

# Bio-Link Discussion Group

January 2003—December 2003

## **Information request (February 2003)**

I'm looking on the web for training opportunities on the biotech validation area. If you know of a site, university or college that can help, it will be a great help for me. Biotech is increasing a lot in PR and I think this is a great opportunity for me. It can be on campus or off campus. (#584)

- We are offering a short course this summer in Madison, Wisconsin on basic biotechnology skills. This course is a laboratory-intensive overview of the basic skills necessary for success in the biotechnology workplace. We will address laboratory techniques, instrumentation, math, regulatory affairs and general workplace skills in industry biotech - what beginning technicians need to know to hit the ground running. It is designed for beginning technicians, those planning on entering the biotechnology workforce, or high school or college instructors wishing to offer this sort of course at their home institutions (stipends are available for educators). The course, Biotech Boot Camp, is based upon the textbook of Seidman and Moore, "Basic Laboratory Methods for Biotechnology." More information and registration is available at <http://matchmadison.edu/biotech/>. *Madison Area Technical College* (#585)

## **Forensics PCR (March 2003)**

I would appreciate hearing from the group about your students' success rates using the conventional methods (Miklos/CSHL) for DNA extraction from buccal swab and hair cells, followed by PCR with the TPA-25, PV-92, and D1S80 primers. Frankly our success rate for the last three years is discouragingly low, even though we are PCR aces in other applications. *Santa Fe Community College* (#587)

- We've moved from buccal swabs to saline mouth washes and our success rate for various PCR labs has been very high for Alu PV-92, D1S80 and mtDNA sequencing. (#588)
- I would concur with your findings. In fact, I did approximately 4 years ago have very, very good results with the Carolina kit; however, the PCR has progressively given poor results, so much so that this semester I am switching to the BioRad PCR kit/primers based on the recommendation of others. Initially, I felt the poor PCR results had to do with our own in class protocols but I honestly think it may be related to the quality of the reagents (of course I am not sure but I am looking forward to testing the BioRad reagents this semester.) Did you have satisfactory results some time ago with Carolina? *Santa Monica College* (#589)
- I have been having similar issues with PCR labs. We have just tried the BioRad bioinformatics kit and found that the results were great. So if you are looking for a quick and simple PCR lab I recommend trying it. However, we are still working on figuring out our other issue with PCR labs. Some of it may have to do with the PCR beads we use in some of our labs. Perhaps the chemistry of the beads has been changed and no longer works well for our applications. *Middlesex Community College* (#592)
- We too have had mixed results with PCR - in one case it was a bad lot of PCR beads - in another case, the primers were too old (more than 12 months old) - I did find that making the students do troubleshooting the source of PCR with new/old primers, new/old beads (different lot #s) was a great learning experience - (I don't use kits but just order the primers for Alu and mt. DNA PCR) *Oklahoma City Community College* (#594)
- We have never had good results with "educational" PCR kits. We found that in the bead-based kits, the primer mixes were O.K. but the beads were dead. The kits provide such a

small amount of dilute primer solution that we now just order the published primer pairs from Sigma-Aldrich or a similar oligo supplier, and the rest of the reagents from Promega. I suspect the template extraction process is the limiting factor. We abandoned kits and prepare our own digestion buffer, and weigh the Chelex directly into the extraction tube. By UV scans the extracts typically have measurable nucleic acid in them, and the TPA-25 PCR works about half the time, but PV-92 and D1S80 hardly ever. This semester I ordered pure human placental DNA from Sigma to use as a positive control, but it is damn expensive and the results were still unimpressive, especially with D1S80, probably because that DNA is from a mixture from many individual donors. *Santa Fe Community College* (#597)

### **Skills standards (March 2003)**

I would like to learn about industry-based skills standards in the area of biopharmaceutical manufacturing. Could anyone lead me to such a resource? I was involved with the Washington Skills Standards Project two years ago, but have since moved to Rhode Island, and am interested in learning more about the specific needs of industry in this region. (#602)

- The Bio-Link Clearinghouse web site has a collection of biotechnology industry-based skill standards. Go to the following links. If you are asked for a username and password, subscription is free: <http://bio-link.org/resSubscribe.htm>. (#608)

### **Chromatography text (March 2003)**

I am looking for an introductory text on chromatography suitable for the community college level. Any suggestions? *Community College of Southern Nevada* (#604)

- An online introduction to chromatography, as well as GLC & HPLC courses can be found at [www.scottishbiotech.org](http://www.scottishbiotech.org). (#605)

### **Yeast transformation (April 2003)**

Does anyone have a procedure to transform yeast to produce green fluorescent protein? If not GFP, then a transformation procedure for another protein would be helpful. My goal is to transform yeast in our Biotechnology class, grow it up in a small fermentor, and then isolate the protein product in the Biochemistry class. GFP would be great since it's visible. We already do E.coli transformation with GFP and purification over minicolumns. We'd like to scale-up and yeast smells a whole lot better than E. coli. *Delaware Technical & Community College* (#612)

- I have a 2 micron based galactose inducible GFP construct that you are welcome to. Also, the Lithium acetate procedure for transformation of *S. cerevisiae* works very well and you can do it in space of one lab period. If you want to do *Pichia* expression you will need to use Lithium chloride for the transformation. The lithium chloride and lithium acetate procedures work very well and are much easier than spheroplasting. *The Community College of Baltimore County* (#613)
- I have a student working on cloning GFP into yeast, but it isn't ready for prime-time. If you are interested in the transformation part, there is an interesting experiment involving yeast in *Biotechnology Explorations: Applying the Fundamentals* Author: Judith A. Scheppler, Patricia E. Cassin, and Rosa M. Gambier Book ISBN: 1-55581-178-7 [www.asmpress.org](http://www.asmpress.org). In this experiment, you transform yeast with two plasmids containing the four genes that produce "golden rice" and you get golden yeast. I have these clones if you would like. If you are interested in scaling up, you may want to consider *Pichia* rather than *Saccharomyces*. Sonia Wallman has a great protocol written up on her website that you can access through the bio-link website. I have a clone that produces B-galactosidase and another that secretes human albumin that I could send you. Isn't it the truth. *Pichia* smells just like *Saccharomyces*. (It's hard to tell them apart.) These cells grow to an unbelievable cell density (40% of media volume). I have my students do cell counts in a hemocytometer, and packed cell volume. *Solano College* (#614)

- The recent e-mails about yeast transformation and protein expression got me thinking about the cost comparisons of the "kit" approach vs. the "do-it-yourself" approach. First of all I should say that I am a dedicated "do-it-yourselfer" and feel that the "do-it-yourself" approach in biotechnology training programs helps impart the proper mind-set, knowledge of process, and trouble shooting behavior that I am striving for. On the other hand I fully appreciate the "kit" approach, and recognize that in many organizations, my students will work with "kits" on a daily basis. Liz mentioned the availability of yeast transformation "kits" from Qbiogene and I thought about comparing the "cost" of the "do-it-yourself" approach vs. buying one of those kits. To transform *S. cerevisiae* using the lithium acetate protocol you would need the following (assuming that you already have Tris and EDTA).

