ENZYMATIC

The Newsletter of the American Society for Biochemistry and Molecular Biology
Undergraduate Affiliate Network

"Success comes from having a community."

June 2004 ***Number 1 Volume 1***

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Editorial: How we teach students

As educators in the arena of Biochemistry and Molecular Biology we know that science changes quickly: one of the exciting things about teaching in this area is that the science is evolving rapidly- what we teach this year may be quite different from what we taught ten years ago and what we may be teaching ten years from now. In keeping with the recently revised set of curricula recommendations from ASBMB where the focus is on skills as well as knowledge and the necessity for an education that brings the fundamentals of biology, chemistry and physics together, Enzymatic will feature a series of editorials by leading educators. Increasingly the focus is on teaching students to think and apply fundamentals to changing scenarios rather than memorizing facts. To start the series I have related some thoughts that came from a talk Dr. Kenneth Wesson gave at the recent ASM Meeting in New Orleans:

Kenneth Wesson
The Latest Research on the Biological Basis of Thinking and Learning

Starting with the premise that "if it's your job to develop the mind, should you not know how the brain works," Dr. Wesson's talks focus on relating how the brain works to how to teach students

Perhaps most important is that the brain is not a constant, the old idea that the brain did not grow after the age of 12 is no longer supported by the latest neurobiological research and understanding what promotes neuronal development and the development of neuronal connections should play an important point in determining the best way to teach. During an entertaining and informative hour Dr. Wesson raised a number of points that faculty involved with day-to-day teaching and the development of courses and programs should think about.

Our goal is to teach thinking, science at the cutting edge needs more interdisciplinary thinking- we should teach more interdisciplinary courses particularly early in a curriculum- basic core courses that are interdisciplinary will promote learning more than having separate disciplinary courses.

Teaching should be in a safe, accepting, interactive, learning environment: to encourage thinking you cannot just tell students what they need to know: they have to make connections for themselves.

Ask questions: Let questions sit there
Ponder the answer: it's better not to tell them the answer and let them think about it for a while- that way they learn-it's better not to make the connection for them: that is don't tell them the answer- which does little good for them at all: it's just another thing to memorize

Make connections- focus on concepts
Use "this is like a——" approaches
More ways of treating/presenting a concept the better
Have students draw the concept, make them use flow charts and visual representations

Use long-term projects to promote long term learning

When grading or correcting student work, Make them think: don't use lots of red pen-don't write out what is wrong or what they should have put- Make them think- a student learns far more by being told that they didn't get something right and having to work out what it was and what was wrong for themselves than simply being told "this is the right answer."

If you must use written comments make them hard to read so that the student has to struggle with them: at least that way they will learn something.

Nothing in education is more dangerous than people who refuse to adapt to change.

Dr. Wesson is both a neurobiologist and educational leader and motivator: to find out more about Dr. Wesson's views see:

http://www.sciencemaster.com/wesson/home.php

Dr. Wesson has been invited to give a plenary lecture at the 2006 ASBMB Meeting

If you would like to respond to these points or raise other relevant issues please contact the Editor of Enzymatic, Ellis Bell, jbell2@richmond.edu

Outreach Activities

What are "outreach activities" and what roles do they serve in our student's education? These are good questions: ones we should all be asking ourselves. From one perspective outreach activities offer a chance to bring the molecular life sciences to all. Whether it is K-12, politicians, or various community groups, science, and science education as a whole is well served by having a more science-educated populace. Whether it is outreach to "non-science faculty and non-science majors on your own campus or to a local youth group or the State legislature, people in general are well served by understanding more science- several well known universities have recently decided that a "liberally" educated student needs to know and understand more science, particularly interdisciplinary science: where better to use Biochemistry and Molecular Biology- the Molecular Life Sciences - to teach students of all types and ages about science. On another level it offers us a chance to allow our students to really test whether they understand the basic concepts that we are teaching them. To paraphrase the old adage " when I can really teach a topic, I know I understand the topic."

An excellent resource on service learning can be found at:

http://www.gseis.ucla.edu/slc/

As part of a continuing series of features in Enzymatic this issue highlights some outreach activities that have been used in teaching at various institutions: in keeping with the "adapt and adopt" philosophy of both Project Kaleidoscope and the National Science Foundation the examples given here are from the recent ASM meeting.

The Unexpected Protocol: Combine Urban Youth, Community Outreach and High Throughput Cloning to Achieve Results: C. Mendis, M. K. Anderson, D.L. Yourick, and M. Jett: Walter Reed Army Institute of Research, Silver Spring, MD.

