brown University in Applied Mathematics—Biology, and a D.Phil. from the Centre for Mathematical Biology, Oxford University, UK. For the past fifteen years she has conducted research on the interface of mathematics and biology, particularly in the diverse areas of enzyme kinetics, cellular immunology, and epidemiology. As a Professor of Mathematics at Kennesaw State University, she also emphasizes undergraduate education, particularly in the science-major preparatory sequence of precalculus, calculus, and differential equations. She currently serves on the Board of Directors of the Society for Mathematical Biology, and in 2004, she won the Kennesaw State University Distinguished Teaching Award.
Pathways to Scientific Teaching: Active Learning and Assessment

Diane Ebert-May, Michigan State University

Friday, May 19, 4:30 pm – 6:00 pm: HPA 119
Saturday, May 20, 10:30 am – 12:00 pm: HPA 116

Novices through experienced teachers will benefit from participating in an interactive workshop that focuses on scientific teaching, active learning, and assessment in undergraduate biology courses, especially those with large enrollments. The workshop is based on current research about how students learn science, and how assessment improves student learning. We shall focus on the “hows” and “whys” to (1) create a student-centered classrooms (both large and small enrollments), (2) use cooperative learning, (3) identify teaching challenges, (4) develop and critique learning objectives and multiple kinds of assessments, (5) analyze and use assessment data to improve instruction, (6) and use technology-based tools for assessment. Issues of diversity will be integrated throughout the workshops as well as course evaluations, faculty evaluations and establishment of networks for continuing faculty support. Please bring goals/objectives and assessments for your courses.

Diane Ebert-May is a Professor in the Department of Plant Biology at Michigan State University. She provides national leadership for promoting professional development, evaluation and improvement of faculty, postdoctoral teaching fellows, and graduate students who actively participate not only in their own discipline-based research, but also in creative research about teaching and learning. Her work in assessment of undergraduate learning in science guides many individual faculty as well as science departments throughout the country. She actively contributes to the educational initiatives of Ecological Society of America, served on the National Research Council (NRC) Committee on Evaluating Undergraduate Teaching, NRC Committee on Integrating Education with Biocomplexity, is a Fellow of the American Association for the Advancement of Science; and is an advisory board member of the National Academy of Engineering’s Center for the Advancement of Scholarship on Engineering Education, and the Smithsonian Environmental Research Center (SERC).

Ebert-May’s research team is developing and testing a model for faculty change in teaching undergraduate science, and model-based reasoning tools designed to enable students in large enrollment science courses to build conceptual understanding. She is PI of project FIRST II (Faculty Institutes for Reforming Science Teaching), an NSF-funded national dissemination network for science faculty professional development in teaching through biological field stations and marine labs. Her recent publications address pathways to scientific teaching based on active learning, inquiry-based instructional strategies, assessment and research. She teaches plant biology to majors and environmental science to non-majors in large enrollment courses. Ebert-May recruits and mentors science postdoctoral fellows and graduate students in teaching and learning research and teaches a graduate-level seminar on scientific teaching. Her plant ecology research continues on Niwot Ridge, Colorado, where she has conducted long-term ecological research on alpine tundra plant communities since 1971.
Searches on DNA Sequences: Another Tool in the Active Learning Tool Kit
Marcia Cordts, University of Iowa

Saturday, May 20, 10:30 am – 12:00 pm: HPA 126
Sunday, May 21, 10:00 am – 11:30 am: HPA 116

