

# **Board of Regents, State of Iowa**

## **Request to Implement a New Baccalaureate Degree Program**

**Institution:** Iowa State University  
**Departments involved:** Computer Science  
Mathematics  
Genetics, Development and Cell Biology (GDCB)

### **CIP Discipline Specialty Title: Bioinformatics**

Title Definition: "Bioinformatics is a new discipline that deals with the research, development, or application of computational tools and approaches for expanding the use of biological, medical, behavioral or health data, including those to acquire, store, organize, archive, analyze, or visualize such data." BISTIC Definition Committee. NIH working definition of bioinformatics and computational biology. <http://grants.nih.gov/grants/bistic/CompuBioDef.pdf.July2000>.

**CIP Discipline Specialty Number:** 26.1103  
**Level:** Baccalaureate  
**Title of Program:** Bioinformatics and Computational Biology  
**Degree Abbreviation:** BS  
**Approximate date to establish degree:** July 1, 2007

**Contact person(s):** Marty Spalding, Chair, GDCB, [mspaldin@iastate.edu](mailto:mspaldin@iastate.edu), 515-294-1749

M. Duane Enger, GDCB, [mdenger@iastate.edu](mailto:mdenger@iastate.edu), 515-294-0320  
Drena Dobbs, GDCB, [ddobbs@iastate.edu](mailto:ddobbs@iastate.edu), 515-294-1112  
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Vasant Honavar, Computer Science, [honavar@iastate.edu](mailto:honavar@iastate.edu), 515-294-1908

### **1. Description of degree program:**

#### **a. Brief description and statement of objectives, outcomes and outcomes assessment.**

We propose the creation at ISU of an undergraduate major in Bioinformatics and Computational Biology (BCB). This major will prepare students for careers at the interfaces of biological, informational and computational sciences. Participation in this field requires that students achieve a high level of competence not only in biology, but also in mathematics, computer science, computer engineering and statistics. Few students currently achieve these competencies at the undergraduate level. Accordingly, most students that pursue graduate studies in BCB take remedial courses at the beginning of their graduate program. The majority of students matriculating in our undergraduate curriculum will seek admission to one of many excellent BCB graduate programs that now exist. They will stand out from other applicants in the breadth and depth of their preparation in both biological and informational/computational sciences. In this context, the desired outcome is that our BS graduates will compete successfully for admission to top PhD programs, and will begin graduate programs of study without having to take remedial (undergraduate) courses in

computational, mathematical or biological sciences. BCB BS graduates seeking direct employment will find ready markets for their talents in agricultural and medical biotechnology industries, as well as in academia, national laboratories and clinics. In this context, the desired outcomes are that graduates will compete successfully for technical positions, and that in these positions they will demonstrate an above-average ability to synthesize what they have learned to solve problems.

**b. Fit with institutional strategic plan and mission.**

The 2005 – 2010 ISU Strategic Plan points clearly to the Biological and Informational Sciences as central to the strengths and future of ISU, and the Battelle Report points to Bioscience as key to the economic future of Iowa. Further, it is important for ISU to continue innovation in undergraduate curricula to keep pace with demand and meet the needs of a changing economy and society.

**c. Relationship to existing programs.**

ISU currently has a commanding position in educational and research programs in plant and animal genomics. The proposed undergraduate major in BCB will not only benefit in a unique fashion from the presence of these programs, it will in turn strengthen and enhance these programs by providing BS-level bioinformatics trainees and graduates. We expect that graduates will step into key technical roles in ISU academic labs, in faculty biotech start-up companies, and in centers and resources such as the USDA Genome Maize Data Base. Further, establishment of this interdepartmental/interdisciplinary major will add to the already exceptional level of collaboration among ISU faculty in different departments and disciplines.

**d. Relationship to existing programs at ISU and elsewhere in Iowa. .**

ISU is uniquely positioned to offer a full-fledged undergraduate BCB program in that it will build on existing strengths in ISU's outstanding PhD program, which was established in 1999 as one of the very first in the nation. This program rapidly established its eminence - as demonstrated by acquisition of prestigious research and training grants and recruitment of outstanding students.

There is currently one Bioinformatics BS degree program in Iowa. This was established recently at UNI. ISU's program will complement theirs in preparing students for graduate study. However, it will differ in that it will function in the presence of externally funded programs of graduate education, research and development in plant and animal genomics. Increasingly, bioinformatics is an integral and essential component of these programs.

There is only one BCB BS degree program in a state contiguous to Iowa - University of Nebraska Omaha (UNO). In addition, Southern Missouri State has a Computer Science BS with a "concentration" in Bioinformatics, and there is one additional BS degree program in the Midwest (Michigan Tech). Among these programs only UNO offers both the BS and PhD in bioinformatics.