This project took pre-college students with no or minimal lab experience and through participation in ongoing research taught a variety of techniques and basic skills. The participants present their results at an end of summer "graduation" ceremony. Formal external evaluations have shown that this initiative has not only given students knowledge and skills but has also enhanced their commitment to science.

Bridges to the Future- Increasing Minority Student Participation in the Biomedical Sciences. I Pillay, S. Baki, K. Chang, K. Germain, and L. Moses: Southwest Tennessee Community College.

This program, funded by the NIH "Bridges to the Baccalaureate Degree Program" allowed Southwest Tennessee CC to serve as a substantial resource for identifying minority students with the potential to make the transition to a biomedical research career. The project identifies eligible students early in their academic career, and during spring semester mentors them in science skills and academic career advising before placing them in a summer research experience at a four year college where they participate in ongoing research. Over a three year period this program has resulted in a significant transfer of students to four year colleges to pursue science degrees.

Upper Level Undergraduates Teach Marine Microbiology to 5th Grade Students: Elise R. Sullivan, University of New Hampshire, Durham, NH

A major component of the UNH Marine Microbiology course, which is a writing intensive course is to have the students visit a local elementary school to teach 5th graders basic concepts about marine microbes- this assignment involved extensive interactions with both the 5th grade teachers and the 5th graders and constituted 20% of the total grade for the course. The assignment developed from wanting students to be able to discuss complex scientific concepts with non-scientific audiences.

Science on Saturdays: Developed by the BMB Students at Gustavus Adolphus College, St Peter, MN.

Students in the BMB Club at Gustavus Adolphus College teamed with their ACS, Tribeta and Physics Club counterparts to offer a wide ranging, hands on Saturday morning experiences for local K-5 children. From a small beginning the first year to over a hundred kids by the third year the Science on Saturdays program involved both college students and local children in hands on science activities. The children were often accompanied by their parents and evaluation responses from both participating children and their parents were extremely positive.

Please share your outreach activities with your colleagues: brief overviews of the program's outreach activities will be a regular feature in "Enzymatic" together with a regular series of contributed articles on how to organize and evaluate the impact of outreach activities.

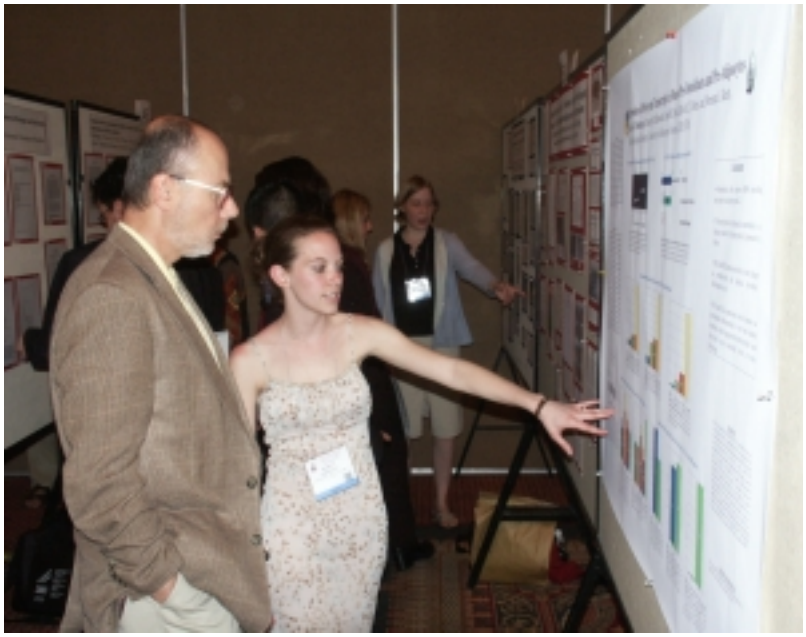
Please submit ideas and comments to **ngrover@ColoradoCollege.edu**

National Highlights: *Going to Boston?*

Although only starting its first year, the ASBMB Undergraduate Affiliate Network will have an impact on this year's National Meeting. At the opening reception there will be a designated area where undergraduates and undergraduate faculty can get together and get to know one another prior to the meeting getting into full swing. Affiliated Programs each receive a travel award to send a student to present in the undergraduate research poster competition, and a number of participants in this year's competition are sponsored by the UAN. The poster session is on Monday evening with judging by a panel of judges going on throughout the evening. Awards for best posters will be made by Meeting Co-Chair Alexandra Newton at the start of the Tuesday afternoon Symposium in the "Signaling Pathways in Disease" Meeting.

