

Who owns the human genome? What can ownership mean with respect to genes?

HUBERT MARKL *

Max-Planck-Gesellschaft, Hofgartenstrasse 8, D-80539 Munich, Germany.

The progressive elucidation of the structure of the human genome with the subsequent use of this information for various purposes, many of which will be of commercial value, raises questions about the ownership of the information. This article points out some of problems of defining the genome as property and explores the relevance of the usual criteria of patent law to this new situation.

‘Who owns the human genome?’ This would seem to be an odd question. Is it not tantamount to asking: ‘Who owns mankind?’ We all know now that human genes determine, or at least influence, many human characteristics (or ‘traits’, as we would say for domestic animals or plants). Can they nonetheless become someone’s property in the sense of exclusive ownership? And not only single genes, but even the whole genome? Do people who ask such questions really understand what they are talking about? Do they mean the genome; that is, the whole set of genes of one particular human being? Yet how could that be owned in any legally relevant sense by someone else without immediately violating the most fundamental of human rights, freedom and autonomy; in other words: exclusive ownership of oneself, each person’s genetic *habeas corpus*, as it were?

However, if the question does not refer to any particular individual’s private genome, which could only be called that particular individual’s exclusive property, then could the expression ‘the human genome’ instead be used to refer to the sum total of all the possible genes in the more than six billion people alive

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today, and perhaps even in some of those already deceased, from whose corpses bits and pieces of DNA could be extracted? However, if that was what was meant by ‘the human genome’, I wonder who in the world could claim ownership of the roughly 10^{20} gene variants (whether single nucleotide polymorphisms or alleles) that may be swimming around in the gigantic gene pool of the human population? Nevertheless, or perhaps for this very reason, the title may be very cleverly formulated because, by asking something that is really impossible, it simultaneously exposes the manifold misconceptions so frequently encountered when discussing the patenting of inventions derived from genetic research. I carefully avoid saying: ‘The patenting of genes’ and thus direct our attention, by inviting a *reductio ad absurdum*, to the really sensible question of what can be owned by whom in the field of gene technology

The somewhat absurd question ‘Who owns the human genome?’, or the more reasonable question of what ownership and property rights could mean with respect to gene technology, or in a broader sense, biotechnology, is, however, only one aspect of a much wider field, namely who can own genes or genomes, or what could be protected by property rights of the genes or genomes of *any* organism. However, there are many millions of species out there, with who knows how many multi-trillions of individuals and multi-quadrillions of genes! This almost leads one to ask: ‘Who can own Nature?’ Now, some would say ‘God’. Others would say ‘Nobody’. Still others might ask ‘What’s the difference?’ Yet others will ponder and reply ‘Well, actually, only humankind can claim ownership of Nature including all those myriads of organisms’ genes and genetic modifications, if only because there is nobody else around to stake the claims’. Thus we arrive at a conclusion that is not very different from the common, ‘politically green’ saying, that Nature, and of course all of its critters, is actually humankind’s common heritage, bestowed upon us by the Lord himself — as religious people believe. If that were so, and there seems nothing completely illogical in this reasoning, it would seem very wise not to try to stake any claims for exclusive property rights to the realms of Nature, which are the collective goods of humankind, such as the laws of physics, chemical elements, the sun’s radiation, clouds, rain or snow. When we think along these lines, a claim for an exclusive, worldwide patent on the chemical elements tungsten, platinum or gold would immediately be refuted as patently absurd. Just as absurd, possibly, as we may soon consider a comparable claim of ownership to a particular sequence of nucleotides, merely because it is there in the cells of a microbe or a human being, from where it has been extracted and sequenced using machines that can be bought off the shelf in the scientist’s supermarket. This is especially true since we now know, after more than 90% of the human genome and that of scores of other animals, plants and micro-organisms have been sequenced, that there is no such thing as a ‘human gene’. We share a large proportion of our genes, which are completely indispensable to our

biological human nature, nucleotide for nucleotide, with not only chimpanzees or mice but also with humble creatures such as fish, flies or worms. To patent these DNA sequences for exclusive use if they are derived from any one of these organisms would seem just as absurd as asking the patent office to award an exclusive patent on a newly discovered species of bird, toad or butterfly.

I think that we have every good reason to stick soberly, even under the hyped-up pressures of a biotechnology stock market bubble, to the three well-known basic principles of international patent law:

- Is it really a new technological invention and not merely the discovery of something already existing in nature?
- Is it an obvious or trivial consequence of knowledge freely available to everyone, rather than the outcome of an inquisitive and creative mind and hand?
- Finally, is it useful; meaning, can it be sold on a market, or is it a gadget without any recognizable functional use — perhaps an ingenious original contraption resembling a piece of art, but without any market potential for those who wish to mass-produce it?

