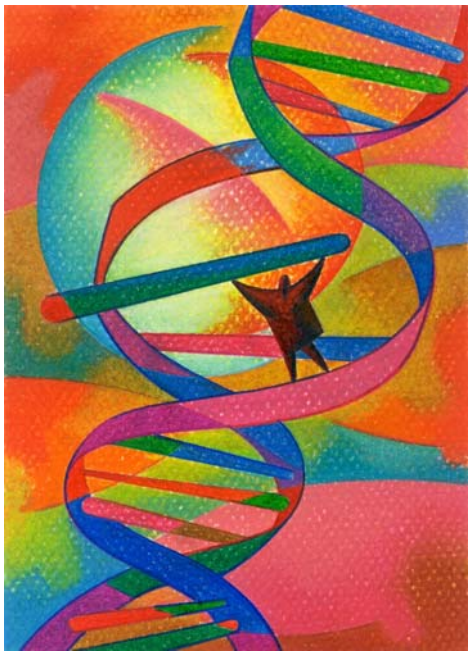
Developing Iowa's Bioscience Workforce

The Role of the Community Colleges of Iowa In Creating Skilled Workers for the Emerging Bioscience/Biotechnology Sector



Iowa Department of Education
Division of Community Colleges & Workforce Preparation

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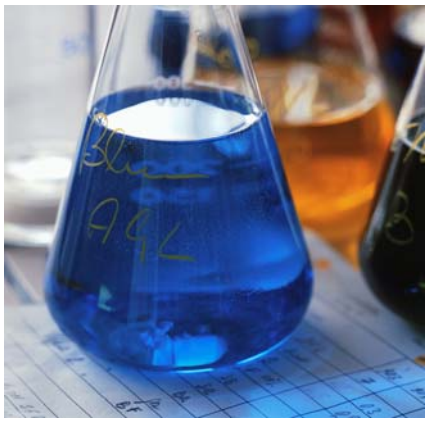

Overview

The Iowa economy is undergoing great change. Among the sectors deemed important to Iowa's economic future is bioscience. A report by Battelle (Iowa's Bioscience Pathway for Development) notes there is no commonly accepted definition of what constitutes the bioscience sector but suggests it includes agricultural, medical, plant-life sciences, and related industrial activity.[1]

Since the value of skills is paramount in the innovation and knowledge economy, higher education institutions play a pivotal role.[2] While often this is perceived as involving only four-year institutions, the pre-baccalaureate level is critical in training and retraining the bulk of the workforce for high value added employment. The importance of community colleges in this effort cannot be understated given the state's high retention of community college graduates.[3] Community colleges' accessibility, flexibility, and relatively low cost put them in a unique position to train or retrain most workers for an increasingly competitive global market.[4]

With regard to biosciences, the Bioscience Pathway for Development report noted that Iowa has the opportunity to build a world-class technical workforce that will provide it with an advantage in attracting and retaining bioscience companies.[5]

In the Batelle Report, the community colleges specifically addressed one of the efforts which the Report recommended in the Mission Statement for the State, that being:

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[1] "Iowa's Bioscience Pathway for Development" Battelle Technology Partnership Practice. July 2004. Available online at: http://www.iowalifechanging.com/downloads/IowaStrategicReport704.pdf

[2] "The 21st Century at Work: Forces Shaping the Future Workforce and Workplace in the United States." Lynn Karoly and Constantijn Panis. Rand Labor and Population. Available online at: http://www.rand.org/pubs/monographs/2004/RAND_MG164.pdf

[3] "Putting It All Together" Kelly, Patrick. National Center for Higher Education Management Systems (NCHEMS). May 5, 2005. Available online at: http://www.state.ia.us/educate/ccwp/cc/reports/implications.pdf
Also, more students attend community colleges than the four-year Regent's institutions.

[4] A series of articles by A. Stephen Dahms highlights the role of community colleges in training and retraining the biotechnology workforce. These articles can be found in the journal Biochemistry and Molecular Biology Education. Available online at: http://www.bambed.org/cgi/content/full/31/5/346

[5] Battelle.

- **Apply itself** (Iowa**) to the creation of an educational, economic, and social environment conducive to the creation, attraction, and retention of human talent**

As part of the mission, the Report recommended that the State …**adopt the best practices proven as drivers….including:**

- **Intensive networking across sectors and with industry**
- **Access to specialized facilities and equipment**
- **Patience and a long-term perspective**

Again these practices have been utilized by the community colleges.
Two key points from the Batelle Report addressed by the community colleges are:

"The current level of Iowa's bioscience employment concentration is considered to be regionally specialized. The fact that bioscience employment in Iowa accounts for a larger share of private sector employment than the industry does at the national level results in an above-average location quotient for Iowa. Overall, the state posses a regional specialization in the bioscience industry that is 24 percent more concentrated than the nation's."

"Iowa also has placed an emphasis on support for 2-year programs and workforce skills training, a process facilitated by the large and innovative community college system. Workforce education and development in Iowa benefits from a strong and dynamic community college system, which comprises 15 institutions."

Production level talent and technicians will be critical to sustain the growth of skill-intensive bioscience businesses (a sizeable percentage of bioscience companies' positions are pre-baccalaureate).[6] The rapidly evolving nature of bioscience industries makes community colleges, which are designed to quickly respond to changing economic needs, an essential part of the multi-tiered workforce development process.[7] Among Battelle's recommendations was the development of a bioscience vocational career education program and articulation agreements between various levels of bioscience education.[8]

Community colleges in Iowa have each developed different programs to train people within their merged areas for changes in the economy. Some have focused on bioscience and related fields more than others. This document comprises a short, non-exhaustive list of community college bioscience programs and offerings.

Program classification is among the principal challenges with compiling such an inventory relates to program classification. It may make sense to limit the discussion of community college bioscience programs by filtering out some traditional nursing, agricultural, and industrial programs -- possibly by emphasizing biotechnology. However, some "life science" programs not considered in the field of "biotechnology"

[6] Two-thirds of biomanufacturing employees have less than a baccalaureate degree.
Window on the Workplace 2003. A Training Needs Assessment for the Biomanufacturing Workforce. North Carolina Biotechnology Center Education and Training Program. March 2003.
[7] Dahms.
[8] Battelle.

are also relevant (e.g. medical equipment programs). The problem is determining exactly where to draw the line – clearly there will be overlap. Depending on the course offerings of a given program, a program may or may not be "bioscience-related. Part of the answer to these issues lies in the curriculum and what skills students are learning. The Battelle report suggests the focus should be on six emerging technology platforms including bioeconomy (e.g. biofuels), advanced food products (e.g. neutraceuticals), animal systems, integrated biosecurity, and pharmaceutical/post-genomic medicine.[9]

Regardless of the definition, the efforts of some community colleges stand out. Several community colleges have developed programs that are explicitly designed to meet the growing need for biotechnology-related technical workers. Many have partnered with local bioscience industries to better train workers for emerging high tech vocations. Others have partnered with area high schools (forming career academies or offering short courses) to spur students' interest and provide skills in bioscience fields.

