Bio-Link Discussion Group
January 2004—December 2004

Mutagenesis labs (February 2004)
I am a new teacher and am developing a laboratory-based course for undergraduates on mutagenesis. Would you know of any good resources for protocols? Also, are there molecular biology labs that you have taught yourself or have heard that work well in a teaching setting? *North Carolina State University* (#895)

- In my senior level genetics course (BY 423) we do a mutagenesis lab with bacteriophage T4 that works pretty well. It's a two part lab in which students mutagenize T4 with BrdU and then in the second week they do a spot plate test on two different strains to identify mutants in the rII (rapid lysis) locus. Essentially this is an example of some of Seymour Benzer's classic experiments with T4. We also do a much simpler prophage induction lab from Carolina that incorporates mutagenesis. Two strains of E. coli, one with a lambda lysogen one without, are exposed to UV light for different time periods. For one of the strains, UV light mutagenizes the lambda lysogen and induces the lytic cycle. For both strains, the highest exposures of UV light kill the cells. A good demonstration of prophage induction and the effects of UV light (which really strikes home with the students). If you are interested in these experiments I would be happy to send you the lab protocols and handouts we use with our students. *Monmouth University* (#897)
- I have taught introduction to mutagenesis courses before. I base my courses around SHORT TERM TOXICITY - MUTAGENESIS ASSAYS. The Ames test, a reversion mutation assay using S. typhimurium, developed by Bruce Ames and others, is a widely bacterial assay used to screen for mutagenesis responses in vitro. The principle of this assay is on mutated histidine operon for bacterial strains to survive when exposed to direct or indirect acting physical (UV light, others) mutagens or chemical compounds (PAHs, etc.). It is a validated assay to correlate mutagenesis associated to cancer. The bacterial strains used in Ames test are not pathogenic. 1) Mutation Research, 31 (1975) 347-364 and 2) a revised protocol Mutation Research, 113 (1983) 173-215. There is a short toxicogenetic assay, the Comet assay, to evaluate DNA strand breaks at the single cell level. It is inexpensive and virtually any type of cell could be used for analysis. Those are just two examples of a battery of systems currently used in mutagenesis and toxicogenomics research that students would love to learn. Also, within my course, I set up active seminar presentations where students search and present papers (and protocols) related to mutagenesis response and its biological consequences. *University of Texas* (#900)

Pipettes (February 2004)
I need to make a decision regarding a big pipette purchase. The dilemma is this. I feel that it is best for students to learn how to use and calibrate the type of micropipette that they will encounter in industry. However, these types of pipettes (I'm hesitant to name brand names on the list serve) tend to be quite vulnerable in the hands of new students. For this reason, we're probably going to order a tougher, and probably less accurate brand of pipette. Do any of you have any words of wisdom on this matter? I'm particularly curious to know if your biotech graduates have encountered any difficulty in transitioning from one brand to another when they begin their jobs in industry. *Comm. College of Rhode Island* (#898)

- Gilman pipettes also sold by VWR (VWR brand) are quite good and a bit more durable. The other brand are still the best for people like me who can never figure out the numeric

system on the others. The biggest problem is adjusting past the limit. What we do is only let new students make the adjustments with and instructor's supervision (i.e. this is what I will set it to is it correct, watch them set it.) Also have enough pipettes so not always needing to change the setting. If protocol uses 800ul 100 and 150 don't use the same pipette. Set 3 pipettes and have students exchange them as they need them. This seems to prolong the longevity of them but alas accidents still happen. (#899)

- I find that Integrapette micropipettes from Integrated Instrument Services, Inc. work very well. They are way less expensive than Gilson's especially when ordered in bulk. I think they're even less expensive than Fisher's micropipettes. They look like a Gilson and work like one (they're red instead of blue). However, they are very durable and relatively resistant to jamming when dialed outside of their expected use range (which seems to be the most common mistake students make). I'm currently transitioning from Eppendorf pipettes (which jam easily and break into many pieces when dropped) to these and have been very happy with them. Some I've had for six years and they are working out very well. The Integrated Instrument Services, Inc. number is 1-800-468-3437. (#901)

Biotech equipment for a startup high school program (February 2004)

We will be starting up a biotech career pathways course at a regional high school career and technical center. The course will be geared towards preparing students for lab tech types of jobs. We are looking for input about the kind of equipment we will need to start up this program. Bear in mind that we have limited funds. We are now beginning to put together lists, and would appreciate whatever help you can give us. (#902)

- I am not sure if you have evaluated this resource yet, but this is one of the best (if not THE best) starting points for getting off the ground. http://success.shoreline.edu/NWBBECC/educators.html *Finger Lakes Community College* (#903)
- Where are you located? Might be able to route some companies your way with surplus equipment. Also be sure to check out local hospital and university surplus sales. *Kitchen Culture Kits, Inc.* (#904)
- I recommend that you contact Ellyn Daugherty listed below. She has an excellent 4 year biotech pathways program for high school. Her new textbook has a complete list of equipment and supplies. (#905)

  Ellyn Daugherty
  San Mateo Biotechnology Career Pathway
  San Mateo High School
  506 N. Delaware St.
  San Mateo, CA 94401
  www.smbiotech.com

