Skill Standards to Curriculum Gap Analysis Process

Gap Analysis Process Description

The purpose of this process is to review existing curriculum against relevant set of industry skill standards to develop recommendations for improvement.

The process involves the following steps:

- Review and discuss the curriculum, activities and assessments,
- Complete gap analysis tool,
- Document findings and develop general recommendations for curriculum improvement.

In order to complete the process, program faculty and facilitators met for three two-hour long meetings to review curriculum and go through the gap analysis tool. Faculty spent about 15 additional hours to complete the gap analysis matrix, and facilitator spent about 20 hours reviewing syllabi and documenting the process. The Shoreline CC Biotech program is particularly well organized and documented through the syllabi, and the two primary faculty have a thorough knowledge of what is being taught in each course. As a result the process took considerably less time to complete than it might have if the participating faculty were not familiar with the content of all program courses.

The success of this process is strongly dependent on the following factors:

- Good facilitation practices — it is sometimes difficult for faculty to interpret specific industry requirements and/or relate these requirements to curricular elements, therefore it is the role of the facilitator to help bridge the two environments.
- Faculty understanding the curriculum value of engaging in this process — the skill standards information should be presented as a wealth of industry-based information to help faculty fine-tune their curriculum.
- Faculty being paid for their time, and being supported, or at least heard, in their recommendations.
- Understanding that the skill standards information covers a broad range of jobs — any individual program will not and most likely should not cover every element of the skill standards. The first step is to identify which parts of the skill standards are relevant to the specific program.

Other general recommendations include:

- Faculty involved in the process should have a thorough and complete knowledge of the program curriculum — ideally all program faculty should participate.
- The facilitator should gain a thorough knowledge of the skill standards information and of the program curriculum (through syllabi, textbooks and faculty interviews). Technical content may be readily assessable from the syllabi and textbooks. However, soft/foundation and process skills, such as teamwork, project organization, can best be assessed through

discussion with the faculty, as they are rarely documented in any detail in the written curriculum.

- It is best, but not necessary for the process facilitator to be outside of the program, this brings a broader and more objective perspective to the process.

It is important to note that both the skill standards and this gap analysis process do not take the place of regular industry input, such as participation from industry advisory committees. The skill standards information covers in great details the types of activities professionals do in the described profession. However this information does not specify the tools and technologies being used as these change very rapidly in today's high-technology environment. It is therefore one of the roles of the industry advisory committee to recommend specific tools, techniques and practices to stay current with the industry.

The gap analysis process helps identify the following:

- Areas of the skill standards that are adequately covered in the curriculum, with the appropriate emphasis, and with appropriate learning and assessment methods.
- Areas of the skill standards that are adequately covered in the curriculum, with the appropriate emphasis, but are not supported by appropriate learning and assessment methods.
- Areas of the skill standards that are emphasized too strongly in the curriculum.
- Areas of the skill standards that are not emphasized enough, or are not covered at all and
  —should be included in the program,
  —do not need to be included in the program at this time, but should be regularly assessed in the context of local/ regional industry shifts.
- Areas of the curriculum that are not properly integrated or articulated throughout the program.

The act of participating in the process brings several benefits to the faculty and to the program:

- as an effective tool and process to facilitate discussion and interaction amongst the program faculty.
- Generates specific questions and proposals to bring to the industry advisory committee.
- Provides validation of alignment of curriculum, and learning and assessment methods with industry needs and practices.
- Generates new ideas for the improvement of curriculum, and learning and assessment methods.
- Provides supporting information to develop request proposals for additional equipment and program resources.
- Generates valuable information to present to funding agencies.

