

## Some Misunderstandings on Both Sides of the Frontier between the Two Cultures

George KLEIN (Stockholm)

### *Abstract*

The boundaries between two cultures, natural sciences and the humanities, may have shifted repeatedly since the days of C. P. SNOW, but they have never been lifted. The paper fathoms some fundamental misunderstandings at the interface between both cultures and discusses resulting implications for ethical considerations.

### *Zusammenfassung*

Die Grenze zwischen den zwei Kulturen, den Natur- und den Geisteswissenschaften, hat sich seit den Tagen von C. P. SNOW zwar wiederholt verschoben, beseitigt wurde sie jedoch nicht. Der Beitrag geht einigen grundlegenden Missverständnissen an der Grenzlinie zwischen den beiden Kulturen nach und behandelt sich daraus ergebende Implikationen für ethische Betrachtungen.

### **1. Introduction**

The border between the two cultures may not be equally continuous as in the days of C. P. SNOW but it has definitely not been abolished. At one extreme, we find the “molecular fundamentalists” who believe that the *Geisteswissenschaften* (for which there is no appropriate word in English) will disappear, once the functions of the brain have been understood in molecular terms. At the other extreme, we find a lack of appreciation for the scientific criteria that help us to distinguish between hard facts, soft facts, hypotheses and speculation.

In RUTHERFORD’S frequently quoted view, the natural sciences in the 19<sup>th</sup> century fell into two categories: physics and stamp collection. This has changed dramatically since the middle of the 20<sup>th</sup> century. Biology now occupies a respected place among the hard sciences. Following the understanding of DNA structure and the deciphering of its code, the developments have been breathtaking. This has not been greeted with universal enthusiasm on the other side of the border, however. The depreciatory stigma of “biologism” is often substituted for attempts to understanding.

One problem stems from the use of words that does not have the same connotation on the two sides of the border. One such word is “culture”. I shall illustrate this with a little story. Some time ago, I met an old friend I rarely see, an outstanding professor of linguistics, who is also known for his moderately radical political views. He spoke about the relationships between the linguistic and the genetic map of Europe, largely based on CAVALLI-SFORZA’S

work with genetic markers and Svante PÄÄBO's work on mitochondrial DNA. He knew of both approaches and had a high regard for the science. "But the conclusion is nonsense, dangerous nonsense" – he added. I was flabbergasted. He accepts the data but regards the conclusion nonsensical? It turned out that he reacted against CAVALLI-SFORZA's conclusion that, in prehistoric times, "culture migrated with the genes". (Culture meant largely agriculture and other major innovations.) To me, this conclusion was perfectly natural and even somewhat trivial. In prehistoric times, when there was no common language, and no efficient means of communications across linguistic and ethnic barriers, innovations moved with the people and, therefore, with their genes. But my linguist friend took it for granted that biologists attributed "culture" to specific, allegedly superior genes. He saw discrimination and racism as the major dangers. I tried to explain that the genetic markers used in CAVALLI-SFORZA's studies were only flags and not genes with alleged "culturally related" functions. Many of them were not genes at all but polymorphic sequences within repetitive DNA. Due to their polymorphism they could be used to trace relationships between different ethnic groups. A brilliant person in other contexts, my friend simply failed to understand my argument and stayed with his opinion about the "dangerous conclusions". What surprised me most was the basis for his reasoning. According to that, conclusions based on scientific studies should be accepted or rejected, not exclusively on the basis of the factual evidence, as customary among scientists, but also, or even primarily, **on the basis of what is seen as potential political or ideological consequences or risks**. Whether the risk assessment is justified is another matter. It can be extremely tenuous, as in the present case.

I have often encountered similar reasoning, not only among colleagues "in the other culture", but also among natural scientists, including biologists, with a strong political conviction. I shall come back to that.

Another, frequent difficulty in conversations between persons in the two cultures is the inability or unwillingness of the non-scientists to realize the distinctions scientists make between hard facts, soft facts, hypotheses and pure speculation. These borderlines may be less sharp and perhaps even less desirable in some of the humanities, compared to the natural sciences. Words with multiple meanings (like culture in the quoted case) may be part of the difficulty. Misunderstandings are not always easy to clear up since rational arguments may be blocked by suspicion or prejudice, as in the present case.