The National Center for Biotechnology Information, with its built-in search tool, BLAST, makes freely available a wealth of on-line information that students can employ for problem-solving and active learning of key concepts in microbiology. As educators, we can construct assignments to direct our students towards meaningful portions of this tremendous goldmine in two ways: first by identifying nucleotide sequences that provide students with interesting starting points, and second by asking the questions that stimulate students to assimilate and cross-link the relevant concepts. With a few minutes of effort, students can learn how to do a BLAST search, and can be engaged by the novelty and fun of discovering the database “hits” on “their” nucleotide sequence. Analysis of their “hit list” can allow the students to discover for themselves many topics presented from traditional microbiology lecture and lab courses. For example, various searches may reveal how widely disseminated a particular antibiotic resistance element is, or how genes are organized along a stretch of some prokaryote’s chromosome, or what is meant by the astounding fact that microbiologists have discovered less than 1% of the prokaryotic world through traditional culture techniques. Microbiology educators who are not already using this resource in their teaching may find it useful to attend my “Try Something New” session to view some of the BLAST-based assignments and demonstrations that I have used in my courses during the past seven years (including the students’ versions of the assignments and my strategies for implementation).

Marcia Cordts received her BA from Stephens College in Columbia, Missouri and her Ph.D. in Microbiology from Cornell University. Since 1997, she has been at the Roy J. and Lucille A. Carver College of Medicine at the University of Iowa. Currently she serves there as the Director of Microbiology Teaching Laboratories, a lengthy title that encompasses teaching microbiology problem-solving skills to second-year medical students within the context of a 4-hour per week microbiology lab. Additional teaching responsibilities include General Microbiology lecture and laboratory and an allied-health microbiology lab course. In all courses, Marcia’s emphasis centers around identification of new questions to ask of the students that may lead them to express microbiology concepts in their own words.

Using Clickers Wisely
Erica Suchman, Colorado State University, Ft. Collins

Friday, May 19, 4:30 pm – 6:00 pm: HPA 126
Sunday, May 21, 10:00 am – 11:30 am: HPA 119

In this session we will discuss and demonstrate a classroom response system (CRS or clicker). Clickers will be provided to participants for use during the session so they can try out the technology, while learning about strategies for effective use of this technology. By the end of this session, participants will be familiar with how CRS technology works, some of the literature on effective uses of this technology, as well as mechanisms for writing effective questions, and getting students to learn their most from this technology.

Erica Suchman is an Associate Professor in the Department of Microbiology, Immunology, and Pathology at Colorado State University. She received her PhD in Molecular Biology and Biochemistry at the University of California, Irvine in 1997. She is a member of the Arboviral Infectious Disease Labs (AIDL) where she studies densouculeosis viruses’ effects on Aedes aegypti mosquitoes, and their potential as biological control agents.
teaches General Microbiology, Molecular and Medical Virology, Virology and Cell Culture Lab, and Service Learning Capstone Microbiology courses. She is currently the chair of the Committee on Technology Enhanced Education, and a member of the Education Board of the American Society for Microbiology.

Using Concept Maps as a Creative Tool for Teaching and Assessment of Learning
Clarissa Dirks, University of Washington

Friday, May 19, 4:30 pm – 6:00 pm: HPA 272
Saturday, May 20, 10:30 am – 12:00 pm: HPA 117

Engage your students in active and meaningful learning using concept maps. First developed by J. D. Novak of Cornell University in the early 1980’s, concept maps are an effective teaching strategy for a variety of educational settings and disciplines. Concept maps teach students to identify relationships among concepts, organize and present information, clarify meanings, and monitor their own learning. Educators can use concept maps to identify student misconceptions and assess student learning. Concept maps provide an opportunity for collaborative learning in large class environments. This hands-on session will introduce you to the creative ways that concept maps may be used in your classroom and will help you to easily incorporate concept maps into your repertoire of teaching tools.

Clarissa Dirks is a Lecturer in the Department of Biology at the University of Washington and will soon begin her faculty position at The Evergreen State College in Olympia, Washington. Clarissa received her B.S. in Microbiology from Arizona State University, her Ph.D. from the University of Washington, and did postdoctoral training at the Fred Hutchinson Cancer Research Center in Seattle, WA. She currently oversees undergraduate programs funded by the Howard Hughes Medical Institute and teaches several undergraduate courses in biology. She conducts science education research and creates related educational materials that aim to engage students in active learning and develop self-assessment skills. Her primary focus is on incoming freshman, particularly those who are underrepresented minorities or economically disadvantaged. Her scientific research aims to better understand the co-evolution of retroviruses and their hosts.
MicrobeLibrary.org
Concurrent Sessions

