Program Overview

Computing systems and technologies have become increasingly essential for modern practice of medicine, pharmaceutical and clinical research, efficient and effective management of health care, and health professions education. To address an increasing demand for well-trained researchers, educators, and managers in the expanding field of biomedical informatics, and a growing critical need for informatics training. The Rutgers, School of Health-Related Professions (Rutgers-SHRP) offers a comprehensive curriculum leading to Ph.D. in Biomedical Informatics, M.S. in Biomedical Informatics, and a post-baccalaureate level Certificate in Health Care Informatics.

As a field of study, biomedical informatics incorporates the knowledge of the health sciences (medicine, dentistry, pharmacy, nursing and allied health sciences) with computer science, engineering, management information science, biostatistics and mathematics. The course work includes the theoretical foundations and the current range of applications of biomedical informatics within contemporary health sciences, and health care delivery systems. The curriculum contents focus on biomedical information in relation to structures, algorithms and design of efficient logic necessary to organize, store, retrieve and analyze data to produce new body of knowledge, techniques, and computational solutions. Such techniques, computational solutions, and discoveries in understanding biomedical information are vital for management of health care/hospital systems, clinical decision making, research in biomedical and pharmaceutical systems, and design and development of new drugs. Besides, core courses, electives and directed research projects, students can pursue an in-depth study in various areas of specialization.
**Program description**

Biomedical Informatics is an interdisciplinary science that involves both the conceptual and practical tools from these diverse disciplines for the understanding, invention, generation and propagation of biological and medical information - to solve complex problems in prevention and treatment of diseases, health care, health sciences and pharmaceutical research, education, clinical/medical decision-making, and delivery of health care. As such, Biomedical Informatics is an essential element of 21st-century health and biological sciences.

**EXAMPLES OF BIOMEDICAL INFORMATICS APPLICATIONS INCLUDE:**

Reducing diagnostic uncertainties and improving clinical decision-making by using computing techniques and information technologies (e.g., develop clinical decision making tools for determining the probability that an ER patient with chest pain actually has acute cardiac ischemia or should be admitted to rule out myocardial infarction).

Designing interactive consultation system to treat patients more efficiently and cost effectively by using national databases referencing to a broad range of clinical experiences and pertinent variables.

- Developing transportable software systems for image reconstruction and for 3-D visualization and analysis of medical image data.
- Developing new medical applications for the methods of 3-D visualization and analysis for improved diagnosis, treatment, understanding and education of abnormalities in internal structures and in their function.
- Designing large databases of digitized medical images for use in medical decision-making, tele-radiology, or tele-consultation.
- Improving research designs and outcomes of clinical trials, epidemiological studies and health services research.
- Developing computing systems and solutions that will help design more effective and more informative clinical trials to cut years out of drug development process.
- Utilizing computational approaches and modern computer-based techniques in drug design, molecular genetics and cellular genetics to solve complex clinical problems.
- Designing and managing clinical, pharmacy, radiology, laboratory or hospital information systems.
- Designing and implementing a system that will emancipate more time for healthcare providers to spend on important aspects of patient care through delegation of some information handling and processing tasks to computers.
- Designing a computer simulation suitable for analyzing medical and health care problems for constructing solutions to optimize decisions concerned with efficacy of information transfer, productivity & resource utilization in a health care facility.
- Performing quality assurance activities, in-service, patient education software development, etc., in a health care facility at that facility's request.
- Designing and implementing computer-based multimedia educational/training systems for intelligent tutoring, self-paced learning, staff development, or improving clinical decision-making on selected topics.
- Designing and implementing ontologies and enterprise wide solutions for the semantic web and as health information portals.

**Student Expectations**

The Ph.D. degree program in Biomedical Informatics represents an articulated program of study designed primarily to serve health care practitioners, health sciences educators and researchers, and students who have completed an MS degree in: Biomedical Informatics, Computer Science, Engineering, Biology, Biomedical Sciences, or students who hold Master's or advance degrees in the health related professions, or basic sciences. The program is designed to prepare individuals for informatics leadership positions in the schools of health sciences, teaching hospitals, health care organizations, pharmaceuticals, biomedical research laboratories, and government agencies. Students can select one of the following areas of specialization/tracks:

- Bioinformatics
- Nanomedicine & Clinical Informatics
- Public Health Informatics
- Hospital/Health Care Management Informatics

The curriculum consists of at least 61 credits beyond MS degree in Biomedical Informatics. Graduate courses taken for a MS degree in any health science, including biomedical informatics, computer science, and computational biology and bioinformatics degrees may be applied to the Ph.D. course requirements. The 61 credits beyond the MS degree in Biomedical Informatics include:

- A total of 61 Credits made up of 24 credits of courses (i.e. 8 courses) and 36 credits of Dissertation Research and 1 credit of the Graduate Colloquium (seminar).
- The 24 credits of courses consist of 4 Core Courses (out of a choice of Six Core courses) all at 5000 level and 2 Track/Specialization Courses (should be at the 7000 level) and 2 more Elective Courses (should be at 7000 level). The list of courses providing the choices for the core, the track and the electives can be viewed in the PhD Program Requirements for Graduation;
Qualifying Examination: Students must pass a doctoral qualifying examination, which is designed to test the fundamental knowledge of students in the area of biomedical informatics theory and systems, health care systems, and selected Biomedical Informatics courses related to the area of specialization. Admission to the doctoral program does not imply candidacy for a degree. Registration for dissertation research will be permitted to those who have passed the qualifying examination.