- I would like to bring to your attention the existence of a new tool for DIALYSIS and Gel EXTRACTION the GeBAflex-tube. GeBAflex-tube is characterized by friendly comfortable handling for both processes. Utilizing standard pipette for material loading and unloading. Standard horizontal electrophoresis unit for electro elution GeBAflex-tube rapid process guarantee maximum recovery: 60% + minimum for Protein, DNA - OLIGO extraction range from 15bp to 200kbp Rapid electro elution deliver intact, 60% + uncontaminated RNA Nucleic Acid electro elution process provide over 60% recovery GeBAflex-tube is the major contributor for a new method for Protein preparation for Maldi-Mass Spec TOF analysis developed by the WEIZMAN Institute. With GeBAflex-tube electro elution process a specially formulated MS buffer clean thoroughly all SDS contained in polyacrylamide gel, improving MALDI-MS Analysis accuracy. GeBAflex-tube is also a high throughput electro elution tool. New staining solution for polyacrylamide gel, provide very high staining sensitivity. Staining solution SB010 has no adhesive, providing maximum Protein recovery from gel

by electro elution process. SB010 Staining can be fully removed for down stream process. ProteoCon Kit concentrator for Native or Denatured re-activate the Protein. The new kit improves Maldi-MS TOF analysis a step further. Visit our website at www.geba.org for further information. GeBA products are now well established in several countries in Europe, USA, and Far East. However in your country, we have no one. Please review our website and product details. (#906)

High school recruiting class (February 2004)

I teach molecular biology laboratories to college juniors, seniors and graduate students. I have been asked to do a short (about 75 minute) recruiting class/lab exercise for high school seniors. I was wondering if anyone knows of some good molecular biology/biotechnology exercises that can be done cheaply in that short of a time frame which are appropriate to high school seniors interested in science careers. (#911)

- Precipitation of DNA using salmon sperm DNA (or some other inexpensive source) with alcohol works well, especially if you give them an expender tube so they can take it home. If you want to talk about protein function, I usually use white glue and borax to demonstrate "change the shape, change the function." Very inexpensive, and bring small zip lock bags for them to take their stuff home. *Chula Vista High School* (#912)
- Check out the University of Arizona's Biotech Project http://biotech.biology.arizona.edu/AboutBIOTECH/AboutBIOTECH.html (#914)
- If your HS seniors haven't had biotech labs before, I would do the DNA extraction with strawberries or bananas in a sandwich bag. Other good quick hands-on ones are Kool-Aid and dye electrophoresis. Shows them the equipment and what you can do with it without using DNA and staining. Be happy to send you the protocols if you don't have them. *San Jose State University* (#915)
- The Kool-aid electrophoresis is also demonstrated in a video made by Pam Weathers group at WPI. Includes how to make homemade gel unit. http://www.kitchenculturekit.com/biotechvideo.htm. *Kitchen Culture Kits, Inc.* (#921)

Physical requirements (February 2004)

I was looking over some program material and noticed that our clinical laboratory technician program posts physical requirements for that occupation. For example they describe typical force exertion and amounts of walking and bending. Are any of you aware of any similar publications for careers in biomanufacturing? *Community College of Rhode Island* (#925)

- Yes, our publication, "California Careers in Biotechnology: A Counselor's Guide to the Best Jobs" does. You can print it from the Adobe PDF file on-line at www.cccbiotech.org, click on "Resources" then click on the title. *Ventura College* (#927)

New DNA model (March 2004)

I have just ordered a DNA model that looks great! I can't wait to get it! If you would like to see it, go to www.modeldna.com. I will use it in my biotech program. (#935)

Program assessment (March 2004)

We're developing a new biotechnology program and would like to plan ahead for assessment of our program in terms of placing graduates, graduate performance in the workplace, etc. I've participated in a gap analysis for curriculum assessment, but am curious to know whether anyone has developed an assessment tool for "post-program" success. *Community College of Rhode Island* (#960)

- When I was at Seattle Central Community College, I used the following things to gage program performance and effectiveness: 1. I learned about missing skills and points of improvement by recruiting former students to participate in our advisory board. This was very helpful because they were familiar with the program's strengths and weaknesses

from a student's point of view. They also helped to provide some of the more academic advisory board members with a reality check. For example, we had one board member who thought his intern (from our program) spent too much time working on his notebook. Our former-student board members were able to point out that his perspective was short-sighted and very different from the feedback they had in industry. They also pointed out that in many cases their lab notebooks got them their jobs. In another example, one of the former-student board members told me that one student hadn't really done many things on his own and he always managed to get other people in his group to load his samples in gels and make buffers. So I learned to add some more skill checks and strengthen the lab practical exam. 2. All of our students were required to do an internship in order to graduate. This often happened later in the program so that meeting with their internship supervisors helped us measure their on-the-job performance. I also kept track of the following data: 1. Which students went where? 2. How long did they stay at the same company? 3. Did they receive promotions? This information was very helpful for finding internships because I could use those student's names when I talked to people at those companies. Often our student's co-workers were unaware that they graduated from a community college biotech program. Once they found out, it generally raised their opinion of the program and they were more inclined to hire additional graduates. To do this - I used an e-mail list and gave the students incentives to send me current contact information. I mailed out job announcements on a regular basis. We also held a party every year and invited former students. So, come spring, I would get lots of e-mails with up-to-date contact information since everyone wanted to know when the party would be. *Geospiza, Inc.* (#962)

National DNA day (April 2004)