Several of the colleges have designed their programs specifically to meet the needs of companies within their districts. Indian Hills Community College (IHCC) has created a bioprocess technology program to meet the needs of biotechnology industries in the Iowa Bioprocessing Center in Eddyville (Cargill, Ajinomoto Heartland, Ajinomoto Food Ingredients and Wacker Chemical). Similarly, Iowa Lakes Community College (ILCC) has developed biomass energy processing and sustainable energy resources management programs specifically designed to meet the growing need for ethanol and bio-diesel production workers and managers. Given the diverse nature of bioscience industries, community college programs vary considerably depending on what types of industries are located within their districts. Iowa Central Community College (ICCC) offers an industrial laboratory technician program to meet the needs of Fort Dodge Animal Health and other pharmaceutical companies. The program emphasizes Good Manufacturing Procedures (GMP) and Good Laboratory Procedures (GLP) that are important to the pharmaceutical industry (rather than fermentation processes important to bio-fuel industries).[10]

While these programs cater to local industries, most two-year technician programs labeled "biotechnology," "bioprocess," or "industrial laboratory" have at their core a similar base of academic courses (e.g. biology I and II, chemistry I and II, microbiology, molecular biology, organic chemistry or biochemistry, and genetics in addition to basic English/math general education courses). While there is some variation, the science background offered with these programs appears similar. The variation that does exist is partially related to variation in local industry needs (e.g. Western Iowa Tech Community College's biotechnology program emphasizes molecular biology because of protein/gene research in the Sioux City area). Individual programs also vary in the proportion of credit hours earmarked for science background courses and applied technical courses. While IHCC's bioprocess technology program is very industry-oriented with a high percentage of courses designed to provide technical skills (no biology II or chemistry II and most

[9] Battelle.

[10] Information about individual community college's bioscience-related programs, efforts and happenings were collected from college websites, Iowa Dept. of Education Shaping the Future Report (available online at: http://www.state.ia.us/educate/ccwp/cc/reports/stf04.pdf), IHCC pamphlets and other literature, and correspondence with deans/program coordinators involved with bioscience-related programs at individual community colleges.

science courses are "applied" science), Des Moines Area Community College's (DMACC) biotechnology program appears to have a high percentage of credit hours earmarked for courses designed to teach scientific principles (with fewer courses for hands-on technical skills such as equipment maintenance).

Most of the variation between programs appears to be in the content of required technical courses. Western Iowa Tech's program includes a pair of four credit biotechnology courses that focus on genomics and proteomics. Iowa Central's program includes a pair of biotechnology methods courses focusing on laboratory methods and GMP/GLC regulations (though industrial processes such as fermentation are also discussed). The bioprocess technology program at Indian Hills is the most industry-oriented with courses in ethanol/bacterial/fungal fermentation, quality management, process control, and industrial maintenance. As with all certificate programs, bioscience-related certificate programs involve less coursework (in both science and technical areas) than associate degree programs.

The programs also vary in the area of work-based learning components. While some programs are entirely school-based and do not require internships (e.g. Western Iowa Tech's biotechnology AS program), others require a large portion of total credit hours to be spent on training at local companies. Ellsworth Community College's (Iowa Valley Community College District) biotechnology program includes 15 credits of co-op field experience (supervised on the job training). Other AS programs appear to have about 3-4 credits earmarked for internships in their fourth semesters (e.g. Des Moines Area's biotechnology AS program).

In addition to credit programs, community colleges are also offering noncredit training (or retraining) to workers in emerging biotech industries. IHCC offers partial day and multi-day workshops on a variety of industrial biotechnology topics at the Iowa Bioprocess Training Center in Eddyville. Iowa BioDevelopment (an IHCC outreach program) offers area industries customized needs assessments, job analyses, and training programs.

It is important that workers be trained for positions likely to become available in their area and that the size of credit biotechnology programs (in terms of enrollment) not exceed projections for industry needs. While many skills students learn are transferable to other related sectors (e.g. chemical processing/manufacturing), this may not be the case for all skills. If biotechnology-related jobs are not anticipated in a given area, it may not make sense for colleges (especially small ones) to invest in expensive two-year biotechnology AS or AAS programs.[11] A July 2004 statewide biotech training needs assessment completed by Indian Hills Community College for the Iowa Department of Economic Development found that in more than half of the community college districts there was only one biotech company or none whatsoever.[12] The Battelle report notes that

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[11] Dahms. (specifically "Commentary: Industrial Biotechnology Education: A Model of Collaboration between Industry and Academia). Dahms suggests such programs are only warranted in industry clusters and even then with only 10-30 graduates each year. He also argues that significant industry support in the form of donated equipment, management time, and facilities is required.
"Signs of Life: The Growth of Biotechnology Centers in the U.S." Joseph Cortright and Heike Mayer. The Brookings Institution Center on Urban and Metropolitan Policy. Available online at: http://www.brookings.edu/dybdocroot/es/urban/publications/biotech.pdf

[12] The 50-company biotech training needs assessment was completed by IHCC for the Iowa Department of Economic Development. However, the methods used in the survey involved community colleges reporting

"a critical mass of customers is needed to justify the investment [into a customized bioscience vocational program]."[13] Instead, it may be appropriate for these colleges to offer biology/chemistry programs designed for transferring to four-year institutions or "shared" programs with other community colleges. It may also be appropriate for certain colleges to become bioscience hubs (training technicians for the industry or providing additional training to individuals with baccalaureate degrees needing practical/hands-on experience) while others focus on other potentially emerging industries within their districts. The Battelle report seems to support such an arrangement stating community college students could learn general coursework at their host college then transfer to the Eddyville Biotech Training Center for more complex core courses.[14] In the future, it is likely community colleges will partner with each other to offer their students access to various bioscience programs (possibly following an IHCC model). It may be possible to further expand IHCC's pilot program to other areas of the state with three to five community colleges acting as bioscience hubs and partnering with the remaining 10-12 colleges. Each hub could potentially focus on specific bioscience/biotechnology fields.[15] Community colleges may also wish to investigate reciprocal agreements with similar institutions in adjacent states (such as Southeastern Community College does to offer Iowa students opportunities in medical imaging programs offered at an Illinois community college).