There are different subcultures even within the natural sciences, that may interfere with the free communication of ideas. In biology this has become particularly conspicuous with the advent and phenomenal rise of molecular biology.

When Barbara MCCLINTOCK, sometimes called the Mendel of the 20<sup>th</sup> century, received the Nobel Prize in 1983, she appeared on the traditional Swedish TV interview program "Geniuses speculate", together with the other laureates. It is led by an interviewer who, also traditionally, tries to make the laureates to comment on "timely" topics that are often discussed in the media. MCCLINTOCK remained passive through the whole program. Towards the end of the program, the interviewer directed a question to her: "Dr McClintock, how did science change since you were a student"? MCCLINTOCK's eyes, that have been half closed during most of the program, were suddenly wide open. She looked straight into the camera and said: "Where have all the biologists gone?"

In today's big science, with its powerful technology that permits the analysis of thousands of genes in parallel, the tradition of conceptualization and the intense debate that characterized the great geneticists of earlier decades have become rare and far between.

In the following text, I shall not deal with changes in biology itself but will try to summarize some of the main problems in the confrontation between biologists and the general public.

## **2. Major Categories of Objections and Fears**

They can be divided into four groups: Ideological, academic-competitive, fear of abuse and fear of the unknown.

### *2.1 Ideological*

This can be subdivided into religious, conceptual, Marxist and ethical.

#### 2.1.1 Religious Objections

Creationists often speak of the “theory of evolution” and try to argue that evolutionary and creationist theories belong to the same category. In doing so, they emphasize minor discordances in the findings or interpretations of the evolutionists. This is a distorted view. Darwinian evolution of the species is a fact accepted by all biologists, fully verified and established in the premolecular era and robustly reinforced by molecular biology.

A great geneticist, Theodosius DOBZHANSKY, who was a Russian Orthodox Christian, has written an often quoted sentence in the 1940s: “Nothing makes sense in biology unless seen in an evolutionary context”.

All living creatures on this planet are built on the basis of hereditarily transmitted instructions, written in the same informational code, DNA or, in the case of the RNA viruses, RNA. There is a close relationship between all the DNA genomes that encompasses all three kingdoms, animal, plant and microbial. The extent of **gene conservation** is striking. Whenever evolution finds a solution to a general problem of cellular and organismal life, it tends to conserve it, sometimes through amazingly long distances. But it is also **dynamically flexible**. New solutions may replace old ones in response to different environments. It is also noteworthy that evolution towards greater complexity often works by the increasingly sophisticated use of a relatively limited repertoire of genes and by ever increasing intercommunication between different pathways, rather than by major increases in gene numbers.

Creationists and their recent offshoot, the protagonists of “intelligent design”, are usually quite uninterested in these scientific developments. They focus on minor discordances of fact and differences in interpretation among biologists, to support their claim that evolution is just another unproven theory. Their goal is not to explore the world around and within us with an unbiased eye, but to find support for their preconceived notions. The task of science is, in contrast, the gradual removal of preconceived notions by the critical examination of the evidence.

In discussions between biologists and anti-evolutionists, the word “**chance**” is the source of frequent misunderstandings, even between highly educated people. Ludwig WITTGENSTEIN is an outstanding example. While wandering in the Alps with his mother as a young man, he said that DARWIN must be wrong. The amazing diversity of the living world “could not have arisen by chance”. This echoes the statement of the 18<sup>th</sup> century theologian William PALEY that “no watch could be made by accident, and without a watchmaker.” Richard

DAWKINS book on evolution, *The Blind Watchmaker*, provides a perfect answer to that. In another book, *Climbing Mount Improbable*, DAWKINS compares organisms to mountain tops. Each has attained its elevated position through a long series of mutations, incomprehensibly long for our subjective concept of time which is based on our limited life span. Each new mutation has to pass the needle's eye of selection, not in one step, but continuously over millions of years. *Mountain Improbable* has a precipitous, almost perpendicular wall with forbidding cliffs to the North, and gentle grass covered slopes to the South. Critiques of evolution often argue against the role of chance, as if evolutionary theory would claim that each species reached the top by jumping from the plain to the peak in a single randomly occurring jump. No biologist claims that. They envisage a slow uphill walk along the gentle slope.

