Education Poster Sessions

E-2000
Bio-Link: Educating the Biotechnology Workforce at Community and Technical Colleges. E. A. JOHNSON. Bio-Link, City College of San Francisco, San Francisco, CA 94103. E-mail: ejohnson@biolink.ucsf.edu
Bio-Link is an Advanced Technological Education (ATE) Center for the nation’s biotechnology industry and is funded primarily by the National Science Foundation to promote and improve technological education. The ATE program focuses on using the resources of community and technical colleges that can prepare technicians for today’s high-performance workplace. Bio-Link, headquartered at City College of San Francisco, has Regional Centers in the states of New Hampshire, Texas, Wisconsin, Washington, and California. Bio-Link is also affiliated with the Northern California Biotechnology Center at City College of San Francisco. The national and regional Centers all work closely with the biotechnology industry to help define curriculum and training that will best meet industry’s needs. They also work with secondary schools and four-year institutions to help create career paths for students who are interested in the cutting edge field of biotechnology. The Center concentrates on professional development for instructors, curriculum improvement, and the sharing of information and materials with biotechnology programs across the country. There is an extensive curriculum and instructional materials clearinghouse and many other services for business, educators, and technicians on the website at www.bio-link.org. Bio-Link is currently in the sixth year of a six-year commitment to NSF and is planning for sustainability as a Biotechnology National Resource Center for many years in the future.

E-2001
Professional Education and Career Options for Today’s Biological Scientists. LINDY A. BRIGHAM. Department of Plant Pathology, The University of Arizona, Tucson, AZ 85721. E-mail: iringham@ag.arizona.edu
The education of scientists in the 21st Century is more complex and challenging than ever before. The options for biologists have never been greater and programs are being developed at a rapid pace to meet the needs of academia and industry. The University of Arizona, with funding from the Alfred P. Sloan foundation, has developed a Professional Master’s Degree Program in Applied Biosciences that combines a graduate level science curriculum with courses in the fundamentals of business and project management to prepare students for jobs in biology-based businesses or the professional management of university and national laboratories. Students in the program can select several tracks or specializations such as Drug Discovery, Clinical Trials Management, Laboratory Management, Bioinformatics, Technology Transfer, Plant Biotechnology, and Veterinary Medicine. An internship provides experience in applied research and is the basis for the capstone project. The Industry Colloquium introduces students to the leading players in commercial and governmental enterprises nationwide. Information will be available for students, faculty, and businesses on the national-wide effort to develop and promote the Professional Science Masters.

E-2002
Internships: A Central Role in the Master of Biotechnology Program, a Professional Science Master’s. DAVID BIEBER and A. Christopher Brinegar. MBT Program and Department of Biological Sciences, San Jose State University, San Jose, CA 95192-0100. E-mail: dbieber@email.sjsu.edu
The Master of Biotechnology (MBT) is a new degree being offered by San Jose State University. It is one of the innovative Alfred P. Sloan Foundation programs for Professional Science Masters. The rationale for these new types of master degrees is to better prepare science and math graduate students for rewarding careers in industry. Students from these programs will bring a unique combination of skills to the workplace and may provide a versatile alternative to either PhD or MBA trained employees in certain kinds of positions. Our MBT program combines advanced laboratory science training with business education drawn from relevant MBA-level course work. Students in the program are not necessarily pursuing careers in laboratory research. Rather, they are also looking for opportunities where master-level scientific and business training can be applied to positions in development, manufacturing, business or commercial functions. These may be entry-level positions in areas such as regulatory affairs, clinical research, project management, quality assurance, production planning, materials management, business development, marketing or sales where scientific training would be an asset. A central part of the MBT program is an industry-sponsored internship that will enhance the student’s prior educational or work experience and help guide their career decision. Such an internship might involve a project in one of the areas mentioned above, or some other area, under the direction of a mentor who can help the student understand the importance of the project to the overall company. MBT students, as all PSM students, are committed to pursuing careers in their specific industry and eager for the opportunity to work as interns in companies where they can gain requisite knowledge and experience.