If you are in Boston for the meeting and want to find out more about the UAN program please stop by the ASBMB On Site Office.

New ASBMB UAN Programs



The most recent additions to the UAN program include Seton Hall University, Rochester Institute of Technology, Spelman College, Montclair State University, Virginia Tech and Hope College. Montclair State University has the distinction of being the first University to host two UAN chapters, one based in the Chemistry/Biochemistry program and one based in the Biology/Molecular Biology program.

One of the most frequently asked questions about the UAN program is "what if I already have an ACS affiliated program?". The answer is that it really doesn't matter- provided that a faculty member sponsor of the UAN is an ASBMB member and you have 5 undergraduate members of ASBMB you can form a UAN. Several schools have found that having a UAN chapter as well as an ACS or Tribeta chapter has helped foster interactions between student groups to the benefit of all the groups.

Regional News:

In the **Southeast Region**, Virginia Commonwealth University Biochemistry Department will host a fall Symposium for undergraduate research presentations in the Richmond vicinity- details can be obtained from Professor Rik Van Antwerpen, hgvanant@hsc.vcu.edu.

In the **Northwest Region**, regional directors Joe Provost and Mark Wallert work closely with the Minnesota Academy of Science to ensure that life science undergraduates are well represented in the Academy's activities and that there are professional symposia at the Academy meeting of interest to the large undergraduate student population in the molecular life sciences.

TOP 10 REASONS TO GET INVOLVED WITH THE ASBMB UAN PROGRAM

10. hplc, uv, ir, nmr, es-ms, afm: and
chemists say that biologists talk alphabet soup!

9.Molecular Biologists have more cultures!

8. You say you want a revolution- We've got the Krebs Cycle!

7.It's a protease eat protein world out there!

6.Where else can you get away with designing really cool drugs!

5. Structural Biologists have bigger magnets and X-ray'ted molecules!

4. Grim, Reaper, Death: who knew that proteins could be so much fun!

3. We can make you fluorescent green, blue or almost any other color

2. Why not BMB, we're all mutants anyway!

and the number one reason to be a ASBMB UAN member is:

All the best questions are in biology, all the best answers come from chemistry- study biochemistry and molecular biology

Does your School or program have a tee shirt or coffee mug design that relates in some way to biochemistry and molecular biology, have you always wanted to design a logo for your program, do you have a "top ten" list related to biochemistry and molecular biology- if you do, or if you want to create one please submit it for consideration for inclusion in an upcoming issue of "Enzymatic". The best submissions will be featured at the ASBMB Booth at the San Diego Meeting in 2005.

Focus on Faculty:

Dr. Neena Grover, Colorado College

Dr. Neena Grover is an assistant professor of biochemistry in the department of chemistry at Colorado College. She received her Ph.D. from the University of North Carolina in Chapel Hill, NC, and did her postdoctoral work on catalytic RNA at the University of Colorado at Boulder and has continued her research in RNA thermodynamics and kinetics, especially as it pertains to metal-RNA interactions. She teaches problem-based service learning courses in biochemistry to foster a connection between the intellectual and personal experiences of science and to develop a sense of civic responsibility in her students.

Currently she is the Southwest regional director for the Undergraduate Affiliate Network (UAN) and a member of the Education and Professional Development Committee of the American Society for Biochemistry and Molecular Biology. Her goals for the Southwest region are to establish a wide variety of opportunities for students and faculty including outreach activities, mentoring for faculty and students, linking graduate schools with undergraduate researchers, and developing research opportunities for faculty and students at undergraduate institutions. The UAN network will also provide a forum to highlight the accomplishments of the talented people in the region and will be a rich resource for regional information for all its members.

Dr. Grover has been extremely active in Project Kaleidoscope and the Pew Midstates Science and Mathematics Consortium particularly in the "SHAPING THE BIOCHEMISTRY CLASSROOM OF THE 21ST CENTURY" series. Dr. Grover maintains an active research group and continues collaborative research with the Uhlenbeck group at the University of Colorado.