This highlights the importance of partnerships. The community colleges with biotechnology-related programs appear to have partnered closely with local industry for curriculum development and internships.. DMACC partners with seven companies for its biotechnology program and ICCC's industrial laboratory technician program has a close relationship with Fort Dodge Animal Health. The active participation of industry in work preparation programs allows educators to better meet industry needs and enhances the competitiveness of graduates in the labor market.[16]

The colleges have also begun partnering with area high schools as suggested by the Battelle report.[17] Kirkwood Community College is creating science-oriented Career Edge academies in five high schools. Hawkeye Community College (HCC) is working to develop a 2+2 biotechnology career academy with area high schools. One barrier to the creation of career academies is the need for high school instructors to have advanced degrees in their field for program articulation. Since bioscience degree holders are already in high demand, finding instructors with advanced degrees is challenging.[18]

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biotech companies within their areas. Some community colleges did not report or underreported (e.g. ICCC had reported no biotech companies within their merged area but the Iowa Biotechnology Association reports companies such as Wyeth division and veterinary pharmaceutical maker Ft Dodge Animal Health is located there) and many companies opted not to participate. Additionally, no attempt was made to project future training needs (the presumption is that the industry is growing).

[13] Battelle.

[14] IHCC is currently working on putting together the "shared" program.

[15] For example, one bioscience hub could focus on bioprocessing while another could focus on the substantively different training needs of pharmaceutical manufacturers. The Biotech Training Needs Assessment confirms that there is significant variation in the training needs of the state's diverse group of biotech companies.

[16] Dahms.

[17] Battelle.

[18] A program designed to encourage high school biology/chemistry teachers to get masters degrees would be valuable.

DMACC, ICCC and WITCC have also made attempts to reach out to high school students to spur their interest in biotechnology and related industries.

It seems possible for community colleges to increase bioscience-related professional development opportunities to high school science teachers as well.[19] Eastern Iowa Community College District has offered several biotech workshops in cooperation with ISU faculty and Monsanto. IHCC partners with its local area education agency (AEA) to provide fermentation-related bioprocess workshops for high school educators. DMACC has provided biotechnology teacher workshops in conjunction with Project SEMI. DMACC reported that while few community colleges offer professional development opportunities to K-12 teachers, many colleges are interested and willing to provide the service. Because of the high cost of laboratory space and equipment, community colleges might better serve teachers' (particularly high school science teachers) professional development needs in this area than other institutions. The distribution of community colleges throughout the state may make it easy for teachers to access workshops and other opportunities. The potential also exists for community colleges to work with high school guidance counselors to highlight emerging bioscience career paths (helping to fill a gap cited by the Iowa Biotechnology Association). IHCC and DMACC have already begun this process.[20]

Partnerships are also growing between community colleges and the state's public four-year universities. Some of the biotechnology-related associate degree programs and many courses of other programs are transferable to four-year institutions. DMACC's biotechnology program is articulated with UNI's biotechnology B.A. program (a 2+2 arrangement). The Battelle report suggests the eventual goal should be seamless 2+2+2 programs (integrated from high school, through two year programs, to baccalaureate programs).[21] HCC appears to be heading in this direction with plans for biotech career academies, a biotechnology AS degree program, and articulation of the two-year program with UNI's biotechnology program. The new biotechnology program at UNI is a starting point for articulation of most community college biotech-related programs, although many program coordinators and deans are not aware of its existence. Additionally, with the highly practical nature of some courses (and skills required by local industries), articulation may not always be possible with all institutions and programs. UNI reported that more standardized programs such as DMACC's biotechnology program are easier to articulate than programs tailored to specific jobs such as the bioprocessing program at IHCC. In cases where articulation is problematic, as many courses as possible should be articulated (especially general science courses). As program and course articulation is improved, it is critical that community colleges make these transferable courses as rigorous as the corresponding courses at the Regent Universities, so students entering challenging four-year science programs are prepared.

A small number of community colleges may wish to consider recruiting recent graduates of four-year biology and chemistry programs for short post-baccalaureate certificate programs. Often, recent four-year graduates lack on-the-job skills and are unable to meet employers' needs. These graduates sometimes become unemployed or

[19] The Biotech Training Needs Assessment report recommended increasing the number of biotechnology professional development opportunities for K-12 teachers.
[20] IHCC's workforce training needs assessment.
[21] Battelle.

underemployed or change careers entirely. This had led a number of community colleges in other states to form "baccalaureate retread" training programs.[22] These continuing education programs are often short industry-oriented certificate programs (designed to provide practical training) and can also be used to meet area industries' retraining needs.

[22] Dahms.
The biotech workforce needs assessment recommended that community colleges begin actively recruiting underemployed four-year college graduates for biotech-related certificate programs.

Bioscience/Biotechnology Focus Groups

The Bioscience/Biotechnology Focus Groups funded by the Iowa Department of Education and hosted by various community colleges around the State, were held to discuss the capacity of Iowa's educational institutions to meet Iowa's current and future bioscience/biotechnology workforce. Individuals invited to these focus groups were:

- Secondary science teachers
- Community college bioscience and biotechnology instructors
- High school and community college administrators
- University science teacher preparation program representatives
- University & college bioscience and biotech program instructors & administrators
- Representatives of Iowa's biotech industries and employers
- Department of Education Pre-K-12 and Community College administrators and consultants
- University/College researchers in cutting edge bioscience and biotech-related areas which have the capacity to influence the future economic development

On average, 40 individuals attended each group; the emphasis of the focus groups centered on the preparedness of high school graduates to enter and to be successful in post-secondary bioscience/biotechnology programs, and how to encourage young adults to pursue careers in these fields. Secondly, employers were asked to help identify the skill sets needed of their employees. Third, the groups looked at the capacity of our post-secondary institutions to deliver in-service opportunities to high school science teachers in the "new" work of science.

Therefore, the groups had the opportunity for educators to talk with area business representatives, and to receive information about what the hosting community college is doing in the area of bioscience/biotechnology. The focus group initiated discussions about program linkages and professional development possibilities for faculty at both the high school and community college levels.

These focus groups specifically dealt with the **Battelle Report Strategy Four** under Strategies and Actions and have begun the process of implementing them.

Strategy Four: Invest in and develop Iowa's bioscience talent pool.

- **Improve K-12 scientific education by focusing on stimulating interest among Iowa's children in science, thereby preparing them for careers in Iowa's growing bioscience sectors.**
- **Develop a bioscience vocational career education program and ensure seamless delivery between secondary and community college programs that serve Iowa's growing concentration of bioscience employers.**
- **Streamline bioscience articulation agreements within and between community colleges and Iowa's regent universities to allow students to transfer credits between academic institutions.**

Outcomes of Focus Groups

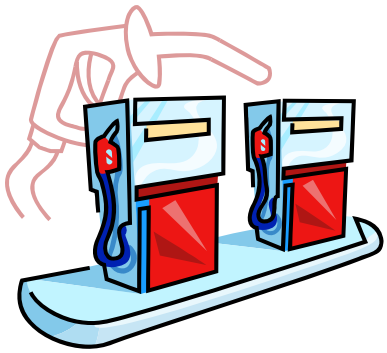
There were six focus groups hosted by the community colleges during the 2005-2006 academic year. The following colleges hosted: Indian Hills Community College (Ottumwa), Western Iowa Tech Community College (Sioux City), Eastern Iowa Community College District (Davenport), Kirkwood Community College (Cedar Rapids), Iowa Lakes Community College (Emmetsburg), and Des Moines Area Community College (Ankeny). Each Focus Group reinforced there is no one definition of Bioscience/Biotechnology in the State. Therefore, it allows the different regions of the State to form the definition for their region to meet the needs of the area. It also allows for variance between the community colleges in terms of programs offered. There were common themes which emerged across the Groups. Those common to the discussions were:

- People participating had "aha!" moments and wondered out loud why there had not been more communication across the educational levels (secondary schools, community colleges, and four-year institutions) in looking at learning comes, subject materials and curriculum.
- The Groups kept reaffirming that one model does not fit all industries. Even though this group of industries may be put under the general category of "biotechnology", the industry needs to vary across the State. Curricula cannot just be copied among the colleges in meeting the needs of a particular region of the State.
- Both community college and four-year institution faculties were willing to assist their secondary counterparts in aligning expectations to make programming more seamless and expressed a willingness and eagerness to make programming more seamless. There was also a willingness stated to explore program options and curriculum revisions.
- While the coupling of mathematics to the study of science and that mathematics are the foundation for research, was most heavily discussed at the Western Iowa Tech Focus Group, this issue came up in several of the other Groups.
- A related topic for industry representatives was the issue of dealing with regulations. Whether it was local, state, national, or international regulations, industry representatives stated that having employees willing to work with and be knowledgeable about regulations was important.
- The last common comment across the Focus Groups was that the meetings were a good first start, but that the conversations needed to continue with all the different educational levels and industry involved in further talks.



Quantifiable outcomes from the Focus Groups:

- Three of the colleges utilized input from the groups as part of their review process for current biotechnology programs
- Three of the colleges planned to utilize input from their focus group in establishing a biotechnology program for their college.
- Industry representatives from all six focus groups discussed the importance of math/science in employee preparation.
- Industry representatives from all six focus groups discussed the needed “soft skills” for employees (i.e. communication skills, computer applications, ethics, problem solving, critical thinking, teamwork)
- Educators at each of the six focus groups plan to continue their discussions across the three levels in working on bioscience/biotechnology curriculum.



Bioscience and Biotechnology Community College Incentive Grants

In the Iowa Department of Education funded bioscience/biotechnology focus groups around the State, the groups attempted to start a dialogue among high school, community college and four-year institution faculty and administrators and Biotechnology Industry Representatives and Employers on what should be taught concerning bioscience/biotechnology. To further this joint planning and alignment activity among the three educational levels, the Iowa Department of Education offered a grant opportunity thru a reserve fund established with federal Perkins Vocational Education funds to support development of programs related to the State's "targeted" biotechnology industry. The grants are to the community colleges for assistance with the expansion of these dialogues and their outcomes throughout the State. The intent was to prepare students for a seamless transition through multiple levels of education in science (secondary to community college to 4-year institution) and to aid employers in determining current and future skill sets needed.

In a recent survey conducted of educational institutions (Fall 2005) by the Iowa Department of Education, professional development opportunities in bioscience/biotechnology are offered piecemeal to K-12 teachers in the State. There are data to support that there are a variety of methods being used to provide professional development opportunities in bioscience/biotechnology, but there is a need for an on-going dialogue among high school, community college and four-year institutions on what should be taught concerning bioscience/biotechnology.

Fifteen Community College Incentive Grants, $5,500 each, were awarded in April 2006. For the colleges, which hosted the six focus groups, the grant for them is to continue the process their institution has started in biotechnology discussions. For the other colleges, the purpose is to begin the process. The colleges will report back to the Department on their grant activities during the grant time period, which ends in September 2007.

Summary of Each Community College's Bioscience-Related Programs and Efforts[23]

At Northeast Iowa Community College:

- An introduction to biotechnology course is offered focusing on DNA-related emerging technologies.
- The college offers several agriculture courses that involve biotechnology including agriscience, animal genetics, animal breeding and reproduction, artificial insemination, swine reproduction and management, and dairy nutrition.
- The college offers enology and viticulture programs involving cultivar selection, fermentation, and other related processes through its partnership in the VESTA consortium. VESTA (Vitculture and Enology Science and Technology Alliance) is a partnership of two-year colleges, universities, vineyards, wineries and state agricultural agencies with a 21st Century vision for education in grape growing and winemaking.
- NICC offers several health programs that may be of interest including an electroneurodiagnostic technology program (AAS) that trains students to work as technologists recording electrical activity in the brain/spinal cord/etc.
- Health career academies have been created through partnerships between NICC and several area high schools.
- The College recently surveyed the biotechnology businesses and organizations in the region to explore career possibilities and employer training needs.

Northeast Future Plans

- NICC has been in discussions about moving forward with a biotechnology-related program within the next year (potentially with a related career academy), including coursework related to biofuels and biofuel production.

[23] Resources used in compiling this inventory include: individual community college websites, Iowa Dept. of Education Shaping the Future Report (available online at: http://www.state.ia.us/educate/ccwp/cc/reports/stf04.pdf), IHCC pamphlets and other literature, and correspondence with chief academic coordinators/deans/program coordinators involved with bioscience-related programs at individual community colleges.

At North Iowa Area Community College:

- For those students wishing to transfer to four-year bioscience programs, NIACC offers a strong biology curriculum.
- NIACC students may transfer into Indian Hills Community College's bioprocessing program or the medical laboratory technician program at Hawkeye Community College.
- NIACC's continuing education division is involved with training at the Golden Grain ethanol plant in Mason City and the Iowa Ethanol plant in Hanlontown with training focused on the improvement of plant operations and financial performance through the application of lean manufacturing processes and courses in plant and equipment maintenance.
- Strong K-12 partnerships are used to ensure that students receive a solid foundation in science before they enter college and that teachers are prepared to provide that background.
- NIACC is helping to prepare elementary school teachers for math and science instruction.
- The college participated in an NSF-funded project to strengthen math and science teacher preparation. During the 2005-2006 academic year, math and science faculty at NIACC will pilot a learning community that combines math and science instruction for elementary school teachers. The college also delivers college-level science courses at area high schools through its school partnership program.
- The agriculture curriculum includes bioscience applications such as embryo transfers in cattle, piloting genetically modified crops, the use of gene marker technology, and more. During the 2005-2006 academic year, the curriculum incorporated new bioscience exploratory labs (e.g. green fluorescent protein chromatography).
- The college's agriculture division recently co-sponsored several workshops with Iowa State University to expose producers and students to biotechnologies.