E-2003
Biotechnology Management - A New Professional Masters Degree Program. S. A. MCCOMMAS. Dept. of Biological Sciences, Southern Illinois University Edwardsville, Edwardsville, IL 62026. E-mail: smccommas@siue.edu
The Department of Biological Sciences at Southern Illinois University Edwardsville has developed a new Professional Masters Degree Program in Biotechnology Management. This was made possible by a Phase A grant for feasibility studies and a Phase B grant for implementation from the Alfred P. Sloan Foundation. The program strongly supports regional efforts to establish the St. Louis metropolitan area as the “Bio-Belt.” An early challenge was to establish an interdisciplinary program between the College of Arts and Sciences, the School of Business, and the Graduate School, merging a solid core foundation in the relevant sciences with business and managerial skills. Graduates from this program will have a fundamental understanding of their technical field that is lacking in managers from typical MBA or other management programs, yet still possess a core of business skills that would assist them in becoming effective project managers. The business courses included in the program were chosen after consultation with an Advisory Board representing startup and large biotechnology firms in the area and the Donald Danforth Plant Sciences Center. Graduates could be placed in many of the region’s biotechnology firms in either managerial positions or as “bench top” scientists with a broader understanding of the business environment. The curriculum for the PSM in Biotechnology Management is a 34 semester-hour program that consists of a required seminar series (4 semester hours), five courses in the biological sciences (15 hours), three courses in business (9 hours), and a directed internship experience in lieu of the more traditional thesis (6 hours). The required seminar sequence provides the “branding experience” that is a common component of existing PSM programs, and the internship provides students an experience in the business setting and local employers a chance to get familiar with potential hires at a nominal cost. Projected enrollment in this program, from surveys of undergraduates and present graduate students, is about 25 students.
Project-based Education in Plant Biotechnology: A Unique Approach. M. AYRAPETOV, C. Longo, A. Neil, M. Budziszek, J. Powell, J. Hague, J. Chandlee, and A. Kausch. Department of Cellular and Molecular Biology, University of Rhode Island, Kingston, RI 02881. E-mail: mail@postoffice.uri.edu

In this unique course, each student receives their own gene construct to introduce and evaluate in transgenic crop plants of interest. These constructs are the basis for real world research projects established with university collaborators from Yale, Cornell, the Salk Institute, Washington University and the University of Rhode Island. In the beginning of the fall semester students are introduced to the theory and practice of gene transfer in plants, utilizing cereal crops (rice and corn) and turfgrass species as systems for crop improvement by genetic modification, resulting in transgenic cell colonies by the end of the first semester. In the second semester, the students return and conduct the molecular and gene expression analysis of these transgenics. Thus, these projects are not merely a trivial training exercise but contributions to on-going research. Here, each transgenic is of real world research significance encompassing academic and research questions concerning basic plant biology and practical agricultural biotechnology. In our first offering of this course we included twelve undergraduates, one graduate student, four High School teachers and fifteen High School students. The results from the first year were published as abstracts and presented to the 2003 ASPB meetings in Honolulu, Hawaii. Eight posters were contributed to the ASPB meetings-co-authored by the students and represented by four undergraduates, one graduate student and two High School students who were sponsored to attend by lifeedu.org. The first time the course was offered it became evident that the time commitment on the part of the 17 students was extremely demanding. In the second offering this year we have included 42 undergraduate interns who are mentored by the students in the class and receive course credit. In addition to interns, we have also included High School teachers and mentor High School students in the laboratory. The students learn science by actually doing it, as well as other qualities of good scientists such as patience, persistence, perseverance, attention to detail, responsibility, and record keeping. This approach drives interest in underlying fundamentals through current and advanced technologies while providing real incentive to burn the midnight oil.

Somatic Embryogenesis and Genetic Transformation in Arundo donax L. ALLISON LESTER, K. Knowles, S. Dhir, and S. K. Dhir. Center For Biotechnology, Fort Valley State University, Fort Valley, GA 31030. E-mail: dhirsd@fvsu.edu