Critical Functions and Key Activities	Where is this activity taught and practiced in the curriculum?	How is it taught and practiced?	How is it assessed?	Degree of emphasis in the curriculum?
A. Perform routine laboratory support work				
A1. Maintain laboratory and equipment	This skill is practiced in all BioTech and ChemTech classes. Students learn to calibrate some of the equipment. Even though the students are not taught or asked to repair equipment, they are asked to recognize when the equipment is not functioning properly. Students are also responsible for organizing and cleaning the lab.	New equipment is introduced through a lecture, followed by a demonstration. Safety videos, if available, manufacturer technical manuals, and student handouts are presented and made available to students. Students usually work in pairs, and check and assist each other. Individual training is given to students by faculty if individual students have difficulty with specific equipment.	Students are observed closely and coached by faculty when they are learning the use of new equipment. The ability to properly calibrate and use the equipment is assessed through most activities and projects, as the results of experiments depend on this ability. Exams include scenario questions regarding use and principles of equipment. As the labs are dedicated to the Biotech program, students have responsibility for care and organization of lab. This directly impacts their ability to perform experiments and there is peer pressure to keep the lab in good working standards.	MODERATE EMPHASIS
A2. Order and stock supplies	BioSc 250, 265, 275 and 285	Students are taught to use catalogs, do research through the Internet and use manufacturers service phone lines. They record lot numbers and dates, and check for expiration before use. Students practice this skill in the Lab Manger project, where students have to order material for a given protocol, figure out the required amount of material, research catalogs, select material and fill out order form.	Scenarios, such as the Lab Manger project, are graded. Students are also asked to make an oral presentation on an industry kit they have researched.	MODERATE EMPHASIS
A3. Operate equipment	This skill is practiced in all BioTech and ChemTech classes. New equipment is introduced throughout the program. Students learn to calibrate some of the equipment. Even though the students are not taught or asked to repair equipment, they are asked to recognize when the equipment is not functioning properly. The use of protective equipment and safety practices is enforced.	New equipment is introduced through a lecture, followed by a demonstration. Safety videos, if available, manufacturer technical manuals, and student handouts are presented and made available to students. Students usually work in pairs, and check and assist each other. Individual training is given to students by faculty if individual students have difficulty with specific equipment. Students are also taught to select the proper protective equipment.	Students are observed closely and coached by faculty when they are learning the use of new equipment. The ability to properly calibrate and use the equipment is assessed through most activities and projects, as the results of experiments depend on this ability. Exams include scenario questions regarding use and principles of equipment. A capstone project in ChemTech 192 requires appropriate selection of equipment given a specific task.	VERY HIGH EMPHASIS
A4. Maintain biological stock cultures	Micro 215, BioTech 250, 260 and 265. Students are required to establish and maintain cultures.	Demonstrations are presented by faculty on procedures, and lab notebooks are available. Even though blank material	Faculty gives verbal feedback on labeling. Students are graded on knowledge of culture care. Projects on separating and	HIGH EMPHASIS

