

Professional Science Master's Program

Bioinformatics & Computational Biology

University of South Florida



Summer 2007

Program Directors:

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<http://molecularmedicine.health.usf.edu>

Master's of Science
In
Bioinformatics & Computational Biology

OVERVIEW:

Program Development And Goal:

The Masters Program in Bioinformatics and Computational Biology at the University of South Florida represents a multi-college partnership and a truly interdisciplinary collaboration. Participating departments include the Departments of Molecular Medicine (formerly Biochemistry & Molecular Biology) in the College of Medicine, Mathematics in the College of Arts and Sciences, Computer Sciences and Engineering and the Division of Biomedical Engineering in the College of Engineering, Epidemiology & Biostatistics in the College of Public Health and Information Systems & Decision Sciences in the College of Business Administration. The program is designed to meet the increasing demand for trained people in this emerging area, which crosses the traditional fields of biological, mathematical and computer sciences. The program, therefore, builds on and complements the current strengths of the university.

The Masters Program in Bioinformatics and Computational Biology was initiated and will be administered by the Departments of Molecular Medicine in the College of Medicine. The program development has been supported by a grant from the Alfred P. Sloan Foundation. At this time, only 13 institutions across the nation have won the highly competitive Sloan Awards to develop intensive two-year professional Master's degree programs in the rapidly growing field of bioinformatics and computational biology.

The goal of the Masters Program in Bioinformatics & Computational Biology is to provide students enrolled in the program with high quality training and education that will prepare them for careers in science, industry, health care and education. The curriculum has been designed accordingly and provides the theoretical background, the practical training and, with the internships, the "real life" experience, which will equip students with the essential tools for a successful career in the field of Bioinformatics & Computational Biology.

Program Description:

The Masters Program in Bioinformatics & Computational Biology is designed for 42 credit hours to be obtained during two years of study. Nine core courses will provide the foundation and basics before advanced work, including four electives, and a Master's thesis or internship will be pursued. The curriculum is flexible and will be tailored to the individual student's background, interests and career goals. However, electives must be selected from at least two of the participating departments to assure breadth of training.

Exceptional students with extra motivation and commitment can enroll in the Ph.D.-PLUS program. The Ph.D.-PLUS program provides the opportunity to study for a Ph.D. in Molecular Medicine and a Master's degree in Bioinformatics and Computational Biology concurrently. Nine credit hours can be double credited.
<http://biochem.usf.edu/phdplus/index.html>

Master's of Science
In
Bioinformatics & Computational Biology

CURRICULUM

Prerequisites: Calculus I-III, linear algebra, biostatistics, at least "C" and "maple" or "mathematica" or "math-cad", one year of general biology and one year of organic chemistry.

YEAR 1

Prematriculation: Fulfillment of prerequisite requirements

Semester:	Course #	Course Title	Credits
I	GMS 6200	Biochemistry and Molecular and Cellular Biology	5
	BCH 6888	Bioinformatics	3
	MAT 5932	Sel.Topics in Combinatorics and Graph Theory	3
II	BCH 6411	Biomedical Genomics and Genetics	4
	GMS 6889	Advanced Bioinformatics	3
	MAT 5932	Selected Topics in Probability Theory	3

YEAR 2

Semester:	Course #	Course Title	Credits
III	GMS 7930	Research Ethics	2
	CIS 6930	Advanced Data Structures	3
	MAT 6932	Sel. Topics in Bioinformatics & Comp. Biology	3
	Elective		3
IV	Elective		3
	Elective		3
	BCH 6942+BCH 6943_Internship (140 contact hrs.)	total	4

The tasks and experiences of the internship will have to be summarized in an Internship Report. Before graduation, the student will provide a short (15 min) Power Point presentation of his/her internship experience to a small group of faculty.

Graduate students must maintain an overall average of 3.0 ("B") in all courses.

