



SMAD

Electronical Journal Mental Health Alcohol and Drugs

ISSN: 1806-6976

Av. Bandeirantes, 3900. Ribeirão Preto/SP - Brasil CEP: 14.040-902 Telefone: 055-16-602-3477 Fax: 055-16-602-4754



AUTONOMY AND THE GENETICS OF BEHAVIOUR

Emilio Mordini¹

Abstract

The idea that behaviour, personality traits, preferences and choices may be the result of a sort of biological decision-making programme, shaped by evolution and carried by DNA, conflicts with the idea of "autonomy". Indeed the term "autonomy" involves the idea of freedom and the capacity to be self-determining, to be in control of one's own life, beyond any influence of biological, psychological and social compulsive forces, genes included. Policy of scientific action has to be based both on a moment of universality, which is represented by determinism, and on the pragmatic demands posed by indeterminism and autonomy. Sometimes, scientists do not seem to realise this.

Key words: genetics, free will, ethics

AUTONOMIA E A GENÉTICA DA CONDUTA

Resumo

A idéia de que a conduta, traços de personalidade, preferências e opções possam originar-se em um tipo de programa biológico de tomada de decisões, modelado pela evolução e contido no DNA colide com a idéia de "autonomia". O termo "autonomia" realmente envolve a idéia de liberdade e capacidade de autodeterminação, controle da própria vida e vai além de qualquer influência de forças compulsivas biológicas, psicológicas e sociais, inclusive os genes. Políticas direcionadoras da atividade científica devem ser baseadas tanto em um momento de universalidade, representado pelo determinismo, quanto nas demandas pragmáticas postas pela indeterminação e autonomia. Às vezes os cientistas parecem não compreender isso.

Palavras-chave: genética, livre vontade, ética

AUTONOMÍA Y LA GENÉTICA DE LA CONDUCTA

Resumen

La idea de que el comportamiento, rasgos de personalidad, preferencias y opciones pueden resultar de una especie de programa biológico de toma de decisiones, formado por la evolución y transmitido por el ADN, choca contra la de la "autonomía". El término "autonomía" realmente implica la idea de libertad y capacidad de autodeterminación, tener control sobre su propia vida y va más allá de cualquier influencia de fuerzas biológicas, psicológicas y sociales obsesivas, genes inclusive. La política de acción científica tiene que estar basada tanto en un momento de universalidad, representado por el determinismo, como en las demandas pragmáticas planteadas por el indeterminismo y la autonomía. A veces los científicos no parecen comprender esto.

Palabras clave: genética, libre voluntad, ética

¹ Professor of Bioethics, Secretary of the Bioethical Commission of the National Research Council (CNR), Director of the Centre for Science, Society and Citizenship – Rome – Italy E-mail: e.mordini@bioethics.it

INTRODUCTION

“One of the greatest risks of this focus on the genome is that people will draw the conclusion that their choices in life are hard-wired into our DNA and free will goes out the window and we move into this mindset of genetic determinism”
(Francis Collins, Human Genome Project)

“If you didn’t believe the will was free, it would be unreasonable to thank someone for passing the mustard”
G.Chesterton

Explanations for human behaviour have followed historical cycles. After the World War II biologists, despite their increasing knowledge on genetics, have been reluctant to challenge the notion that human behaviour is largely shaped by environment and culture. Till the Eighties of last century, to speak of the role of genes in shaping differences between individuals was almost taboo. The fear was that the ability to predict personality traits will lead to eugenics. But the pendulum swung. When 1976 E.O.Wilson published his influential, and highly controversial, book, “Sociobiology: the New Synthesis”, he was accused to be nearly a nazi, but when, in 1999, he wrote another book to affirm that all branches of human knowledge, from ethics to economics and law, will eventually be unified by understanding the genetic rules of the human mind, there was almost no scandal.