Critical Functions and Key Activities	Where is this activity taught and practiced in the curriculum?	How is it taught and practiced?	How is it assessed?	Degree of emphasis in the curriculum?
		is used, safety procedures are used as if material were hazardous. Proper labeling is covered. Students often work in pairs. Students develop a prelab plan before each experiment. They are also taught to recognize dead cultures.	maintaining cultures are graded. Notebook entries on processes used and on culture observations are maintained by students and assessed by faculty. Students can replace dead cultures in exchange for points, in order to complete their experiments.	
A5. Clean and prepare items for lab	Covered to a limited extend in BioSc 285.	Demonstration of autoclave, and videos on proper handling of glassware are presented to the students. Staging of lab items is covered to a limited extend.	Not assessed.	SOME EMPHASIS This skill applies more specifically to a production environment. There is usually specialized staff to take care of washing lab items. These employees are often high school graduates.
A6. Prepare biological and/ or chemical materials	This skill is emphasized throughout the curriculum. Basics are presented in Chem 101. Handling of hazardous material is taught and reinforced throughout BioTech and ChemTech courses.	Students are required to calculate solution concentrations. They are taught proper disposal procedures (calling the correct organization). Students are introduced to MSDS sheets. Students troubleshoot problems and can ask for help while they are learning new processes.	Quiz questions on exams assess students' knowledge related to this skill. As students progress through the program they are asked to perform tasks of increasing complexity and are given decreasing levels of help from faculty. This skill is assessed through lab experiments and lab notebooks.	VERY HIGH EMPHASIS
A7. Send, receive and distribute biological and chemical materials	This skill is not covered in current curriculum. This skill can be taught on the job, as shipping and receiving procedures are usually company specific. A specialized department often handles these functions.			NOT COVERED
A8. Perform routine animal care duties	This skill is not covered in the current curriculum. Routine care, such as cleaning cages is done by personnel with little training. Animal care on the other hand requires certification and some veterinary knowledge beyond the scope of this program.	Speakers are invited to come and talk to the students about animal handling and the use of animals in clinical trials. Students are exposed to concepts of animal care and to the ethical treatment of animals in a medical context. There is no hands-on practice.		LOW EMPHASIS
A9. Communicate with co-workers to ensure quality laboratory work	This skill is emphasized throughout the curriculum. The Human Relations course emphasizes multicultural issues.	When an experiment or activity does not work, students are asked to troubleshoot as a group. Workplace scenarios are used as case studies for group discussion, brainstorming and troubleshooting. Faculty sometimes models the process of troubleshooting and outlines an approach.	Students receive feedback on their interaction and communication skills from faculty and peers.	MODERATE EMPHASIS

Critical Functions and Key Activities	Where is this activity taught and practiced in the curriculum?	How is it taught and practiced?	How is it assessed?	Degree of emphasis in the curriculum?
B. Assist with research & development				
B1. Perform assays and experiments	This skill is taught and practiced in all lab classes. It is reinforced through 850 hours of lab work.	Students use lab and company manuals to write and apply protocols. They read scientific papers, do research and develop flow diagrams to develop and document protocols. Videos, demonstrations, in-class speakers, field trips and tours all reinforce student knowledge related to this skill.	Students' oral presentations on their protocols and their lab books are assessed by faculty. Students' performance of this skill in the lab is graded through lab notebooks, experimental results, quizzes, and 'question and answer' tests.	VERY HIGH EMPHASIS
B2. Assist in method development	Students design and adapt protocols in capstone course projects.	Students are taught to adapt and troubleshoot protocols. They design a protocol, carry it out and report on the experiment both verbally and in writing.	Open book exams, and oral and written reports on writing and testing of protocols are assessed by faculty.	HIGH EMPHASIS
B3. Investigate new technologies and methodologies	This skill is practiced through several courses.	Students conduct library research on new techniques and are asked to report through an oral presentation. They are taught how to effectively use technical help lines to obtain information. They read scientific papers and use the Internet as a resource.	Faculty grades individual and group oral and poster presentations of research.	VERY HIGH EMPHASIS
B4. Perform data analysis	All lab classes during first and second year, Computer 105, and Statistics course.	All of the points in this area are taught and practiced. Methods include graphing exercises, organization and presentation of data using tables and diagrams as appropriate. Both computer generated and hand-drawn data preparation is taught and practiced. Notebook documentation includes a requirement that raw data be presented, objectively discussed and analyzed. Each notebook entry includes the following required sections: Experimental Goals, Preparation, Procedural Description, Raw Data and Description of Results, and Analysis and Conclusions. Other teaching tools are: Study Questions (at the end of an experiment), independent experimental projects, lectures (especially in intro courses), instructor modeling of how to analyze data, and laboratory reports. The computer course teaches data analysis using MS Excel and the Statistics course teaches data analysis using statistical methods.	Assessment methods include quizzes, exams, grading of notebooks, group discussion, one-on-one discussions in lab, study sheets, lab reports, student presentations and reports on ChemTech capstone project.	VERY HIGH EMPHASIS