Atlas-Protocol Project
Ann Smith, University of Maryland, College Park

Saturday, May 20, 2:30 pm – 3:15 pm: Starts in HPA 119
Breakout Rooms:
HPA 116, HPA 117, HPA 119, HPA 125, HPA 126, HPA 246, HPA 272

The ASM Committee on Technology-Enhanced Education, along with the MicrobeLibrary Visual Resources Review Committee, has developed a new collection for the online microbiology education resource. The new project, “MicrobeLibrary Atlas and Protocol Collection,” was introduced to a focus group at the 2004 ASMCUE. The new collection contains sets of images related to general microbiology protocols and recipes. Five protocols were published in 2005. Seven new projects have been assembled for publication in 2006 and will be available for review.

The Saturday afternoon session will begin with an explanation of the projects. Participants will then break out into concurrent sessions to review and provide feedback for each project. We encourage you to choose to attend the Atlas/Protocol sessions where you have the most expertise. The sessions and Project Managers are:

- **CAMP Test**: Anne Hanson, University of Maine
- **Capsule Stain**: Roxana Hughes, University of North Texas
- **ELISA**: Samuel Fan, Bradley University
- **Mannitol Salt**: Patricia Shields, Univ. of Maryland, College Park and Anne Tsang, University of Maryland, College Park
- **Plaque Assay**: Sue Katz, Rogers State University, Claremore, OK and Marie Panec, Oak Park, CA
- **Spread Plate**: Kathryn Wise, Minnesota State Moorhead
- **Use of Luria Broth**: Maria P. MacWilliams, University of Wisconsin-Parkside and Min-Ken Liao, Furman University

By attending one of these sessions, you will contribute to the project as a peer-reviewer of the collection content and images. Participants will also contribute to the development of a “comments and tips” section that is one aspect of each Atlas and Protocol Collection.

Ann C. Smith, faculty member of the Department of Cell Biology and Molecular Genetics at the University of Maryland (UM), College Park MD, received her B.A. in Biology at the College of Wooster, Wooster OH and her MS and PhD in the Department of Microbiology at the University of Rochester, Rochester, N.Y. As an instructor of the large lecture general microbiology course since 1987, she is interested in finding ways for engaging students in learning science in large enrollment courses. She is investigating the use of technology, case studies, and collaborative learning as tools to promote active learning in large classes. She is the PI for a UM curriculum development initiative to increase the depth of learning of Host Pathogen Interaction (HPI) concepts through the use of active learning pedagogy in microbiology courses. The HPI initiative involves the development of a Host Pathogen Interaction Concept inventory for assessing student understanding of basic HPI concepts before and after completion of microbiology courses. In 2002 along with her colleagues she received the University of Maryland Teaching with Technology Award for efforts made in
using technology to engage students in learning. She is a member of ASM Committee on Technology Enhanced Education, Editor of the Visual Resources Collection of the MicrobeLibrary and member of the National Steering Committee for Project Kaleidoscope.

Curriculum Activity Development
Jean A. Cardinale, Alfred University

Saturday, May 20, 2:30 pm – 3:15 pm: HPA 112

Do you have that perfect classroom or laboratory activity that really motivates students to learn? Would you like the chance to share that activity with the microbiology education community? Have you ever wondered the steps necessary to develop your activity for publication in ASM’s award-winning educational resource, MicrobeLibrary.org? This Saturday afternoon session will begin with an explanation of the submission and review procedures for the Curriculum Collection in the library. Participants will then break out into review groups to discuss the submissions and offer valuable insights for improving, tailoring, and/or adapting these exercises for multiple learning environments.