- 36 credits of dissertation research culminating in submission of the final draft of the dissertation. In addition to the dissertation, submission of at least one research paper for publication in a peer reviewed journal.
- Registering for the BINF7910 Biomedical Informatics Colloquium / Seminar once during the sojourn of the PhD program constitutes the remaining 1 credit making up the total number of credits to be 61 credits. Besides registering once for BINF7910 the student is also required to attend the colloquium each semester during the length of his/her PhD program.
- Oral Examination: The dissertation must be defended in an oral examination.

**Full-time and Part-time status**

Both full-time and part-time students are admitted in the program. Full-time students may complete the program in three to five years. Part-time students may take up to seven years to complete the program. Students successfully completing the program will be granted the Ph.D. degree in Biomedical Informatics by Rutgers.

**Department Faculty**

Please see the department faculty under Health Informatics department/Newark campus.

**Primary Campus Location**

Newark Campus for In-Class version & Moodle Course Management System for Online version.

**Curriculum**

See database for program requirements and course descriptions and select your program.

**Note:** Curriculum Requirements for Graduation for the Program of Ph.D. in Biomedical Informatics:

1. Complete Core and Advance Courses Related To The Area Of Specialization
2. Pass The Qualifying Examination
3. Submit And Defend Successfully Dissertation Proposal
4. At Least 12 Credits Must Be at 7000 Level
5. Completion of Dissertation: the dissertation must be defended in an oral examination.
6. Completion of the Department/School requirements for submission of dissertation.

All students must complete at least 61 credits beyond the Master of Science degree; and maintain an average grade of 3.0 or better, with no more than two grades of C, and one credit hour of colloquium in biomedical informatics.

**Mission/Goals/Objectives**
Upon completion of this program, the student have attained knowledge generation competency in one of the five specialization tracks of Biomedical Informatics. Graduates of this program develop, implement and evaluate informatics algorithms, biomedical computing solutions and technologies for decision support tools for improving clinical practice, and health care delivery and management; and design systems for more effective and informative research and education. Thus, expanding and advancing the science and methods of biomedical informatics.

As the health care systems continue to become technology based, the demand for graduates of Biomedical Informatics (professionals who understand both the health care environment and computing systems and technologies) will only continue to grow significantly. The curriculum provides in-depth training in biomedical informatics, computer science, health care management systems, and research methods.

Graduates of this program will have knowledge, skills and credentials needed for a rapidly growing market. Program completion will provide for a wide range of career opportunities as managers, specialists, scientists, researchers and educators in various health care settings including: hospitals and health care facilities, laboratories, pharmaceutical companies, insurance and private and governmental agencies, and colleges of medical, dental, nursing and health professions in the nation - which must utilize modern information technologies. With the necessary academic preparations and informatics experiences, these careers can lead to positions as chief information officers (CIOs), scientists and directors of research, managers of hospital and laboratory information systems, and faculty members in various health sciences educational institutions.
Admissions Requirements

General Requirements: Applicant for admission to the Graduate Programs in Biomedical Informatics must hold a Masters degree from an accredited institution in the US or its equivalent with a major in any field of health sciences (including medicine, dentistry, allied health, nursing, public health, pharmacy), or biological sciences, computer science, engineering or an equivalent field of study. A student seeking admission to any of the Graduate Programs must satisfy all entrance requirements of Rutgers-SHRP. These requirements include:

- Completed applications form with the SHRP’s application fee.
- Three (3) letters of recommendation. Professors and/or individuals directly responsible for supervising the applicant, attesting to the candidate’s potential success in the program, should write these letters.
- Official transcripts(s) of previous collegiate work or last earned degrees.
- GRE scores.
- Personal statement describing interest and commitment to the program.

GRE Exemption: Applicants already holding a doctoral (e.g., Ph.D., M.D., D.D.S.) or MS in Computer/Information and Engineering Sciences, Public Health, Nursing, Business Administration degree from an accredited institution in the USA, or Rutgers medical, or dental students are exempted from the GRE requirement.

International Students and TOEFL: In addition to the requirements stated above international students are required to provide evidence of English language proficiency by submitting Test of English as a Foreign Language (TOEFL) examination scores. Applicants with scores below 550 or CBT equivalent are not considered for admission.

Prerequisites:
International students please see either the Admissions and or the Office of International Services for more information on Visa or similar issues.
Applications for Fall admission must be received by June 1. Supporting documents must be filed by July 1. Application for Spring admission must be received by October 1. Supporting documents must be filed by November 1.

For more information
Application packets including program related information may be obtained by writing or calling the Office of Enrollment Services. Alternatively, please call Office of Enrollment Services at (973) 972-5336 or via e-mail.

For more specific information contact the program at:
Rutgers, The State University of New Jersey
RBHS - School of Health Related Professions
Updated 06/13

Department of Health Informatics
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