Critical Functions and Key Activities	Where is this activity taught and practiced in the curriculum?	How is it taught and practiced?	How is it assessed?	Degree of emphasis in the curriculum?
B5. Handle and/or maintain biological stock cultures	Taught specifically and intensively in BioSc 215 and BioSc 260. Practiced in BioSc 250 and 265. Some introduction to the process in BioSc 285	(All points are covered except for last "animal models" point.) BioSc 215 and BioSc 260- entire course curriculum including lab activities, protocols, capstone project (identification of bacterial unknown), lecture, demonstration, students maintain their own cultures. BioSc 260 also covers culture of animal cells. BioSc 250/265- Introduction to procedures by lecture and lab activity, demo. Also, students maintain their own cultures as part of their course project in BioSc 265.	Assessment methods include: Quizzes, exams, capstone project, direct observation, notebook documentation, experimental results, study questions.	HIGH EMPHASIS with learning and practicing opportunities dispersed throughout curriculum.
B6. Troubleshoot experiments and equipment	All lab courses. Concepts of scientific method and experimental controls are taught in BioSc 201 and Chem 101, and are practiced throughout all other lab courses.	Independent experiments and capstone project (ChemTech). Lecture, video, group and class discussion, one-on-one discussion in labs, study questions, notebook requirement for troubleshooting when problems arise. Actual troubleshooting experiments are developed and performed by the students as needed in BioTech lab courses.	Assessment methods include: Lab reports and notebooks, scenario questions in quizzes and exams, study questions, observation.	VERY HIGH EMPHASIS The program strives to integrate the practical side of experimentation, including troubleshooting into all BioTech and ChemTech courses. One could say it is part of the "program culture". Students know this is expected of them.
B7. Communicate results	English 101, Multicultural Course (SpeechComm), all lab courses	Engl 101-writing Speech communication. Bio 201- lab reports; group discussion; lab partner discussions. Bio 108-case study presentations, group discussions. Chem 101- notebooks or lab reports. ChemTech courses- detailed documentation in lab notebooks; capstone project written and oral report. BioTech courses-lab notebooks, study questions, group discussion, student presentations, research papers.	The following student works are graded: - Class presentations - Poster presentation (Bio 275) - one-on-one discussion (instructor-student) - notebooks - short essay questions on quizzes and exams Several opportunities for formal individual presentations.	VERY HIGH EMPHASIS Very high emphasis on written communication. Very high emphasis on "informal" oral communication (although assessment isn't formalized or used as a fire wall).
C. *Manufacture the product or provide the service*				
C1. Set up equipment for the production process	Covered indirectly only in biotech classes.	Exposure to equipment, processes, data gathering which may be used in the production process.	Assessment of underlying is covered in key activity B1.	NOT COVERED indirect only

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C2. Perform and monitor the process to make the product or provide the service	Covered indirectly only through the development of underlying skills in all biotech and chemtech classes.	All lab work: careful data collection required, attention to detail, precise documentation of work in lab notebook, any deviations are documented, knowledge of safety procedures, data presentation and interpretation, general knowledge of production process.	Lab notebooks, testing, presentations are assessed.	NOT COVERED indirect only
C3. Inspect materials at all stages of process to determine quality or condition	Covered indirectly only through the development of underlying skills in all biotech and chemtech classes.	Attention to detail in using materials for experiments: labeling, appearance, and expiration. Troubleshooting to identify source of error- such as a solution being made improperly.	Same as discussed under B1.	NOT COVERED indirect only
C4. Participate in the installation, modification and upgrade of equipment	Not directly.	Underlying skills of familiarity with machines and their use.	Same as discussed under B1.	NOT COVERED indirect only
C5. Prepare final product for shipping or distribution	Not directly.	Underlying skills of careful adherence to protocols, documentation and data handling.	Same as discussed under B1.	NOT COVERED indirect only
C6. Monitor, maintain and troubleshoot equipment, tools and workstation	Not directly.	Attention to calibration of pipettors, pH meters, spectrophotometers, etc. Appropriate use of machines, assurance that they are functioning properly.	Same as discussed under A1.	NOT COVERED indirect only
C7. Communicate with co-workers and/or customers to ensure production or service meets requirements	Not directly as regards to production: All biotech and chemtech classes emphasize workplace communication.	Follow established lab procedures, implement protocols, note any changes, problems; communicate to lab partner, other students or faculty as appropriate.	Lab notebooks, one on one observation.	NOT COVERED indirect only
C8. Coordinate logistics	Indirectly in all biotech and chemtech classes.	Students coordinate prep for each experiment by establishing a plan of work, determining what materials are needed and how they are to be used, document their process.	Informal and formal observation and testing	NOT COVERED indirect only