**e. Special institutional features and conditions.**

This new BS program at ISU will offer unprecedented opportunities for undergraduate participation in cutting-edge research through partnerships with ISU's L. H. Baker Center for Bioinformatics and Biological Statistics, its Center for Integrated Animal Genomics (CIAG), the USDA Maize Genome Data Base, and the Computational Intelligence, Learning and

Design Center. The presence at ISU of over 60 faculty in the BCB PhD program will offer unique opportunities for BCB undergraduate majors to participate in faculty research programs, and will provide an unusually large and powerful (existing) faculty base from which to draw instructors, mentors and advisers.

**f. Resources.**

Because of the prior establishment at ISU of a BCB PhD program and BCB centers, ISU already has resources more than adequate to support the major, thereby allowing establishment of the BCB BS program through reallocation of existing faculty, staff and facilities.

**g. Student demand.**

The current lack of BCB programs at the BS level nationally means that first, not enough students are adequately prepared for graduate study and second, that because too few adequately trained BS graduates are available, PhDs are often hired to fill technical slots that would otherwise be filled by BS graduates. Currently, many PhD candidates leave graduate school to assume positions that could be filled by BS graduates were enough available to meet demand.

**2. National workforce need and demand for graduates:**

Although there are currently fifty seven graduate programs in bioinformatics, there are only sixteen BS degree programs, six “concentrations”, one certification and two “options” that can serve to prepare students for graduate study or for the workforce in this interdisciplinary field. Correspondingly, there are relatively few BS bioinformatics graduates adequately prepared for work in the rapidly growing biological R&D establishment across the nation, and especially in Iowa. Although the Bureau of Labor Statistics projects that the bioscience sector will grow in concert with the economy as a whole, its growth in Iowa is greater. Furthermore, the Bureau projects that growth for BS and MS bioscience graduates will grow more rapidly than that for PhD’s. According to the Iowa Department of Economic Development, Iowa has a solid bioscience foundation upon which to launch new initiatives for growth. Currently this sector represents seven percent of Iowa employment. The average wage of an Iowa bioscience worker in 2002 was more than \$10,000 higher than the statewide annual wage. Because modern medical, plant, and animal bioscience R&D increasingly deals with complex systems and huge data sets, a bioinformatics component is more often than not essential to these efforts. Also, there are suggestions for more than average growth of the nation's bioeconomy sector. In California’s “Silicon Valley,” for example, biomedical/biotech venture capital investment now exceeds investment in information technology (both now exceed one billion dollars per quarter).

There has been a 100% success rate in obtaining the “preferred first job” on the part of graduates from the ISU PhD program in bioinformatics.

**3. Other institutions in Iowa with degree programs in bioinformatics: UNI (BS)**

**a. Ability of other institution to meet the need for the new program.**

UNI does not offer a PhD program in BCB, nor is it an institution with centers or training grants in bioinformatics.

**b. Consultation with representatives of other program.**

Kevin O'Kane, PhD in Computer Science was our initial contact at UNI. He indicated early on that their Provost had no objection to a BS in BCB at ISU. Also, a letter of support has been received from Dr. Eugene Wallingford, Head of the Computer Science Department at UNI, who notes that our proposed program "complements ours, with our program emphasizing the discovery and implementation of algorithms and tools, and yours emphasizing the discovery and application of biological knowledge". Also, he sees "many opportunities for interactions between UNI and ISU in relation to our program and your proposed program". This letter is attached.

**c. Possibilities for an inter-institutional program or cooperative efforts.**

Possible exchange of undergraduate interns and of mentoring for senior research projects will be developed and implemented depending on student/faculty areas of mutual interest. A collaboration with SUI exists already in the form of a funded summer training program, and UNI sees opportunities to share speakers, research programs and courses (see attached letter).

**4. Estimated numbers of students in the program.**

Enrollment projections are based primarily on enrollments in recently established programs. Ramapo (NJ) opened enrollment into their BS program in 2003. By 2005 they had twenty-five students enrolled. Michigan Tech projects an enrollment of 150. UCLA, one of the few institutions with both a BS and PhD in bioinformatics, limits enrollment in their Bioinformatics BS program to 50, and the number of pre-majors is limited to 125. Three years following inception of their program, University of Nebraska Omaha enrolled 50 in its undergraduate Bioinformatics major. We can also base an estimate on current ISU enrollment in specialty bioscience majors such as Genetics. This major currently experiences entry classes of fifteen to twenty five students. Based on these observations, we project an entry class of ten to fifteen students, rising to an entry class of twenty to thirty within four to five years.

**a. Projected enrollment of undergraduate majors, years one through seven.**

Yr1	Yr 2	Yr3	Yr 4	Yr5	Yr6	Yr 7
10-15	15-30	30-50	50-70	70-100	90-130	100-150

**b. Projected enrollment of graduate majors.** Not Applicable.

**c. Anticipated sources.**

Because so few BS programs exist in the Midwest, we expect to draw a relatively large number of students from states surrounding Iowa.