April 30th is National DNA day. There are lots of great things posted at the NHGRI web site along with a web cast from April 2003 where James Watson and Francis Crick discuss the completion of the human genome. http://www.genome.gov/DNAday/. *Geospiza, Inc.* (#971)

Suggestions for biomedical informatics courses (April 2004)

I am in the process of developing two Biomedical Informatics courses. I would appreciate suggestions for books, course content, labs. Below are descriptions of the two courses: 1. Tools, Algorithms and Methods for Biomedical Informatics with Lab. This course approaches, in practical terms, a broad collection of topics in contemporary biomedical informatics tools, algorithms and methods. In addition selected topics are covered in depth to demonstrate the critical thinking and methodology that underlie biomedical informatics. Studies include power searches, data mining, biostatistics applications, and use of tools such as BLAST. Controlled terminologies approaches, ontologies, data acquisition, data integration, methods for search and optimization, and information retrieval are explored. Lab exercises relate to topics discussed. 2. Advanced Computer Techniques for Biomedical Applications with Lab. Students explore pattern recognition, imaging, gene arrays, histograms, two dimensional tomography, cluster pattern analysis, and statistical methods and hypothesis testing, as well as forensic medical applications. Through lab exercises, students apply advanced computer techniques in a biomedical context. (#997)

- You may find some helpful materials at the site that we developed for Bio21 - a conference on teaching biology with bioinformatics. There is a page with information from some different bioinformatics programs or courses and links to the programs or course syllabi. http://www.geospiza.com/outreach/bio21. There are also links to presentations and materials from hands-on workshops. Since your course has a medical emphasis, you may want to look at Stuart Brown's web site, too. http://www.genomicshelp.com/resources/. For microarray materials and software for microarray analysis, Laurie Heyer has software that's freely available at:

http://www.bio.davidson.edu/projects/magic/magic.html. She also has a user guide, data sets, and links to tutorials that were developed by her and Malcolm Campbell. You may also find some of Geospiza's tutorials to be helpful, particularly our tutorial on Cancer biology and advanced searching with PubMed, given your interest in controlled vocabularies and biomedical subjects. http://www.geospiza.com/outreach/cancer. We have other tutorials available at: http://www.geospiza.com/outreach/tutorials.htm. *Geospiza, Inc.* (#1001)

Biotech equipment info (May 2004)

As part of my new duties here at Ward's I am trying to identify college/university level biotech products. Our main market has always been secondary education but we are now gearing up for a major push into the college/university market. So, I would appreciate it very much if you could furnish me with the favorite brands that you and your colleagues use for the following type products: electrophoresis chamber (agarose); electrophoresis chamber (PAGE); power supply; micropipettor; thermal cycler; microcentrifuge; transilluminator; camera system; any other hardware you might consider essential for a DNA/Protein biotech lab. *WARD'S Natural Science Establishment* (#1013)

- We use the following: electrophoresis chamber (agarose) - we use Wards for HS outreach but OWL for program students; electrophoresis chamber (PAGE) - Biorad and OWL; power supply - BioRad; micropipettor - Rainin; thermal cycler - Hybaid; microcentrifuge – Jouan; transilluminator - alpha-imager; camera system - alpha imager; any other hardware you might consider essential for a DNA/Protein biotech lab - Juoan floor centrifuge. (#1016)
- We use the following: electrophoresis chamber (agarose) - Bio-Rad; electrophoresis chamber (PAGE) - Bio-Rad Mini Protean; power supply - Bio-Rad (300); micropipettor – Ranin; thermal cycler - Applied Biosystems GeneAmp Systems; microcentrifuge – Heraeus; transilluminator - UVP Model TFM-30 and TFM-20 Transilluminator; camera system - Kodak EDAS 290. *Finger Lakes Community College* (#1019)
- Some of GeBA products are educative tools in the following application fields Dialysis. Electro elution of Protein, DNA-Oligo, RNA, GeBA tools market standard electrophoreses gel box unit for agarose to electro elute Protein, DNA, or Nucleic acid. GeBA could provide some of the product for a minimal cost. Review our website for further product details at www.geba.org. (#1020)

Laminar flow hoods (May 2004)

I would be very grateful for any advice on the best laminar flow hoods for teaching cell culture and sterile technique in community college biotechnology courses. Some attributes that I think are important are size - ductless bench top would be preferable, visibility of the student working in the hood so techniques can be assessed, durability and of course cost. Can any one suggest a hood they have been happy with? Any other attributes I should consider when making my decision? (#1022)

- The best laminar flow hood is the Baker Edgeguard. Stainless steel. Lasts forever. Be careful of hoods with plexiglass sides. Alcohol and other chemicals will cause them to break down. *Kitchen Culture Kits, Inc.* (#1023)
- We bought 2 of the Envirco laminar flow hoods from VWR. They are plexiglass on three sides, so visibility for observers is great. We bought rolling tables with white laminate tops to put them on from an office supply store. The hoods work great, and the convenience of being able to roll them out of the way or over to where they are needed is useful as well. The office supply store was also cheaper than what science suppliers want for their stands. Price is about $1,800. VWR part number VF-10557. *Indian Hills Community College* (#1025)

Looking for text book (May 2004)

I had sent out an email quite some time ago looking for some ideas on a text book for an introductory HIGH SCHOOL biotechnology class. I got some response, but thought I would give it another try and see if any new suggestions pop up. Anybody have any suggestions for a high school biotechnology text? *Susquehannock High School* (#1027)