Sigma catalog Size Item Cost  
 L4158 250 gm Lithium acetate 29.45  
 P3640 500 gm PEG-3350 22.85  
 D1626 1 gm Salmon Sperm DNA 39.90  
 Total Cost : \$92.20

You should be able to get thousands of transformations out of this home-made kit. However, the "real" cost for the transformation is the media necessary for growing the yeast. Assuming that you are selecting for Ura<sup>+</sup> transformants (complementation of uracil auxotrophy) you will need to make "drop-out" mix and drop-out media, for which I've enclosed the following recipes taken directly from. Kaiser, C., Michaelis, S., and Mitchell, A. (1994). *Methods in Yeast Genetics*. Cold Spring Harbor Laboratory Press, Cold Spring Harbor N.Y., N.Y.

Drop out mix:

Adenine 0.5gm	Leucine 10.0gm
Alanine 2.0gm	Lysine 2.0gm
Arginine 2.0gm	Methionine 2.0gm
Asparagine 2.0gm	p-ABA 0.2gm
Aspartic acid 2.0gm	Phenylalanine 2.0gm
Cysteine 2.0gm	Proline 2.0gm
Glutamine 2.0gm	Serine 2.0gm
Glutamic acid 2.0gm	Threonine 2.0gm
Glycine 2.0gm	Tryptophan 2.0gm
Histidine 2.0gm	Tyrosine 2.0gm
Inositol 2.0gm	Uracil 2.0gm
Isoleucine 2.0gm	Valine 2.0gm

To make a particular drop-out mix, for example Uracil drop-out, weigh each of the above ingredients, except uracil, and combine in a 50ml conical centrifuge tube. Make sure everything is well mixed. The amounts given above make enough drop-out mix for 26 liters of media, but you can always scale the amounts up or down depending on your requirements. I keep stocks of Uracil drop out, Histidine drop out, Tryptophan drop out, and Lysine drop out on hand for use in my biotech and genetics courses. To make the drop-out media, combine the drop-out mix with yeast nitrogen base w/o amino acids (YNBw/oA.A.), glucose (or galactose if doing gal induction) and agar for solid media at the following proportions.

To make the drop-out media:

YNB w/o A.A. 6.7gm  
 Glucose 20gm (can use galactose if doing gal induction)  
 Agar 20gm  
 Drop-out mix (from above) 2.0gm  
 H<sub>2</sub>O to 1 Liter

I did a little cost comparison for packaged yeast media vs. "you-formulate-it". Without going into the details, let me just say that if you are using small amounts of media (< 50 Liters) you will be much better off buying the packaged formulations. You can buy smaller quantities of different drop-out media for doing genetics experiments and so on. You can save money by preparing your own formulations once your usage gets above 100 Liters or so. I have not used the Qbiogene media but from looking at their catalog it looks like a pretty complete selection of different formulations at a reasonable price. For instance you can get 5 Liters of Uracil drop out media (with glucose) for \$53.00 (or \$10.60/Liter). I hope this helps anyone contemplating doing yeast experiments in their biotechnology courses. Joan is right, they do smell better than E. coli! Community College of Baltimore County-Catonsville (#617)

### **Looking for biotech teacher workshop for summer (April 2003)**

I am looking for a summer workshop that provides educators a well rounded experience in the latest biotechnology techniques and shows us how we can integrate them into our classrooms. I have searched the Bio-Link site but did not find what I need. I did see some great workshops offered in the UK but don't have the funds for that. Kitchen Culture Kits, Inc. (#623)

- Try the University of Texas Medical Branch in Galveston. They have some wonderful workshops and programs for educators and students. This program is through the Office of Educational Outreach. The Administrative Assistant is Sylvia Torres and she can be reached at storres@utmb.edu. I am sure she can point you in the right direction. Galveston College (#624)
- Virginia Tech (Fralin Biotechnology Center) offers a program for Biotech Educators. It includes lectures and workshops. 3 1/2 days. Contact Erin Dolan at (504) 231-2692. Burlington County College (#625)
- You can find information about the Fralin 2003 Biotechnology Conference, July 16th-19, posted at: <http://www.biotech.vt.edu/conferences/biotech2003/>. Geospiza, Inc. (#626)
- Here at MATC, we are offering our NSF grant sponsored workshops for biotech educators this summer. The one in June is on protein purification and proteomics and the one in August is Biotech Boot Camp (see description, not molecular biology). You can find information about these opportunities at our website <http://matchmadison.edu/biotech>. The direct link is <http://matchmadison.edu/biotech/meetings/meetings1.htm> If you are a biotech educator, these workshops are subsidized by our grant so the price would be right! Madison Area Technical College (#627)

### **Community college program size (April 2003)**

Here at Seattle Central CC, we're working on reorganizing our program. One question that has recently come up is class size. We've been averaging 12-15 students, but the official cap on the course is 24. We'd like to official drop the class size to 14-16 students, justifying that with safety issues, equipment limitations, and the complex nature of the skills being taught. It would be helpful as we build this argument to have information about other CC biotechnology training program class sizes. If people could let me know how big your classes are and why you cap them as you do, it would be very helpful! Seattle Central Community College (#628)

- We usually cap them at 16 due to equipment limitations and the negative impact on learning. We do occasionally let them go to 20, depending on the class, but that does not work well for most equipment intensive classes, such as cell culture, chromatography, etc. Madison Area Technical College (#629)
- Try teaching at the high school level.... we cap at 30 or 36! and those are considered small classes. Chula Vista High School (#630)
- We currently are offering two pilot biotech courses, and our class sizes have been 12 and 10 students this year. We are just developing our curriculum. Let me know how it goes. Pima Community College (#631)