ELECTIVE COURSES

Molecular Medicine:

BCH 6135	Methods in Molecular Biology	4
BCH 6627	Metabolic And Genetic Basis of Human Diseases	3
BCH 6876	Selected Topics in Protein Structure/Function Analysis	2
GMS 7930	Proteomics and Structural Biology	3
BCH 6876	Special Topics in Molecular Modeling and Drug Design	2
BCH 6876	Special Topics in Cell Signaling Pathways	2

Management Information Systems:

ISM 6124	Advanced Systems Analysis and Design	3
ISM 6218	Advanced Database Management	3
ISM 6225	Distributed Information Systems	3
ISM 6930	Data Warehousing and Data Mining	3
ISM 6930	Information Technology in Medical Care	3

Computer Science and Engineering:

COT 6405	Introduction to the Theory of Algorithms	3
CEN 6016	Software Engineering	3
CAP 5625	Introduction to Artificial Intelligence	3
CAP 6638	Pattern Recognition	3
CAP 5400	Digital Image Processing	3

Mathematics:

STA 5326	Math Statistics	3
MAD 5305	Graph Theory	3
MAD 4504	Theory of Computation	3
STA 5166	Computational Statistics I	3
MAT 6939	Graduate Seminar	2

Epidemiology & Biostatistics:

PHC 6051	Biostatistics II	3
PHC 6053	Categorical Data Analysis	3
PHC 6054	Design of Experimental Studies for Health Researchers	3
PHC 6058	Biostatistical Inference I	3

Biomedical Engineering

ESB CIS 6930	Bioinformatics in Biomedical Engineering	3
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DESCRIPTIONS OF CORE COURSES

GMS 6200 Biochemistry and Molecular and Cellular Biology

The overall objective of this course is to provide students with a solid foundation of biochemical principles that underlie normal cellular and physiological processes.

BCH 6888 Bioinformatics

Bioinformatics I is designed to introduce students to the diverse applications of bioinformatics and computational biology software in probing both DNA and protein structure-function relationships. Students will develop familiarity with a broad range of algorithms designed to facilitate DNA sequence assembly and manipulation, protein structure analysis, motif identification, evolutionary alignments and structure prediction. Examples focus on major software applications that are routinely in Molecular Medicine.

MAT 5932 Special Topics in Combinatorics and Graph Theory

This course studies combinatorial and graph-theoretic techniques needed in dealing with discrete objects.

BCH 6411 Biomedical Genomics and Genetics

The course is designed to introduce students to multiple features of biomedical genomics and genetics such as genome composition and evolution, gene expression, genetic instability, mapping and identification of genes and susceptibility to Mendelian and complex diseases. Applications of genomics and genetics in therapeutic treatments including gene therapy, stem cell therapy and pharmacogenomics will also be discussed.

GMS 6889 Advanced Bioinformatics

Advanced Bioinformatics is designed to provide an in depth analysis of DNA and protein function using information derived from both current DNA and protein sequence databases. Advanced algorithms will be used to survey gene/protein functions and construct 3-dimensional protein models that will be used for rational ligand design.

MAT 5932 Selected Topics in Probability Theory

This course studies probability theory with an introduction to random processes.

GMS 7930 Scientific Writing and Ethics

The objectives of the course are to involve the student in the complete writing of a scientific paper or grant proposal and to train the student in the area of scientific ethics.

CIS 6930 Advanced Data Structures

Fundamentals and design of data organization for purposes of program efficiency, clarity and simplicity will be addressed. This course will be different from a traditional CS course in that it would use bioinformatics related examples and assignments. It will also be a graduate level course that non-CS majors can take, without prior exposure to an undergraduate course. This course will be the crucial bridge into advanced graduate level CS courses for non-CS majors.

MAT 6932 Special Topics in Bioinformatics and Computational Biology

This course is intended to be a series of seminar type lectures covering mathematical techniques, models and theories in biological processes.