In the last decades several bestsellers – asserting that sensitive aspects of human nature are shaped by genes – have been published. It is sufficient to remember Wilson and Herrnstein’s “Crime and Human Behaviour” (1986), Le Vay’s “The Sexual Brain” (1993), Herrnstein and Murray "The Bell Curve" (1994). The idea that the destiny of human beings is written in their genes is becoming more and more commonsensical. The discoverer of the DNA structure, J.Watson, stated: “We used to think our fate was in our stars. Now we know, in large measure, our fate is in our genes” ⁽¹⁾, and the French geneticist – and currently French Minister of Health - J.F. Mattei, wrote: “We shall soon, (and this is already being done)

foretell what fate holds in store for us before life even starts, as if we are the fortune-tellers of modern times. Southern blots now replace the crystal ball”⁽²⁾.

This paper will deal with this very idea, the idea that genes may shape our destiny. Our method will be that of travelling around the West culture to trace some of the origins of this idea. Obviously we shall only hint at few of them, but I hope that the journey will be worth all the same. I am a philosopher but I’m also a practising psychiatrist. I am used to thinking that we need to explore fantasies of the past to understand events of the present. As Rorty (1979) claimed: “Just as the patient needs to relive his past to answer his questions, so philosophy needs to relive its past in order to answer its questions”⁽³⁾.

Genetics and autonomy

There is a certain irony in the fact that in a hypothetical lexicon of key medical words of the 20th century both genetics and autonomy would occupy the first rank. It is difficult to imagine two words harder to conjugate.

Genetics refers to those biological factors which pertain to the “gene”, the Greek term for race, tribe. In other words, genetics relates to those elements that are common to a line of living beings, that are transmitted (inherited) along this line, and that each individual possesses only because she is part of that line. These elements – the genes – control many biological features of living organisms. Observations have also shown that patterns of behaviour exist which are typical of given species. These patterns of behaviour, which are innate and relatively independent of learning, are usually called “instincts”. The term has been applied to a wide range of behaviour (e.g., maternal instinct, nesting instinct, self-preservation

instinct, etc.) and has often served us as a loophole to extricate ourselves from the issues raised by finalistic animal behaviour.

The term “instinct” has also been widely applied to human behaviour. At the beginning of the 20th century Sigmund Freud spoke of “instinctual drive” (as the German word *trieb* should be more correctly translated rather than simply as “instinct”) and postulated the existence of primordial fantasies – *urphantasien* – connected with the remorse for the murder of the primal father. Carl Gustav Jung went beyond this and proposed the existence in human beings of innate patterns of psychological performances, manifested in behaviours and emotions. He called these patterns “archetypes”. Even later psychoanalysts, such as Isaacs, Bion and Matte Blanco, spoke of innate, inherited mental structures. Ethologists (e.g., Lorenz, Tinbergen, and others), sociobiologists (E.O.Wilson) and neurobiologists (E.Kandel) have also discussed the validity of the concept of instinct. However human behaviour has always been too complex to be understood in terms of sequential patterns. Admittedly, while genes play a role in determining human behaviour, it has always been said that the genetic component in most human behaviour was too intricate to be analysed because it was polygenic - that is, many genes are involved – and polygenic traits were believed to be too difficult to be studied.

Today polygenic characters no longer pose an insurmountable obstacle: new molecular genetic strategies and new statistical techniques allow to detect genes which contribute, even modestly, to the variance of a behavioural trait, and many types of behaviour - from normal variations in personality to complex psychiatric disorders - are now under scrutiny. The implication of these studies is that we are now considering the possibility to demonstrate that genetically encoded sequences of behaviour may play an important role in humans and that the genes that underlie these sequences can be identified and even manipulated.

The idea that behaviour, personality traits, preferences and choices may be the result of a sort of biological decision-making programme, shaped by evolution and carried by DNA, conflicts with the other keyword of today: “autonomy”. Indeed the term “autonomy” involves the idea of freedom and the capacity to be self-determining, to be in control of one’s own life, beyond any influence of biological, psychological and social compulsive forces, genes included.