- I used to direct the Biotechnology Lab Technician program at Bates Technical College, Tacoma, Washington. I had 20-25 students in my program. I certainly agree with you that capping students at 10-12 per class will allow students to master skills and meet competency requirement in biotechnology techniques and laboratory safety. National Institutes of Health (#632)
- Our program started in 1996 with 22 students in the class. WAY too many. We have since limited the enrollment to 15 and that seems to be the magic number. (#633)

### **Curriculum resources for drug approval (May 2003)**

Can anyone direct me to some curriculum resources for high school students about how pharmaceuticals are developed and approved? (basic research, clinical trials, FDA, advertising, etc). Illinois State University (#661)

- Modern Drug Discovery Published by the American Chemical Society [www.moderndrugdiscovery.org](http://www.moderndrugdiscovery.org). Also Drug Discovery Technology Event 2003 8/10-15 Boston Hynes Convention Center [www.drugdisc.com](http://www.drugdisc.com). (#662)
- There is a case study about Frances Kelsey and thalidomide in the Bio-Link clearinghouse of instructional materials. This case study talks about how drugs are developed and approved and also guides students into some of the complex social and ethical issues involved. Also, the story of Frances Kelsey is quite interesting for its own sake. You can access this case study, and other info about drug regulations, at [www.bio-link.org](http://www.bio-link.org). Go into the clearinghouse and then look at the table of contents for instructional materials. The title of the case study is: "Pharmaceutical Regulation in the United States: History and a Case Study"(If you have not already subscribed to the clearinghouse, you will need to do so -- it's free and easy to do.) Madison Area Technical College (#663)
- There is a wonderful series of High School level interactive lab manuals published by the W.H Freeman company in conjunction with the American Chemical Society, (Science in a Technical World). One of the manuals is Discovering new medicinal Drugs. I was able to get a free sample copy of the manual at their web site <http://www.whfreeman.com/stw/stw.htm>. Madison Area Technical College (#666)

### **Training for limited English proficient workers (June 2003)**

I am currently researching whether it is possible and useful to create biotech-related training programs for recent immigrants with low English skills. If any of you run trainings or know information about whether such programs already exist (for example, if there is a Vocational ESL for Biotechnology program out there), please let me know. If you have thoughts about whether there are entry-level positions that those still learning English can realistically access, I would be interested in that as well. You should feel free to e-mail me off-list at [lchiyi@caasf.org](mailto:lchiyi@caasf.org) as I know that this group gets a fair amount of traffic. If anyone is interested, let me know directly, and I can send you the messages I receive, or I may just send out a compiled set of responses at the end. Chinese for Affirmative Action (#682)

- I don't know of any but I think this would be useful. I have had some experience with Chinese grad students. When they take normal ESL they do not learn science/lab related terminology. We train at our college here in Canada in French and English. The exposure for the French students to the English program is good as most labs in the world end up using English as the main language and most protocols are in English as well. I would encourage you to try to put something together. Let me know how you make out. Centre of Excellence in Agricultural and Biotechnological Sciences (#683)
- The folks at Cold Spring Harbor are preparing some working materials for Chinese scientists which are in press and due out in September 2003. Here is the ad, but I am not associated with them directly- sorry if this is junk mail for others. I think the Laboratory Navigator book is also a great book for new scientists coming to the country. My experience is that this sort of class would be GREAT for scientists from China- they are

so bright and English skills hold them back. Writing skills especially. A technical writing in English class for non-natives would be very helpful. (#684)

- I am a teacher and a consultant to the worldwide biotechnology industry. For the past 15 years, my consulting activities and services have focused on both the business and technology of the biotech industry. Since my clients are both English- and non-English-speaking and writing, I recognized several years ago the need to help those people with low English skills to better understand biotechnology. I offer a seminar entitled "An Introduction To Biotechnology For The Non-Scientist" which I believe could be modified for use in a biotech-related training program for recent immigrants with low English skills. My wife is a teacher of ESL, Spanish, and French, and is also director of the International Foreign Language Immersion Programs, Inc. (IFLIP). I believe we could create a successful biotech-related training program using our unique combination of skills and talents in biotechnology and foreign language and ESL methodologies.

*BioBusiness International, Inc.* (#685)

I apologize for taking so long to send out compiled responses in regards to my question about trainings for limited English proficient workers. As I had previously mentioned, at Chinese for Affirmative Action, we've been trying to assess whether it might make sense for us to pursue a Vocational ESL biotech training program for job seekers that we serve, and I've been trying to assess all the information I have collected to see whether that might be a possibility. At this time, we will not be creating such a program. The client base we had in mind when looking into this topic has low English levels, just "high beginner" or basic communication skills. With the economy still weak, we don't think that we'd be able to get jobs for the individuals that we're targeting, although it might be possible for individuals willing and able to pursue long-term education to be tracked into more mainstream training programs affiliated with City College of San Francisco. While our clients might be able to learn all the skills to become successful manufacturing assistants, material handlers, or other entry level positions, they are unlikely to be able to compete with the unemployed workers in the Bay Area which includes quite a number of college graduates and folks laid off from the tech sector. I also haven't found much interest from the employers that I contacted, which would be an important part of making a training successful. Regardless, there is a service gap in Vocational ESL for biotech out there. There are Vocational ESL programs in areas like health, and there are biotech trainings that include English (but not for the lower skill level we're considering). If someone were to develop a program aimed toward immigrants with some scientific or related background and a higher starting English level, they might be more likely to have success. A number of people mentioned working with graduate students and foreign scientists, and they probably have a lot of potential for making it in this field in the U.S. Thanks to everyone who offered their input. It's interesting to see the interest and related programs that are out there. I will keep your responses in case things change in the future and want to follow up with you. Please do not hesitate to e-mail me directly if you have any questions for me. Here are the compiled responses: (#687)

I think it is useful to create biotech program for recent immigrants with low English skills. I used to teach vocational Biotech program at a Technical College in Tacoma, Washington. Some of my students did not have strong background in math and English. Most of them were not immigrants. Students needed to demonstrate competencies in performing biotech techniques in order to graduate.