**5. Plans to offer the program off campus.** None.

**6. Review by campus committees and authorities.**

The proposed curriculum was developed by an interdepartmental committee composed of representatives from Computer Science (Vasant Honavar), Mathematics (Stephen Willson), Computer Engineering (Srinivas Aluru), Statistics (Karin Dorman), and Genetics, Development and Cell Biology (Drena Dobbs). Prior to submission to the College of Liberal Arts and Sciences, the curriculum was reviewed and approved by the faculties of

Mathematics, Computer Science, and GDCB. The faculty and chairs of Computer Engineering and Statistics also reviewed the curriculum and provided input that was integrated into the final proposal.

**7. Date of submission to ICCPHSE.**

**8. Accreditation.**

There are at present no accreditation sources or mechanisms.

**9. Articulation.**

Kirkwood Community College is implementing a two-year program in bioinformatics. The possibility of an articulation agreement with them will be explored through the ISU College of Liberal Arts and Sciences Dean's office.

**10. Sources of required faculty, facilities and equipment.**

Because there are over sixty faculty in ISU's PhD BCB program, new hires will not be necessary to initiate the BS major. Classrooms and computer labs will be needed to accommodate the few new courses to be offered. However, it is projected that existing facilities will be adequate to the need. Also, based on success to date in acquiring training grants in for the graduate program in BCB, the probability of attracting significant external funding for enhancing the BS major appears high.

**11. Likely new expenditures for establishing and maintaining the program, and sources of funds.**

Establishment of the program will require the addition, through reallocation, of a partial P&S position to coordinate student advising, recruiting, and placement. This reallocation will in large part be enabled by the 2003 elimination of the Zoology major (the staff person responsible for coordinating this major resides in GDCB). As the number of Zoology majors diminishes from pre-2003 levels of 100-125 to none, this position increasingly becomes available to provide student services for the BCB major. The position will be housed in one of the GDCB departmental offices, so its establishment will not create a need for additional space.

No new faculty positions will be required to establish the major. Dr. Marty Spalding, the chair of GDCB (a department with ten BCB faculty), has committed reallocation of faculty duties sufficient to develop and staff the new courses needed. This reallocation has been enabled by recent and pending hires of cell and developmental biologists as well as the phase-out of the Zoology major. These new hires will teach cell and developmental biology courses now taught in part by faculty who can teach new and existing BCB courses. Faculty previously engaged in the instruction of courses in the Zoology curriculum are now involved in instructing significantly fewer sections of these courses. Also, some of the previous Zoology listings have already been discontinued.

Therefore all staff, faculty and space resources required for implementation of a new major in Bioinformatics and Computational Biology will be provided through reallocation, and at the departmental level.

## 12. Total costs for a seven-year period.

a. **New costs:** None.

b. **Estimated value of reallocations** (based on \$100,000 per faculty, \$65,000 per staff FTE):

	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7
Year's total	\$100,000	150,000	200,000	225,000	250,000	275,000	300,000
Increment	\$100,000	50,000	50,000	25,000	25,000	25,000	25,000

## 13. Program requirements.

### a. Prerequisites for prospective students.

Prospective students must meet the requirements of the College of Liberal Arts and Sciences at ISU. These entail satisfactory completion at the high school level of:

4 years of English

3 years of social studies

3 years of mathematics (four is recommended for students enrolling in the BCB major)

3 years of science (to include biology, physics and chemistry)

### b. Language requirements.

The language requirement will be that of the College of Liberal Arts and Sciences.

This entails either three years of high school or two semesters of university foreign language.

### c. Courses and seminars presently available for credit toward the major.

Chemistry 177, 177L, 178, 331.

Physics 221.

Mathematics 165, 166, 265, 307.

Statistics 330, 341, 430.

Computer Science 227, 228, 330, 363

Biology 211, 211L, 212, 212L, 314

Genetics 313, 313L, 411

Bioinformatics & Computational Biology 484, 495, 538, 539, 542, 548, 549, 550, 551, 593, 594, 596, 597. Many of these can be offered initially as combined 400/500 level courses.

### d. Proposed new lecture courses.

#### ***BCB 211. Introduction to Bioinformatics and Computational Biology.***

(3-0) Cr. 3. F. Overview of bioinformatics and computational biology. Database searching, sequence alignment, gene prediction, RNA and protein structure prediction, construction of phylogenetic trees, comparative and functional genomics.

#### ***BCB 401. Fundamentals of Bioinformatics and Computational Biology I.***

(3-0) Cr. 3. F. Prereq: BCB 211, Com S 228. Biology as an information science. Generative models for sequences. String algorithms. Sequence alignment. Algorithmic and statistical aspects of database search. Basic methods in molecular phylogeny/phylogenomics. Genome sequence assembly.