DESCRIPTIONS OF ELECTIVE COURSES

Molecular Medicine:

BCH 6135 Methods in Molecular Biology

This practicum teaches state of the art methods and techniques that are applied in Molecular Biology such as PCR, RT-PCR, Immunoprecipitation Western (Immuno-) Blotting, Gel Mobility Shift Assays, Northern, Site-Directed Mutagenesis, Sequencing

BCH 6627 Metabolic and Genetic Basis of Human Diseases

“Metabolic and Genetic Basis of Human Diseases” will deal with the genetic, molecular, and biochemical basis of human diseases. The objectives of this course are: (i) to provide a thorough understanding of the principles that underlie inheritance and expression of genetic information; (ii) to present a wide variety of genetic diseases, based on their different modes of inheritance and the different nature of the gene products responsible. We will discuss autosomal dominant, autosomal recessive, X-linked, and atypical patterns of inheritance. Several diseases will be discussed to serve as examples, including diseases related to metabolic pathways (anabolic, catabolic, and salvage), trafficking, receptors, channels, and transporters.

BCH 6876 Selected Topics in Protein Structure/Function Analysis

Recent advances in protein structure acquisition and analysis have provided new approaches to understanding protein function. This course will focus on selected protein structural classes with the objective of understanding the role of specific structural motifs in regulating protein folding and architecture.

GMS 7930 Proteomics and Structural Biology

Proteomics and functional genomics are rapidly developing areas that impact on a wide range of disciplines. The course, "Proteomics and Functional Genomics", emphasizes the interdisciplinary nature of proteomics and functional genomics and focuses on various aspects that will enable students to relate theoretical concepts and experimental approaches to a wide range of potential research problems. The course aims to provide a solid foundation and breadth of understanding in proteomics and functional genomics that will facilitate application to current or future research problems. The initial section of the course provides a brief overview of the human genome project and proteome initiatives. The second section focuses on tools and technologies that have supported advances in proteomics and functional genomics. The third section is a series of major subtopics and applications of proteomics and functional genomics. The fourth section focuses on various aspects of clinical proteomics and genomics, followed by a section of recent developments related to proteomics and functional genomics. The final section is devoted to student presentations on selected topics of particular interest to individual students.

BCH 6876 Selected Topics in Molecular Modeling and Drug Design

Molecular modeling can provide valuable insights into the role(s) of specific amino acid residues in protein structure and ligand interactions. This course will examine the use of selected molecular modeling software suites to construct altered protein conformations in response to mutational events and to develop structures that represent various protein-ligand and protein-protein interactions.

BCH 6876 Selected Topics in Cell Signaling Pathways

The interplay between intercellular and intracellular signaling constitutes the main information transfer mechanism underlying the development and function of multicellular organisms. A malfunction in even a single step in this signaling network can lead to severe developmental disorders, psychiatric, neurodegenerative, vascular, and hormonal diseases as well as many forms of cancer. The students will be introduced to many parts of the complex network of interacting signaling systems with an emphasis on development, metabolism, the nervous system, cell cycle control and defects in this systems.

Mathematics:

MAD 4504 Theory of Computation

This course provides an overview of various aspects of computation theory, including grammars, languages and automata theory.

STA 5326 Math Statistics

This course focuses on the mathematical underpinning of statistical techniques and models.

MAD 5305 Graph Theory

Graph theory provides a basis for studying the relationships between discrete objects. This course will concentrate on various graph-theoretic properties.

STA 5166 Computational Statistics I

Statistical analysis of data by means of statistics package programs. regression, ANOVA, discriminant analysis and analysis of categorical data. Emphasis on inter-relation between statistical theory, numerical methods and analysis of real life data.

Computer Science and Engineering:

COT 6405 Introduction to the Theory of Algorithms

Analysis techniques for algorithms. Characterizing algorithms in terms of recurrence relations, solution of recurrence relations, upper and lower bounds. Graph problems, parallel algorithms, Nondeterministic Polynomial time. Completeness and approximation algorithms, with relationship to practical problems.