A friend forwarded me your email inquiring about biotech vocational training programs for limited English proficient speakers. I have been in the adult ESOL field for 20 years, with an interest and background in both health education and health care employability. I recently created and ran a successful program for the Massachusetts Department of Mental Retardation that recruited limited English speakers for an intensive ESOL/job

training program that prepared them for positions as direct care workers (similar to CNAs) I would be happy to provide information about this program and also to discuss this concept online.

I don't know of any but I think this would be useful. I have had some experience with Chinese grad students. When they take normal ESL they do not learn science/lab related terminology. We train at our college here in Canada in French and English. The exposure for the French students to the English program is good as most labs in the world end up using English as the main language and most protocols are in English as well. I would encourage you to try to put something together. Let me know how you make out. Centre of Excellence in Agricultural and Biotechnological Sciences

The folks at Cold Spring Harbor are preparing some working materials for Chinese scientists which are in press and due out in September 2003. Here is the ad, but I am not associated with them directly- sorry if this is junk mail for others. I think the Laboratory Navigator book is also a great book for new scientists coming to the country. My experience is that this sort of class would be GREAT for scientists from China- they are so bright and English skills hold them back. Writing skills especially. A technical writing in English class for non-natives would be very helpful

I would like to respond to the e-mail from Leo Chyi dated 6-27-2003 with subject "[bio-link] Training For Limited English Proficient Workers". I am a teacher and a consultant to the worldwide biotechnology industry. For the past 15 years, my consulting activities and services have focused on both the business and technology of the biotech industry. Since my clients are both English- and non-English-speaking and writing, I recognized several years ago the need to help those people with low English skills to better understand biotechnology. I offer a seminar entitled "An Introduction To Biotechnology For The Non-Scientist" which I believe could be modified for use in a biotech-related training program for recent immigrants with low English skills. My wife is a teacher of ESL, Spanish, and French, and is also director of the International Foreign Language Immersion Programs, Inc. (IFLIP). I believe we could create a successful biotech-related training program using our unique combination of skills and talents in biotechnology and foreign language and ESL methodologies. BioBusiness International, Inc.

I have been teaching Introduction to Biotechnology for about 10 years. Over that period of time I have taught ESL students from everywhere you can imagine. I take the following approach in my class...While English is not everyone's first language, biotech is definitely not everyone's first language. Therefore, we cover vocabulary as part of every assignment. Part of the curriculum in the class is to keep a notebook of biotech vocabulary words that they derive from their reading. This approach levels the playing field and generally works well. However, I have definitely considered a biotech vocab course much in the same way medical terminology is taught to Allied Health students. I have not had the funding or time to pursue this. I am definitely interested in other people's approach to this problem.

Miramar College

### **Plumbed DI water vs. Millipore-type equipment (July 2003)**

We are starting up a new Bioscience Technician program and are right smack at the decision point about purified water...and needing to make a decision very, very soon! We plan to teach classes in cell and tissue culture and also use a variety of fairly sensitive equipment, including HPLCs. We are trying to decide between the following options: 1. having the architects include deionized water that is centrally plumbed; we are trying to service a total of 4 labs, a prep room,

and an autoclave room; then we would get ultrapure equipment to further purify the water for HPLC and tissue culture (remove TOC and pyrogens). 2. Just bypassing a DI plumbed system completely and getting a fairly large scale system from someplace like Millipore where we needed hose that would use the RO water as feedwater. The autoclave we're going to get requires DI (or RO) water, as does the glassware washer. We don't anticipate needing to have sterile steam for cell culture. Has anyone worked with RO wall-mount systems and a storage tank (we're thinking maybe 75-80 L/hr capacity of the RO system will be fine) in such a setting? What might the worst-case scenario be in terms of maintenance? I have few details about the local water characteristics but I suspect it's rather hard. *Gateway Technical College* (#688)

- Just a note to say we've just done the second option, also with Millipore, and we are very happy with the system. Some cautionary advice: make sure you size the system properly in the beginning and purchase the right sort of plastic tubing and plastic fittings (no metal throughout the system). Despite close communication with the contractors, we still got the wrong type plastic tubing installed between the reservoir and the RO system and that is causing "problems" with TOC content. They say to be patient and the TOCs will eventually be leached from the tubing, but I am not perfectly happy with this part of the installation. *New Hampshire Community Technical College* (#689)
- We had house-distilled water in my building at Washington State University and ran this through the Milli-Q system. My first set of cartridges lasted about 3 years. The Milli-Q worked great for my plant tissue cultures. I have heard about problems with the reverse osmosis system but don't have first hand knowledge. *Kitchen Culture Kits, Inc.* (#690)
- I have experience using the second option with AQUA SOLUTIONS type I reagent grade DI system which operates on ordinary tap water. You need to change filters annually. Since your water usage exceeds 100 liters/week and the incoming local water is hard, Compact RO+DI System from AQUA SOLUTIONS will give you better quality water at lower cost. In term of maintenance, contact AQUA SOLUTIONS, Inc at 1- 800-458-2021. (#691)

### **Quality science in the courtroom (August 2003)**

I found a very good journal article discussing the Daubert factors or the criteria that scientific data must meet in order to be admissible in court. I have included the Daubert factors in my own course on cGMP. The first author of the article is a member of my Biotech program advisory committee. The complete citation is: Quality Science in the Courtroom: U.S. EPA Quality and Peer Review, Policies and Procedures Compared to the Daubert Factors by George Brilis, Jeffrey Worthington & Dallas Wait. *Environmental Forensics* (2000) 1: 197-203. *Community College of Southern Nevada* (#698)

- Thanks for sending the paper. You may be interested to know that one of consequences of the supreme court, accepting the Daubert rules, was that fingerprint evidence was ruled unscientific, in Jan. 2002, by district court judge, Louis Pollak, He said it failed to meet three of the four Daubert standards, because: 1. It has not been subject to review by the scientific community, 2. Does not have a known error rate, and 3. Cannot be tested in a rigorous manner. This ruling was later overturned. *Geospiza, Inc.* (#699)

### **Freezer life of PCR primers (August 2003)**

What is your experience with storing primers - we have purchased the primers from biotech company, diluted with dist. Sterile water to 100 pmol/microliter, aliquotted out, and stored in -20 freezer- then we dilute to required concentration and used in pcr reactions - with variable results - how long is the freezer life of these - anybody have any experience to share? *Oklahoma City Community College* (#701)

