Information Technology and Genetics Research – A Few Observations

The relationship between information technology (IT) and genetics research has not received the attention it properly deserves. This is odd when one considers the sheer scope and fundamental intimacy of the relationship. Certainly genetics research would neither have burgeoned so quickly nor, indeed, assumed the principal hermeneutical role in contemporary culture without the widening availability and accelerating power of IT.

Genetics research is reliant on IT in ways which are complex but also manifestly productive as the Human Genome Project so ably and thrillingly demonstrates. According to Oak Ridge National Laboratory (USA), "genetic data will provide the foundation for research in many biological sub-disciplines, leading to an unprecedented understanding of the inner workings of whole biological systems"[1]. More specifically, it notes and predicts that "the benefits of genomic research are, or soon will be, realized in such areas as forensics and identification science, ecology and environmental science, toxic-waste cleanup, creation of new bio-energy sources and more efficient industrial processes, as well as in understanding the mysteries of evolution, anthropology, and human migration."[2]

Yet with the dazzling advances in scientific knowledge comes our growing awareness of a corresponding cat's cradle of ethical issues brought about by the interaction and intensification of converging disciplines and IT. In this context, the significance of IT in genetics research might be usefully summarised thus:

i) without IT, genetics research would not have the capacity to collect, systematise and subsequently analyse the sheer volume of relevant data.
ii) without IT, the individual or collective outcomes and products of genetics research would not be usefully distributable, either commercially or for not-for-profit purposes.

In short, contemporary genetics research is wholly dependent on information technology to achieve its goals as indeed are many other areas of research; more explicitly, its dependency is critically related to the overall volume of data, the relevant speed required to process it effectively and the overarching integrity of the processing itself.

Issues relating to volume of data and speed of processing in genetics research are far from theoretical. Indeed researchers are now using grid computing to speed up investigations into new ways of tackling disease. The UK company Oxford GlycoScience, for example, has "implemented the technology to improve the utilisation of its server infrastructure and shorten the time it takes to process work".[3] On its implantation the company immediately "noticed a reduction in turnaround time: one job scheduled to take three months was done in a week, while others typically processed in week were done in a day or less".[4] Indeed in the future the company "may not even have to worry about a server infrastructure at all: using grid engine portal technology [it] could connect to grid computing resources anywhere in the world".[5]

However, the use of information technology in distributing the outcomes and products of genetics research is just as significant as the actual research itself. In particular the development and maintenance of databases which have as their *raison d'être* the systematic storage and retrievability of identifiable DNA or other biometric information raise acute questions about the ownership and integrity of the data, as well as the fundamental principles governing the right of access. All databases which contain personal information pose significant risks in terms of the reliability of the data and potential system abuse through poor security architecture and management protocols. Existing national databases, such as those operated by credit reference agencies, law enforcement agencies or government departments, suggest the need to nurture a culture of high vigilance rather than one of settled complacency.[6]

Ethical issues relating to information technology are just as diverse and pressing as those encountered in the field of genetics research. Indeed it could be argued that information ethics has in some senses a *logical* priority over other fields of ethical concern insofar as the procurement, storage and management of information, from the highest policy level to the most elementary issues surrounding the installation and maintenance of hardware or software[7], has the potential of impacting critically on the lives of specific individuals as well as society as a whole. Without good information (i.e. *quality* information *reliably* collected and stored) rational decision-making is compromised in both the political and personal sphere. Often it is difficult to make wise or prudent decisions even when individuals or communities are furnished with the best possible information. However, when information is limited, corrupt, or merely irrelevant,

personal decision-making and public policy development are inevitably frustrated or endangered. Good information requires good information systems whose integrity encompasses transparent policy goals and management practice as well as robust technical design and capability.

The close relationship between genetics research and IT becomes even more obvious when we consider the wider role of information ethics in society. According to Luciano Floridi:

> "There has been a fundamental blind spot in our ethical discourse, a whole ethical perspective missing, which information ethics and its applied counterpart, computer ethics, seem to be able to perceive and take into account. The shift from an anthropocentric to a bio-centric perspective, which has so much enriched our understanding of morality, is followed by a second shift, from a biocentric to an onto-centric view. This is what information and computer ethics can achieve, thus acquiring a fundamental role in the context of ethical theories. The object-oriented ontocentric perspective is more suitable to an information culture and society, improves our understanding of moral facts, can help us to shape our moral questions more fruitfully, to sharpen our sense of value and to make the rightness or wrongness of human actions more intelligible and explicable."[8]

Certainly in the area of genetics research the rewards offered by IT are immense; but so too, undoubtedly, are the risks. Try as we might, we cannot deny that our genetic data is related, both directly and mysteriously, to our infrangible sense of what it is to be 'us'.

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Notes

[1] See http://www.ornl.gov/sci/techresources/Human_Genome/education/careers.shtml

[2] Ibid

[3] James Watson, 'Genetics role for grid computing', *Computing*, 19 June 2003

[4] Ibid

[5] Ibid

[6] See GeneWatch UK's publication 'The DNA Expansion Programme: reporting real achievement' (February 2006) and its Parliamentary Briefing No. 6 'The police National DNA database: an update' (July 2006)

http://www.genewatch.org/uploads/f03c6d66a9b354535738483c1c3d49e4/DNAexpansion_brief_final.pdf

http://www.genewatch.org/uploads/f03c6d66a9b354535738483c1c3d49e4/MPSBrief_1.pdf

[7] A good if somewhat trivial example is provided by Barry R. Zeeberg et al. in the article 'Mistaken Identifiers: Gene name errors can be introduced inadvertently when using Excel in bioinformatics' (see http://www.biomedcentral.com/1471-2105/5/80)

[8] Luciano Floridi, 'Information Ethics: On the Philosophical Foundation of Computer Ethics' (see http://www.philosophyofinformation.net/ie.htm)