CEN 6016 Software Engineering I

Basic principles and formal methods for systematic development of software systems. Software life cycle, formal specifications, design, verification, and reliability analysis.

CAP 5625 Introduction to Artificial Intelligence

Basic concepts, tools and techniques used to produce and study intelligent behavior. Organizing knowledge, exploiting constraints, searching spaces, understanding natural language and problem solving strategies

CAP 6638 Pattern Recognition

Syntactic pattern recognition, Classification techniques, Performance characterization.

CAP 5400 Digital Image Processing

Image formation, sources of image degradation, image enhancement techniques, edge detection operators and threshold selection, low-level processing algorithms for vision, image data compression

Management Information Systems:

ISM 6124 Advanced Systems Analysis and Design

This course covers advanced topics of information systems development. Students learn to manage and perform activities throughout the information systems development life cycle. State-of-the-art system development processes, methods, and tools are presented.

ISM 6218 Advanced Database Administration

Advanced database design and management. Review of Codd's rules for relational databases. Database control issues. Object-oriented database analysis and design. Distributed database design and use of parallel systems. Expert and intelligent databases. OLAP databases.

ISM 6225 Distributed Information Systems

Analysis, design, implementation, and management of distributed information systems and networks.

ISM 6930 Data Warehousing and Data Mining

This course covers the rapidly emerging data warehouse and data mining technologies that are likely to play a strategic role in business organizations. Topics include the differences between operational and analytical database systems, dimensional modeling and star schemas, data warehouse performance issues, data quality, the data warehouse development cycle, data warehouse navigation, and data mining techniques. The Oracle database system will be used to illustrate many of the concepts covered in class.

ISM 6930 Information Technology in Medical Care

An examination of the application of information technology in the contemporary medical care industry from both an administrative and patient care perspective. Topics will include medical care decision making, information systems planning, designing and implementing information systems and the role of information technology in patient care.

Epidemiology & Biostatistics:

PHC 6051 Biostatistics II

Intermediate level biostatistical methods with a focus on analysis of variance, multiple regression, and analysis of covariance. Emphasis on residual diagnosis and model building with application to epidemiological and health studies.

PHC 6053 Categorical Data Analysis

Studies of techniques used in analyzing data where subjects have been cross-classified by two or more categorical variables. Special emphasis given to problems frequently arising in epidemiology, public health and medicine.

PHC 6054 Design of Experimental Studies for Health Researchers

This course offers an interdisciplinary overview on the design and analysis of experimental or observational studies in health related research. It focuses on the use of statistical principles and strategies to ensure the validity, reliability, and efficiency of a design and corresponding data analysis.

PHC 6057 Biostatistical Inference I

This course provides an overview of the theoretical foundation of biostatistical inference with an emphasis on applications to biological, medical, and health science research.

Biomedical Engineering:

ESB CIS 6930 Bioinformatics in Biomedical Engineering

The course discusses applications of bioinformatics and computational biology in areas such as biomechanics, implant device development, biomaterials & biocompatibility, rehabilitation engineering, biomedical imaging, biosensors & biomedical instrumentation, novel drug delivery, cardiovascular and biorheology technology and health management.

FULFILLMENT OF PREREQUISITES

Prerequisites:

1. Calculus I-III,
2. Linear algebra,
3. Biostatistics,
4. At least "C" and "maple" or "mathematica" or "math-cad",
5. One year of general biology
6. And one year of organic chemistry.