- I have had lots of experience with these but not recently. Are you sure you were supposed to dilute them in sterile water? Assuming that you do, they should be stable for a very long time in the freezer (2-5 years at least). The variable results could be coming from

many other sources (PCR buffer, Mg concentration, Taq, etc.) but if you think it is the primers you can up the concentration a little. (#702)

- I asked my good friend, Frank Stephenson, at Applied Biosystems who does industry and teacher training in PCR. He wrote the following: Primers stored at -20 should be good for several years. To even further ensure stability, we resuspend our primers in TE buffer (10 mM Tris, pH 8.3, 0.1 mM EDTA). (#703)
- A question came up about using EDTA. Here is the response from Frank. The EDTA concentration is low enough (when at 0.1 mM in the template or primer stock) that it does not chelate a significant amount of the magnesium needed in the reaction. (#704)
- When we use the standard abbreviation of TE buffer, it is understood to be:  
10 mM Tris  
1 mM EDTA  
pH of approximately 8  
For diluting DNA and storing primers, we usually drop the EDTA concentration by a factor of 10, so  
10 mM Tris  
0.1 mM EDTA  
pH of approximately 8  
I do not know if there is a standard abbreviation for this latter buffer. Remember to use a Tris compatible pH probe when measuring Tris containing solutions, and know that the pH will vary with temperature. (#705)
- We produce a range of molecular biology solutions that are ready-to-order including TE buffer. Our TE buffer is sterile and is molecular biology grade composed of: 1X TE, pH 8.0 (10mM Tris HCl, 0.1 mM EDTA) and is DEPC TREATED. (#706)
- I recommend using siliconized tubes to store the primers to prevent DNA binding. Also, aliquot to reduce freeze thaws and contamination. I use Fisher brand part number 02-681-311. They cost a little more, but DNA can adhere (variably, alas) to plastics used in these tubes. I used to work for a biotech company and we preferred to use these tubes types of tubes for this work (I think we used Sarksted there, but Fishers are also good). I pay a little more for these and keep them in a separate drawer- we use the cheap ones for assays and stuff and these for reagent storage and critical assays. (#707)

### **Image of capillary electrophoresis unit (August 2003)**

I am looking for an image of a capillary electrophoresis unit to show my students. Any advice. Have not found one on web yet. *Kitchen Culture Kits, Inc.* (#711)

- You can find a picture of a capillary system on Amersham's web site, at <http://www1.amershambiosciences.com/aptrix/upp01077.nsf/Content/Products?OpenDocument&ModuleId=40027&hometitle=search>. If the link doesn't work, go to [www.amershambiosciences.com](http://www.amershambiosciences.com) > use their search box, type in MegaBACE, and select the link that says MegaBACE™ DNA Analysis Systems. *Geospiza, Inc.* (#712)

### **Suggestions for a high school biotech teacher (October 2003)**

I am teaching a high school biotechnology class. I would like to tap this wealth of talent for the benefit of my students. If anyone has any curriculum outlines, quality labs, group activities, or just general information that you would like to share, please feel free to email me directly. I would be most appreciative. *Susquehannock High School* (#785)

- If you haven't already done so, you might want to check out the Bio-Link Curriculum and Instructional Materials Clearinghouse ([www.bio-link.org](http://www.bio-link.org)). On the curriculum side, there are some course outlines from other high school teachers, some activities, and lots of good links. The instructional materials side has more activities, both for high school and college. You will need to subscribe to the site, but that is free and easy to do. *Madison Area Technical College* (#786)

- If you haven't done so already, I would contact Nadi Wehmeyer, at the Biotech Project at the University of Arizona, and check out what they have on their website. <http://biotech.biology.arizona.edu/AboutBIOTECH/AboutBIOTECH.html> *Pima Community College* (#787)
- Austin Community College has been supporting a high school biotechnology course for the past 3 years. Information about the course, including a course outline and original materials developed for it, are at [www.austincc.edu/biotech](http://www.austincc.edu/biotech). (#790)
- If your students are interested in learning more about careers, please visit [www.biocom.org](http://www.biocom.org), click the education tab, and poke around the "students folder". You'll find links to useful career information. (#792)
- We have several regional partnerships in the San Francisco Bay Area that support high school biotechnology education through teacher training, kits of equipment, supplies and reagents. For the south bay, SCCBEP (Santa Clara County Biotechnology Education Partnership, <http://www.babec.org/SCCBEP>) serves middle school to community colleges in Santa Clara County and other outlying schools. Most of our curricula are not on-line. However, you can see the different types on the web site. All the PCR labs supported by our umbrella organization BABEC (Bay Area Biotechnology Education Partnership, <http://www.babec.org>) are on-line. You'll have to register (free and private) in the BABEC Nucleus to access them. *San Jose State University* (#793)
- I teach a 3 YEAR BIOTECH program at an underperforming urban high school; the target of my students are the kids who have failed biology and Algebra and are on their way out of school. I can send you electronic versions of my course descriptions and skills lists, but that is a limited view of my course. I am working on a CD of lessons plans but it is slow - I find little time while teaching. Email me directly (don't send it to the entire group or you too may be as famous as Susan!) if you'd like more info; or if you are in the San Diego area, stop by and meet the kids - Chula Vista High School is just south of San Diego and 5 miles north of the Mexican border. *Chula Vista High School* (#794)
- Thanks for starting this discussion. Bio-Link website has a Curriculum Clearinghouse that is intended to facilitate an exchange of Biotechnology curriculum, lesson plan ideas as well as actual materials to use in the classroom. Anyone who is interested in sharing curriculum or instructional material is encouraged to send it in to the Bio- Link clearinghouse. We will reformat it and place it on the website. If you are in need of materials, we already have a pretty good collection, check it out at <http://www.bio-link.org/resMaterial.htm>. If there are specific areas or topics that you need investigated, let us know we may have some resources to share with you directly as well. You will need to subscribe to access the material, there is no charge and it is easy to do. *Madison Area Technical College* (#800)

### **Community college transfer (October 2003)**

We are currently in the process of designing a 2 year biotechnology program that will not only be a terminal degree but transfer to a 4 year school. What has your experience been with these kinds of partnerships? What are the pros and cons? What are some things to watch out for? *Ivy Tech State College* (#801)