The word “autonomy” has had various uses. In strict philosophical terms it refers to the Kantian theory of morality. In a broader sense it has been much invoked in recent applied ethics, esp. in bioethics. At the end of the 1970s and beginning of the 1980s, bioethics affirmed the individual’s right to deliberate about his/her own health and freely choose those moral values according to which each one takes health care decisions. Autonomy – as a bioethical principle – chiefly refers to the patient’s right for self-determination in opposition to medical paternalism.

The word “autonomy” has, however, a long history, dating back from ancient Greek. In the Greek language, autonomy literally means “self-law”: a subject is autonomous when he/she has the capacity for self-government. In Greek philosophy, autonomy was mainly a political concept and, in practice, it referred to self-ruling free citizens as opposed to the subjects of a monarchy.

In Western thought the word autonomy has also acquired a metaphysical sense from the Jewish culture. According to Judaism, the relationship between humans and the law is inherently theological, concerning the way in which humans accept or refuse God’s will. Autonomy is both what makes humans made in God’s image and what may turn them into His parody (Genesis 3, 22-24). Human beings –the Bible tells us – are always verging between becoming God’s image or becoming a grotesque imitation of Him. When they break

their alliance with God – namely when they become autonomous from God – they just become God’s tragic caricature, for they pretend to rule themselves as if there were God. Therefore, according to the Bible, the internalisation of God’s law is the only way in which human beings can become fully human and truly free.

The key to Christianity’s view on autonomy is found in Luke 22:42, when Jesus – praying on the night when he was betrayed and handed over to his executioners, says: “Father, if thou be willing, remove this cup from me: nevertheless not my will, but thine, be done”⁽⁴⁾. Indeed Christianity not only accepts the Jewish theological dimension of autonomy but goes even further. It has been said that Christianity was more interested in “theonomy” than in autonomy. Christian medieval scholars were fascinated by the issue of free will but they were very far from our view of the problem. Their focus was on God’s omnipotence rather than on human agency.

The modern account of autonomy emerged during the Reformation: for the man of the Reformation, autonomy dwells in the inner conscience – the “absolute conscience” in Luther’s words – of each human being and it represents the actual centre of the person. Locke, Hume and Kant were then to ground this concept on non-religious bases. Stuart Mill completed the idea of moral autonomy with the idea of liberty – intended as political autonomy.

Determinism and Indeterminism

Thus the problem raised by the genetics of behaviour is only an episode of the long-running dispute between determinism and indeterminism. This quarrel is a good example of those problems that philosophers love so much because they are impossible to solve.

Determinism assumes that all events are caused. More precisely “Determinism is the general philosophical thesis which states that for everything that ever happens there are conditions such that, given them, nothing else could happen”⁽⁵⁾. At a first glance this thesis seems to be commonsensical but if we look at it more in depth, it raises a lot of problems.

First, determinism implies a doctrine of causation. Causation is the relation between two events, when there is one event which occurs, and produces, determines, or necessitates the other. There are several models of causation. For instance, early genetics made large use of a linear model of causation. According to this model each event is part of a series, being both the effect of a previous event and the cause of the next. Causation can be consequently analysed as a linear sequence of discrete events. Of course the model can be complicated considering various concomitant sequences that interact with each other and sometimes cross. In genetics, the simplest “complex model” provides for two concomitant sequences: genes and the environment; other, more complex, models consider neurodevelopment, societal influences, cultural heritage, and so on.

The idea of causation seems to be reasonable and intuitive. However philosophers know that there is no way to demonstrate that causes exist or, to put it differently, that each effect requires a cause. Kant discussed this point in the third antinomy of the Pure Reason. The principle of sufficient reason, *viz.* each effect requires a cause, is the typical example of those synthetic propositions *a priori* that Kant showed to be “regulative”, namely about our way to think of the world, rather than “constitutive”, namely about the reality of the world. Undoubtedly we think of the world as if any effect has a cause, but there is no way to demonstrate that the world really works in such a way. As empiricist philosophers claim, we can just say that we perceive regularities in the world.