North Iowa Area Future Plans

- North Iowa plans include building off of its strengths in manufacturing technologies and biology by creating a bioprocessing technology specialization within its industrial technology AAS degree program. This program will be designed to support the needs of multiple local biotechnology manufacturing companies in the areas of ethanol production and animal pharmaceuticals. Students will take a core of courses in manufacturing fundamentals, such as manufacturing processes, fluid power, and electrical concepts, before taking courses in their emphasis area of bioprocessing technology. An industry expert will teach the bioprocessing component of the program.

At Iowa Lakes Community College:

- A Biomass Energy Processing program began Fall 2005. The two-year program focuses on preparing technicians to successfully transition to work as a process operator at an ethanol plant.

- Students in the Emmetsburg-based program will be instructed to use the latest techniques for producing alternative fuels such as ethanol and soy diesel and the program may later be expanded to include other fuels such as methane and hydrogen.
- It is likely that instructors will be shared between industry and the biomass program.
- Career academy opportunities are being planned for on-campus delivery.
- A sustainable energy resources management program is a two-year career option program designed to train managers for renewable energy businesses and industries.
- NSF funding is being sought for the program to disseminate knowledge and create (re) training opportunities.
- Growth in enzyme technology is affecting agriprocessing and will need to be expanded in the future.
- Area industry professionals and educators met to identify a list of core academic and skill competencies important for technicians. Preliminary findings include: Awareness that a curriculum in biotechnology will require a **substantial science background**; that students will need to prepare for a career in the field **early**; and that **family awareness and support** of Biotechnology career opportunities are vital for sustained growth of the number of students continuing science and math education
- Non-credit courses are also being considered.

Iowa Lakes Future Plans

- The College will partner with Biotechnology Education Outreach Center to provide faculty training in this emerging area for secondary life and agriculture science instructors in Iowa and Minnesota.
- The College is awaiting final notification of a National Science Foundation Advanced Technology Education Grant designed to support collaborative Biotechnology curriculum development and dissemination. **Note: Iowa Lakes was notified on June 26, 2006, that the College had been awarded the grant.**
- The College will replicate the process used in the Bioscience Focus Group (April 2006) to develop industry specific skills matrixes through a series of industry-driven discussion forums.

At Northwest Iowa Community College:

- Northwest offers transferable introductory chemistry and biology courses.
- The NCC Business and Industry Center, in partnership with the Iowa Corn Promotion Board, created the Ethanol Technical Servicing Project in 1996. The project works to expand the use of ethanol through educational activities.
- The college has offered training opportunities for area ethanol businesses on a case-by-case basis.
- Continuing education training is held annually for water and wastewater system operators.
- Northwest received a $1.7 million Community-Based Job Training Grant from the Department of Labor to develop and deliver an education program to provide trained lab technicians for industry in the fields of life science, value added agriculture, and environmental protection. Industries to be served include: wastewater/water

treatment, animal pharmaceuticals, medical lab technician, animal genetics, food production, ethanol and biodiesel.

- The College's training grant is aimed at addressing the needs identified by multiple industries.

Northwest Future Plans

- The College is investigating offering a biotechnology credit program (probably a laboratory technician program with options for emphases in either medical or ethanol areas), but currently no bioscience programs or courses are available and planning for the new program is in its early stages. However, some general science courses (e.g. microbiology, biology, chemistry) have biotechnology or related units within them.
- In the future, NCC may partner with IHCC to offer continuing education courses to area ethanol companies.
- The College plans to work with four-year institutions (i.e. Iowa Regent Universities, Dordt College) in allowing students in the program to transfer credits into a Bachelor's degree related field.

At Iowa Central Community College:

- ICCC offers a Biotechnology Program and Biofuels Technology Program. Each of these programs are full two-year AAS degree programs.
- The Biotechnology Program focuses on GMP/GLP and analytical procedures.
- The Biofuels Program addresses two main facets of biofuels production; production operations and product analysis.
- The Biofuels Program was created with direct input from area industries such as West Central (biodiesel), Hawkeye Renewables (ethanol), and VeraSun (ethanol) and was specifically designed with industry needs in mind.
- The two programs have 17 to 18 students enrolled in them with enrollment evenly split between the two programs.
- ICCC has developed an "early bird" biotechnology course to be offered as a contracted course to area high schools. While not a career academy, the course is offered at seven partnering high schools to spur students' interest in biotechnology and raise awareness about emerging career opportunities.

Iowa Central Future Plans

- ICCC is collaborating with the National Corn-to-Ethanol Research Center and ISU (and others) on a NSF-ATE grant to create a biofuels training consortium.
- ICCC is working with Storm Lake, Jefferson-Scranton, and Webster City on career academies.

At Iowa Valley Community College District:

- Created a "first in the State and one of the first in the nation" articulated A.S. college parallel-career option biotechnology program (AS) at Ellsworth Community College.

- A one-year biotechnology practitioner diploma program is offered providing students with the option to transfer their credits into the two-year biotechnology or laboratory technology program.
- The practitioner program is designed to provide training for technicians in genetic engineering, monoclonal antibodies, tissue culture, enzymology, fermentation, and embryo transplants. The associate degree program has additional coursework and a total of 15 credits of supervised on-the-job training.
- Graduates of the AS degree program may transfer to Iowa State University and major in agronomy (with a biotechnology option) or veterinary medicine or transfer to similar programs at other colleges.
- IVCCD closely partners with local industries and students participate in internships with industries around the state.
- The College is working on creating new industry partnerships to meet the needs of the growing ethanol industry.
- The college has received 2 years of ACE funding towards building a Renewable Energy building.
- The college is looking into starting vocational courses in molecular biology, protein technologies, and ethanol production processes.
- NSF funds are being sought to expand the college's biotech program and its partnerships with K-12 institutions.
- A laboratory technology program is exposing students to opportunities in food technology, agriculture technology, pollution control technology, and chemical technology.
- Graduates of the program are expected to work as production technicians, research technicians, quality control technicians, pollution control technicians, technical service personnel, and related supervisory positions. Students are given the option of specializing in biotechnology, veterinary assistant, agriculture technology, chemical technology, and environmental technology.

Iowa Valley Future Plans

- The college is in the process of articulating the AS program with UNI's biotechnology BA program.
- A Renewable Energy Technology track is being added for Fall 2006.

At Hawkeye Community College: Fall 2006

- Has developed an associate degree program in biotechnology with both career and college parallel options. The program educates students about biotechnology fundamentals and broad-based industry-specific skills (e.g. courses in genetic engineering, polymerase chain reaction methods, bioinformatics, government regulations).
- Graduates will be prepared to work in the biotechnology industry as entry-level technicians in bioinformatics, biotechnology, and analytical protein chemistry or to transfer to baccalaureate programs in bioinformatics, biotechnology, and related fields in biology.