Courses that have to be taken for fulfillment of pre-requirements of the Master's Program in Bioinformatics and Computational Biology do not have to be taken at the University of South Florida. Some classes from the University of South Florida that will be accepted for fulfillment of the entrance requirements are listed below:

ESB CIS	4930	C++
ESB CGS	5765	Unix/C
ESB CIS	6930	Intro to VLSI CAD
CHM	2210	Organic Chemistry I
CHM	2211	Organic Chemistry II
BSC	2010	Biology I- Cellular Processes
BSC	2011	Biology II: Biological Diversity or Cell Biology
PCB	3023	Cell Biology
MAC	2243	Life Sciences Calculus I-III
MAC	2311	Calculus I-III
MAS	1100	Constructive Number Theory and Linear Algebra
MAS	3105	Linear Algebra
PHC	6050	Biostatistics I
PHC	6057	Biostatistical Inference I

Please note:

- Not all courses are offered in each semester.
- Some courses require extensive prerequisites. Please discuss with the individual course directors if some pre requirements can be waived due to prior training.
- For more information on individual courses check the following web sites:
Oasis schedule of classes: <http://isis2.admin.usf.edu/ssearch/search.asp>
Search a bull: <http://www.ugs.usf.edu/sab/sabs.cfm>

APPLICATION AND ADMISSION

In order to be considered for admission, a first time graduate student or a student transferring from a graduate program at another university must fulfill the following requirements:

General Admissions requirements:

- A bachelor's degree
- Must fulfill the prerequisites as stated in the curriculum
- A minimum undergraduate GPA of 3.0 on a 4.0 scale
- A minimum combined GRE general test score of 1100 (verbal and quantitative portions), not older than 5 years
- Three letters of recommendation
- Statement of purpose
- Complete transcripts of undergraduate work and any previous graduate work
 - a transcript evaluation is needed for international students, see:
<http://web.usf.edu/iac/admissions/transcript.html>
- A completed online USF Application to Graduate Studies
The general guidelines of the USF Graduate School apply:
<http://admissions.grad.usf.edu/criteria.html>

Financial Aid:

For inquiries about financial aid please visit:
<http://usfweb2.usf.edu/finaid/grad.htm>

Fellowships and Grants:

<http://www.grad.usf.edu/newsite/diversity/fellowships.asp>

USF Career Center:

http://usfweb2.usf.edu/career/students/career_fairs.htm

Application deadlines:

Domestic Students	Fall	June 1
	Spring	October 1
International Students who are NOT in the United States:		
	Fall	January 2
	Spring:	June 1
International Students who are currently IN the United States:		
	Fall:	March 1
	Spring:	August 1

Late admission is possible in selected cases.

For answers to questions regarding the international admissions process, please go to <http://web.usf.edu/iac/admissions/faq.html>.

Application Material:

Domestic Application to Graduate Studies:
http://www.grad.usf.edu/newsite/admissions/grad_app.asp

International Application to Graduate Studies:
<http://web.usf.edu/iac/admissions/>

Send a hard copy of the online application and all additional documentation to:

Bioinformatics Program
Dr. Inge Wefes,
Department of Molecular Medicine
College of Medicine,
University of South Florida
12901 Bruce B. Downs Blvd./ MDC Box 7
Tampa, FL. 33612-4799

Program Directors:

For more information contact the program directors:

Michael Barber, Dr. Phil.,	mbarber@hsc.usf.edu	(813) 974-9702
Inge Wefes, Ph.D.,	iwefes@hsc.usf.edu	(813) 974-5360

EMPLOYMENT PERSPECTIVES IN BIOINFORMATICS

http://www.aw-bc.com/info/campbell_krane/1_faq.html

What prospects are there for work in bioinformatics in the future?

There is already an extensive need for professionals with a background in bioinformatics and that need will continue to grow. For instance, the genomic information available at the National Center for Biotechnology Information (NCBI) currently doubles every 14 months and industry analysts forecast that the market for genomic information alone (and the technology to use it) will reach an annual US \$2 billion by 2005. The current shortfall of bioinformaticians has been estimated to be as much as fifty-fold!