"Enzymatic" will be published 6 times a year, in June, August, October, December, February and April. Each issue will contain features about partcipants in the UAN program as well as highlights of regional and national meetings. In addition to regular content aimed towards outreach activities, teaching innovations and assessment of student learning, several issues during the year will have a focus on academic opportunities for student members as follows:

August/October: Choosing a Graduate Program and Preparing the Application
December: Opportunities for Summer Research Programs
February/April: Getting Ready to go to the ASBMB Meeting

News and Views

We welcome contributions to the pages of enzymatic, either contributed articles for the various ongoing themes of Enzymatic, news of student and faculty achievements, or views on the materials presented in these pages: contact jbell2@richmond.edu for further information.

Teaching Resources

Biochemistry and Molecular Biology Education-BAMBED
May/June 2004, Vol. 32, No. 3

Each issue of Enzymatic will feature several articles from BAMBED- if you teach and want to find some new approaches to presenting difficult or old concepts, or if you are new to teaching and want to find interesting "tested" approaches for innovative teaching, BAMBED contains articles and connections that are of use to you.

If you are tired of using the same old approach to teaching metabolism have you tried:

Metabolic Minimaps:
Purine and Pyrimidine Metabolism, Designed by Donald Nicholson: Commentary
Donald Nicholson.

If you haven't used the Minimaps yet, give it a try: created by 80-something young investigator Don Nicholson these minimaps bring a refreshing vitality to metabolism.

If you are thinking of starting a Biochemistry and Molecular Biology program and think it can't be done in a creative and very effective way in a comprehensive state university try reading this: there is something inspiring for every educator in the way that MSU Moorhead does biochemistry and molecular biology:

Mini-Series: The ASBMB Recommended Biochemistry and Molecular Biology Undergraduate Curriculum and its Implementation: Implementing the Recommended Curriculum in Biochemistry and Molecular Biology at a Regional Comprehensive University through a Biology/Chemistry Double Major: The Minnesota State University Moorhead Experience
Mark Wallert, Ellen Brisch, Chris Chastain, Michelle Malott, and Joseph Provost
Minnesota State University Moorhead (MSUM) is a regional comprehensive university that is part of the Minnesota State Colleges and Universities (MnSCU) system. The current student population consists of 7,600 full- and part-time students who are enrolled in one of 135 majors that lead to baccalaureate degrees. MSUM is committed to excellence in science teaching and research for undergraduates. It is an institutional member of the Council on Undergraduate Research and has three faculty members participating in Project Kaleidoscope (PKAL) Faculty for the 21st Century. Fourteen years ago, MSUM renewed its effort to have faculty participate in active research. All science faculty members hired since that time have been required to establish research programs. The primary purpose for the faculty engaging in ongoing research projects is to involve undergraduates in a meaningful research experience, thus training these students to become scientists.

Tired of students just not getting quantitative calculations and concepts: this article shows you how to bring one of the most fundamental but often ignored quantitative concepts in biochemistry to your students:

Oxidation-Reduction Calculations in the Biochemistry Course
Richard D. Feinman
Redox calculations have the potential to reinforce important concepts in bioenergetics. The intermediacy of the NAD+/NADH couple in the oxidation of food by oxygen, for example, can be brought out by such calculations. In practice, students have great difficulty, and even when adept at the calculations, frequently do not understand their significance. The causes of this problem are identified with 1) the context in which redox

calculations are presented and 2) the confusion over the formalism of the redox potential, particularly the meaning of the sign that refers to direction of current flow but is frequently confused with the thermodynamic sign. A method is described for teaching redox calculations that is straight-forward and simple for students to perform but, at the same time, brings out the key concepts. The primacy of the free energy is emphasized and the method is used to reinforce an understanding of respiration.

Are you developing a new laboratory sequence: here's one ready made that can be easily adapted to almost any ongoing faculty research project:

Gene Amplification by PCR and Subcloning into a GFP-Fusion Plasmid Expression Vector as a Molecular Biology Laboratory Course

Joshua A. Bornhorst, Michael A. Deibel, and Amy B. Mulnix

A novel experimental sequence for the advanced undergraduate laboratory course has been developed at Earlham College. Utilizing recent improvements in molecular techniques for a time-sensitive environment, undergraduates were able to create a chimera of a selected gene and green fluorescent protein (GFP) in a bacterial expression plasmid over the course of a single semester in a weekly 3-h laboratory period. Students designed PCR primers for amplification of the selected gene using computational DNA sequence analysis tools. During the experimental portion of the course, students amplified and ligated the target DNA into a commercially available GFP expression vector. Following transformation of the ligation product, plasmids were harvested from the resulting bacterial colonies and were analyzed by restriction digestion to confirm the creation of the chimeric GFP-DNA. This course gave students valuable experience with commonly used molecular techniques in an authentic research project. In addition, students gained experience with experimental design and execution. The techniques presented here are flexible and can be generalized for use with almost any DNA sequence and expression vector. This series also serves as an example of how faculty can adapt their ongoing research projects to the undergraduate laboratory.