Giant reed (Arundo donax L.) is a tall, erect, non-food woody perennial crop plant. Recently, this plant has been considered for its use in phyto-remediation, in particular, for phosphorus uptake. With this objective in mind, we initiated in-vitro regeneration, genetic transformation studies. Embryogenic calli were observed on Murashige and Skoog (MS) medium supplemented with 2.0 mg/L of 2,4-Dichorophenoxyacetic acid (2,4-D) using immature inflorescence tissues. Regular sub-culturing of embryogenic callus, on MS media with various concentrations of 2, 4-D (0.5-2.5 mg/L), 3% sucrose and 0.4% gelrite, different developmental stages of embryos including torpedo and cotyledonal stages were observed. Mature somatic embryos were transferred onto medium supplemented with GA3 germinated into plantlets. The jellyfish green fluorescent protein (GFP) gene, a new tool to monitor gene expression was used as a reporter gene for genetic transformation stages. Embryogenic calli, induced on MS media were bombarded with 1.0 μm gold particles coated with a plasmid DNA vector containing GFP and NPTII genes fused to a 35S constitutive gene promoter. The GFP culture was observed under UV/blue light. Maximum gene expression was observed after 24 hrs (approximately 200 spots/bombardment) after culture. Prolonged exposure of high intensity blue light did not alter the number of transient events. The effect of different parameters such as types of tissues, distance, varying pressures on stable expression of GFP in embryogenic callus tissues will be discussed.
E-2008

Somatic Embryogenesis and Plant Regeneration in *Stevia rebaudiana*. KAYE KNOWLES, S. Dhir, and S. K. Dhir, Center for Biotechnology, Fort Valley State University, Fort Valley, GA 31030. E-mail: ddhir0@tvsu.edu

An efficient and rapid tissue culture system is developed for Stevia via somatic embryogenesis. Multiple shoots were induced from shoot tips cultured on Murashige and Skoog’s (MS) medium supplemented with 0-3.0 mg/L of Benyladenine (BA). Green true shoots with fully developed leaves were observed in almost 70% of initial cultures. Roots were induced in 30 d old shoots, transfer to MS medium individually supplemented with IAA or IBA (1-4 mg/L). Several plant growth regulator’s 2, 4-dichlorophenoxyacetic acid (2,4-D), and 2,3,5-triodobenzoic acid (TIBA), alone or in combination of BA, Kinetin (KN) and Zeatin (ZT) were tested for their capacity to induce somatic embryo from leaf segments using in vitro raised plants. The callus was observed in leaf segments on Murashige and Skoog’s (MS) medium with 3% sucrose and 0.3% (W/V) gelrite in all the combination tested. However, at 0.5 mg/L of 2, 4-D medium maximum number (94%) of the leaf explants produced embryogenic callus. After subculturing of calli on the same composition medium, embryos at various developmental stages (globular, heart and torpedo shaped) were observed. Subculturing of these embryo clusters onto MS medium supplemented with low concentration of 2, 4-D with glucose produced secondary embryos. Particle bombardment of leaf segments and embryogenic calli were performed at various levels of acceleration pressure (450-1800psi). An average 30 to 35% leaf segments and young embryogenic callus tissue expressed transient GFP gene expression at 1100 psi with a 6 cm distance from stopping screen to target tissue using gold particles. Leaf and embryogenic tissues bombarded with GFP gene were sub-cultured on embryo induction medium. Embryos at various developmental stages (globular, heart and torpedo shaped) expressing GFP genes are being recovered. Experiments on natural sensitivity and selection of transformed tissue under selective agents and PCR analysis of transgenic material will be presented.

E-2009

Novel Polymorphisms of the Prostate-specific Antigen (PSA) Gene: The Tobago Prostate Cancer Study. S. K. GAUR. University of Pittsburgh NovoLabs, A. World Congress on In Vitro Biology Abstracts 40-A

An efficient and rapid tissue culture system is developed for Stevia via somatic embryogenesis. Multiple shoots were induced from shoot tips cultured on Murashige and Skoog’s (MS) medium supplemented with 0-3.0 mg/L of Benyladenine (BA). Green true shoots with fully developed leaves were observed in almost 70% of initial cultures. Roots were induced in 30 d old shoots, transfer to MS medium individually supplemented with IAA or IBA (1-4 mg/L). Several plant growth regulator’s 2, 4-dichlorophenoxyacetic acid (2,4-D), and 2,3,5-triodobenzoic acid (TIBA), alone or in combination of BA, Kinetin (KN) and Zeatin (ZT) were tested for their capacity to induce somatic embryo from leaf segments using in vitro raised plants. The callus was observed in leaf segments on Murashige and Skoog’s (MS) medium with 3% sucrose and 0.3% (W/V) gelrite in all the combination tested. However, at 0.5 mg/L of 2, 4-D medium maximum number (94%) of the leaf explants produced embryogenic callus. After subculturing of calli on the same composition medium, embryos at various developmental stages (globular, heart and torpedo shaped) were observed. Subculturing of these embryo clusters onto MS medium supplemented with low concentration of 2, 4-D with glucose produced secondary embryos. Particle bombardment of leaf segments and embryogenic calli were performed at various levels of acceleration pressure (450-1800psi). An average 30 to 35% leaf segments and young embryogenic callus tissue expressed transient GFP gene expression at 1100 psi with a 6 cm distance from stopping screen to target tissue using gold particles. Leaf and embryogenic tissues bombarded with GFP gene were sub-cultured on embryo induction medium. Embryos at various developmental stages (globular, heart and torpedo shaped) expressing GFP genes are being recovered. Experiments on natural sensitivity and selection of transformed tissue under selective agents and PCR analysis of transgenic material will be presented.