***BCB 402. Fundamentals of Bioinformatics and Computational Biology II.***

(3-0) Cr. 3. S. Prereq: BCB 401. Genome annotation. DNA and protein motifs. DNA microarrays. Introduction to gene expression studies. Protein, DNA and RNA structure. Structure representation, comparison and visualization. Biological networks and systems.

***BCB 442. Bioinformatics Tools and Techniques.***

Cr. 1 per module. F, S, SS. Prereq: BCB 211. Workshops in basic bioinformatics tools and techniques. Offered on a satisfactory-fail grading basis only. Sections A - F.

**e. Thesis and non-thesis options in master's programs** - not applicable.

**f. Implications for related areas within the university.**

Because of the phase out of the Zoology major there should be little net increase in student demand for lower level, support courses such as Math 165, 166; Chem 177, 178, etc. Upper level courses offered by participating departments will see increased enrollment.

**g. Admissions standards for graduate programs** - not applicable.

**14. Memos regarding asset reallocation.**

**a. Memorandum from Marty Spalding, Chair of GDCB is attached.**

**15. Letters.**

**a. Letters from other Regent Institutions.**

University of Iowa  
University of Northern Iowa

**b. Letters from programs and departments at ISU.**

Genetics, Development and Cell Biology  
Mathematics  
Computer Science

**c. Letters from relevant Iowa bioscience industries and associations:**

Iowa Biotechnology Association  
Technology Association of Iowa  
Pioneer Hi-Bred International

# **Proposed Catalog Description**



# CATALOG DESCRIPTION

Requirements for a Major in Bioinformatics and Computational Biology  
College of Liberal Arts and Sciences

## I. College General Education Requirements

### A. Communication Proficiency – 9 credits

1. English 150 (test out credits count towards graduation, 3 credits)
2. English 250 or 250H (3 credits)
3. **Student must earn an average of C- or better in 150 and 250/H**
4. Advanced communication skills – see major course requirements

### B. World Language Requirement – 0-8 credits

1. Student must satisfy a graduation requirement equivalent to the first year of university-level study in one world language (normally, completion of a two-semester sequence in any one world language).
2. Students who have completed three or more years of one high-school world language are deemed to have completed the requirement.

### C. Library Proficiency – 0.5 credits

1. Library 160 (0.5 credits) or
2. Passing a test-out exam administered by the library staff.

### D. General Education Area Requirements – 32 credits

See <http://www.las.iastate.edu/academics/generaleducation/index.shtml>

#### I. Arts and Humanities – 12 credits

#### II. Natural Sciences and Mathematical Disciplines – 11 credits

This requirement will be met by taking courses required for the major.

#### III. Social Sciences – 9 credits

The University requirement for 3 credits each in approved U.S. Diversity and International Perspective may be met by choosing courses from a list that may be found at [www.iastate.edu/~registrar/courses/div-list.html](http://www.iastate.edu/~registrar/courses/div-list.html).

These courses may also be used to meet GER requirements.

## II. Required Courses for the BCB Major

### A. **Advanced Communication Skills** - 3 credits

1. Students must take an advanced English writing course selected from Eng 302-316.

### B. **Chemistry** – 10 credits

1. Chem 177, 177L, 178 and 331.

### C. **Physics** – 5 credits

1. Phys 221.

### D. **Statistics** – 9 credits

1. Stat 330, 341 and 430.

### E. **Biology** – 11 credits

1. Biol 211, 211L, 212, 212L and 314.

## III. Courses within the BCB Major

### A. **Genetics** – 7 credits

1. Gen 313, 313L and 411.

### B. **Computer Science and Computer Engineering** – 13 credits

1. Com S 227, 228, 363 and 330(or Cpr E 310).

### C. **Mathematics** - 15 credits.

1. Math 165, 166, 265 and 307.

### D. **Bioinformatics and Computational Biology** – 12.5 credits

1. BCB 110, College/Department Orientation, 0.5 credits.

2. BCB 211, Introduction to Bioinformatics, 3 credits

3. BCB 401 and 402, Fundamentals and Principles, 6 credits

4. BCB 490T, Senior Research Projects (team) or BCB 490R, Independent Research, 3 credits.

- E. **Support Electives** – 3-9 credits to be chosen from the following list:  
BCB 495, 539, 542, 548, 549, 550, 551, 593, 594, 596, 597  
Physics 222  
BBMB 404, 405  
Biology 315, 423, 462, 465, 472  
Genetics 340, 410  
Statistics 342, 402, 416, 432  
Com S and Cpr E courses at the 300 level and above  
Math 266, 304, 314, 385, 471, 481.  
One credit modules in BCB 442, Workshops in Bioinformatics Tools and Techniques.

BCB majors are encouraged strongly to take at least 6 credits of support electives that have a BCB designation.

**F. College Grade Requirement -**

The major must contain at least 8 credits in ISU courses numbered 300 or above and in which the student's grade is C or higher. In addition, the average of all courses in the major must be 2.0 or higher.