Critical Functions and Key Activities	Where is this activity taught and practiced in the curriculum?	How is it taught and practiced?	How is it assessed?	Degree of emphasis in the curriculum?
D. Maintain a safe and productive work environment				
D1. Participate in employer sponsored safety training	First Aid and Safety course (PE) Bio 285 has units on safety in different areas of labwork (eg. centrifugation, chemical safety, general lab safety precautions, etc.) Every lab course in the program has a required safety training component.	Safety procedures are taught and practiced through videos, lecture, written safety guidelines, MSDS booklet introduction, activity questions, demonstrations	Assessment methods include: quizzes, exams, direct observations, "Laboratory Attributes" evaluation sheet at the end of some courses.	VERY HIGH EMPHASIS consistent emphasis throughout program
D2. Participate in emergency drills and emergency response teams	First Aid Course and video in BioSc 285	In BioSc 285 and other BioSc classes to a limited extent — the students view a video, read from a text, and discuss within the context of the procedures and safety concerns of the curricula.	Assessment methods include: exam questions, observation during lab classes	MODERATE EMPHASIS COVERED in the context appropriate for the techniques and situations in our teaching labs. Not in the context of a particular company's policies and requirements. SAFETY itself is VERY strongly emphasized.
D3. Identify unsafe conditions and take corrective action	Mostly in BioSc 285, chemistry courses, other biotech courses to some extent	This skill is taught though video, lecture, readings, and demonstrations. There is limited ability to teach and practice this skill in a comprehensive way as the Biology technical preparation area is not accessible to students and the laboratory contains only a limited amount of the raw materials and equipment. Students, however, practice this on a "smaller scale" as it applies to particular safety concerns within the confines of the teaching labs. Students are expected to recognize and identify any safety problems with commonly used equipment in the lab such as UV light boxes and power supplies. The mode of reporting is always by direct and immediate oral reporting to the course instructor. No written documentation component has been incorporated.	Assessment methods include: Observation; "Lab Attributes" evaluation at end of some courses; quiz questions.	VERY HIGH EMPHASIS STRONG within the context of the safety requirements for the procedures performed in the lab courses. Safety, in general, is VERY STRONGLY emphasized in a consistent way in all lab courses.
D4. Suggest continuous improvements	Not part of the curriculum.			NOT COVERED

