A Programming Course in Bioinformatics for Computer and Information Science Students

Appendix III: Medical Informatics at Stanford (http://www-camis.stanford.edu/smi)

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Medical Informatics and Bioinformatics

This new course was offered in part to provide an introduction to bioinformatics to students in medical information sciences (MIS). Stanford has had a program in MIS for over ten years. In the early years of this program, the focus was almost exclusively on the application of information technologies to problems in the delivery of patient care, support of physician decision making, and clinical databases—*clinical informatics*. Starting in 1992, the program has launched an effort in *bioinformatics* to complement its previous strengths in clinical informatics. The reasons for this effort include the following:

1. With the advent of the human genome project, and its anticipated effect on the practice of medicine, it is clear that clinical informatics and bioinformatics are converging in terms of the types of information that must be stored, retrieved, analyzed and managed—particularly in academic medical centers. This convergence is still perhaps more than a decade away, but the next generation of biologically savvy scientists and engineers should be trained on this model.

2. The principal funding agencies for traditional clinical informatics have all established arms devoted specifically to bioinformatics, and thus it is somewhat useful to have faculty and student interests that are coincident with these arms. For example, the Biomedical Library Review Committee at the National Library of Medicine has a Biotechnology Information subcommittee for evaluating bioinformatics or biocomputing proposals.

3. Perhaps most importantly, there is a fundamental similarity between many of the issues faced in clinical informatics and those faced in bioinformatics. Perhaps because both are based on the study of living organisms, and the systems that are established to maintain them, they are more similar to each other than they are to more traditional engineering applications. The issues of database design and integration, representation of uncertainty in data, pattern matching for diagnosis, standard vocabularies, representations of variable biological function, elucidating relationships between structure and function (and many others) are all common to both fields and contributions in one may have an impact in the other.

The program in MIS at Stanford has three full-time tenure-line faculty (all with courtesy appointments in Computer Science), and another three Senior Research Scientists. The program is based in the Department of Medicine at Stanford. MS and PhD programs are offered, with approximately 25 students currently enrolled. The required curriculum includes courses in basic biology/physiology, computer science, statistics/probability and decision sciences, scientific ethics and social issues, as well as core courses in MIS. The course described in this paper has been made a required core course. The Stanford model of merging clinical informatics and bioinformatics is by no means universally accepted, and has drawn valid criticisms from both sub-disciplines. At this point, it can be considered an experiment. The advantages to students of this broad training and exposure to issues of clinical information as well as basic biological information remain to be evaluated.