**G. Additional College Course Requirement -**

Students must accumulate at least 45 credits at the 300 level or above taken at a four year college, and a total of at least 120 credits.

# **Letter on Asset Reallocation**

IOWA STATE UNIVERSITY  
OF SCIENCE AND TECHNOLOGY

Martin H. Spalding  
Professor and Chair  
Department of Genetics,  
Development and Cell Biology  
1210 Molecular Biology  
Tel: (515) 294-3909  
Fax: (515) 294-6755

Interoffice Memorandum

Date: October 6, 2005

To: Helen Ewald, Chair  
Curriculum Committee  
College of Liberal Arts and Sciences  
427 Ross Hall (hewald@iastate.edu)

From: Martin Spalding, Chair  
Department of Genetics, Development and Cell Biology  
1210 Molecular Biology

Subject: Interdepartmental Major in Bioinformatics and Computational Biology

I am writing to voice my strong support for the proposed interdepartmental undergraduate major in Bioinformatics and Computational Biology (BCB). BCB is an interdisciplinary field, dedicated to the discovery and implementation of mathematical, statistical, and computational techniques that facilitate the understanding of biological processes. The 2005-2010 ISU Strategic Plan clearly points to Biological and Informational Sciences as central to the strengths and future of ISU, and the Batelle Report points to Bioscience as key to the economic future of Iowa. Furthermore, it is important for ISU to continue to be innovative in developing new undergraduate curricula to keep pace with demand and meet the changing needs of a changing society. There is now a large, high-quality pool of students in the biological and informational sciences who would major in bioinformatics, if the opportunity were available. At present, these talented individuals must piece together their own ad hoc curricula, often with little guidance. Thus the timing is ideal for a new undergraduate major in BCB at ISU. Demand for bioinformatics graduates should be high, and the program will capitalize on the thriving graduate BCB program, and will almost certainly achieve the same level of prominence.

This new major will be of central importance to the GDCB Department as one of the key disciplinary areas served by the department. GDCB, along with the Department of Ecology, Evolution and Organismal Biology (EEOB), has arisen from the recent reorganization of the biological sciences at ISU with a new paradigm for undergraduate education. Because of the inherent interdisciplinary nature the biological sciences at ISU, the GDCB Department decided not to offer its own undergraduate degree but to depend instead on the existing interdepartmental undergraduate program in Biology (administered by GDCB and EEOB) and to convert the formerly departmental Genetics major into a parallel interdepartmental undergraduate program

(administered by GDCB, EEOB and BBMB). With 17 faculty members associated with the Graduate BCB program, GDCB has a very strong presence in the area of bioinformatics and computational biology, so this proposed undergraduate program is of keen interest to us. In a formal vote, the faculty of the GDCB Department voted unanimously to support the proposed BCB undergraduate major.

In addition to providing vocal support for the proposed major, the GDCB Department is also committed to providing a significant level of support in the form of staffing for needed new courses. Based on the proposed curriculum, current GDCB faculty will be made available to teach all or part of up to 4 new courses, including an experimental course developed this year by Dr. Drena Dobbs (GDCB) and Dr. David Fernandez-Baca (Computer Science) in a collaboration between the GDCB and Computer Science Departments.

**Letters from**  
**University of Iowa**  
**University of Northern Iowa**



April 3, 2006

M. Duane Enger, Ph.D.  
Department of Genetics, Development and Cell Biology  
Iowa State University  
509 Science II  
Ames, IA 50011-3220

Re: Iowa State University's Baccalaureate in Bioinformatics

Dear Dr. Enger:

I am delighted to provide my support of your proposal for an undergraduate degree in Bioinformatics and Computational Biology at Iowa State University. I like the mix of courses involved this program. In particular, I think the math, statistics and computer science courses are excellent choices. While I perhaps agree with Professor Hannover regarding the greater ease with which Engineering/Computer Science students move into this area, care should be taken to avoid discouraging students from Biology. Depth in computing training is needed early, and your proposal does a good job of that.

The one suggestion I have is to include a specific course on Bioinformatics Tools and Techniques, which should be a second course in computing. This course would look at the common tool bag of bioinformatics--Perl, BioPerl, BioJava, database libraries, R, etc. Terry Braun, Assistant Professor, here at The University of Iowa has developed such a course. It is possible that courses listed in your program, could include this content. I don't have access to the full course descriptions, but I could help you get in touch with Prof. Braun.