- I have used several. DNA Science: The Awesome Skill 2nd ed by I. Edward Alcamo Biotechnology an Introduction by Susan R. Barnum DNA Science A First Course by David Mickols and Greg Freyer. We are currently using the DNA Science and I supplement with the other two. My course is set up as a dual credit course with a college. Hope that this helps. (#1028)
- When I taught at Juanita High School and Bates Technical College in Seattle, Washington, we used several books including Recombinant DNA & Biotechnology: A guide for teachers by Helen Kreuzer and Adrianne Massey Published by American Society for Microbiology (January 2001) ISBN 1555811752 Price $54.95; DNA Science: A First Course by David Micklos and Greg A Freyer Published by Cold Spring Harbor Laboratory (January 2003) ISBN 0879696362 Price $39.95 and Biotechnology: BioSources Lab Program by Holt, Rinehart and Winston ISBN 0-03-051407-X. (#1029)

PCR kits (July 2004)

Can any of you recommend a good PCR kit for use in a freshman majors biology course? We recently used BioRad's Chromosome 16 forensic kit and all students were homozygous for the same allele, save one student who was Native American. According to the tech rep the other allele is seen at low frequency only in Asian populations. I would like to find a kit that is a) interesting and b) does not require sensitive staining of the gel (i.e. ethidium bromide) to see the product. *Pima Community College* (#1060)

- The PV92 kit from Biorad is good. But I can send you a primer set for Alu in the TPA gene that works great. It is 50/50/50 usually in my classes of 24. *Mesa Community College* (#1061)
- I am very comfortable using ethidium bromide which I incorporate into the gels. I do wear gloves while handling the gel and I do not let students handle them. You use only 5 microliters et br per 100 mL agarose solution. It works beautifully and there is no down time for staining/destaining. You see the bands as soon as you put the gel on the UV viewbox. Cold Spring Harbor's Dave Micklos says you can throw the gels into the regular trash (I use our biohazard disposal since we have the service)…the et br is bound up in the gel and the amount is so small. (#1062)
- I too have had mixed success with the Bio-Rad kit. We have had much better results with the two kits from Carolina: Human Alu Insertion Polymorphism, and Human VNTR polymorphism. Although we stain gels with EtBr, each kit can be used with methylene blue or other similar stains. I can send you the student protocols we use if you are interested. *Monmouth University* (#1064)
- When we used the PV92 kit, the reaction worked great, but we only saw one allele in over 90% of the students. The controls worked and there was one student who was heterozygous. What allele frequencies do you see? I assumed there must be a technical failure, but tech support said that the second allele is found at very low frequency and is typically seen only in Asian populations, and that they are working on a new kit. They had previously used TPA but abandoned it because of the to TPA and genetic privacy issues. I would greatly appreciate giving your primers for the TPA gene a try. *Pima Community College* (#1065)
- I have used TPA and have had about a 50/50 ratio. I will send you the primer seq. tomorrow as they are in the lab. *Mesa Community College* (#1066)
- I would be interested in getting the primer sequences for a number of the alleles that you mentioned in this discussion some time ago. I also would be interested in exchanging

ideas. We have been teaching a 2 year biotech program for about 8 years now. Our biggest problem is getting students from high school as most don't know what biotech is or the career opportunities that there is in this sector. (#1088)

- Would it be difficult for you setting up an Outreach Program?? One idea I have is that you can make a short lecture (high school level) about Introductory Biotechnology, applications and potential job market in your area. It would be nice if you also set up a short laboratory demonstration and-or practice (hands on DNA Isolation, etc.) and engage kids in this activity. I am sure you can get some free kits from educational companies! Your biotechnology students would love to participate in these activities as well as instructors/assistants. I have not set up an Outreach Program yet but this is what I plan to do in the near future for my program. Just ideas. *Galveston College* (#1090)
- We do this and have been doing it for about 5 years now but our province is sparsely populated and schools spread out. This means quite a load for us as instructors to do this as well as our regular work. We have linked with the local university and are doing joint outreach. It seems to pay off but difficult to measure the success. We also do in house full day labs for advanced students and this seems to be enjoyed by all. Thanks for the ideas. Always good to know that we are on the right track and if you have any ideas of labs that are good to do let me know. We do DNA extraction from banana for younger grades and simple gel electrophoresis. For higher grades we do bacterial transformation. Also have done DNA fingerprinting in the past as well. Centre of Excellence in Agriculture and Biotechnology (#1091)

Shoestring biotechnology lab book (August 2004)

I would appreciate if someone replies with information on how to get a sample of the Shoestring Biotechnology Lab Book published by NABT. *Galveston College* (#1083)

- The lab manual is available through the book section of the NABT web site. http://www.nabt.org/sup/publications/books.asp. *Monmouth University* (#1084)

Plant biotech class (September 2004)

I have been contacted by a teacher who wants to do plant biotechnology in her classroom and needs to know what others teach in a one semester plant biotech class and if there are any competencies or suggestions of schools that offer a plant biotech class that she might contact. I am a plant tissue culturist so am biased to all plant tc but assume plant biotech classes get into DNA analysis, etc. too. *Kitchen Culture Kits, Inc.* (#1097)