Jean A. Cardinale is an assistant professor of Biology and of Biomedical Materials and Engineering Science at Alfred University (AU), where she teaches a range of courses mostly focused on ‘the small’: microbiology, molecular cell biology, biochemistry, immunology and others. She began her academic career at the University of Rochester, where she received a B.S. in Cell and Developmental Biology. After a series of explorations in theatre and field hockey, Jean rediscovered a fascination of ‘how life works’ and re-started her scientific career again in Rochester, where she received her MS and PhD in Microbiology and Immunology. Current research focuses on microbial community dynamics, and on development of a novel microarray system for bacterial contaminant analysis which she is doing in collaboration with Dr. Becky DeRosa. On top of teaching, research and AU campus involvement, Dr. Cardinale also serves as Chair of the American Society for Microbiology MicrobeLibrary Curriculum Review Committee, and is a 2006 Artist in Residence at the Institute for Electronic Arts.

Call for Experts!

Authoring MicrobeLibrary.org Visual and Curriculum Resources

ASM seeks your advice in creating a more author-friendly MicrobeLibrary (ML) site. Join ASM to test the newly revised site and help shape its future! If you are interested in authoring either an ML Visual or Curriculum Resource, here’s an opportunity to familiarize yourself with the process. Two sessions are scheduled on Saturday, either 3:30-4:30 pm or 5:00 – 6:00 pm. Both sessions are in HPA room 104. Please join us and lend your expertise!
ASM Branches offer an excellent forum for college faculty to share ideas, learn from one another, and improve undergraduate teaching and learning. In a new initiative, **Branching Out 2010**, ASMCUE attendees will be empowered to lead ASM Branches in advancing excellence in teaching and learning. In doing so, the Branches can play a critical role in supporting college faculty and students.

**Objectives**

During the ASMCUE lunchtime discussions, attendees will have the opportunity to work with colleagues to begin planning a series of outreach activities for Branches. This may include activities held in conjunction with the Branch or Regional Branch Meetings such as:

- Education session or series of sessions focused on best practices in teaching, mentoring and reaching out to the public
- Pre-meeting workshop for more-in depth training on effective teaching strategies
- Award to recognize an undergraduate educator
- Biannual or quarterly events to come together and share teaching problems
- Symposium for students to present their research

**Methodology**

During lunch on Saturday you will meet with Branch colleagues and begin a discussion to:

- Identify needs of the local educators’ community
- Identify strategies through which you could work with the Branch to address the educator community needs
- Outline a 3-year plan for addressing the needs and sharing with the Branch leadership
- Identify lead volunteers to implement the plan and a schedule to do so.

**Approach to Achieving Branch Out 2010**

**Getting Started**

- In the Conference List of Attendees, participants have been listed by Branches and Regional Branch Groups. In addition, your name badge includes pertinent information to help locate Branch colleagues
- Sit with Branch colleagues during lunch on Saturday. There are 30 to 40 attendees per Regional Branch Group and classrooms have been reserved for each Regional Group. Break-up into smaller groups of 8 – 10 persons if desired.
- Identify a group leader, scribe and time-keeper for your group; one person leads/moderates the discussion, a 2nd person takes notes, and a 3rd person keeps time so that each person gets a chance to share his/her ideas.
Working Hard

- Each person in the group should provide a 3-minute introduction identifying his/her microbiology education needs. These needs could be ones own professional needs and/or student needs.
- Taking turns, discuss how to work with and through the Branch to address needs; be sure to take notes as you go along.
- Reserve 15 minutes at the end to summarize the discussion, identifying only one activity to do in year 1. Think about:
  - What is(are) the activity(ies)
  - When will the activity be scheduled
  - Where will it be
  - How will it be done
  - How much will it cost
  - Who will prepare a budget and ask for support
  - How much might come from the Branch, the Branch Regional Group, or registration fees
  - Who will do the work
  - How will other educators know about the activity
  - Names of key contacts who will lead the Branch effort
- In a bulleted list, add other ideas for years 2 and 3. Remember the trick to success is to start with a single, small activity and add more later.
- If necessary, arrange another time during ASMCUE (e.g. Saturday reception, Sunday breakfast) to flesh out ideas and continue working.