- Students will grow microbial plant, animal and mammalian cells, recover their DNA and proteins, and analyze these macromolecules while following Good Manufacturing Practices (GMP, critical to pharmaceutical manufacturers).
- HCC is planning 2+2 tech. prep. programs (career academies) in biotechnology utilizing partnerships with area high schools located in Waterloo and potentially Cedar Falls.
- HCC is developing a 2+2 articulation agreement with UNI's biotechnology baccalaureate program, giving students the option of continuing their education in Cedar Falls.[24] The goal is to create a seamless 2+2+2 arrangement as recommended by the Battelle report.
- HCC is planning to establish a technical assistance center at the Cedar Valley Tech Works (a facility that will research, produce and showcase biotech products such as soy-based industrial lubricants developed at UNI) that will provide specialized technical assistance to biotech-related businesses in the Cedar Valley and establish an interface with Tech Works' portal program to offer college services through "webinars." Once complete, the Tech Works facility is expected to hire some HCC biotech graduates and provide internship opportunities for high school and college students in the area. It was noted that continuing education courses and workforce development training would be offered at the facility as some college operations phase in over the next year.

At Eastern Iowa Community College District:

- The college partners with Mississippi Bend AEA and 20 high schools in the Eastern Iowa Agriculture Learning Cooperative.
- The cooperative facilitates program articulation and professional development for high school ag. teachers.
- Project Lead the Way, a pre-engineering program, has recently expanded to more high schools and several 2+2 career academies have been developed in areas such as health.
- An NSF Grant funded the NewVentures AgTech Initiative created to investigate emerging technologies and evaluate their potential for local commercialization. Collaborating with the NewVentures Initiative, a privately funded non-profit organization dedicated to accelerating the startup of tech-driven companies, the partners hope to make eastern Iowa a hub for innovation by connecting entrepreneurs with capital, markets, and business expertise.
- EICC has served as the home for the NSF-funded Advanced Technology Environmental Education Center (ATEEC) for the past 11 years.

[24] Students take introductory science courses at UNI to ensure they receive a complete sequence of freshman and sophomore science classes, increasing the likelihood of them graduating in four years.

Eastern Iowa Future Plans

- Investigating programs in biotechnology and bioprocessing.
- There are two proposals are in the works – one with the National Science Foundation (NSF) for a biotechnology certificate program and the other as part of a Department of Labor proposal for a bioprocessing degree program.
- The certificate program would provide students with basic laboratory skills and some bioprocess control training.
- The AS degree program would provide bioprocessing skills needed by area industries such as GPC and Monsanto but would likely be more general (less fermentation-focused) than IHCC's program. If grant funding is received, the programs will likely be housed in the new 37,000 square foot John T. Blong Technology Center (home to a number of industry-oriented credit and noncredit classes and programs) in Davenport.
- EICCD is partnering with high schools to provide students additional opportunities.

At Kirkwood Community College:

- Opted to train students seeking four-year degrees in biotechnology by offering a transfer program. Students completing the program transfer to four-year institutions with B.S. programs in biology with emphases in biotechnology.
- The transfer program was created eight years ago in collaboration with regional biotechnology and bioprocessing companies.
- Ongoing discussions with industry will lead to additional programs of study.
- Significant numbers of technicians trained in basic laboratory skills and more advanced techniques in forensics, medical, quality control, and biotechnology labs are increasingly needed by regional industry.
- Technicians trained to monitor and control bioprocesses (e.g. fermentation used in ethanol production) are in demand and the demand appears to significantly outstrip the current production rate of graduates in nearby programs such as the bio-processing program at IHCC and the medical technology program at the University of Iowa.
- Multi-million dollar National Science Foundation grant to create and operate AgrowKnowledge, the National Center for Agriscience and Technology Education. The center is a national partnership of community colleges with business and industry, leading universities in agriculture education, secondary schools, and professional associations. AgrowKnowledge understands the increasing demand for high-tech careers in such areas as biotechnology, alternative energy production, precision agriculture, natural resource management, and nutritious food production. As a result, AgrowKnowledge partners better prepare students to use emerging technology.
- Kirkwood is the recipient of an NSF $500,000 STEP grant to increase the number of students majoring in Science, Technology, Engineering, and mathematics (STEM). Partners include Kirkwood, public schools in the Cedar Rapids/Iowa City metro area, Grant Wood AEA, Women in Science and Engineering (WISE), and local industry. Grant activities are supporting the creation of seamless STEM pathways from high

schools to area colleges and universities. High schools will use Career Edge Academies to recruit, support, and motivate students to pursue STEM majors in college. Students will explore future career possibilities, academic programs, and personal characteristics needed for success. The program will also engage high school teachers in professional development opportunities. Five metro schools have joined in the discussions so far (with plans to create science academies by 2006-2007), but the College expects additional schools to be added as supplemental funds become available.

- Career Edge Academies will compliment existing 2+2 programs in several applied science fields of study.

Kirkwood Future Plans

- New programs options will likely include crop genetics, animal genetics, fermentation, medical technology, forensics, and quality control and will be added to the existing core of science and agriculture courses.
- Future STEM academies may include biotechnology, engineering, pre-medical professional, environmental science, and forensic science. Dual Enrollment will be an option for students who wish to get early exposure to specific disciplines not currently part of the high school curriculum. Such courses may include microbiology, introduction to biotechnology, or Project Lead the Way pre-engineering courses. Other programs potentially of interest include environmental technology (college parallel), water quality and wastewater technology (career, articulated), various health programs (including career academies), and continuing education courses.

At Des Moines Area Community College:

- Has partnered with its local area education agency, several area industries, any high schools, the University of Northern Iowa, and Iowa State University to expand opportunities for students in the growing biotech areas.
- DMACC offers an A.S. biotechnology program designed to prepare students to work as biotechnology technicians in research and development, quality control, and manufacturing.
- Students are prepared for careers requiring skills related to the genetic engineering of plants or microorganisms, gene therapy, DNA fingerprinting, vaccine development, or the production of food/drugs/consumer products.
- Internships are arranged in cooperation with employers who serve on the program's advisory committee).
- A 2+2 agreement with UNI's biotechnology B.A. program (and biology B.A. program) was recently completed and most credits are transferable to other four-year institutions such as ISU.
- DMACC is partnering with Indian Hills Community College and the Iowa Biotechnology Association in a Department of Labor grant.
- While the college has agreements with 52 area high schools for the delivery of college credit offerings, biotechnology is not among DMACC's eight 2+2 career advantage programs.

- A pilot program for college credit courses in biotechnology are offered through a partnership between DMACC and East High School in hopes of drawing more minority students into the field of biotechnology.
- Project SEMI, in an effort to provide secondary education students in Iowa with biotechnology laboratory experiences (and recruit them into the sciences), offers a series of teacher leader workshops on topics such as horizontal gel electrophoresis to prepare teachers to use the Project SEMI lab and partners Integrated DNA Technologies and Pioneer Hi-bred have hosted similar workshops using their own curricula.
- A veterinary technology program is designed to train technicians to provide support for veterinarians and potentially biomedical researchers.

DMACC Future Plans

- A curriculum in the growing field of proteomics is being developed.