E-2010

Effect of Glucose on Cell Culture System. STEPHEN WEN LI, Ada Burk, and Xuejun Fan. 1.Clear Brook High School, 4607 FM 2351, Friendswood, TX 77546 and 2.Department of Hybridoma Lab, Diagnostic Systems Laboratories, Inc., 445 Medical Center Blvd., Webster, TX 77598. E-mail: lianl@dslabs.com

In the past year, I have conducted experiments to demonstrate the importance of CO2 and pH in the development of cell culture. The CO2 and pH level are factors in the outside environment of the flask in the cell culture system. Like the role of CO2, and pH in that experiment, glucose is also a key factor that affects how cells grow during cell culture. During glycolysis, the glucose is converted to pyruvate, which then produces ATP for the cells. Glucose is one of the primary energy sources for cultured cells. Thus, to explore the amount of glucose in the culture media is very important in the engineering of the cell culture systems (Bioreactor). In this project, I have designed two experiments: in experiment I, different groups of anti-human insulin cells (control, groups 1, 2, and 3) were cultured under additional amounts of fresh medium (0, 5, 10 and 15 ml). After day 1, 2 and 4 of incubation the number of live cells were counted with a cell counting chamber and the levels of glucose and lactate present in the medium were measured with a spectrometer. Since there are other nutrients in the cell culture medium (such as glutamine and FCS), in experiment II, I added glucose (0, 20, 40 and 80mg/flask) directly into the culture flasks (different groups of anti-human insulin cells: control, groups 1, 2, and 3). The number of live cells was counted and the level of glucose was measured.

The results illustrated that in experiment I after day 1 of incubation the number of live cells did not change, and the glucose did not drop, and lactate did not increase significantly when compared to control group. After day 2 of incubation, there was a significant increase in the number of live cells in groups 3 and 4, but the glucose did not decrease, and lactate did not increase considerably as compared with control group. After day 4 of cell culture, all the groups had significant increase in cell proliferation as compared with the control group. Also, the levels of glucose had decreased tremendously (almost to the same level as the control), and the lactate level skyrocketed (group 4). In experiment I after 2 days of cell culture, the cell proliferation had significant increases in groups 3 and 4, while the glucose level was significantly high in the culture medium. In conclusion: (1) After two periods of cell doubling time, the glucose was all used, and the cells proliferated considerably. (2) The amount of glucose (3-times more than normal culture media) present during the cell culture, had a significant impact upon cell growth. This observation will greatly aid in understanding the role of glucose in cell culture system (for Bioreactor). This project was awarded first place in Microbiology at the Exxon Mobil Texas Science & Engineering in Arlington, Texas 2003 and a special Society for In Vitro Biology Science Fair Award.

E-2001

Community Colleges Biotechnology Manufacturing Training Programs: A Proposal. P. MCKAY, P. Lloyd, M. Hill, and H. Stern. Genentech, Inc., South San Francisco, CA 94080. E-mail: mckay.patrick@gene.com

Employee performance was evaluated for new manufacturing hires during the 06/2000 to 08/2002 period. The results of this evaluation showed comparable employee performance (based on factors including employee retention time and salary increases) for those manufacturing employees that had two-year college degrees as compared to those that had four-year college degrees. Genentech will continue to recruit and hire graduates with two-year college degrees to work in its manufacturing facility. Genentech will also continue to collaborate with community colleges to establish, develop and implement a biotechnology manufacturing curriculum to prepare these graduates to work in biotechnology manufacturing environments.