Finishing Up

- Identify the Regional Planning Coordinator for your area.
- Identify a spokesperson for the group.
- Agree on a time for the two leaders to work together and report back next steps for planning.
- Provide a copy of the group’s work to the Conference co-chairs.

Lunch Room Assignments by ASM Region

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<th>ASM Region</th>
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2005-2006 ASM Branch Organization Committee

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Region I Regional Planning Coordinator:
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E-mail: jmcsharry@ordwayresearch.org

Connecticut Valley - Territory includes all zip codes in the states of Connecticut and Rhode Island, New Hampshire zip code areas 03400-03499 and 03600-03799, and Massachusetts zip code areas 01000-01699.

Eastern New York - This territory includes New York zip code areas 12000-12499, 12700-12999, and 13300-13399.

New York City - Territory includes New York City zip code areas 09000-11999 and 12500-12699.

Northeast - Territory includes all zip codes in the states of Maine and Vermont; New Hampshire zip code areas 03000-03399, 03500-03599, and 03800-03899; and Massachusetts zip code areas 01700-02799.

Region II Regional Planning Coordinator:
Allen Laskin, Ph.D.
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Somerset, NJ 08873
Phone: (732) 873-8741
Fax: (732) 873-8618
E-mail: alaskin@hughes.net

Maryland - Territory includes all Maryland zip code areas except 20700-20999.

New Jersey, Theobald Smith Society - Territory encompasses all New Jersey zip code areas except 08000-08499.

Eastern Pennsylvania - Territory includes all zip codes in the state of Delaware; Pennsylvania zip code areas 17000-17199, 17300-17699, and 17800-19699; and New Jersey zip code areas 08000-08499.

Virginia - Territory includes all Virginia zip code areas except 22000-22399.

Washington, DC - Territory includes all zip code areas in the District of Columbia 20000-20999, Maryland zip code areas 20700-20999, and Virginia zip code areas 22000-22399.

Region III Regional Planning Coordinator:
Kenneth J. Goodrum, Ph.D.
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E-mail: goodrum@ohio.edu

Allegheny - Territory includes all zip codes in the state of West Virginia; Pennsylvania zip code areas 15000-16999, 17200-17299, and 17700-17799.

Indiana - Territory includes all zip codes in the state of Indiana.

Kentucky-Tennessee - Territory includes all zip codes in the state of Kentucky and Tennessee.

Michigan - Territory includes all zip codes in the state of Michigan.

Western New York - Territory includes New York zip code areas 14000-14399, 14700-14799, and 14900-14999.

Ohio - Territory includes all zip codes in the state of Ohio.
Region IV Regional Planning Coordinator:

Michael Schmidt, Ph.D.
Medical University of South Carolina
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Fax: (843) 792-2464
E-mail: schmidtm@musc.edu

Florida - Territory encompasses Florida zip code areas 33000-33499, 33900-34099, and 34900-34999.
North Carolina - Territory includes all zip codes in the state of North Carolina.
Puerto Rico - Territory encompasses the Commonwealth of Puerto Rico.
South Carolina - Territory includes all zip codes in the state of South Carolina.
South Central - Territory includes all zip codes in the states of Arkansas, Louisiana, and Mississippi.
Southeastern - Territory includes all zip codes in the states of Alabama and Georgia; Florida zip code areas 32000-32099, 32200-32999, 33500-33899, 34200-34299, and 34600-34699.

Region V Regional Planning Coordinator:

Michael Sadowsky, Ph.D.
University of Minnesota Soil Water & Climates
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Fax: (612) 625-6725
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Alaska - Territory includes all zip codes in the state of Alaska.
Illinois Society for Microbiology, Inc. - Territory includes all zip codes in the state of Illinois.
Missouri - Territory includes all zip codes in the state of Missouri.
North Central - Territory includes all zip code areas in the states of Iowa, Minnesota, North Dakota, South Dakota, and Wisconsin.
Northwest - Territory encompasses all zip codes in the states of Montana, Oregon, and Washington; Idaho zip code areas 83500-83599, 83800-83899; and British Columbia.