One of the problems with enzyme kinetics labs is that students never get good enough data the first time around to be able to make meaningful interpretations of their data: here is a way to incorporate data into problem sets or lectures that will challenge students and help teach enzyme kinetics

Lucenz Simulator: A Tool for the Teaching of Enzyme Kinetics

Alan G. Clark

A program has been developed that will produce simulated enzyme kinetic data suitable for inclusion in problem sets for undergraduates. Mechanisms simulated include one- and two-substrate reactions and various types of inhibition. The effects of variation of pH and temperature may be modeled, as may the effects of random errors on the experimental procedure. The graphical output is suitable for use in lecture demonstrations.

Emerging Areas in the Molecular Life Sciences

Preview of the Education Sessions at the ASBMB Annual Meeting

Computers and computational approaches to science are revolutionizing the way we do and think about science and are also changing the types of ways that we can teach science. While bioinformatics and molecular modeling are becoming commonplace in many courses in the molecular life sciences, more advanced topics such as computational chemistry and biochemistry and advanced topics in bioinformatics delving into proteomics and structural genomics are becoming important components not only of advanced courses but throughout the undergraduate curriculum.

The Sunday and Monday morning symposia in the "**The Future of Education and Professional Development in the Molecular Life Sciences Meeting"** in Boston focus on just these issues. These sessions, chaired by Judy Voet and Jessica Bell, feature a variety of speakers who have brought computational approaches to the forefront. On Sunday three talks will focus on bioinformatics and how to use various resources in the classroom. The talks,
"Visualizing the science of genomics" by Kathy Takayama, Univ. of New South Wales, Australia,
"Using the PDB for structural biology education" by Judith Voet, Swarthmore College, and
"Using simulations to introduce proteomics and bioinformatics to undergraduates" by Paul A. Craig, RIT, should provide useful insight for both in and out of classroom experiences for students. On Monday morning the focus switches to more advanced topics and in particular the science behind the topics. With an introduction to structural biology and its place in the curriculum by Jessica Bell, three talks will focus on advanced methodology and facilities that are perhaps not usually introduced into the undergraduate curriculum but students really need to be aware of. The talks: "Bioinformatics education programs in Japan" by Minoru Kanehisa, BioInformatics Center, Kyoto Univ., Japan, "Molecular visualization in education" by Jane S. Richardson, Duke Univ. Med. School, and "Dynamics, pathways, and tunneling - a computational perspective of enzyme catalysis" by Jiali Gao, University of Minnesota will be followed by a lunchtime "brown bag" session with the speakers to discuss innovative ways that the necessary background for these more advanced topics can be put into introductory courses in the curriculum so that the topics themselves can be integrated into more advanced courses
.

What to Do After Graduation?

Usually the best time to start thinking about this is early in your undergraduate education when your faculty advisor or mentor can be of most help. After you have read the Careers booklet from ASBMB and decided upon a path to your future there are still many hurdles before you. Many useful hints to guide you along the path from deciding what you want your future to be to actually living your future are contained in a new web site from the ASBMB UAN:

Planning and Preparing for a Career in the Molecular Life Sciences

By
Peter J. Kennelly
Department of Biochemistry
Virginia Polytechnic Institute and State University
Blacksburg, VA 24061

This site, accessible from the UAN regional websites gives students a wealth of useful tips and guidelines as they prepare for their future: this site should be "must reading" for every faculty mentor and student alike. The contents of the site are given below:

INTRODUCTION. WHO HIRES BIOCHEMISTS AND MOLECULAR BIOLOGISTS?

I. Who employs persons trained in Biochemistry and Molecular Biology?

WHERE DO I START?

II. Some basic principles of career building.

III. What are potential employers looking for?

IV. Self assessment. In order to determine what you want and how to get it, you must first know yourself.

INFORMATION FOR CURRENT AND PROSPECTIVE COLLEGE STUDENTS.

V. What can I do with my B.S. in Biochemistry, Molecular Biology, or related area?

VI. How can college students obtain career-related experience?

GRADUATE SCHOOL AND POSTDOCTORAL TRAINING.