Critical Functions and Key Activities	Where is this activity taught and practiced in the curriculum?	How is it taught and practiced?	How is it assessed?	Degree of emphasis in the curriculum?
D5. Coordinate with work team	All biology and chemistry courses (first and second year of curriculum). Human Relations course. Other general distribution courses where cooperative learning takes place (eg. Speech communications, First Aid, English 101)	Students often are required to coordinate and cooperate with a lab partner. Group projects are present in several courses. In ChemTech and BioTech courses students are required to plan their time and show written evidence for this planning. Suggestions are given and examples modeled, especially earlier in the program. As time goes on, students are required to be more independent in their ability to coordinate team activities.	"Prep sheets" or "Flow Charts" are graded. (These represent the students' planned timing of activities for a lab period(s). Direct observation, and in some courses (with some instructors) peer evaluation is used as well.	VERY HIGH EMPHASIS
D6. Provide orientation and training to other employees	Not part of the curriculum			NOT COVERED Indirect only in working with lab partners and in groups
D7. Handle and dispose of hazardous materials	BioSc 285, covered in general terms, not at the policy level	Lecture, video, reading, demo of MSDS sheet use; short activity where students access information from MSDS sheets. WA State regulations are not specifically discussed other than to point out strongly that they exist and must be adhered to in the workplace.	Quizzes; lab notebook	MODERATE EMPHASIS Proper disposal of hazardous material and biohazard in all labs.
D8. Maintain Security	Not part of the curriculum			NOT COVERED
E. Perform documentation				
E1. Maintain lab notebook	All biotech and chemtech classes.	Lab notebooks are kept in accordance with specific instructions. Some steps must be signed off by lab partner or instructor.	Lab books are graded.	VERY HIGH EMPHASIS
E2. Create documents	All chemistry and biology classes.	Lab reports, notebooks, written reports must follow specific format. Data must be presented in acceptable format. Students are given verbal, written instructions as to the form in which the material must be presented.	These student works are graded.	VERY HIGH EMPHASIS

Critical Functions and Key Activities	Where is this activity taught and practiced in the curriculum?	How is it taught and practiced?	How is it assessed?	Degree of emphasis in the curriculum?
E3. Document Good Manufacturing Practices, Good Laboratory Practices and Good Clinical Practices work	285, 275, internship	Presented in concept, speakers, tours, articles and speakers		SOME EMPHASIS Minor component of the program
E4. Write reports	BioTech and ChemTech classes, 215, 108	Written reports according to assigned format. Reports may include library research, internet, scenarios, case studies, capstone projects. They must be professionally prepared and properly referenced.	Reports graded by instructor, may be feedback from other students and may be orally presented.	VERY HIGH EMPHASIS
E5. Maintain equipment logbooks	Not covered in a structured logbook format			NOT COVERED
E6. Maintain chemical / biological stock records	Not covered			NOT COVERED
E7. Maintain training documentation	All BioTech and ChemTech classes	Lab notebooks kept in all of these classes.	Lab notebooks are graded.	VERY HIGH EMPHASIS

Shoreline Community College Biotechnology Lab Specialist Program Gap Analysis Results

The analysis of the Shoreline CC Biotechnology Lab Specialist Program is documented in detail in appendix. In summary, the analysis yielded the following findings:

- The program strongly emphasizes the "Research and Development" section of the Research, Development and Manufacturing cluster of the Biotechnology and Biomedical Skill Standards. Even though some of the skills taught in the program apply to the manufacturing environment, biotechnology manufacturing is not a focus of this program. This is justified as the local biotechnology environment is not at this time heavily involved in manufacturing.
- The program does not cover key activities, skills and knowledge documented in Regulatory Affairs and Clinical Trials cluster of the Biotechnology and Biomedical Skill Standards. This area of the biotechnology profession falls outside of the program goals. At this time, this is a good choice as this area is still emerging and many of the employers in this cluster currently prefer Bachelors or Masters level education. However, this decision should be reevaluated periodically with an industry group.
- Hands-on activities, complemented by introductory lectures and demonstrations, prepare the students for realistic situations and problems. The activities/projects are well designed to build on prior knowledge and integrate technical and soft/foundation skills. They present the students with a good progression in task complexity and in increased self-reliance throughout the program. There is also a good balance between individual and team activities and projects.
- Real-world scenarios incorporated in most courses, especially in the higher program courses, prepare students for a real-work environment. The program benefits from a strong and constructive relationship with its industry advisory committee in defining real-world experiences and scenarios. The program also includes an effective internship course at the end of the degree.
- The program emphasizes the soft/foundation skills that are identified as critical by industry: careful planning, attention to detail, problem solving, task organization, documentation, oral and written communication and team skills.
- The technical content and skills are covered in depth and practiced thoroughly. Technical skills specifically emphasized in the program include: maintaining cultures, preparing biological/chemical materials, performing assays and experiments, developing methods, analyzing data, troubleshooting experiments, maintaining a safe environment, maintaining lab notebooks and writing technical reports.
- The underlying science skills are taught and emphasized throughout the program in the context of biotechnology. These include mathematics, scientific reasoning, and design of experimentation, fundamental biological concepts and chemistry.
- New skills and knowledge are most often introduced through lectures and/or demonstrations and developed to mastery

through a wide range of activities and projects.