Region VI Regional Planning Coordinator:

Philip D. Lister, Ph.D.
Creighton University School of Medicine
2500 California Plaza
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Phone: (402) 280-1881
Fax: (402) 280-1225
E-mail: pdlister@creighton.edu

Missouri Valley - Territory includes all zip codes in the states of Kansas, Nebraska, and Oklahoma.
Rio Grande (formerly New Mexico) - Territory includes zip codes in the state of New Mexico and Texas zip code areas 79800-79999, 88500-88599.
Rocky Mountain - Territory includes all zip codes in the states of Colorado and Wyoming.
Texas - Territory includes zip codes in the state of Texas excluding 79800-79999, 88500-88599.

Region VII Regional Planning Coordinator:

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1001 Potrero Avenue
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Fax: (415) 206-3045
E-mail: mary.clancy@ucsf.edu

Arizona - Territory includes all zip codes in the state of Arizona.
Northern California - Territory encompasses California zip code areas 93600-96599; Nevada 89400-89899.
Southern California - Territory encompasses California zip code areas 90000-93599; Nevada 89000-89199.
Hawaii - Territory includes all zip codes in Hawaii.
Intermountain - Territory includes all zip codes in the state of Utah, Nevada zip code areas 89300-89399; Idaho zip code areas 83200-83499 and 83600-83799.
Branch Program Diversification Funding

The Branch Organization Committee (BOC) of the American Society for Microbiology (ASM) would like to make you aware of a new program. In hopes of serving the broadest possible constituency of ASM members, the BOC has developed a new funding resource called Branch Program Diversification Funding. Program diversification funding is designed to provide financial support for projects which facilitate activity and meeting initiatives which are new when compared to the Branch’s recent activity history. The BOC anticipates that this program will serve as a catalyst for many new programs and welcomes your input and participation as follows.

As you and your institutional colleagues consider organizing meetings and activities for your students and faculty this academic year, we encourage you to coordinate your ideas with your local ASM Branch representatives to determine whether the Branch will sponsor funding for the project. Note: Branch support for your events will not impact the funding available to them for their more traditional programs. This new funding opportunity will enable Branches to expand their program offerings to attract new members and scientific constituencies to Branch meetings.

The BOC strongly believes that Branches afford students a unique opportunity to present research to colleagues in a comfortable setting and would like to reinstate the traditional connection between educational institutions and ASM Branches. ASM Branches have been deeply committed to student outreach. Through program diversification funding, the BOC hopes that your students will be able to take advantage of the many resources available through Branches: (1) networking with other microbiologists, (2) award programs, (3) travel grants, and (4) participation in local scientific meetings.

To learn more about this program or apply for funding, please feel free to contact the Regional Planning Coordinator in your area who will assist you.

Sincerely,

Toby K. Eisenstein
Chair, Membership Board

Norman P. Willett
Co-Chair, BOC

Stephen A. Sonstein
Co-Chair, BOC
Staying Involved with ASM After ASMCUE 2006

STAY IN TOUCH

• Sign up to be an ASM Division W member
• Sign up and regularly read messages on Edualert
• Sign up and participate in the education listserves and discussions [www.asm.org/subscribe.asp](http://www.asm.org/subscribe.asp)
• Sign up to reach out to K-12 teachers, student and others at the
  o Minority Mentoring Network [www.asm.org/profile/minoritymentorjoin.asp](http://www.asm.org/profile/minoritymentorjoin.asp)

REVIEW, REVIEW, REVIEW

• Serve as a reviewer for:
  o MicrobeLibrary visual and curriculum resources,
  o *Microbiology Education* journal and *Focus on Microbiology Education*
  o Abstracts and/or travel grants, ASM Conference for Undergraduate Educators (ASMCUE)
  o Abstracts and/or travel grants, Annual Biomedical Research Conference for Minority Students (ABRCMS)
  o ASM undergraduate student fellowship program
• Submit a review of a microbiology education resource (e.g. book, multimedia program, software) to the MicrobeLibrary’s Collection of Reviews or the summer issue of *Focus on Microbiology Education*.