- We have a two-year degree program at Miss Gulf Coast Comm. College, started in 1996. I will be happy to share any info with you about our program. *MS Gulf Coast Community College* (#803)
- We are in the very early stages of the process, but I would be happy to discuss some of these issues with you. *Galveston College* (#804)
- We are beginning the third year of an A.S. degree program in biotechnology. Graduates are guaranteed admission to upper-division studies at any institution in our state's (Florida) State University System. Needless to say, the general issues involved are far too

extensive and complicated to address in emails, but in summary it can be done and our experience has been extremely positive so far. *Santa Fe Community College* (#808)

### **Biotech jobs (October 2003)**

Does any body know about how the job market is in Bio Tech Industry. I am looking for change of career in Bio Tech Industry. Can some body tell what are the good web sites and newspapers are to look for the jobs in this industry? (#814)

- I am in the process overseeing the development of biotech courses and a possible biotech degree program at a 2 year community college. One of my main concerns is the job market outlook for graduates. Any input on what others have seen as far as their students getting jobs would be helpful. *Harrisburg Area Community College* (#815)
- What we've discovered, at least in our area, is that employers like Associate degreed people for certain kinds of jobs. They find they fit in better and stay longer. So I think that 2 year people have that advantage. But if its a job with advancement often they are completing for the same jobs as biology BSs. I was also surprised to find the money the same for AAS and BS, in a biotech firm. Again this is what we've heard from our industry here. *Ivy Tech State College* (#817)

### **Biotech class textbook suggestions (October 2003)**

Does anyone have suggestions on a text book that would be appropriate for a HIGH SCHOOL biotechnology class? These are academic students but I am looking for a text book that will accommodate many reading levels. If you happen to know the vendor or have a contact for their sales dept. I would appreciate that information as well. Also, thank you to the many that responded to my request for curriculum ideas for the same class. The response was overwhelming and I am still checking out the various links and ideas that you were kind enough to share with me. MANY THANKS! I am also looking for a biotech company, research facility, university, and/or forensics lab in the York, PA to Baltimore, MD area that would be open to the idea of having about 40 high school students tour their facility. If you know of, or are an employee of such a facility, please advise. I would like to show the students some "real world" applications of biology and hopefully interest some of them in a career in a biotech related field. Thanks again for your help! *Susquehannock High School* (#819)

- Ellyn Daugherty of San Mateo High School has had a very successful 3 year biotech pathway program. She wrote a text book that many teachers in the San Francisco Bay Area are piloting for various levels of biotech courses with different student abilities. Her contact info is listed below. I believe she is self publishing. *San Jose State University* (#820)
- If you are looking for a book that will accommodate several reading levels I would suggest Biotechnology (ISBN # 0-8134-3161-1) by Interstate Publishing. This book is good for beginners. Another book hot off the press is Understanding Biotechnology an Integrated Cyber-Based Approach by Pearson Prentice Hall. This would be for students who have had at least one year of Biotechnology. (ISBN # 0-13-094500-5) (#821)
- To add to the discussion without excessive promotion, Bill Thieman (Ventura College, CA) and I recently authored "*Introduction to Biotechnology*" (ISBN 0-8053-4825-5) by Benjamin Cummings. Designed primarily for introductory courses at the community college and 4-year levels there are a number of high school programs and biotech specialty high-schools that are using the text. If interested, I would be happy to continue this conversation with anyone off-line. *Monmouth University* (#822)
- A really great book although a bit dated is a Canadian book call Biotechnology unzipped by Eric s. Grace and published by Trifolium books. This is a very easy to read but comprehensive book. Unfortunately it is pre dolly so missing some recent advances (covers all the sectors plus discusses ethics etc.) (#823)

- The text I use in my Biotech I class is DNA Technology The Awesome Skill By I. Edward Alcamo, WCB Pub. MGCCC Jeff Davis Campus. (#824)
- With regard to lab texts, Dr. Cynthia Moore and I published a textbook about the biotechnology lab. It is not a "lab manual" in that it does not have student lab exercises or experiments. Rather, it has lots of information about such things as: how to make reagents; measure pH, weight and volume; lab safety; dilutions; and so on. The title is "Basic Laboratory Methods for Biotechnology: Textbook and Laboratory Reference", by Lisa Seidman and Cynthia Moore, published by Prentice Hall. Madison Area Technical College (#826)
- I can vouch for the "Basic Laboratory Methods for Biotechnology: Textbook and Laboratory Reference". It is a well-organized lab "bible" that was obviously written by people who have spent a great deal of time in the lab. I think Lisa forgot to mention that it does contain plenty of sample problems and exercises for students to try. The practical information is presented in such a way that it is easily adaptable for student laboratory exercises. This should be required reading for anyone new to the lab. Another great resource is the Howard Hughes Medical Institute online catalog (at <http://www.biointeractive.org>; click on "order materials" on the bottom left and follow the links to the online catalog). There are several excellent lab safety videos (molecular biology and tissue culture), and their academic holiday lectures by science heavyweights are superb. Best of all, everything is FREE! Houston Community College Northwest (#828)
- I can also vouch for the "Basic Laboratory Methods for Biotechnology: Textbook and Laboratory Reference". We use it in our intro. biotechnology course, but students find it useful for later courses as well. There is a wealth of information from documentation to centrifugation and everything in-between in this text. The text that we use for our "proteins" course is "Protein Methods 2nd Ed. by Daniel Bollag, Michael Rozycki and Stuart Edelman 1996, Wiley-Liss ISBN 0-471-11837-0. I'm still looking for a good text that has laboratory protocols for use in our nucleic acids course. Currently, I'm using numerous lab protocols that I have borrowed from Molecular Cloning and Short Protocols in Molecular Biology, both good references if your thinking of designing your own experiments. (#829)
- I have been following the discussion of biotech books and I haven't had a chance to respond. I have a big review of biotech books, with my reviews, that I've been compiling for a while. (It's up to 33 pages.) I always try to keep it up-to-date, but I've been so busy that haven't gotten to review a few of the newest books, but here is what I have. For example, Jim Watson has a new edition of "Molecular Biology of the Gene" coming out and Bill Thieman's new book isn't on it. Someone asked about lab books, so I'll reprint that section here, but I'll include the whole review as a Word file attachment. Let me know if the attachment doesn't go through. I always urge faculty to turn in requests for these books to their librarians. It's my experience that librarians are always looking for suggestions and that few faculty participate. Solano College (#836)