Sincerely,

Thomas L. Casavant, Ph.D.  
Roy J. Carver Jr. Chair in Bioinformatics and Computational Biology  
Director, Center for Bioinformatics and Computational Biology  
The University of Iowa



Martin H. Spalding, Professor and Chair  
Department of Genetics, Development and Cell Biology  
Iowa State University  
1210 Molecular Biology  
Ames, Iowa 50011-1020

August 15, 2006

Dear Dr. Spalding:

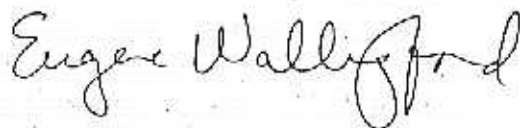
The faculty of the Department of Computer Science at the University of Northern Iowa have reviewed your department's proposal to offer an undergraduate degree in Bioinformatics at Iowa State University. As you know, UNI began offering a B.S. major in Bioinformatics in the fall of 2006. We think that your program complements ours, with our program emphasizing the discovery and implementation of algorithms and tools, and yours emphasizing the discovery and application of biological knowledge. Further, we think that the state would do well to produce a substantial number of graduates in this area in order to develop economic strength in this market.

Our bioinformatics faculty found your curriculum to be appropriate for a degree of this type. Indeed, it seems to overlap our curriculum substantially. The only suggestion our faculty had related to the tools and techniques course added most recently to the program. In some ways, this course looks out of place. However, from your department's perspective, a course on tool usage is perhaps appropriate, as the focus of the rest of your program is on the biological knowledge that underlies the discipline.

We see many opportunities for interactions between UNI and ISU in relation to our program and your proposed program. These range from hosting local and regional conferences, to bringing national-caliber speakers to our two campuses, to having students interact on research with students and faculty at the other institution. Given the budget climate in the state, we might also look for opportunities to share courses that might not be able to attract enough students on just one campus, but which when offered jointly would be feasible.

We look forward to working with you in the future.

Sincerely,



Eugene Wallingford, PhD  
Associate Professor and Head

**Letters from**  
**Programs and Departments at ISU**

IOWA STATE UNIVERSITY  
OF SCIENCE AND TECHNOLOGY

Justin R. Peters, Chair  
Department of Mathematics  
400 Carver Hall  
515 - 294 - 1752  
515 - 294 - 5454 (fax)  
[peters@iastate.edu](mailto:peters@iastate.edu)

I would like to express my support for the interdepartmental undergraduate BCB major. While statistical analysis of experimental data has long been used in the biological sciences, there is now a need for mathematical modeling of biological phenomena. Interdisciplinary training for undergraduates in biological and mathematical sciences is recognized at the National Science Foundation. (See, for example, [http://www.nsf.gov/funding/pgm\\_summ.jsp?pims\\_id=12207&org=DMS](http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=12207&org=DMS) ) Not only will an undergraduate BCB help students by allowing us to make better use of our resources, but I believe it will make us more competitive in securing external funding for programs such as this.

The Mathematics Department has several faculty with interests in mathematical biology, and I expect we will hire additional faculty in the area. So I fully expect we will have resources to devote to the undergraduate BCB program.

I endorse the formation of the undergraduate BCB major.

IOWA STATE UNIVERSITY  
OF SCIENCE AND TECHNOLOGY

College of Liberal Arts and Sciences  
Department of Computer Science  
226 Atanasoff Hall  
515 294-4377  
FAX 515-294-0258  
Internet: www.cs.iastate.edu

Interoffice Memorandum

Date: April 4, 2006  
To: Helen Ewald, Chair  
Curriculum Committee  
College of Liberal Arts and Sciences  
427 Ross Hall (hewald@iastate.edu)  
From: Carl K. Chang, Chair, Computer Science



Subject: Interdepartmental Major in Bioinformatics and Computational Biology

Department of Computer Science strongly supports the proposed interdepartmental undergraduate major in Bioinformatics and Computational Biology (BCB), and look forward to participating in the development of its curriculum. BCB is an interdisciplinary field where computer science faculty has shown keen interest in collaborating with other ISU colleagues in bioscience, statistics, and mathematics. It is very critical and timely to establish such a program in order to further strengthen ISU's position in this emerging field that is dedicated to the discovery and implementation of mathematical, statistical, and computational techniques to facilitate the understanding of biological processes. We are encouraged by the 2005-2010 ISU Strategic Plan and the recently released Battelle Report that clearly positioned Biological and Informational Sciences to play a central role for ISU to fulfill its mission. Computer Science faculty is fortunate to be part of this new endeavor and will contribute our faculty's strength and talents to help ISU achieve a high level of prominence should the proposal be approved.

In addition to providing vocal support for the proposed major, the Computer Science Department is also committed to providing a significant level of support in the form of staffing for needed new courses. Based on the proposed curriculum, current Computer Science faculty will be made available to support the teaching of the planned new courses, including an experimental course developed this year by Dr. Drena Dobbs (GDCB) and Dr. David Fernandez-Baca (Computer Science) in a collaboration between the Computer Science and GDCB Departments.