Not only is the premise of determinism more metaphysical than one might imagine, it is also highly unmanageable in its consequences. While determinism in the physical sciences does not pose major problems, it creates a lot of problems when applied to human beings. Any explanation of human behaviour, and especially of moral conduct, in terms of causes, effects and necessary laws raises the problem of free agency. In this sense it does not matter whether the causes are the planets, the economic structure, the unconscious or genes: in all cases if one's actions are predetermined by any past event, one is not free to choose between alternatives, and therefore one cannot be held accountable for one's behaviour. The controversy on the respective causal role of nature and nurture in determining human behaviour does not alter the framework of the problem. Whether one speaks of environmental determinism, social determinism or biological determinism, the basic problem remains the same: if human actions are embedded in a system that presupposes universal causation, we are mere automatons, as predictable – at least in principle – as any physical event. If we are predetermined we are not responsible for our actions, thus neither ethics nor law can be rationally justified.

Some philosophers contest this statement. They state that determinism and free agency are not mutually exclusive. At the turn of the 19th century W. James introduced a distinction that has remained in use to this day. He distinguished between hard and soft determinism. While hard determinism assumes that everything is caused and consequently, in principle, everything is predictable (knowing the initial conditions and the relevant laws), soft determinism – also called “compatibilism” - says that to a certain degree, there is freedom, or randomness, in the universe, or, at least, we had better believe there is. The soft determinist position is well expressed by Quine: “One is free, in the ordinary sense of the term, when one does as one likes or sees fit; and this is not altered by the fact, if fact it be, that what one likes

or sees fit has had its causes”⁽⁶⁾. James himself accepted the idea of free agency only on pragmatic grounds. In his opinion that was the only way to maintain hope for a better future. He called the doctrine of free will “a general cosmological theory of promise”. Another influential philosopher who tried to conciliate human freedom with determinism was J.Dewey. Dewey argued that freedom could not mean “without any cause”, because if it did human actions would be totally inexplicable. Undoubtedly one’s acts are the result of one’s personality and character. Yet people can modify their natural tendencies by understanding them. Dewey argued that intelligence and knowledge are the keys to freedom of action. Other philosophers focused on the consequences of determinism, contesting that this doctrine may threaten our system of wages and rewards: “I agree that praise and blame should be deserved to free acts; a man is not to blame for bruising someone into whom he was pushed. But I hold that heroes, geniuses, and criminals deserve praise and blame, reward and punishment, for their acts despite any causal chains [...] The social efficacy of these institutions does not hinge on freedom of will as opposed to causal determinism; on the contrary, we weave reward and punishment into the causal network in order to help to cause the desired behaviour”⁽⁶⁾.

Yet it is hard to confute that a strict determinism undermines ethics and law. People want reward and punishment to be grounded in justice, not in utility. Discoveries in the genetics of behaviour may have profound legal implications. Most courts, for example, accept a claim of insanity as a defence in certain criminal cases. If a propensity towards aggression or violence is shown to have a genetic basis, a lawyer may argue that his client could not control his violent urges*.

* The possibility that Behavioural Genetics might be used as the basis for some kind of ‘genetic defence’ in criminal cases was first brought to public attention by the Stephen Thomas Mobley case in the U.S. Mobley was convicted in February 1994 of the murder of John Collins and sentenced to death. His lawyers attempted to put together a genetic defence (Mobley vs. The State 1995). The defence claimed that there was a pattern of aggression in Mobley’s ancestry which suggests a relevant genetic aetiology underlying his criminal behaviour. In Mobley’s case the genetic defence was rejected by the jury.