<http://www.bio-itworld.com/archive/061202/class.html>

Demand for the marriage of biology and IT skills

The demand for the marriage of biology and IT skills is a recent phenomenon, with the higher priority placed on a biological background, according to Boston-area recruiting firm Remington International, which also notes starting salaries of \$60,000 to \$90,000 are typical for qualified applicants.

<http://www.nature.com/drugdisc/nj/articles/nj6939-566a.html>

Short supply

Improving proteomic techniques will tackle questions in cell biology, signal transduction and clinical research. But workers with the key knowledge in protein biochemistry, mass spectrometry and bioinformatics are hard to find, says Kendall Powell.

John Bergeron is being swamped. His team feeds peptide after peptide, isolated from a range of cellular components, into the lab's mass spectrometer, which in turn churns out reams of data. The researchers then scramble to use this information to identify new proteins and the cellular processes in which they are involved. Even though only a quarter or so of the proteins are identified, Bergeron says that his group at McGill University in Montreal, Canada, can barely keep up. Bergeron's experience is not unique — he, along with colleagues in North America and Europe, is finding it difficult to find qualified scientists to help tame the outpouring of protein data.

Areas of employment for bioinformaticians

Published by the Institute of BioScience and Technology © Cranfield University

The pharmaceutical industry: The considerable potential for the discovery of new drugs has ensured that pharmaceutical companies are the predominant investors in bioinformatics, and a major employer of bioinformaticians. As bioinformatics technologies are applied not only in early discovery but all along the drug discovery process, the demand for bioinformaticians is unlikely to diminish in the near future.

The bioinformatics industry: In recent years, many new companies have been established solely to provide bioinformatics products and services. Activities are focussed mainly on the development of software and databases, but also include work related to business issues and intellectual property rights. Students with the mix of biology, computing and commercial expertise gained on the Cranfield course have the potential to progress rapidly in these companies.

The biotechnology industry: Aside from pharmaceuticals, bioinformatics promises to aid research and development in many other areas, including medical diagnostics, pathology, genetic engineering and the next generation of high throughput biological data acquisition. The IT industry: The rise of bioinformatics has generated a substantial new market for IT infrastructure and services, with many companies seeing strong opportunities for growth in the life sciences.

Sloan Foundation:

A 1999 study commissioned by the Sloan Foundation indicated that entry level salaries for graduates of Masters programs ranged from \$45,000-\$100,000. It was also estimated that current “supply” is sufficient to satisfy only 15% of the “demand” for students trained in bioinformatics and computational biology and demand appears to be increasing.

FLORIDA BIOTECHNOLOGY COMPANIES

"Through an extensive research and interviewing process, Enterprise Florida developed a database of Florida-based biotechnology companies. There are currently **over 80** Florida companies that apply biological knowledge and techniques pertaining to molecular, cellular, and genetic processes to develop products and services, including applications in medicine, agriculture, and environmental management. This database does not include biotech services companies."

<http://www.eflorida.com/keysectors/bio/bio.asp?level1=22&level2=115&level3=365&level4=116®ion=nw>

Also, "the Scripps Research Institute is establishing a major science center in Palm Beach County, Florida, focusing on biomedical research, technology development and drug design". www.scripps.edu/florida/e_index.html

Abc Research	Corp Gainesville
Accentia Biopharmaceuticals	Tampa
Altor Bioscience Corp	Miramar
Apton Corporation	Miami
Applied Genetic Technologies Corp	Alachua
Applied Genetics Laboratories, Inc.	Melbourne
Aquagene, Llc	Alachua
Argonide Nanomaterial Technologies/ (The Argonide Corporation)	Sanford
Axogen, Inc	Gainesville
Banyan Biomarkers	Alachua
Bc International Corp	Alachua
Berna Products	Coral Gables
Bio Nucleonics Inc.	Miami
Bioavailability Systems, Llc	Cocoa Beach
Biodyne Inc.	Sarasota
Bioheart, Inc.	Weston
Biomed Immunotech	Alachua
Biomedtech Laboratories, Inc	Tampa
Bioresource Technology, Inc.	Lauderhill
Cardiovascular Sciences, Inc	Orlando
Copharos, Inc.	Ponte Vedra Bch
Custom Biologicals	Boca Raton
Custom Synthesis Inc.	Delray Beach
Cygene, Inc.	Coral Springs
Cytorex Biosciences Inc	Weston
Daimonion Diagnostics Llc	Gainesville
Dnaprint Genomics Inc	Sarasota
Dor Biopharma	Miami