**Letters from**  
**Bioscience Industry and Associations**



IOWA  
BIOTECHNOLOGY  
ASSOCIATION

4536 N.W. 114th St., Suite A  
Urbandale, IA 50322  
Tel: 515.327.9156  
Fax: 515.327.1407  
Web: IowaBiotech.com

March 17, 2006

Dr. Duane Enger  
GDGC  
Iowa State University  
Ames, IA 50010

Re: New Undergraduate Major – Bioinformatics and Computational Biology

Dear Dr. Enger:

On behalf of the over 90 members of the Iowa Biotechnology Association we support the development of a new undergraduate major at Iowa State University. Bioinformatics and Computational Biology have become one of the major new areas of scientific research. Genomic sequencing requires the power of advanced computer processing to manage the broad array of information, data and combinational analysis.

Companies like NewLink Genetics, Integrated DNA Technologies and Cellular Engineering Technologies are examples where the potential of the biological sciences and data management are taking place in Iowa. Major companies specializing in seed trait development, fermentation and nutraceutical product development and production represent other examples where the work force of tomorrow will need a well-developed background in biology and analyzing large volumes of data.

An undergraduate major and the University's master's degree in Bioinformatics will provide a well-rounded course offering for tomorrow's scientists.

Sincerely,

Doug Getter  
Executive Director

**Board Members**

**Dave Tierney, Chair**  
Monsanto

**Dr. Bart Bergquist**  
University of Northern IA.

**Michael Budnick**  
Proliant

**Dr. Joe Denhart**  
Lloyd, Inc.

**Dr. David Faber**  
Trans Ova Genetics

**Dr. Walter Fehr**  
Iowa State University

**Sarah Fiedler Thorn**  
Pioneer, a DuPont Co.

**Dr. Meredith Hay**  
University of Iowa

**Kurt Hejar**  
Regena Therapeutics

**Kate Kulesher**  
Wyeth/Pf. Dodge Labs

**Karen Merrick**  
IA. Dept. of Econ. Dev.

**Dr. Jennifer Radosevich**  
Kemin

**Elliott Smith**  
IA. Business Council

**Jack Staloch**  
Cargill Corn Milling

**Jeff Stroburg**  
West Central Cooperative

**Roman Terrill**  
Integrated DNA Technology





**TECHNOLOGY  
ASSOCIATION  
OF IOWA**

March 25, 2006

Lisa Lorenzen, Ph.D.  
Iowa State University, Director of Industry Relations, Vice Provost for Research Office  
Biotechnology Liaison, Office of Biotechnology  
2810 Beardshear  
Ames, IA 50010

Dear Lisa:

Please know how pleased the Technology Association of Iowa (TAI) is to learn that Iowa State University (ISU) is considering an undergraduate major in Bioinformatics and Computational Biology. TAI enthusiastically supports the creation of this unique major, and welcomes the impact it would have on establishing Iowa as a technology state.

TAI is a nonprofit, membership-based organization of nearly 200 firms and institutions. Today, we are poised to help fuel the technology ecosystem that will make Iowa known as a leading state for technology. Iowa's IT sector includes over 3,000 companies—employing over 46,000 people. These firms are growing faster than the national average.

TAI believes that the future of Iowa is dependent on a technology-based economy supported by an educated workforce.

As an association, we support the proposed bioinformatics and computational biology undergraduate major. This undergraduate major will teach students the skills of handling large volumes of data and how to extract information and knowledge from this data. These are skills that cross a wide variety of technology platforms.

For example, TAI members Bioforce Nanosciences and Vida Diagnostics are companies that have bioinformatics and computational biology as an integrated part of their business. Companies like Kingland and Oracle, on the other hand, produce hardware products that are used for computational analysis.

In addition, the undergraduate major will nicely compliment the graduate major currently offered – providing Iowa's young people the chance to pursue high tech degrees and jobs without going out of state.

We applaud ISU's vision as it contemplates the creation of this exciting new major, and as it continues to keep Iowa on the leading edge of technology and education.

Best regards,

Leann Jacobson  
President

400 Locus Street, Suite 340  
Des Moines, IA 50319

PHONE 515.245.7703  
FAX 515.245.7708

[www.iowatechnology.org](http://www.iowatechnology.org)



DuPont Agriculture & Nutrition  
Pioneer Information Management  
7200 N.W. 62nd Ave.  
P.O. Box 184  
Johnston, IA 50131-0184  
(515) 270 3201 Tel

April 4, 2006

Lisa Lorenzen, Ph.D.  
Director of Industry Relations, Vice Provost for Research Office  
Biotechnology Liaison, Office of Biotechnology  
Iowa State University  
2810 Bearshear  
Ames, Iowa 50010

Dear Dr. Lorenzen,

This letter is in support of your efforts to establish a Bioinformatics undergraduate major at Iowa State. In my role as Director of Bioinformatics and Computational Biology at Pioneer Hi-Bred International, I am leading a team of twenty five people with skills in the areas of computational biology, bioinformatics, software development and statistics. I work closely with the leaders of Pioneer's Research groups to insure that needed bioinformatics capabilities and solutions are developed and delivered to them so as to enable their work.