The question is not much simpler as regards the second branch of the dilemma: i.e. indeterminism. Indeterminism – which is also called libertarianism – makes no assumption on general causality; it focuses only on human agency. Its starting point is the basic experience that we are able to choose among alternatives. As a matter of fact, we all live – even determinist philosophers! - as if we were free agents. Early libertarians founded their theory on religious bases, claiming that free agency was the effect of being made in God’s image, and thus free. Contemporary libertarians usually cite quantum mechanics as evidence that determinism is false. Even if this is so, it is difficult to say how the random behaviour of atoms can influence human behaviour: “Sometimes people suggest a way in which chance might allow us to escape from determinism. There might be quantum effects which mean that, at least at the neurophysiological or neurochemical level, we can’t make predictions about behaviour. I am doubtful about this escape for two reasons. One reason is scepticism about the claim that quantum effects actually do affect gross physical objects very much...The other worry I have about that sort of approach is that even if it could be shown that some of our behaviour was unpredictable - that indeterminism held for human decision - it doesn’t seem to rescue freedom... An element of randomness does not seem to be the same as an element of freedom”⁽⁷⁾.

Libertarianism is not only theoretically weak, but it also practically arguable. One basic experience should be expounded in order to clarify the framework of the problem: this experience is well known to psychiatrists and is called “posthypnotic suggestion”. During a hypnotic session a subject can be given instructions to be carried out afterwards; say a patient is told to open the window as soon as he/she awakes. What is remarkable is not that the hypnotized subject obeys but that he/she invariably produces a rational explanation to justify the gesture. So for example, in this instance, if asked why he/she opened the window, the

subject might answer: “It’s too hot” or “the air is stale”. Basically, the subject will come up with the same kind of explanation that any one of us might provide to explain such a gesture. So, if an action that is attributed to conscious intention might, in fact, be carried out because of previous suggestion, how can we be sure that we do not live under the effect of suggestive influences? Desires, preferences, thoughts, and any mental content, could be just ad hoc rationalizations that we construct *a posteriori* to justify what we have thought and done under suggestion. What holds true for suggestion could be told for any other cause that might underlie our behaviour. In other word, the libertarian’s argument based on the “freedom experience” does not prove anything.

Actually both determinism and indeterminism – considered in an absolute sense – lead to a nonsense. We neither experience the universe as entirely determined by necessity, nor do we ever experience – not even in the moral realm, despite Kant – an unlimited and absolute freedom. In everyday life it is impossible either to deny the concept of cause or to accept that everything is strictly determined by causation.

The Genetically Modified Society

The genetics of behaviour have achieved great popularity in the media and hardly a week goes by without some news on the discovery of some other “gene for” some other aspect of human behaviour, be this intelligence, aggression, antisocial behaviour, impulsiveness, sociability, dominance, anxiety, novelty-seeking, alcoholism, addiction, obesity or sexual orientation.

Many policy reports and academic papers has been published on ethics of genetic of behaviour. Recently the Nuffield Council on Bioethics has published a Report entitled

“Genetics of Behaviour: the ethical context”. The report focused on ethical, social and legal issues arising from the study of the genetics of variation within the normal range of behavioural characteristics. The traits on which the Report focused were intelligence, antisocial behaviour, personality and sexual orientation. The Report recommended that sponsors who intend to increase funding in this area should pay careful attention to public concerns about the research and its applications. The Report noted that terminology such as ‘a gene for intelligence’ or ‘the gay gene’ is very misleading because it fails to convey the complexity of the role of genetic factors in causal explanations of human behaviour and concluded that researchers and those who report research have a duty to communicate findings in a responsible matter. Information senders should always consider the way in which their messages are received. People - like children who like to be scared by fairy tales - do like to be troubled and thrilled by the fantasy of a genetically engineered world as portrayed in “GATTACA”, the 1997 movie that describes a genetically modified society. In other words, people want to imagine that science will allow them to play God.