At Western Iowa Tech Community College:

- Developed a biotechnology program (AS) to train technicians needed in the areas of medicine, pharmaceuticals, environmental science, agriculture and forensics.
- Students are provided with a strong science background with basic courses in general biology, microbiology, general chemistry, and organic chemistry, and specialty courses in genomics, proteomics, and bioethics. While the program is academic in orientation, students learn technical skills such as how to use lab equipment, perform tests, prepare media/reagents, calibrate/maintain equipment, maintain documentation on lab protocols/procedures, collect/analyze/report data, and perform laboratory tasks related to DNA technology and protein chemistry.
- The college has applied for approximately $400,000 in federal funds for bioscience lab equipment and recently received a $49,000 grant for a DNA genetic sequencer.
- A summer biotech institute was held in early June 2005 for high school girls who have finished a year of high school biology and chemistry. Participants gained experience in DNA extraction and fingerprinting, bacterial transformation, polymerase chain reaction, protein purification and analysis, and bioinformatics. A Gender Equity Grant from the Iowa Department of Education funded the program.
- WITCC offers an A.A.S. biomedical equipment technology career program in which students are trained to interpret schematics and wiring diagrams of electronic equipment used in hospitals.

Western Iowa Tech Future Plans

- WITCC is currently developing a 2+2 agreement between its biotechnology AS program and UNI's four-year biotechnology program. The college is also developing partnerships with area high schools to offer college credit courses to their students.

At Iowa Western Community College:

- Biological sciences and chemistry AA programs. Students completing the programs are expected to transfer their credits to similar life sciences programs at four-year institutions.
- The curricula consist primarily of biology, chemistry, anatomy/physiology, physics and math courses (i.e. not career-oriented technical courses).
- A microbiology transfer (AA) program is also offered providing students with the opportunity to take their first two years of a four-year microbiology program at IWCC before transferring to Iowa State University.

At Southwestern Community College:

- Chemistry, biology, a course in biotechnology, math and other bioscience-related courses are offered, but SWCC currently does not have any bioscience/biotechnology program.
- SWCC has made investments in science facilities to support courses in chemistry and biology but this was done primarily to enhance required courses for the nursing program.

At Indian Hills Community College:

- The college offers an articulated bioprocess technology degree (AS) program (career option and college parallel) and a 21-month ethanol plant technician (AAS) program.
- The bioprocess technology program teaches students to apply scientific principles and technical skills in support of biosynthesis and fermentation in research and industrial settings.
- 8-12 students graduate annually with greater than 95% finding employment with local biotech companies.
- The ethanol plant technician program focuses on ethanol fermentation and distillation processes with instruction in electronics, process control, lab techniques, digital fundamentals, and high-level equipment maintenance and analysis.
- IHCC offers a 21-credit hour process control certificate program which is closely linked to the bioprocess technology degree program.
- The college operates the Iowa Bioprocess Training Center near Eddyville and closely partners with several area bioscience companies and related industries.
- Utilizing a grant from the National Science Foundation and in cooperation with Iowa State University, IHCC has developed a mobile virtual reality computer system to assist in instructing students about fermentation and other industrial processes.
- During the school year, the faculty host a number of public school field trips and Iowa BioDevelopment team members has provided supplies to 15 area middle and high schools to conduct presentations on corn milling, DNA extraction, fermentation (using the virtual reality system or CO_2 probes), and biotechnology career opportunities.

- IHCC's biotechnology programs are partially funded by a grant (one of only five awarded in the country) from the U.S. Department of Labor to develop new curriculum and training models for biotech workers. The college completed a statewide workforce training needs assessment of 50 biotechnology/bioprocessing companies in Iowa (funded by Iowa Department of Economic Development) in 2005 with the goal of using the data to expand training options throughout the state by offering its bioprocess technician program to other community colleges as a "shared" program.
- Currently, the college is seeking funding from business and industry through Accelerated Career Education programs to further build its career and technology-based programs. It is also seeking additional federal funding to build new programs in bioprocessing (biomanufacturing) technologies utilizing fermentation, cell culture, and other associated processes) and biocatalysts with the goal of being the state's premier biotechnology/bioprocessing workforce development institution.
- Through the Iowa BioDevelopment outreach program, IHCC provides statewide biotech and value added agriculture industries with affordable access to customized needs assessments and training programs. The non-credit programs (awarding continuing education units) include the industrial biotechnology continuing education program and a number of workshops ranging from a half day to five days. The workshops cover a range of topics including enzymes, introduction to molecular biology, ion-exchange chromatography, and much more. Technical assistance is offered to small and start-up companies to conduct research in their pilot facility. Iowa BioDevelopment has been designated as a National Center for Excellence in Biotechnology Workforce Training by the Department of Labor.

Indian Hills Future Plans

- Future presentations by Iowa BioDevelopment could include topics such as the making of biodiesel, corn chemistry, DNA forensics, and more.

At Southeastern Community College:

- Southeastern provides a biological science curriculum (including chemistry, organic chemistry, biology and microbiology courses) for AA students and allows emphases in biotechnology, clinical lab science, botany, microbiology, and zoology.
- SCC provides a biomedical option with its two-year electronics technology program.
- Transfer plans exist to provide students the option to further their studies at Iowa State University (BS industrial technology program), University of Northern Iowa (BA technology management), or Western Illinois University (BS manufacturing engineering technology).
- Southeastern Community College and Carl Sandburg Community College have a reciprocal agreement to permit Iowa students to attend classes at Carl Sandburg and Illinois students to attend courses at SCC at in-district, resident tuition rates allowing SCC students access to several radiological technology programs (with focus areas of magnetic resonance imaging, CT, and diagnostic medical sonography).

Southeastern Future Plans

- SCC is considering developing any new bioscience programs in partnership with IHCC. Such an arrangement would allow SCC students to take part in IHCC biotechnology-related programs.

Community College Faculty Involved In Bioscience Education

While instructors in bioscience fields are in high demand (especially in technical areas), Iowa's community colleges have been able to attract talented faculty, often with doctorate degrees. The following are brief biographies of some of the college faculty involved in bioscience instruction at the community colleges.

Photos have been included where available.

Brian Albrecht

Brian Albrecht, Chair of the Lab Technician Program at Northwest Iowa Community College, earned a M.A.T. in Science Education, a B.A. in Biochemistry, and a B.S. in Exercise Science from the University of Iowa and has been a faculty member at NCC since 1999. Before starting at NCC, he worked for a number of years as a research assistant at the University's Diabetes-Endocrinology Research Center. Albrecht also has worked on projects with the University's Department of Biochemistry and the University's Water Treatment Plant.