Dyadic International	Jupiter
Ecoarray Llc	Alachua
Encor Biotechnology Inc	Alachua
Exactech, Inc.	Gainesville
Forseti Biosciences, Inc.	Delray Beach
Geneex Inc	Plantation
Global Laboratories, Inc.	Alachua
Gmp Companies, Inc Ft.	Lauderdale
Goodwin Biotechnology, Inc	Plantation
Integrated Plant Genetics Inc	Alachua
Ivigene Corp	Alachua
Ixion Biotechnology, Inc	Alachua
Life Sciences, Inc.	St. Petersburg
Molecular Meds	Alachua
Morphogenesis Inc	Oldsmar
Nabi Biopharmaceutical	Boca Raton
Nanobac Life Sciences	Tampa
Nanomedex	Alachua
Nanosystems Research, Inc	Alachua
Nanotherapeutics	Alachua
Neurostem (Formally Regenmed)	Alachua
Novamin	Alachua
Oglesby Plant Laboratories Inc	Altha
Oragenics Inc	Alachua
Osprey Biotechnics	Sarasota
Osprey Pharmaceutical Company	Ponte Vedra B.
Pasteuria Biosciences Llc	Alachua
Quick-Med Technologies, Inc.	Gainesville
Regeneration Technologies Inc	Alachua
Saneron Ccel Therapeutics, Inc	Temple Terrace
Smith & Nephew Inc	Largo
Somatocor Pharmaceutical Inc	Alachua
Source Molecular Corporation	Miami
Sunol Molecular Corporation	Miramar
Tequesta Marine Biosciences	Boca Raton
Toxin Technology, Inc.	Sarasota
Transdermal Technologies	Lake Park
Transgenex Therapeutics Inc	Tampa
Tutogen Medical, Inc.	Alachua
Usbiomaterials	Alachua
Vaxdesign Corporation	Orlando
Vicor Technologies Inc	Boca Raton
Viragen, Inc	Plantation

FLORIDA PHARMACEUTICAL COMPANIES

“There are currently 81 companies, employing more than 4,000 Floridians in the pharmaceutical and medicine manufacturing industry. The state’s pharmaceutical companies tend to be clustered along the high tech corridor (particularly in the Tampa bay area) and in south Florida. The industry can further be broken down into the following sub-categories:”

<http://www.eflorida.com/keysectors/bio/bio.asp?level1=22&level2=115&level3=363&level4=117>

- *Medicinal And Botanical Manufacturing (Naics 325411)
- *Pharmaceutical Preparation Manufacturing (Naics 325412)
- *In-Vitro Diagnostic Substance Manufacturing (Naics 325413)
- *Biological Product Manufacturing (Naics 325414)