Determinism has a deep psychological impact on people’s mind. Determinism excites fantasies by stimulating desires of omnipotence and absolute control. The idea that the world is fully determined gives birth to the idea that one – if he can get hold of the keys - can control everything and thus have infinite power. Given today’s *zeitgeist*, these keys are seen by many to be provided by genetics. This is the real novelty of genetic determinism, which is in many ways similar to the ancient, wicked dream provided by any kind of magic, or any kind of gnosticism. Central to gnosticism, a doctrine that saw the light in the Roman-Hellenistic culture, was the idea that a secret knowledge exists which enables those who possess it to overcome human finitude and to become God-like. In any mass society – and Roman-Hellenistic society was the first mass society in our history – individuals feel their

identity threatened and power as a distant, impersonal Leviathan. As Foucault has correctly pointed out, in mass societies power is dispersed, manifesting itself only in the forms of surveillance and regulation. In these societies people tend to develop paranoid fantasies, among which fantasies on determinism usually play a pivotal role. Sometimes scholars label these fantasies as Promethean fantasies. I think that is to give them an unmerited mark of nobility. Actually they are just clichés. It is not by chance that determinism has been the official doctrine of ideologies such as Nazism and Communism. Totalitarian regimes have always relied on the idea that human beings can be controlled by manipulating their structures, whether these be economic, psychological or biological. All totalitarian regimes initially dream of improving the world through absolute dominion over it. And this kind of foolish dream is always bound to turn, sooner or later, into a nightmare.

CONCLUSIONS

Determinism in itself is not at all a bad thing. Science needs determinism. It is obvious that scientists hope to get increasingly closer to a determinist picture, but they should be aware that this is just an ideal, not a metaphysical dogma. One should beware of determinism when it becomes a social rule rather than a scientific law. Sometimes scientists do not seem to realise this. What is even more worrying, is that the media don't either. Philosophers, scientists and policy-makers are worried by the ethical challenges that genetics poses and is likely to continue posing for our society. In genetics, the ethics of research and its medical applications is undoubtedly important, but media ethics is and will be still more important. In the information society what shapes public opinion is more the way in which scientific discoveries are presented to the public than their actual essence. In turn, the way in which the

public is formed affects scientific research, both by influencing funding agencies and exerting psychological pressures on researchers, thus establishing a circle that can be either virtuous or vicious. Media ethics is thus vital. The warning was already given in the issue of Science announcing the sequencing of human genome: “As we enter a genomic era in medicine and biology, perhaps the greatest danger I see stems from the enormous emphasis placed on the human genome by the media. The successes of medical genetics and genomics during the last decade have resulted in a sharp shift toward an almost completely genetic view of ourselves. I find it striking that 10 years ago, a geneticist had to defend the idea that not only the environment but also genes shape human development. Today, one feels compelled to stress that there is a large environmental component to common diseases, behaviour, and personality traits! There is an insidious tendency to look to our genes for most aspects of our "humanness," and to forget that the genome is but an internal scaffold for our existence”⁽⁸⁾. History teaches that worrying overmuch about technological change rarely stops it. The practical consequences of the genetics of behaviour might be bad or it might be good. But, if we are concerned about its ethical implications, we would do better to form a clearer picture of how scientists should communicate with the public.

In one of his letters from prison the German pastor Dietrich Bonhoeffer, who was hanged by Nazi executioners on 9 April 1945, wrote: “I often wonder where the line between the necessary resistance and the equally necessary surrender to destiny can be drawn”⁽⁹⁾. This question is still the best antidote against any paranoid fantasy of omnipotence - as well as against any form of cynical fatalism.

Acknowledgments - *This work was partly funded by a grant from the European Commission - DG Research – Contract nr QLG6-CT-2002-01796. An early version of this*

paper was presented as a plenary lecture in the XI World Congress on Psychiatric Genetics (Brussels, October 9-13, 2002).

References

1 - Peters T. *Playing God? Genetic Determinism and Human Freedom*. New York: Routledge; 1997.

2 - Mattei JF. 1991, The use of Prenatal Diagnosis for Psychiatric Diseases. In: Srám RJ, Bulyzhenkov V, Prilipko L, Christen Y, editors. *Ethical Issues of Molecular Genetics in Psychiatry*. Berlin: Springer-Verlag; 1991. p.87-94.