#### LABORATORY BOOKS FOR TEACHING LABS

Biotechnology: A Laboratory Manual in Molecular Biology  
 Teresa Thiel, Shirley Bissen, Eilene Lyons  
 McGraw Hill 2001 - \$ 65  
 ISBN 0-07-241664

This book serves as the lab manual for one of the Solano College laboratory courses that Jim teaches. It uses a semester long project where students manipulate genes for amylase and work with this important and interesting enzyme. It also integrates excellent exercises in bioinformatics and 3D computer modeling of protein and DNA with the web

lab procedures. But, there are a few things that really offend me. First, \$65 for a very thin spiral bound book seems outrageously expensive. Also, until recently the bacterial strains weren't available through a third party vendor; they had to be ordered from ATCC; the publisher told me that this has been changed. Also, each experiment uses very expensive reagents. If you need the bacterial strains, contact Jim and he'll mail them to you.

#### Biotechnology Explorations

##### Applying the Fundamentals

Judith A. Scheppler, Patricia E. Cassin, Rosa M. Gambier

ASM Press - 2000 - \$ 49.95

ISBN 1-55581-178-7

Wendie Johnston of Pasadena City College and Jim both really like the experiments in this book. It has an excellent upfront explanation of keeping lab books and making solutions. It starts with basic experiments in microbial cell culture and DNA isolation. It has students work with green fluorescent protein and it has an interesting experiment where students probe 16S RNA genes from a variety of organisms representing 5 Kingdoms (if you still adhere to the 5 Kingdom classification scheme.) It has the list of vendors that can supply the appropriate microbial strains, vectors, and primers, but only the primary source (like the ATCC) is given for obtaining the 10 organisms. Since each costs over \$145, I worry that most of the experiments would exceed the budget of most schools. Again, if you need any of the bacterial strains, contact Jim.

#### Unraveling DNA: Molecular Biology for the Laboratory

Michael R. Winfrey, Marc A. Rott, and Alan T. Wortman

Prentice Hall - 1997 - \$ 54

ISBN 0132700344

This is the book that Philip Jardim of City College of San Francisco uses; he worked with the authors at the University of Wisconsin-La Crosse. It has very interesting experiments where the lux operon of *Vibrio fischeri* is cloned into an expression plasmid that's used to transform *E. coli* to make it bioluminescent. Recently, Fotodyne has contracted to carry the plasmids and the bacterial strains: [www.fotodyne.com](http://www.fotodyne.com). I was surprised at how dim the glowing bacteria can be - it has to be really dark for you to see the bioluminescence of the *E. coli* transformed with the lux gene.

#### Basic Laboratory Methods for Biotechnology

##### Textbook and Laboratory Reference

Lisa Seidman, Cynthia Moore

Prentice Hall - 1999 - \$ 66.75

ISBN 0137955359

This excellent lab book emphasizes calculations that students can practice and covers all elements of the laboratory experience like safety, making solutions, volume, mass, pH, and temperature measurement, and the operation of many common laboratory instruments. It also instructs students on how to keep a notebook, and how to collect and analyze data. There are sections that are appropriate for a manufacturing curriculum that discuss GMP and ISO 9000. If a student could master this book, they should be hired immediately.

#### Laboratory DNA Science

Bloom, Freyer, and Micklos

Benjamin Cummings - 1995 - \$ 33

ISBN 0-8053-3040-2

Excellent experiments developed by the team at Cold Spring Harbor Laboratory. Every student should perform the two PCR experiments that use tPA-25 Alu sequences and DS180 VNTR detection. (Cold Spring Harbor Laboratories currently recommend an experiment that looks at Alu in a different region of the genome, since the Alu in tPA-25 has been found to be associated with one form of heart disease. Of course, Cold Spring Harbor Labs supports and continues to develop new exercises. This has a new edition due to be released in June 2002 by Cold Spring Harbor Press.

DNA Science: A First Course in Recombinant DNA, Second Edition

David Micklos and Greg Freyer

Cold Spring Harbor Press - 2002 - \$ 39.95

ISBN 0-87969-636-2

This new edition will incorporate the changes that the team has made; the website indicates that “the first eight chapters have been completely revised, extensively rewritten, and updated.” This edition will include the new experiments developed at Cold Spring Harbor’s Dolan DNA Learning Center; presumably this includes the experiment where students cycle sequence a section of their mitochondrial DNA. Carolina Biological will carry the appropriate kits, primers, and strains.

Biotechnology - A Laboratory Course Third Edition

Becker, Caldwell, and Zachgo

Academic Press - 1996 - \$ 30

ISBN 0-12-0845628

This book has some excellent experiments. I especially like its treatment of routine laboratory procedures, like making up phosphate buffers. It has an excellent series of experiments that have the students generate, purify, and assay  $\beta$  galactosidase.

Fundamental Laboratory Approaches for Biotechnology

Alexander Ninfa, David Ballou

Fitzgerald Science - 1998 - \$ 44.95

ISBN 1891786008

This book begins with protein purification and follows later with experiments in DNA. It has some excellent sections on protein purification and detection which include discussions of buffers, chromatography, electrophoresis, enzyme kinetics, and spectrophotometry. In several experiments, it uses E. coli Alkaline Phosphatase as the model protein to purify and assay.

Short Protocols in Molecular Biology - Fourth Edition

Edited by Frederick M. Ausubel, Roger Brent, Robert E. Kingston, David D. Moore, J.G. Seidman, John A. Smith, Kevin Struhl

J. Wiley Press - 1999 - \$ 120

ISBN 04732938X

I refer to this book often as a reference (rather than the larger Maniatis et al.) Wendie Johnston at Pasadena City College has her students reference this book to give them independence after they graduate. The major drawback is the cost: the fourth edition’s price jumped from \$ 80 to \$ 120.

At the Bench - A Laboratory Navigator

Kathy Barker

Cold Spring Harbor Laboratory Press - 1998 - \$ 47

ISBN 0-87969-523-4

This excellent book should be given by P.I.'s to their new graduate students or should be purchased by new graduates beginning an R and D career. It helps to orient the new researcher to what is not important in the lab (there is no dress code) and what is (attend every lab meeting and keep your lab notebook up to date). It contains tips on how to organize your lab bench ("its setup and maintenance are integral to the reproducibility of your experiments) and how to design an experiment. It also has some nuts and bolts instruction on how to make buffers, maintain bacteria stocks and cell lines, and how to dispose of wastes.