SHARE YOUR WORK, SHARE YOUR WORK

• Submit abstracts and presentations to:
  o ASM Conference for Undergraduate Educators
  o ASM Branch or ASM Regional Branch Meeting
  o ASM General Meeting Division W Sessions
• Submit manuscripts to:
  o *Focus on Microbiology Education*
  o *Microbiology Education* journal
• Submit activities to the MicrobeLibrary:
  o Curriculum Collection
  o Visual Collection
• Submit an educational feature or forum article to *Microbe* (formerly *ASM News*)
• Submit an application to the ASM Scholars-in-Residence Program
• Submit an application to the ASM/BioQUEST Bioinformatics Institute

MENTOR, MENTOR, MENTOR

• Mentor a student and submit an abstract for the Annual Biomedical Research Conference for Minority Students (ABRCMS)
• Mentor a student and submit an application for an ASM student fellowship
• Mentor a graduate student and submit an application for the ASM Kadner Institute in Preparation for Careers in Microbiology
• Mentor a new ASMCUE attendee
• Mentor a new ASM Scholar-in-Residence
• Mentor a graduate student or postdoctoral scholar interested in teaching
• Mentor another faculty at a 2 or 4-year institution in your area; share problems and ideas
**LEAD, LEAD, LEAD**

- Disseminate information about and encourage colleagues to participate in ASM Education Programs [www.asm.org/Education/index.asp?bid=369](http://www.asm.org/Education/index.asp?bid=369)
- Sponsor a session at:
  - ASM Conference for Undergraduate Educators
  - General Meeting, Division W
  - Branch Meeting or Regional Branch Meeting on a topic related to education
- Recruit a new member for:
  - Membership in ASM Division W
  - ASM Conference for Undergraduate Educators
  - ASM Scholars-in-Residence Program
  - ASM BioQUEST Bioinformatics Institute
  - Annual Biomedical Research Conference for Minority Students (ABRCMS)
- Sponsor a brown bag lunch discussion on best practices in teaching on campus
- Sponsor a career day or research symposium for students on campus
- Sponsor a student chapter or become involved in an existing one
- Represent ASM at a biology teacher and/or student meeting (ASM staff will send you show and tell materials to take along. Contact educationresources@asmusa.org)

**SHOW APPRECIATION**

Have coffee with your dean and tell him/her how much you appreciate his/her support in for your participation in ASM education programs
2007-2008 ASM SCHOLARS-IN-RESIDENCE PROGRAM
ASM’s program for advancing scholarly teaching in microbiology

Application Deadline: March 2, 2007

Apply to this year-long program which begins July 25-28 with the inaugural ASM Scholarship of Teaching and Learning (SOTL) summer workshop.

A limited number of “Scholars” will be chosen through a competitive evaluation and selection process. The summer workshop will provide direct access to six Carnegie Scholars who will share their experiences in evidence-based education reform.

ASM SCHOLARSHIP OF TEACHING AND LEARNING SUMMER WORKSHOP
July 25-28, 2007
ASM HEADQUARTERS, WASHINGTON, DC

For more information on this program visit http://www.asmcue.org/index.asp?bid=2332.
Benjamin Cummings invites you to join us in celebrating the Annual ASM Conference for Undergraduate Educators.

Visit our book display for a taste of paradise and to learn about the microbiology of chocolate.

Complete our brief survey to receive a microbe poster and enter a drawing to win your choice of gourmet chocolates.

Delectable New Microbiology Offerings from Benjamin Cummings:

Microbiology, Second Edition
Robert Bauman, Amarillo College

Microbiology: An Introduction, Ninth Edition
Gerard J. Tortora, Bergen Community College
Berdell R. Funke, North Dakota State University
Christine L. Case, Skyline College