3 - Rorty R. *Philosophy and the Mirror of Nature*. Princeton: Princeton University Press; 1979.

4 – *The Role Bible*. King James version. Grand Rapids (MI): Zondervan Publishing House; 1995. Luke 22:42.

5- Taylor R. *Determinism*. In: *The Encyclopedia of Philosophy*: New York: Macmillan; 1967.

6 - Quine WV. *Quiddities*: Cambridge (MA): Harvard University Press; 1987.

7-Glover J. The implication for responsibility of possible genetics factors in the explanations of violence. In: Bock GR, Goode JA, editors. *Genetics of Criminal and Antisocial Behaviour*. Chichester: John Wiley; 1996. p.237-55; p.244-5.

8- Paabo S. *Genomics and Society: The Human Genome and our View of Ourselves*. *Science* 2001 Feb 16;291(5507): 1219 – 1220.

9 – Bonhoeffer D. *Letters and Papers from Prison*. London: S.C.M. Press: 1953.

Complementary Bibliography

Alper JS, Beckwith J. Genetic Fatalism and Social Policy. *The Implications of Behaviour Genetics Research*. *Yale J Biol Med* 1993;66:511-24.

Andrews BL, Nelkin D. *The Bell Curve: A Statement*. *Science* 1996;271:13-4.

Bouchard TJJ, McGue M. Genetic and Rearing Environmental Influences on Adult Personality: An Analysis of Adopted Twins Reared Apart'. *J Personality* 1990;58:263-92.

Herrnstein RJ, Murray C. *The Bell Curve: Intelligence and Class Structure in American Life*. New York: Free Press Paperbacks; 1996.

Holden C. A Cautionary Genetic Tale: The Sobering Story of D2'. *Science* 1994;264:1696-7.

Loehlin JC, Horn JM, Willerman L. Heredity, Environment, and Personality Change: Evidence From the Texas Adoption Project. *J Personality* 1990;58:221-43.

- Maddox J. Has Nature Overwhelmed Nurture? *Nature* 1993;366:107.
- Mordini E. Commentary on "The Stoic Concept of Mental Disorders" *Phil Psychiat Psychol* 1997; 4:297-301.
- Mordini E. Brain Research and Human Diversity. In: Mordini E, Pasquini P, editors. *Ethics and Neuroscience*. Annali dell'Istituto Superiore di Sanità 1997;33:469-73.
- Mordini E, Ethical, Legal, and Social Aspects of Brain Research. *Curr Op Psychiatr* 1998;11:575-80.
- Mordini E, Linear Destiny and Geometric Fate. In: Thompson A, Chadwick R, editors. *Genetic Information: Aquisition, Access and Control*. London: Kluwer Academic/Plenum Press; 1999. p. 309-20.
- Mordini E. Playing God. In: Cosmi EV, editor. *Proceedings of Renaissance Congress of the 21st Century on The Woman and Child Before, During and After Pregnancy*. Monduzzi, Bologna; 2002.
- Nelkin D, Lindee SM. *The DNA Mystique: The Gene as a Cultural Icon*. New York: WH Freeman; 1995.
- Nuffield Council on Bioethics. *Genetic of Behaviour: the ethical context*. London: Nuffield Council on Bioethics; 2002.
- Plomin R, Owen MJ, McGuffin P. The Genetic Basis of Complex Human Behaviours. *Science* 1994;264:1733-9.
- Rose S, Lewontin RC, Kamin LJ. *Not in our Genes*. Harmondsworth: Penguin Books; 1984.
- Freud S. Totem and Taboo. *Stardard Edition* 1913;13:1-161.
- Tandon K, McGuffin P. The Genetic Basis for Psychiatric Illness in Man. *Eur J Neurosci* 2002;16(3):403-7.
- Wilson EO. *Consilience: The Unity of Knowledge*. Random House; 1999.