At the Helm - A Laboratory Navigator

Kathy Barker

Cold Spring Harbor Laboratory Press - 2001 - \$ 55

ISBN 0-87969-5838

This book addresses the key flaw of the American Research University system: lab directors are trained at the lab bench and to critically review the scientific literature, but not trained to do what they end up doing - running a lab and managing personnel. This book addresses the key challenges in running a lab.

Lab Ref: A Handbook of Recipes, Reagents, and Other Reference Tools for Use at the Bench

Jane Roskams and Linda Rodgers Eds.

Cold Spring Harbor Press - Due July 2002 - \$ 24,95

ISBN 0-87969-630-3

This small book is much less useful than the other Cold Spring Harbor laboratory manuals.

Plant Tissue Culture Studies

Smith

National Association of Biology Teachers - 1997

ISBN 0-941212-24-6

I haven't performed any of these experiments, but they seem excellent.

For anyone who is interested in teaching biotechnology, the easiest way to jump in would be to order a teaching kit from one of the vendors below.

Biotechnology Teaching Experiment Vendors:

BioRad <http://www.bio-rad.com>

Edvotek <http://www.edvotek.com>

Fotodyne <http://www.fotodyne.com>

Modern Biology Inc. <http://www.modernbio.com>

Carolina Biological <http://www.carolina.com>

Wards <http://www.wardsci.com>

The kits sold by these companies allow someone who is trying to establish a program to jump in quickly. I especially like the BioRad series that use Green Fluorescent Protein which I view as inspired; the other companies have followed with GFP experiments of their own.

**Article on community college biotech programs and needs (November 2003)**

Article on community college biotech programs and needs:

[http://www.signonsandiego.com/news/business/biotech/20031112-9999\\_1b12biotech.html](http://www.signonsandiego.com/news/business/biotech/20031112-9999_1b12biotech.html).

## Staffing needs seen in biotech industry

By Terri Somers

UNION-TRIBUNE STAFF WRITER

November 12, 2003

A top Labor Department official said yesterday that community colleges nationwide could boost their courses in the life sciences next year as part of an effort to meet the staffing needs of the biotechnology industry. The courses would aim to address a shortage of workers with the skills to work in drug development and to create a pool to fill future manufacturing jobs, Assistant Labor Secretary Emily Stover DeRocco said at a meeting with San Diego biotech executives. New courses would be funded through the \$15 billion Workforce Investment Act, a 1998 law currently up for renewal before the U.S. Senate. The administration has identified biotechnology as a key emerging industry, promising to provide valuable technology and create thousands of high-paying jobs in the coming years, DeRocco said. Last week, President Bush visited biotechnology executives in North Carolina's Research Triangle area outside Raleigh. DeRocco said she expected that the industry in San Diego – at 25 years old still in its formative years – would need a worker pool for manufacturing jobs that are just beyond the horizon for many companies. The challenge, DeRocco said, is to train the work force now so that workers are ready to fill the manufacturing jobs when they become available. If the work force isn't ready when the jobs become available, San Diego risks losing those jobs to another state or country, she said. The executives also reported a shortage of employees experienced with the developmental or middle stage of the process in which a new drug is brought to market. A quick survey of executives sitting around the conference table talking to DeRocco revealed there were probably more than 50 midstage jobs available now. The shortage is prompting companies to rob employees from each other, said Steven J. Mento, chief executive of Idun Pharmaceuticals. These would include people to build and run a company's pilot manufacturing plant, as the company prepares to make drugs that will be used in clinical trials. Other jobs would include a process development coordinator, which according to a survey of midsize Massachusetts biotechs pays \$49,000 to \$85,000 annually; or a quality control technician that pays \$31,000 to \$43,000 annually; or a quality assurance documentation specialist that pays \$36,000 to \$52,000. Adding to the worker drain on the area's smaller biotechnology companies, 90 percent of which employ fewer than 100 people, are the big pharmaceutical companies that have moved into San Diego. "Big pharma" can offer benefits packages many small biotechs can't compete with. Many of these jobs, as well as manufacturing jobs, would suit someone with an associate's degree from a community college, the executives said. But California's community colleges were hard hit by budget shortfalls and could use federal help, they said. The skills companies are looking for include a good work ethic, a good level of literacy, a basic understanding of biological processes, an understanding of the importance of good documentation and some insight into the federal regulatory process. With those fundamentals in place, companies can each do their own training that is specific to their individual products and needs, the executives said. The basic skills the companies are looking for would be valuable across the country, DeRocco said. And they could be taught with one basic curriculum established for community colleges around the country, a project that would be within the purview of the Labor Department, she said. San Diego Workforce Partnership President Lawrence Fitch said, however, that the education push in the life sciences must start before the community colleges. It should begin in elementary school and extend through high school, to get students interested in pursuing the sciences as a career path, he said. "Too many math and science teachers aren't subject experts," Fitch said. He suggested finding programs to get teachers into companies to see how the subjects they teach translate into the work force.

*Solano College (#831)*

- Thanks for sending me this article. Two others sent me this article, suggesting at least a few people think of me still in biotech. (#832)
- Thanks Jim it is always heartening to see something in print that I already know. Lets hope this keeps up. (#833)
- As the flagship community college biotechnology program in the state of Florida, we are excited about the \$300M branch of The Scripps Institute slated to open in south Florida next year. I'd like to hear of the experiences other community colleges especially in southern California have had with Scripps. *Santa Fe Community College* (#835)
- Was there any detail about exactly how they expect the federal DOL funds to get utilized? Will there be a new category or a change of emphasis away from universal access and services to more targeted use of funds for actual training? *North Carolina Community College System* (#837)

### **Chromatography website (November 2003)**

Let me recommend the following website from Amersham on Chromatography. Look until Education Centre – and there are animations of gel filtration, ion exchange, HIC, and affinity chromatography. I use it in class:

[http://www.chromatography.amershambiosciences.com/aptrix/upp00919.nsf/content/labsep\\_homepage](http://www.chromatography.amershambiosciences.com/aptrix/upp00919.nsf/content/labsep_homepage). *Solano College* (#840)