- I teach my students DNA isolation and RNA isolation from Monsanto RR/BT soy (they also look at phenotype by adding round-up to each plant). Then they use RT-PCR and PCR to identify the RR event and quantify it. We also have them bring in soy products for real-time PCR (QPCR) analysis to see the % GMO in their soy milk, etc. Lastly, the students culture potato sprouts from stem cuttings and then we have them use agro to transform tobacco cell lines with GFP and observe them under the inverted fluorescent scope. *Mesa Community College* (#1098)
- The DNA Learning Center of Cold Spring Harbor Laboratory has developed a curriculum for the teaching of plant molecular biology, genomics, and bioinformatics. It consists of four modules, the wet labs of which are all based on simple PCR-protocols. One module entails work with GMO plants as well as supermarket-derived foods. Another module allows students to discover the nature, location, and effect of the clf-mutation in Arabidopsis and to develop an integrated phenotype/genotype concept. A third module connects classical gene-mapping with molecular and computer-based methods of gene identification, CAPS-mapping the ago-gene in Arabidopsis. The curriculum is designed for advanced high school classes (grades 10-12) and undergraduate courses; it is in the process of being posted at http://www.greenomes.org. The DNALC will distribute these laboratory- and computer-based modules to college faculty in week-long NSF-funded

workshops in Summer 2005; if you wish to be a hosting site, please contact Uwe Hilgert at hilgert@cshl.edu or 1-516-367-5180. If you wish to participate in a workshop, please keep your eyes on http://www.dnalc.org where details will be posted in January or February 2005. (#1099)

Thermal cycler (September 2004)

I'll be purchasing a new thermal cycler for our high school equipment loan program sometime in the next month and was wondering if anyone had any suggestions regarding reasonably priced models that have worked well for you. We primarily run the PV92 Alu PCR with our students. Comments on machines to stay away from will also be appreciated. *University of California* (#1100)

- I have 2 models from Bio-Rad: a)the compact, non-refrigerated one - works okay, accepts 24 samples, no mineral oil needed, holds 0.2 ml tubes. 2) The My Cycler, refrigerated one - works much better, accepts 96 samples, no mineral oil needed, holds 0.2 ml tubes. You might also want to look at MJ: these thermal cyclers cycle very quickly, completing most runs in 1.5 hrs. They accept only 15 samples per run. (#1101)
- The My cycler is the best machine for the job, and can be upgraded to gradient later on for about $350. We have 4 at MCC and the icycler for qpcr. Never had a problem. If you speak with Anthony Green, he may be able to get a better deal for you. He's the West Coast Rep. Tel# 859-321-0921 *Mesa Community College* (#1102)
- I have several thermal cyclers in my lab that are used by undergrads. Of these I am very happy with the Bio-Rad mycycler. Good price and very student-friendly. *Monmouth University* (#1104)

Laminar flow hoods (September 2004)

I have a question for those of you who teach tissue culture in vocation programs: How many laminar flow hoods do you have? Or rather what is your student to hood space ratio? What strategies do you use to avoid bottle-necks? These are bulky and many of us are limited on space, yet we want to give each student as much hands on experience as possible. *Pima Community College* (#1116)

- We use two three-seater hoods. There is a "bottleneck", but we are limited in space. It usually takes a good 2 hours of lab to put them all (24 students) through, but we don't use it very often (5-6 labs/semester). Most of the things they do (Q-PCR, protein/RNA isolation/microarrays) they do at the bench (since they don't really need the hood). They just set up experiments in the hood (e.g. PMA/estrogen treatment/transformation, etc.) I have the lab techs passage the cells after the students do it a couple of times (freeze/thaw). *Mesa Community College* (#1117)
- You can find some information about the MV (face to face top bench). This product is designed for teaching applications. http://www.adslaminaire.com/en/Pages/Product.asp?PRODUCTINDEX=51. (#1118)
- You can do open bench tissue culture. Not the best situation and you probably do not have areas in the room with little air movement but it is an option. Another option is to adopt the kitchen methods used in tissue culture and go with a plastic box or pvc structure box. These provide the protection from "stuff" falling into your cultures and they work. Check out this for one example: http://www.kitchenculturekit.com/pvccleanbox.htm. *Kitchen Culture Kits, Inc.* (#1119)
- We have just one 6-ft. laminar flow hood (seats 2), due to space and budget constraints. The largest class size that I have had going through the cell culture course was 9 students, and it did create a bottleneck. To overcome this, I had several open labs scheduled during the week for the students to come in and do their routine passaging. Although this meant working the extra time into their schedule, the students seemed to like it as it gave them a real sense of ownership for their work. They typically came to

open lab at least once a week in order to passage their cells, and sometimes a second time to feed, if they didn't get to do it during class time. So they got plenty of practice with the routine operations. The down side was that I had to sacrifice my free time to be in open lab to supervise the students! *Sinclair Community College* (#1120)

- We have two laminar flow hoods so it is potentially an issue since we can have as many as 16 in the cell culture class. The way we have dealt with it is to use the hoods only for animal cell culture tasks and students alternate doing plant cell culture projects at the lab bench when they are not at the hoods. Then we also rotate students through other tasks like making media and other reagents so that they use their time wisely while not actually manipulating cells in the laminar flow hoods. *Madison Area Technical College* (#1121)
- We have 4 hoods. The students use them in pairs. That allows a maximum of 8 students per lab period. We run the course with a joint lecture and then as many 8-person lab sections as it takes to cover the need. *Montgomery College Biotechnology Institute* (#1125)

BLAST searching (October 2004)