The book title of Jacques MONOD *Chance and Necessity* says it all. Chance refers to random mutations. Necessity means the selective survival of the fittest. Mutations only provide the basis for what can happen. Selection decides what actually happens. To talk about chance alone is to miss the point.

In one of his sonnets of incomparable beauty, MICHELANGELO says that every block of marble contains all imaginable sculptures. Only the hand of the artist can bring out a statue. The objection that chance cannot explain the vast variety of the living world corresponds to the obvious absurdity that the variety of art cannot be explained by the random splitting of marble blocks.

In one of his more recent books, DAWKINS quotes the argument of an intelligent lawyer against evolution. If humans would have come from a large ape, similar to a chimpanzee, there would have been a chimp who would have fathered a human son. This does not happen. Quite true. But in species, like salamanders or finches whose closely related subspecies spread over large geographical regions, neighbors differentiate slowly into subspecies. In the beginning, the closest neighbors can still generate hybrid offspring. As the distance increases, a point is reached where the extremes no longer interbreed. This is the point where one usually starts speaking about different subspecies. When the intermediates are lacking, as they usually do, because many of them have died out, the lawyer's statement may appear plausible at first sight, but it is a spurious argument.

### 2.1.2 Conceptual Objections

*Human dignity.* Depriving humans from their previously alleged special status and classifying them as "just another" primate species is experienced by some as depriving us from our human dignity. I believe that the opposite is true. I feel an enormous satisfaction over the fact that we share our genetic language with the entire living world on this planet, and by the understanding we now have for our past and present place among the species. Its most satisfying aspect is that it is **true**. We still maintain our unique distinction due to our **brain**, the source of all our cultural achievements. Laments about the loss of belief in our allegedly special position strikes me as both pretentious and contorted.

I often quote a conversation between Jonas SALK and one of his advisers, the physicist Leo SZILARD, when the Salk Institute was being built in La Jolla. SALK asked SZILARD whether it was really necessary to build a mouse house which was very expensive. SZILARD said that it was necessary because a bacterium like *E. coli* was not a man, *Drosophila* was not a man, but a mouse was a man. The mouse house was built.

Commenting on the full DNA sequence of *Drosophila*, Craig VENTER more recently said that we have to see fruit flies as “small humans with wings”. The extensive gene conservation and the many homologous functions between fly and man make this reasonable. But it does not mean that SZILARD or VENTER want to reduce us to mice or flies. It only means that we share many genes and functions. There are also many differences. It is clear that we have to deal with each level, biological, cognitive, psychological, and cultural, on its own terms, acknowledging that each level has its special language and that the whole is more than the sum of its parts.

Most but not all biologists recognize this. I have encountered one colleague, an outstanding senior molecular biologist, who claims to believe that a detailed understanding of the higher nervous system in terms of molecular structure and function, will eventually obliterate the need for psychology, sociology, and other disciplines that deal with higher neural functions in non-molecular terms. He is an intelligent person and has been a prominent leader of a major institution of molecular biology, but he has a blind spot on this point. When I pointed out that his view was like saying that you could experience a MOZART symphony in the same way from looking at the sound waves on an oscillogram as by listening to the music, he answered that an accomplished musician could hear the music when looking at a score, so why not an oscillogram? I replied that his view did not refer to an accomplished musician, but to someone who has never heard a sound in his life.

Discussing this view with other molecular biologists, I was told that this “fundamentalistic” view is not so exceptional in the younger generations of molecular biologists, but is rarely found in a senior person. I hope we can regard this as a freak.

Critics of biology sometimes say that molecular biology reduces life to chemistry, humans to animals, thoughts and feelings to neurochemical processes. It is a distorted view. The complexity of our biology and particularly our brain exceeds all man-made myths and fantasies. The most fantastic stories are not told by supernatural beings, but the ingenious solutions of evolution.