If we cling to such basic patent principles, then it would seem to me that it would be very difficult to defend patents, i.e. the limited exclusive ownership of rights to make use of an invention on the complete description of a single deciphered gene, much less a whole genome, be it from a virus, a plant or a human being. We know that every gene is nothing but a highly complex chemical substance. As in the case of nitrogen, chlorophyll or rhodopsin, awarding a patent on such a genetic substance would mean rewarding a perhaps wonderful scientific discovery but not an invention. Of course, a process for mass-producing any substance of this kind might be eminently eligible for such selective intellectual property rights, but not the chemical formula for such a substance itself, and any gene *is* just such a substance with a well-defined formula. Therefore, many, if not most, of us bioscientists are convinced that it takes more than sequencing in order to obtain a patent. Namely, it takes a defined description of what kind of useful product can be derived from a gene, usually a protein or a complex group of proteins, and how this knowledge and the availability of such a product can be used practically in a marketable product, for instance in a drug against a particular disease.

This said, I want to make it perfectly clear that I am *not* against the patenting of genetic information, even from humans, as long as these basic conditions are fulfilled. We should, however, be carefully aware that it is not the chemical formula of a gene, but the functional information that is the truly patentable content. Only by providing access to such a functional process, and not from the genetic substance itself, as in a natural biochemical compound such as an

antibiotic, can the marketable benefit be derived. If this defined and useful function is clearly proven, I can see no legitimate legal or moral argument against issuing patents for genetic sequences derived from the human genome, which may, as has already been mentioned, anyway be identical to sequences from other organisms. There can be no doubt that we need patents in order to encourage the costly development of useful products from genetic discoveries and to get the information from the secrecy of laboratories or from arcane scientific publications out into the open, where anyone interested can obtain a licence for further fruitful development. Of course, for this to occur, it is necessary that patent holders should be able to exploit their monopolistic privilege themselves for a limited time period, if they wish to develop a marketable process or product. But they should not be able to hold on to a patent, quite contrary to what the root of the word says, in order to hinder competitors from making use of this knowledge through licence contracts. This would not so much harm the freedom of research, which is safeguarded by patent laws, but would hurt the freedom of economic exploitation of existing knowledge, which patent law is primarily intended to promote. To use patents to block competitors should be regarded as a despicable practice because it destroys rather than enhances potential benefits to public welfare.

‘No patent on life’ is a nonsensical phrase since it is not life that can be or should be patented, but only practically useful and creatively applied knowledge or material derived from living matter. The patent system should encourage the development of useful products but should not award entitlements for mere catalogues of nucleotide sequences, nor ownership of entire species.

I also wish to emphasize strongly that it is definitely desirable to limit the patent rights given to a well-defined and clearly proven useful function, since we know now that each single gene, of which we may have only 25,000 to 40,000 altogether in one human genome, may be involved in the production of a ten- or twentyfold number of functional proteins, and that many such proteins may be enmeshed in a number of different functions of an organism. Assigning broadly defined patent rights to a specific gene plus its protein, for which only one function has been described, in such a way that all additional functions described in the future are also covered, even though this is common practice when granting traditional patents on chemical or pharmaceutical substances, could be ruinous to an economic landscape of biotech start-ups, because the actual inventor of a completely new marketable use would immediately be subjected to serfdom under licence to someone who did not contribute his or her own creative intellectual or practical effort to a new development in that field. Sweeping genetic technology patents could thus all too easily brush a promising new industry down the drain.

Of course, I realize that there are many people who can contribute much more expertise to these matters than I can muster on the basis of my limited knowledge. The Max Planck Society is proud to have among its ranks some of the most highly

respected specialists on questions of intellectual property rights in general and, more specifically, in the area of genetic technology. In fact, we believe that there is so much potential for productive development in this whole area, from e-commerce to Internet software, to the human genome, that the Max Planck Society has followed my proposal, based on the advice of international experts, to expand our existing Max Planck Institute for Foreign and International Patent, Copyright and Competition Law over the coming years into a completely refurbished *Munich Intellectual Property Law Center*. This will be achieved in close cooperation with the Ludwig Maximilian University and the Technical University of Munich and will also work in close contact with the German and the European Patent Offices, and the Federal Patent Court, which is also based in Munich.

As in the past, I am pleased that I will continue to be able to rely on the expert legal knowledge developed by the scholars working at that Institute, and I am even more proud to see that these scholars have been, and will remain, deeply involved in German, European and international developments, and in the drafting of regulations and laws pertaining to their field of specialization.

To pick just one example: if we ever succeed in obtaining Community patents within the European Union, if we finally see the day when this European patent is granted under conditions that are really competitive with the US patent system, for instance by giving European scientists, engineers and inventors the same benefit of a grace period, and if all this should ever happen in our lifetime, it will be mainly to the credit of identifiable individuals at the Max-Planck Institute.

Even if I suspect that answering the rhetorical question of 'Who owns the human genome?', cannot be answered, except perhaps by the simple word 'Nobody', and if the suggestions that I have made from my own limited perspective do not meet with agreement, then I do not mind as long as I can be sure that the right people find more appropriate ways of posing these questions and to supplying much better answers.

About the Author

Hubert Markl was the President of the Max-Planck-Gesellschaft from 1996 to 2002 and, while holding this post, was on leave from his position as Professor of Biology at the University of Konstanz. His main scientific interests are in evolution and behavioural biology. His present address is University of Konstanz, Department of Biology, Mail Box M612, D-78457, Konstanz, Germany.