I am attempting to put together a web quest, or similar web based activity, that would allow my high school biotechnology students to link a genetically based disorder back to the protein and to the linear nucleotide sequence in the DNA. I hope to introduce them to BLAST searching or other similar genome data base search engines. This is a mixed level of students (academic and standard), and their instructor (ME!) has very little experience in this area, so I am looking for activities that are basic and interesting for the students. If any of you have experience with a basic level activity, please share. I have been searching the web and just can't seem to find anything that is a nice basic tutorial, or basic activity. *Susquehannock High School* (#1130)

- Jeffrey O'Neal's group has been doing much with bioinformatics and teachers and might be able to help. Also Alexandra Van Kley at SFASU. *Kitchen Culture Kits, Inc.* (#1131)
- Stephen Wefer published a paper "Name that Gene" in The American Biology Teacher, vol 65, October 2003 p. 610-613 which described a basic but informative lesson on BLAST searches and bioinformatics that I would recommend as a starting point. *Monmouth University* (#1132)
- Try out our VERY basic intro to bioinformatics. http://www.okccc.edu/BBDiscovery/documents/Modules/Bioinformatics%20Module.htm , http://www.okccc.edu/BBDiscovery/documents/BiomedBioinf.htm, one is more biomedical, the other more general biology. *Oklahoma City Community College* (#1133)
- We had developed some curriculum on an ATE project that included a nice (basic) bioinformatics activity that might be useful. Go to http://www.hofstra.edu/academics/soeahs/tec/tec_nyscate.cfm and on the left of the screen select NYSCATE products. Go to modules 1-7 and select bioprospecting. Although the curriculum includes a variety of activities, it is based on a case study that you could break out and use the bioinformatics part. There are some nice thought questions that go along with the activity that might be useful. *Finger Lakes Community College* (#1136)

Human Alu insertion polymorphism kit (October 2004)

Does anyone know of websites that could enrich the Human Alu Insertion Polymorphism Kit by Carolina Biological? Any activities that support the kit? I would like to present it to my high school students. I will also present the Nature's Dice genetic screening simulation. Has anyone had experience utilizing these kits? Any suggestions? *University of Phoenix* (#1137)

- Figured you would have already looked at the Dolan DNA Learning Center's Genetic Origins site: http://www.geneticorigins.org/geneticorigins/. There are a number of activities at the site above that you can use to expand on the Alu lab. And don't forget, WARD'S has an Alu lab also! *WARD'S Natural Science Establishment* (#1138)

- I have been working on PV-92 for some time now. I have a lab that I use for 181/245/46 students that you are welcome to. It is a hybrid between the Dolan LC and Biorad kit. You also are welcome to use the 377A DNA sequencer if you like, or you can outsource it to ASU for $5/rx. You just provide the purified template and primer (s). For a rundown, my students calculate genotype freq. from their PCR and upload to www.bioservers.org allele server. Then they determine if they are in Hardy -Weinberg. They purify their fragment (s) from the gel and do an Alu restriction digest on it. They also sequence their DNA, and upload the sequences to www.bioservers.org sequence server, do an alignment and blast search and construct a phylogeny. They also use their sequence alignments to identify the insert and blast to look for Alu transposon-like sequences. There's an exercise you can use that uses PV-92 NCBI sequences if you don't want to have the students sequence their own DNA. I also have all of the 13 CODIS FBI primers I use for fingerprinting. You are welcome to use any or all of them if you like. We also have tons on enzymes if you want to do RFLP. *Mesa Community College* (#1139)
- For a short and succinct PV92 bioinformatics exercise check out http://www.dnai.org/lesson/go/2120 and click "DNA Fingerprinting - PV92 polymorphism." The module consists of seven slides. I use this successfully when I teach the PV92 wet labs. *Dolan DNA Learning Center* (#1140)

Stem cell resources (November 2004)

I'm preparing to give a brief introduction to stem cell technology and would like to follow up with a discussion/debate in my introductory biotechnology course. I began doing some internet research and my head is spinning with the amount of information out there. In particular, I'd like to find some nice graphics or animations. I recall there is a group in Canada that has prepared a stem cell lesson. Is it available online? Any other suggestions? *Community College of Rhode Island* (#1146)

- Here's a link to a lesson I developed for my Online Biotech/Bioethics class: http://www.canbyhs.canby.k12.or.us/chsstaff/~swihartc/Stem_Cells.html. You may find some of the animations and articles useful for your purposes. Let me know if I can provide you with further information. For anyone else who would like more information about this class I developed, please feel free to contact me. *Canby High School* (#1147)
- Try the genetic science learning center at Utah - great animations, lots of info: http://gslc.genetics.utah.edu/. *Oklahoma City Community College* (#1150)
- NWABR did a fantastic workshop on stem cells about a month ago. Lots of great ideas and links to other sites. http://www.wabr.org/education/stemcellforum.htm *Navigator Academy* (#1151)

Microplate reader (November 2004)

Could any of you suggest an inexpensive microplate reader with just the visible wavelength range capability for doing protein assays? *Sinclair Community College* (#1152)

- We currently use several of the low end Bio-Tech readers. *IBT Reference Laboratory* (#1153)
- I use BioRad's plate reader. I think it was around $3000. *Mesa Community College* (#1154)

FDA tutorial (November 2004)

I just discovered this great interactive tutorial on the FDA website: http://www.fda.gov/cder/handbook/develop.htm. It is called "The New Drug Development Process: Steps from Test Tue to New Drug Application Review". *Community College of Rhode Island* (#1155)