A Healthy Alternative Inc.	Punta Gorda
Advanced Nutrients Science Int'l.	Largo
Arnet Pharmaceutical Corp.	Fort Lauderdale
Aurora Laboratories Inc.	Palm City
Balassa Laboratories Inc.	Port Orange
Bausch & Lomb Pharmaceuticals	Tampa
Beach Products Inc.	Tampa
Bgs Medical Products Inc.	Venice
Biodyne Inc.	Sarasota
Bio-Nucleonics Inc.	Miami
Biotelemetrics Inc.	Boca Raton
Cardinal Health Inc.	St. Petersburg & Winter Haven
Cargill Inc.	Auburndale
Central Admixture Pharmacy	Hialeah
Conseal International Inc.	Longwood
Coronet Industries Inc.	Plant City
Dci Biologicals	Dunedin
Florida Supplement Corp.	Hollywood
Great American Natural Pdts	St. Petersburg
Gulf Coast Nutritionals Inc.	Greens +Vero Beach
H V S Labs Inc.	Naples
Health & Nutrition Systems	Naples
Healthlink	West Palm Beach
Hill Dermaceuticals Inc.	Jacksonville
Horizon Worldwide Export Corp.	Sanford
Innovative Health Products Inc.	Miami
Ion Laboratories Inc.	Largo
Ivax Baker Norton	Clearwater
Ivax Corp.	Miami
	Miami

Kato Sales Inc.	Altamonte Springs
King Pharmaceuticals Inc.	St. Petersburg
Kirk Pharmaceuticals Inc.	Fort Lauderdale
Kos Pharmaceuticals Inc.	Hollywood
Kos Pharmaceuticals Inc.	Miami
Lex Inc.	Miami
Life Extension Foundation	Hollywood
Life Sciences Inc.	St. Petersburg
Millenium Natural Health Inc.	Miami
Montco Research Products Inc.	Hollister
Monticello Drug Co	Jacksonville
Nabi Biopharmaceuticals	Boca Raton
Nature's Path Inc.	North Port
Nature's Products Inc.	Fort Lauderdale
Naturopathic Laboratories Intl.	Clearwater
Naturopathic Research Labs	North Port
Nephron Pharmaceuticals Corp.	Orlando
North Amer Biopharmaceuticals	Hollywood
Nutraceuticals Corp.	Fort Lauderdale
Nutrition Formulators Inc.	Miami
Optimum Nutrition Inc.	Sunrise
Osprey Biotechnics Inc.	Oneco
Pal Laboratories Inc.	Miami
Peak Performance Nutrients Inc.	Boca Raton
Pegasus Laboratories Inc.	Pensacola
Pet Net Pharmalogic Llc	Fort Lauderdale
Pharmakon Laboratory Inc.	Tampa
Plantation Botanicals Inc.	Felda
Prostahelp Inc.	Coral Gables
Protech Manufacturing & Packg	Clearwater
Quest International Inc.	North Miami
Re-Vita Manufacturing Co	Orange Park
Rexall Sundown Inc.	Boca Raton
Saw Plmtto Berries Coop Of Fla	Naples
Schering-Plough Corp.	Hialeah
Schleicher & Schuell Microscience	Riviera Beach
Sentry Supplement Co Inc.	Opa Locka
Smith & Nephew Inc.	Largo
Southern Botanicals	Clearwater
Star Pharmaceutical Inc.	Pompano Beach
Swiss Caps Usa Inc.	Miami
Synergy Nutritional Industries	Fort Walton Beach
Thermadrol.Com	Fort Lauderdale
Transdermal Technologies Inc.	West Palm Beach
Trim International	Pensacola
Unico Holdings Inc.	Lake Worth
Viragen Inc.	Plantation
Vista Pharm	Largo

Vitarich Laboratories Inc.
Watson Laboratories Inc.
Zirin Laboratories Intl.

Naples
Hialeah
Pembroke Pines

“The Bioscience Industry is emerging as one of the key technology sectors in Florida and, with its continued growth, is playing a vital role in the economic diversification of our state. BioScience is one of the most viable, dynamic industry sectors in the world. With the continued support of and collaboration among our public and private leaders, Florida is poised for rapid growth and national leadership in this important industry.”

Governor Jeb Bush
(<http://www.bioflorida.com/>)

University of South Florida

**MASTER'S DEGREE IN BIOINFORMATICS &
COMPUTATIONAL BIOLOGY**

**<http://molecularmedicine.health.usf.edu>
contact:iwefes@health.usf.edu**