- The assessments are progressive in difficulty throughout the program, well adapted to the skills being assessed and use a variety of assessment techniques. They map very well to the assessment criteria in the skill standards information.

A few areas were identified for increased emphasis, with specific recommendations for incorporation into the current program:

- ***Maintain Equipment—log of routine calibration, maintenance.***
  Even though the students use and calibrate the equipment, and are expected to recognize when the equipment is not functioning properly, they are not responsible for maintaining equipment as defined in the industry skill standards.
  Recommendation: In the second and third quarters of the second year of the program, assign students or pairs of students the on-going responsibility for a specific piece of equipment. The students will check to determine if the equipment is functioning properly before it is needed, calibrate it, and will maintain equipment logs, which will be provided by faculty. They may be asked to review the manual and identify the most common problems. They may be also be asked to report to other members of the class.

- ***Inventory of stock—expiration dates, shipping requirements***
  Even though students are aware and expected to check for expiration dates, they are not involved in shipping of material.
  Recommendation: Consider demonstration in the Media and Solution Prep class, as well as videos, and possibly field trips. Ask for additional suggestions from the program industry Advisory Committee.

- ***Dispose of hazardous materials***
  Even though students are taught general practices regarding the disposal of hazardous material, and practice procedures to dispose of material generated in the lab, this is not a strong area of emphasis for the program.
  Recommendation: Consider in Media and Solution Prep class, by adding diagrams of waste stream handling, such as where the material goes after leaving the lab. Can also bring in speakers trained in this area.

- ***Perform data analysis—database software, statistical testing***
  Even though data analysis is already a strong component of the program, additional elements were recommended to further emphasis data analysis, especially in the use of computer tools for data analysis.
  Recommendation: Have agreement to add Access database training to the Compu105 class required in the program. Ask for additional suggestions from the program Industry Advisory Committee.

- ***GMP procedures — health, safety, environmental compliance;***

inspect materials at various stages of the manufacturing process; prepare product for shipping

This area is already strongly emphasized in the curriculum. However documentation of procedures could be reinforced.
Recommendation: add the use of forms needed for documentation to appropriate classes. Consider forms obtained at Bio-Link workshop and other sources.

- ***Monitor, maintain and troubleshoot equipment for manufacturing***

Even though manufacturing is not a strong emphasis in the program, students could chose to develop specific skills directly for the manufacturing environment through program options.
Recommendation: Possible short course, field trips or focus in internship as appropriate.

- ***Maintain a safe and productive environment — safety drills; keep training records; identify unsafe conditions and take corrective actions; handle and dispose of hazardous materials***

Safety is a strong emphasis throughout the program. However ideas were generated to further solidify students' understanding and mastery of the skills in this area.
Recommendation: Continue to use safety videos and procedures in the lab. Consider biotech students making safety presentations to Intro Cell Biology class during lab in which horizontal DNA gels are done. Ask the students to develop posters. Consider extra credit for these activities.

For further details on scenarios developed to further emphasize some of the industry skills and to strengthen the overall curriculum, please see the appendix.

RECOMMENDATION

- Scenarios developed as part of this project should be reviewed by industry for validation and further definition, and should be piloted in the classroom.
- The goals and content of the program should be reviewed against industry trends and needs on a regular basis, at least once a year for a field such as Biotechnology that is evolving rapidly.