The past several years have seen a large increase in the availability of large scale biological datasets. These data resources are expected to continue to grow – this is exemplified by the recently initiated public projects to sequence the genomes of maize and soybean. These genomic datasets require skilled bioinformaticians to carry out analyses, quality control, and data integration all aimed at enhancing the effectiveness of the numerous discovery and validation projects underway within Pioneer's Research groups. The scale of biological data now available necessitates the use of computers to collect, store, display and annotate the information. The increasing breadth of types of information available (DNA sequence, RNA expression, proteomics, metabolomics, QTL's etc.) places a premium on bioinformaticians that can develop and enable new ways to integrate these large biological datasets so as to enhance the speed and accuracy of the discovery process, which at Pioneer has the ultimate aim of generating new and competitive agricultural products.

I fully expect that the importance of bioinformatics to successful biological discovery and product development will continue to increase. Thus, the establishment of an undergraduate Bioinformatics major at Iowa State University would be of significant benefit to both regional and U.S. employers that are seeking well trained individuals to apply their skills to real-world research and development challenges in the area of bioinformatics and computational biology.

Best wishes,

Christopher H. Martin, Ph.D.  
Director of Bioinformatics and Computational Biology  
Pioneer Hi-Bred International  
Johnston, Iowa



# **Letter to the Curriculum Committee**

**IOWA STATE UNIVERSITY**  
OF SCIENCE AND TECHNOLOGY

Department of Genetics,  
Development and Cell Biology  
1210 Molecular Biology Building  
Ames, Iowa 50011 3260  
515 294-7322  
FAX 515 294-6755

Date: October 19, 2006

To: Ken Kruempel, Chair  
Faculty Senate Curriculum Committee

From: M. Duane Enger, GDCB



Subject: Interdepartmental Undergraduate Major in Bioinformatics and  
Computational Biology (BCB BS)

CC: Martin Spalding, Professor and Chair, GDCB

Attached for Faculty Senate Curriculum Committee consideration is our proposal for a new undergraduate major in bioinformatics and computational biology. This proposal is the product of extensive interdepartmental and intercollegiate faculty collaboration. It is strongly supported by the chairs of GDCB, Mathematics and Computer Science (departments who will initially administer the major). Implementation of this BCB BS program will be facilitated by the existence at ISU of a large BCB graduate faculty. The presence of this faculty, combined with a departmental commitment to reallocate faculty time as well as space and administrative support, means that new resources will not be needed to establish the major. Students in this major will benefit greatly from the potential of this large, research active faculty to provide a source of mentors, advisors and instructors. They will benefit also from internships and research experiences in ISU's many centers in plant and animal genomics and bioinformatics; as well as in local biotechnology industries, start-up companies, and federal research laboratories.

We will greatly appreciate your assistance in taking this to the Faculty Senate Curriculum Committee, and we look forward to working with you to ensure successful implementation of this faculty initiative.

# **Proposed Program Governance**

## **Faculty Governance, BCB BS Major**

### **BCB Faculty.**

The Bioinformatics and Computational Biology faculty will be comprised of the faculties of Computer Science; Mathematics; and Genetics, Development and Cell Biology. A structure for facilitating their continuing involvement in the governance of academic matters within the BCB major will be provided by the formation of a BCB Curriculum Committee (BCB CC).

### **BCB Major Curriculum Committee (BCB CC).**

The BCB CC is to be comprised of two members from each of the departments of Mathematics; Computer Science; and Genetics, Development and Cell Biology. They will together administer the undergraduate major in Bioinformatics and Computational Biology. Members will be appointed by the respective department chairs to serve three-year appointments, which initially will be staggered to provide overlap in such fashion that two members will be replaced each year. The BCB CC membership shall elect one of their members to serve as Chair, who will be appointed to a three-year term with possible renewal. The chair position shall rotate amongst representatives of the three participating departments.

The BCB CC will oversee academic matters, and will consult on budget, staffing and other resource matters with the three departmental chairs. These academic matters include curriculum, course offerings and catalog, and advising. The BCB CC will evaluate the curriculum and the governance document continually, and will recommend changes in either or both to the participating departmental faculties. Approval by majority vote on the part of each participating departmental faculty will be necessary to change this document or the curriculum.

The BCB CC shall have the concurrence of the departmental chairs in making recommendations to the faculty that involve resource implications or affect resource allocations.

The BCB CC chair will make recommendations for course listings and staffing to the department chairs in preparation for each semester's offerings, will manage an instructional budget as allocated and reviewed by department chairs, and will assist them in them in the preparation of budget requests. The CC chair will bring curricular matters to the faculties, and will call for and conduct meetings to address these curricular matters both on a regular basis and as needed.