PCR labs (November 2004)

I have a colleague who is teaching a first year molecular and cellular class for the first time. During this semester course, they have 34 labs (2x a week for 3 hours per lab). She is looking to add a basic PCR class. She was thinking about using water baths and having the students manually cycle the tubes. However, she is looking for suggestions for the template DNA and the primers. Does anyone have a basic lab that they would be willing to share? (#1156)

- Look at the DNA Learning Center's site at www.dnalc.org. In their Genetic Origins site they outline protocols for Alu and mitochondrial DNA (click on "recipes" at the top of the page) including primer sequences. The mitochondrial DNA procedure is the most likely to work even with manual cycling. You won't see any differences in band lengths on an agarose gel but you can send in samples to the DNA Learning Center for sequencing (instruction are on the Website). (#1157)

Fermentor query (December 2004)

I am about to put in order for Bio-fermentor system and want to know if you have any recommendations as to brand, setup, etc. - right now I have quote from New Brunswick for 7.5 L with bioprocessing software - our local industry is about to acquire a biomanufacturing company and I want to give students experience but it will not be a big part of our program right now - any advice would be welcome. *Oklahoma City Community College* (#1158)

- We have a New Brunswick BioFlow 110 set up with a 3 Liter vessel. We don't have the monitoring software, but I would recommend getting it if possible-otherwise your manually recording pH, DO levels, agitation and so on. I have been pretty happy with the 110, the nice thing is that you can add additional vessels (up to three) and controllers as your needs grow, and the footprint of the vessel allows it to be set up on a standard lab bench. One thing to keep in mind is how you are going to set up and process the fermentations run. With a 7.5 liter vessel (if full) you will need to spin out 7.5 liters which if you just have one swinging bucket centrifuge will take awhile - otherwise you need a continuous flow centrifuge (sharples or equivalent). With the three liter vessel we can grow as little as 1 liter of cells and can process that in one centrifuge run. Also, the cost of media and reagents for induction need to be considered-you wouldn't want to use up all of your IPTG in one batch. Another thing to consider is the size of your autoclave. Our three liter vessel fits into our department’s autoclave upright so we can sterilize with media in place. If your considering larger vessels you might not be able to do this and sterile transfer of media can be a big headache, otherwise it's steam in place units which require steam lines or steam generator. I would take a look at the BioFlow 110 from New Brunswick - I've been happy with it and it has survived a year and a half of student handling. I really can't comment on other makes and models that are out there. (#1159)
- Go for the best you can afford in the bench top size. If you can get insitu sterilization go for that as well. I would suggest getting one that can do mammalian cells (airlift) as microbial fermentation although good to learn the basics is becoming less and less used. It is good to do both. As Tom noted if it isn't insitu sterilization you have to make sure you vessel will go in the autoclave in the upright position. Software is good as well. I have been teaching microbial cell culture for 6 years now and can give you some help. I am always changing what I grow and process from year to year. If any one has any suggestions on a protein from yeast that can be extracted and tested for activity I would appreciate that. *Centre of Excellence in Agricultural and Biotechnological Sciences* (#1160)
- If you’re looking for a protein to express and purify from yeast (Saccharomyces cerevisiae) I have a galactose inducible GFP expression system that you are welcome to. The GFP is His tagged so you can do either IMAC or HIC purification. The protein is not excreted (I'm working on it) so you will have to harvest and break cells. (#1161)
- I'll take you up on it. I am trying to find a protocol to purify alcohol dehydrogenase from yeast. I believe it is also intercellular and lysis is require. I would like to find an excreted

protein (that can be induced in fairly high concentrations) and am working on this. I will share with you any procedures that I manage to come up with. We prepare our procedures as SOP's so easy to reproduce. (#1162)

- I have an antibody against yeast alcohol dehydrogenase that may assist your assessment of purity. Carl A. Ascoli, Ph.D, Laboratory Director, 1-610-369-1008 or 1-800-656-7625, 1-610-367-7825 fax, www.rockland-inc.com. (#1163)

LiCOR educational grants (December 2004)

LI-COR has just announced educational grants for institutions who are interested in purchasing LI-COR sequencing instruments. If your students wish to see their data, we have free software for viewing the results and, if the quality scores were calculated by the base-calling software, they can evaluate data quality, too. I'm not sure if the
LI-COR base caller calculates a quality score or not, but you can at least see if there are ambiguous base calls. The LI-COR grant info is at:
http://www.licor.com/bio/education/edumain.jsp. FinchTV (Geospiza's free trace viewing software) is available from: http://www.finchtv.com. *Geospiza, Inc.* (#1169)

- We received a LI-COR Genomic Education Matching Fund (GEMF) grant this summer to purchase a LI-COR 4300L DNA sequencing package. Our undergraduates learn to use the system in two of our courses to gain hands-on experience with computer-automated DNA sequencing. We also use the system for publication quality sequencing in student-faculty research projects and have been very happy with its performance. I definitely encourage interested faculty to apply for this program. (#1170)

Experiments for fermentor system (December 2004)

We will soon have a 3.5L BioFlo fermentor system and I am seeking some robust protocols for teaching students to use it – any suggestions on lab manuals or protocols or sources? (#1172)