VII. Some common misconceptions concerning graduate study in the life sciences.

VIII. M.S. or Ph.D.?

IX. The graduate school application process.

X. What about taking a 'year off' before graduate school?

XI. Some observations concerning postdoctoral training.

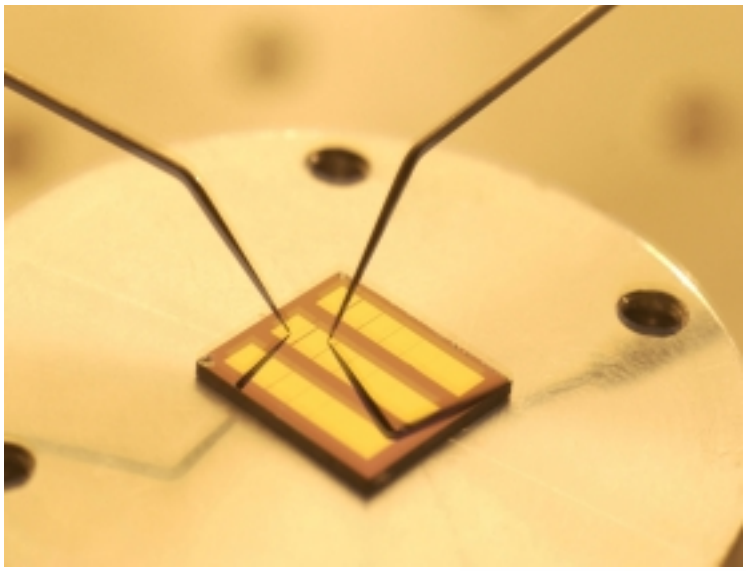
THE JOB SEARCH.

XII. Advertisements and other sources of information.

XIII. Résumés, CVs, and cover letters.

XIV. Letters of reference.

XV. Some examples of "action" verbs for résumés.



THE INTERVIEW AND BEYOND.

XVI. Preparing for the interview.

XVII. Some tips on interviewing.

XVIII. Success in the workplace.

LOOKING FOR MORE INFORMATION?

XIX. Other resources.

Becoming a UAN Member

The ASBMB **Education and Professional Development Committee (EPD)** has created a community for undergraduates interested in biochemistry and molecular biology.

The Undergraduate Affiliate Network (UAN) aims to form scientific and educational communities across the country to help institutions of all types develop the best possible undergraduate curricula and to provide more research and learning opportunities for students by pooling their resources and working together. The UAN is divided into **six geographical regions**, each of which will have a regional director and dedicated website.

GOALS

The EPD has identified four goals of the UAN. They are:

- To assist in the development of strong undergraduate programs in biochemistry and molecular biology.
- To provide undergraduate programs with access to seminar speakers and regional programs and symposia.
- To foster interactions between undergraduate educational and outreach programs both regionally and nationally.

To recognize outstanding educational activities in the arena of biochemistry and molecular biology by individuals and by programs.

To affiliate with ASBMB as an undergraduate Biochemistry and Molecular Biology network member, programs should:

- Have five or more undergraduate student members of ASBMB.
- Have a faculty advisor who is a member of ASBMB.

It is not necessary for the College or University to have an undergraduate major in Biochemistry and Molecular Biology- just students and faculty interested in the area of Biochemistry and Molecular Biology.

BENEFITS

Through the regional organization of the UAN already local and regional symposia for undergraduates to present their research are being organized. Each regional website has its own resources as well as links to national resources such as the "How to Prepare a Resume and for an Interview," and the newsletter "Enzymatic". The UAN has a list of consultants who can be approached for things such as program reviews etc. by member institutions and also is building a list of available seminar speakers on a regional basis. In addition,

- Each affiliated program will be awarded one $350.00 travel grant to send an ASBMB undergraduate member to the **ASBMB Annual Meeting** to present their research in the Annual ASBMB Undergraduate Poster Competition.
- Each affiliated program may nominate an outstanding ASBMB Senior undergraduate member for one of ten competitive Seniors in Science Excellence Awards. Award winners will also receive a $350.00 travel grant to present their research in the Annual ASBMB Undergraduate Poster Competition.

UAN faculty advisors may apply for one of 20 competitive $500.00 travel grants to attend the **ASBMB Annual Meeting**.

Application materials for UAN membership can be found at the website:

http://www.asbmb.org/ASBMB/site.nsf/Sub/UndergradAffiliates?Opendocument

For more details please contact either Ellis Bell or any of the regional UAN directors