### 2.1.3 Marxist Criticism

It resembles religious criticism in being based on preconceived notions. In contrast to creationistic views, Marxist arguments may come from outstanding scientists. Richard LEWONTIN is one of the most prominent representatives. He is a widely recognized population geneticist who has made numerous important contributions. As long as he discusses the genetics of plants or animals, he stays within the accepted limits of the science. Speaking about human genetics, his views are colored by Marxistic dogma. In his view, the genetic components of human behavior have been overemphasized. In a book, written by LEWONTIN, KAMIN and ROSE, entitled *Not in Our Genes*, he tries to explain away, minimize and question all evidence on the effect of genetic factors on human behavior. Speaking about the Human Genome Project, he used the term “genomania”. Some of his arguments are purely absurd. An extreme example is his criticism of twin research. They are of no value, in his opinion, because, according to him, parents of identical twins are known to have a nearly pathological obsession to force their twins to behave in the same way. Actually, the opposite is true. Parents and the twins themselves, try to cultivate whatever differences there are. Twins who have grown up in different environments are more alike than twins who grew up in the same environment. With advancing age, as acquired characteristics tend to fall by

the wayside while genetically determined differences become more prevalent, the similarity of identical twins increases. Moreover, environmentally conditioned similarities between fraternal twins decrease with age. Also, an orphan whose parents were highly intelligent but who has been brought up in a family of average intelligence may have difficulties in school, but has a good chance to emerge as a brilliant person at middle age. An orphan who stems from a family with average intelligence but has been brought up by highly intelligent adoptive parents may achieve good results in school, but has greater difficulties after middle age.

Taken as a whole, the twin studies have shown that genetic factors may play an important role for different types of human behavior, although they always act together with the environment.

Returning to LEWONTIN, he has not directly defended the nonsensical claims of the charlatan LYSENKO, but he has at least tried to “explain them”. In a book, written together with Richard LEVINS, he has written: “Only anti reductionist, non bourgeois science would help humanity to attain the ultimate, the highest goal, a socialist world”.

In a recent book, entitled *The Blank Slate*, Steven PINKER has written a devastating criticism of politically biased science.

**Nature via nurture** is the title of Matt RIDLEY’s excellent book on these much debated issues. He stresses that two decades of studies on twins separated from the beginning, have led to the undoubted conclusion that genetic factors influence most personality traits in Western societies. Differences between dizygotic twins and sibs depend more on genetic differences than on differences in the family background.

The current consensus is that five major behavioral traits are strongly influenced by genetics (The Big Five), namely openness, conscientiousness, extroversion, agreeableness and neurotic tendencies (OCEAN). The genetic influences on these traits vary independently of each other. Twin research indicates that more than 40 % of the variation is due to genetic factors. Less than 10 % can be attributed to the common environment. About 25 % can be related to variable historical factors like disease, accidents, temporary contacts, etc. The remaining 25 % reflects sources of error.

As RIDLEY points out, heredity plays an approximately similar role for personality as for body weight. This is an illuminating metaphor, since it also illustrates how the environment can dominate under certain conditions, while genetic factors prevail under other conditions. In developing countries where the majority lives near starvation, there is a clear correlation between body weight and environmental factors (who can afford to buy food). In the Western middle classes where everybody has open access to food, variability in body weight is largely due to genetic factors.

Considering the influence of state-directed, and/or Marxist ideology on science, physiology in the Soviet Union of the mid 1900’s is a relevant example. In this case the party line of the Soviet Union has adopted a great scientist, PAVLOV, as the founder of official ideology. This turned out to be almost equally detrimental for Soviet physiology, as the adoption of a charlatan, LYSENKO, was for Soviet genetics.

The important lesson is that **any ideology becomes destructive if it is allowed to influence science**. Science must be allowed to proceed according to its own criteria, striving to remove preconceived notions and gain an increased understanding of the world outside and within us.

#### 2.1.4 General Ethical Considerations

The alleged moral responsibility of scientists for the application of scientific results is untenable in its generalized form. An important exception is the use of microorganisms for biological warfare or terrorism. This is morally condemnable. Apart from that, science has no other ethics than what concerns the truthful reporting of the results. Already the medieval philosopher CUZANOS has pointed out that the ethics of science are determined by the ethics of the society where it operates.

I see considerable danger in much of the currently prevailing discussions on the ethics of biology. It takes many of its clues from objectively irrelevant medial attention and/or unrealistic theological considerations. The debate on stem cell research is a good case in point. This pseudodiscussion is dangerous because it diverts attention from real problems that need to be faced without preconceived notions. Urgent questions include the handling of unexpected information, discovered as a side-effect of genetic testing, e.g. on the susceptibility to specific diseases like cancer or diseases of the nervous system. How much information should be provided on cognitive abilities, as information now rapidly increases? How can one prevent gene map based competition in relation to employment, advancement and marriage? Where does one draw the line between legitimate prenatal testing (for major debilitating diseases) and just another instrument of competition? How does one prevent a culture of selection as already practiced in relation to female fetuses in certain countries? These and other real problems must be faced by lawmakers, politicians, biologists, and the medical profession, unburdened by unrealistic focusing on pseudoproblems, inflated by partisan groups.