- A very good book is "Principles of Fermentation technology" 2ed. Standbury, Whitaker and Hall. Butterworth-Heinmann ISBN: 0750645016. A test is very hard to come by. This one costs about 100$ Can. I have used the ASM Industrial microbiology and biotechnology manual as a source book but it is too expensive for students. I will send you some SOP's when I get a chance. (#1173)
- If your interested I can send you a yeast (S. cerevisiae) strain that produces GFP under control of the Gal1 (galactose induction) promoter. I also have an E. coli strain that produces GFP under control of the phage T7 promoter (pET system). We use these with our fermentation (they are also suitable for shaker flask) and protein purification course. I have growth, induction, and purification protocols available as well. (#1177)
- Can some tell me how to Validate a fermentor? (#1189)
- A fermentor is not validable equipment. The correct word or action is qualification. You must validate the process of fermentations. The first step is qualify your installations and facilities (I.Q., O.Q, P.Q), calibrate all the equipments, validate the water system and all devices involucrate including raw materials, etc. (#1190)
- I would like to reframe my question. After the IQ is completed how does one go about with OQ and PQ? What tests does one do in OQ to confirm it suitability for PQ? (#1191)
- After IQ (has been completed) is convenient prepare a Validation Protocol following guidelines you can find in EMEA, FDA, or WHO sites (into FDA look in CBER in case of biologic products). (#1192)

Biotechnology textbook (December 2004)

I am starting a biotechnology class for 11 & 12 grades next year at my high school. I was wondering if any of you had any suggestions for a good introductory biotechnology textbook. All suggestions will be appreciated. *Mariner High School* (#1174)

- I teach a biotech class for mostly 12th grade students. I do not use a book -- too many changes in biotech to warrant investing in a book for 7 years or so (as it is in our district). I use "DNA Science" (Micklos) for reference for me and I use a TON of online resources, readings and animations. I generally do not print out anything - just give the students the web page and questions, etc. I teach two sections each semester (for 10 years or so). *Middleton High School* (#1175)
- DNA the awesome science is nice. For someone using labs, I like DNA Science second edition with 10 well written labs. (#1178)
- I just adopted a new text book for this school year. After considering many books, I came up with about 3 that I thought fit the bill for my 10-12 grade Biotechnology Class. My final selection was, Introduction to Biotechnology, Thieman and Palladino, ISBN 0-8053-4825-5, Benjamin- Cummings. The book seems to be right on target with my mixed academic level students, but I also supplement with current materials from online and periodical sources. I also use Wards and Carolina Biological Supply Co. for their kit style labs. The kits are a bit expensive, but have easy prep requirements and the tech support from both sources has been excellent. Some of the others I was impressed with, but did not select were (in no special order): Biotechnology, an introduction by Susan R. Barnum; Biotechnology, Demystifying the Concepts by Bourgaize - Jewell – Buiser; DNA Science: A First Course, Second Edition By David A. Micklos, Dolan DNA Learning Center, Cold Spring Harbor Laboratory; Greg A. Freyer, Columbia University, New York. Previously I had used Biotechnology Unzipped, Promises & Realities by Eric S. Grace. *Susquehannock High School* (#1179)
- I am piloting Ellyn Daugherty's text and manual to be published this spring. It is excellent, broad ranging, not just DNA work, designed for high school level. As a former research scientist in biotech, I highly recommend it. *Castro Valley High School* (#1180)
- Ellyn currently has a publisher and has helped dozens of Bay Area high schools start or broaden their biotech program. Her book is called "Biotechnology: Science for the New Millennium". Table of contents and web site to take a peek is at http://www.skipwagner.net/smbiotech/bioteched.htm. *San Jose State University* (#1182)
- Introduction to Biotechnology by Thieman and Palladino is a good text and although it maybe deeper than what most 11th and 12th graders would be ready for, you can control the depth. (#1183)

Biotech negative impacts information (December 2004)

I am developing an introductory undergraduate course called "Biotechnology & Society". My biases and accumulation of information, perhaps like some of yours, are more towards the positive aspects and impacts of biotechnology on society. However, I would like to make sure that my course adequately reflects the real, and perhaps already documented negative impacts that biotechnology can have on society. Can anyone direct me to resources (or case studies) that illustrate how biotechnology failed to improve or benefit society, or even perhaps had a negative impact on society? Also, can anyone suggest some good textbooks that fairly treats both the positive and negative impacts of biotechnology on society? *Clemson University* (#1186)

- Below are links to a few sites that present pretty good pro and con case study scenarios that I have used or modified. Hope this helps. http://www.ncbe.reading.ac.uk/NCBE/GMFOOD/casestudies.html; http://www.bioethics.iastate.edu/forum/plant_biotech99.html; http://www.oup.co.uk/best.textbooks/biosciences/slater/cases/general/. *Monmouth University* (#1187)
- I have prepared a book list with detailed reviews. If you want the opposition, I would suggest Biotech Century by Jeremy Rifkin, who is an excellent, excellent writer; you can critique his ideas, but not his ability to write. It might be a good exercise for the students to look at his ideas critically. I might also suggest that you have them read “Brave New

World" – a timeless book – by Aldous Huxley. Also, I might also recommend Enough by Bill McKibben that doesn't have a current negative, per se, but has cautionary tales about the future of germ line genetic engineering – this book I think is very realistic about the new ethical
challenges. http://search.barnesandnoble.com/booksearch/isbnInquiry.asp?userid=xt1DhRHATt&isbn=0805075194&itm=9. *Solano College* (#1188)