 **Jane Bradley**

Jane Bradley, Chair of the Biotechnology Program at DMACC, is a Ph.D. candidate at Texas A & M University and has done graduate work in Biochemistry and Biophysics at the University of Oklahoma. She began her post-secondary education at Seminole Junior College in Oklahoma where she received her A.S. Bradley has previously worked as a biology instructor at Seminole State College in Oklahoma and as a lab manager at the Oklahoma State University College of Veterinary Medicine.

Chuck Crabtree, Director of Iowa Biodevelopment at IHCC, earned his master's degree in Environmental Toxicology from Clemson University, Clemson, South Carolina. Crabtree's previous work experience (Texas Tech University) has primarily dealt with the effects of agricultural activities on environmental systems.

Dr. Dilip Dias, biotechnology instructor at Ellsworth Community College (IVCCD), is from Sri Lanka where he received a BS degree in agriculture from the University of Peradeniya, Sri Lanka. He came to the United States in 1985 and attended the University of Houston where he received his Masters degree. He continued his education at Texas A & M University and earned his Doctorate in Plant Physiology and Plant Biotechnology. He later worked as a scientist studying how plants tolerate drought stress before moving to Iowa in 1996 to take a position with Garst Seed Co. Dr. Dias joined the Ellsworth Community College faculty in December 2004.

Dr. Patrick Galliart, chair of the Natural Science Division and instructor of biological sciences at NIACC earned his M.S. and Ph.D in Zoology at Iowa State University. Since 1993, he has taught biological science courses at the college. Dr. Galliart has authored several scientific papers on insect behavioral ecology in peer-reviewed journals, instructor's manuals for anatomy and physiology textbooks, and a laboratory manual for anatomy and physiology labs.

Dr. Donald Heck, Program Coordinator for the Biotechnology and Biofuels Technology programs at Iowa Central Community College, earned his Ph.D. in Pharmacology from the University of Nebraska Medical Center. He also has completed postdoctoral research in the Department of Biochemistry, Biophysics and Molecular Biology at Iowa State University. He has taught and teaches a variety of biology, biochemistry, cellular biology and molecular genetics courses for Iowa State and Iowa Central. Since his start at Iowa Central in 2005, Dr. Heck has had close involvement with area industries, especially the biofuels industries, in custom-tailoring a degree program that trains students with the specific skills and expertise to work in the biotech and biofuels arenas. In addition to his teaching experience, he has numerous conference presentations as well as publications to his credit, which include refereed articles, book chapters, and abstracts.

 **Le Shawn Howard**

Le Shawn Howard, Business and Industry Trainer, Lab Technician Bioscience/Biotechnology Careers at Northwest Iowa Community College, earned her B.S. degree in Chemistry and Biology from the College of the Ozarks in 1997. Her industry experience includes quality control/assurance in dietary supplements and food manufacturing, qualitative and quantitative chemical and microbial analyses, research and development, method development, and laboratory safety coordinator.

 **Nihal Kassieh**

Nihal Kassieh, Bioscience Instructor at Northwest Iowa Community College, earned her B.S. degree in chemistry from Gardner-Webb University in 2002 and is a masters candidate at Iowa State University in bio-analytical chemistry and chemical education. She ran chemistry labs at Gardner-Webb University as well as served as a teaching assistant and adjunct instructor in chemistry at Iowa State University.

Dr. Suzanne Keller

Dr. Suzanne Keller, Project Assistant of Iowa BioDevelopment at Indian Hills, earned her doctorate in Microbiology from the University of Texas Health Science Center at San Antonio, San Antonio, Texas. Keller's previous work focused on pathogenic yeast and telomere regulatory proteins.

Dr. Paul Mayes, Department Coordinator of Science and Math at Muscatine Community College (EICCD), earned his Ph.D. in higher education and zoology from the University of Iowa in 1992. He has been involved with biotechnology education and staff development for middle and high school teachers since 1993. Dr. Mayes has also served as an instructor for Project BIO and Iowa State University's Biotechnology Program (including outreach efforts such as professional development for K-12 teachers).

Dr. Kamali Muthukrishnan, Department Chair of Science at WITCC, earned her Ph.D. in Bioscience from the Indian Institute of Technology in Madras, India in 1980. She received postdoctoral training at the University of Texas M. D. Anderson Cancer Center and University of Texas Medical School in Houston, Texas. She had also worked as the equipment coordinator for the Department of Biochemistry and Cell Biology at Rice University in Houston, Texas and with the University of Texas Southwestern Medical Center in Dallas, Texas. Dr. Muthukrishnan has been a faculty member with WITCC since 1998.

Eric Olson

Eric Olson, Instructor Bioprocess Technology and Ethanol Technician programs at IHCC, earned his B.S. in Biology with an emphasis in molecular biology at Northwest Missouri State University in Maryville, MO. Prior to teaching Olson worked for approximately 9 years at Fort Dodge Animal Health in R&D, SOP development, technician training, and bio-manufacturing. Olson was instrumental in the development of veterinary vaccines using bioreactors, microcarriers, and mammalian tissue culture.

Janet Paulson

Janet Paulson, Project Coordinator of Iowa BioDevelopment at IHCC, earned her B.S. degree in Food Technology with an emphasis in science from Iowa State University, Ames, Iowa. Prior to this position, Paulson worked for Cargill for about 10 years in quality control and research and development. Projects she has worked on included training lab personnel for a Cargill citric acid plant start-up in Brazil and helping with the piloting and plant start up of neutraceutical product for Cargill (glusosamine hydrochloride).

Dr. Greg Romig, Instructor in Biology at WITCC, earned his D.A. (Doctor of Arts) in Biology from the University of North Dakota. His previous teaching experience was at the Minnesota Academy of Mathematics and Science in Winona, Minnesota. At WITCC, Dr. Romig teaches Nutrition, Anatomy and Physiology, and Genetics.

Dr. Renee Romig

Dr. Renee Romig, Instructor of Chemistry and Biology at WITCC, earned her Ph.D. from the University of Nebraska Medical Center where she was a student at the Eppley Cancer Research Training Program in the Department of Biochemistry and Molecular Biology. She has over five years of high school and college teaching experience and has been teaching at WITCC since the fall of 2000. Prior to 2000, Romig taught at the Minnesota Academy of Mathematics and Science in Winona, Minnesota where she served as the Biochemistry instructor and later Director of Academics and Student Affairs. At WITCC, she teaches Nutrition, Organic Chemistry, Biochemistry, Biotech I (Genomics), Biotech II (Proteomics), and Issues in Biotechnology.

Dr. Suresh Tiwari, Dean of Arts and Sciences at HCC, earned his Ph.D. in Developmental Biology at the Australian National University in Canberra, Australia. Prior to becoming actively involved with community colleges, Dr. Tiwari was engaged in scientific research in cell, developmental, and molecular biology for over 15 years. He has authored over thirty scientific papers, invited reviews, and book reviews published in peer-reviewed, national and international journals. He is an active member of numerous professional organizations and has taught or worked as a researcher at numerous colleges and universities on four continents.