#### 2.2 Academic Competition

This is trivial, but should not be underestimated. In the humanities bordering on the natural sciences, linguistics, sociology and psychology, sometimes there is resentment against the quick advances made in biology and the support it enjoys.

#### 2.3 Fear of Abuse

When we think of eugenics, we should not primarily think of the Nazi perversion that arose by the merging of classical Christian anti-semitism with the unscientific absurdities of racial biology, but of the worldwide eugenic movement, initiated by Francis GALTON, DARWIN's cousin, around 1860 that was soon represented at many universities of the world, including Sweden, resurfacing again in the 1950s and 1960s.

**Hubris** is one source of eugenics. As soon as we have learned something about genetics, some people jumped to the conclusion that enough was known to start tampering with the genetic material of our species. The eagerness of the "social engineers" and the *Zeitgeist* was another factor. The road to hell is paved with good intentions, as is vividly illustrated by the Swedish sterilization program.

Between 1934 and 1976, 60,000 Swedes were sterilized according to the decision of the medical authorities. Sweden is the second country after Nazi Germany that has performed the largest number of sterilizations. The amount of Swedish sterilizations actually increased after the Second World War.

Influential politicians, including some of the great ideologists of modern Swedish social democracy, advocated sterilization. Some wanted a much more drastic application than what

had become permissible according to the law of 1932. Not only voluntary but also coercive sterilization was advocated. In a seminal paper of 1935, Gunnar and Alva MYRDAL recommended, on the basis of “racial hygiene” the “eradication of all kinds of physical and psychological inferiority within the population, such as mental disease, mental retardation, physical diseases and bad character”. They admitted that the science of heredity has not yet provided methods to identify “the carriers of the undesired trait” and that even environmental factors could play an important role. Nevertheless, they criticized the view that sterilization should only be performed if the probability of serious disease or defect was nearly certain. They advocated the opposite: a widening of the area of sterilization. They were convinced that the general opinion was going to change so that sterilization would be accepted even in cases where the risk of disease was not serious.

In the second series of their recommendations, the MYRDALS spoke about “social education”. They advocated for sharper application of the law, including even low risk diseases. They supported the strictest application of the sterilization law – and if voluntary sterilization was refused, the use of coercion. Individuals who should be sterilized included those who would “offer their children such an obviously unsuitable environment that they cannot require that society should protect their life”.

Social democracy notwithstanding, this is hypocrisy, and mobbing. Today’s reader is appalled by the self righteousness that was hiding behind the facade of social concern.

On the other side of the coin, the social engineers of the blank slate theory have gone to similar extremes. Perhaps the greatest abuse that needs to be feared is the **practice of Messianism**, of whatever color.

Realistic concern today does fortunately not stem from eugenics, although the danger of its raising its ugly head is always present. Problems of confidentiality and the protection of individual privacy are prevalent. This is no greater than keeping more conventional medical secrets, like HIV infection, cancer or pregnancy, however, and can be dealt with by similar measures.

## 2.4 Fear of the Unknown

Media tend to create sensationalism. They can deal with real but highly improbable matters, or with imagined but unrealistic dangers of the new technology. It is difficult for the lay public to distinguish between real and overemphasized or imaginary dangers. The task of the newspapers is to report news. But news are not always true, and the truth based on years of serious research, is no longer news. The relative acquiescence about cigarette smoking, responsible for one third of all human cancers, can be contrasted to the sensationally created unrealistic fears e. g. about acrylamide or other substances that caused some cancers in highly artificial animal systems. The representatives of the media bear a major moral responsibility for giving a realistic picture.

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Prof. Dr. George KLEIN  
Department of Microbiology, Tumour and Cell Biology  
Karolinska Institutet  
Box 280  
SE 17177 Stockholm  
Sweden  
Phone: +46 8 7286731  
Fax: +46 8 330498  
E-Mail: georg.klein@ki.se