Francis Crick

Discoverer of the genetic code

M.Ridley

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That... such giant shadows are cast by such pygmies
only shows how late in the day it has become[1]

Francis Crick was an indifferent student in his youth, subsequently to become a failed graduate student in physics and did not enter the field of biology until he was over thirty. This certainly would come as a welcome anti-dote to the brilliancy at inception which is too often the case with most biographies of successful scientists. In short, there is hope for us all. However, such legends of initial mediocricity do usually not survive closer scrutiny. Passion there always was, and competence, especially mathematical, there never was any doubt of, but guidance perhaps not, finding his scientific bent took him some time. Science is usually portrayed as a young mens game, but Crick by dint of mental agility coupled with indefatigble energy, serving him to the very end, was able to overcome those initial drawbacks and provide the exception that formulates the rule. Luck certainly played its role, but this is in the nature of great scientific discoveries, which by their very nature as great are necessarily unexpected, yet luck only strikes the prepared mind, the latter being a necessary prerequisite but not a sufficient.

The early part of the 20th century was the realm of physics, the middle part that of biology, or more precisely molecular biology and biochemistry. Many of its pioneers were in fact physicists looking for new unchartered territory, and Schrdingers short pamphlete of a book 'What is Life' is supposed to have provided a formative inspiration, although Crick himself claims that in his case the book had no impact whatsoever. Philosophy is usually discarded by most scientists (Crick by no means an exception) as being in the nature of endless squibbles over pedantic points pertaining to castles freely floating in the air without any empirical anchorage. Yet philosophy is unavoidable, and when not formulated, versions of it are being taken for granted. The man who disowns metaphysics does in fact thereby make a metaphysical statement, as the philosopher and historian Collingwood pointed out with bitter triumph. And the modern thrust into biology has been motivated, and subsequently vindicated, by the attack on the notion of vitalism, the last stronghold of religious thinking in the sciences. Its purpose has been to show that the the laws of physics ultimately are enough to explain the emergence of life and thereby both demystifying the concept of life as well as, which is a point most people miss, to make it far more fascinating in the process. This approach is commonly refered to as reductionist, of attempting to build things from the bottom and up; and the greatest irony of it, only noticed by the few (such as the abovementioned Collingwood), consisting in that the ultimate motivation for it being the exaltation of the human intellect, the typical

[1] This was quoted to me by my biologist friend thirty years ago. I was a bit taken aback at the time

top-down approach of philosophical idealism.

The concept of evolution rests on a few principles, each of which is indispensible to it. The most basic - inheritance, also being the one known for the longest time. With the rediscovery of the work of Mendel, the discrete nature of inheritance was highlighted, leading to the notion that inheritance was transmitted by discrete units, refered to as genes. But what were genes? As far as one was concerned genes were just constructs of the mind, just as the notion of atoms as originating in ancient Greek thought[2]. Slowly one was able to pinpoint where among the various gunk of micro-biology genes may hide, and much of the work of biologists were devoted to the successive isolation and refinement, of which so much routine chemical work consists. Such work, based on long tradition and evolving intricate technology, carried on my many an anonymous worker, usually never gets its proper due in accouts of scientific discovery. But it is not only important if mostly dull, it is indispensible, and makes science into a collective enterprise, without which the brilliant insight of the solitary genius, would find no purchase, and hence inevitably wither. The crucial question was however, how those proverbial genes looked like. In chemistry it is comparatively trivial to find out the basic units of molecules and their proportions, what is far harder and more important is to find out how they are spatially built up, because their geometric forms are the keys to the way they interact. To do so, the technique of X-ray diffraction and its ties to classical 19th century crystallography, became available in the beginning of the 20th century. When applied to simple crystals very precise information can be read off directly, when it comes to more complicated molecules, the inverse problem of properly interpreting the diffraction patters become far more of an art, where inspired guess-work is a prerequisite. Neither Watson nor Crick were chemically very knowledgable, thus liable to make elementary errors in their assumptions, but to such egregious errors not even the experts, as exemplified by Pauling, were immune. By combined efforts, of which Cricks seem to have been the most crucial, the double helix form was eventually derived in 1953, after a few years of dead-ends and barking up wrong alleys. Once a model was exhibited, the simplicity of it compelled it to be the solution. And as in life, verification is often far easier than discovery. The problem to a large extent having been mathematical more precisely geometrical, shows the imprint of Cricks mathematical competence and supposedly legendary power if visualization. But why was it so revolutionary? Why was it not simply another technical tour-de-force, of which science abounds, but which often are not more than sweet challenges for the scientists to dig their teeth into? It is ultimately a matter of philosophy, i.e. not so much actually finding but to decide where to look. Crick was passionately interested in what constituted life, and its ability to reproduce and prolong itself, and thus inheritance was the key.

Once the structure of the DNA molecule had been revealed, it gave a strong hint as to its function. Thus the notion of a genetic code was born, and for the next thirteen years the real work of Crick begun, namely to crack it. In cracking the code Crick played a pivotal role. His enthusiasm, his ability to quickly synthesize large amounts of data, and to intuitively isolate the gems from the chaff is legendary. He read and read, but also

[2] Whether atoms existed as material objects, or were just theoretical constructs, was a source of controversy, which was not settled until the beginning of the 20th century, when the spectacle of radioactivity allowed events to be pinned down to individual atoms.

he travelled widely and above all talked and talked. While other scientists may prefer to think in peace, he thrived on conversation as a means of coming to conclusions. The structure of the DNA molecule initiated a new field which quickly grew, no doubt fuelled by the vast resources that comes with medical research and made possible not only by the option but also the requirement for routine work, and by the end of the century it had become Big Science par excellence. This developement is something that does not properly get explained in the present account, with its emphasis on a few people, tossing around ideas, and throwing wild parties, and all ending up getting Nobel Prizes. It seesm so simple, if somewhat excentric. But biological research is industrial, so different from the pursuits of matematicians and humanists, where people tend to be deeply specialized into narrow technical grooves, and few have the general overlook. In this context the achievements of Crick were noteworthy, his general approach being that of a philosopher, yet with intermittent descent into honest experimental work getting his hands proverbially dirty.

The fundamental difference between mathematics and biology is exemplified by the genetic code. The code works as strings of four letters read off sequentially. Early on it was decided that the basic units were triplets whose 64 combinatorically different versions would code for the 20 basic amino acids. The instincts of a mathematician is how to naturally relate those two numbers. One simple and elegant solution presented itself. Namely that out of the tree cyclic permutations of a single code word, only one would be legal. Thus out of $(64-4)/3 = 20$ would follow the relation. Also such a code would have the advantage of doing away of commas, i.e. delineations of the words. Such a simple solution must be true! Yes often in science the simple and the elegant is indeed true, nature working with economy; but it is not always so, and to Cricks uncanny genius belonged his instinctive scepticism. The final solution based on dull and painstaking empirical research provided a far more mundane solution, with no intrinsic elegance. But this is life, in particular, this is biology.

With the growth of the science of molecular biology came prestige and fame, the latter meaning that far more people wanted to communicate with Crick than he was able to reciprocate. The outside social world impignes on you in a sense it never does when you enjoy obscurity. He naturally found it a distraction, rejecting on principle honors and royal patronage, although no scientists is known to turn down the Nobel Prize, and even Crick with his anti-royal stand, had no problems bowing in front of the Swedish King, receiving the ultimate accolade. He had his rows with Watson in regards to his publishing of the Double Helix, a bestselling book whose publication he in vain sought to stop, as he thought that watson had been far too frivolous in his presentation of scientific discovery, focusing on personal qyuirks, rather than the seriousness of the quest. But one never destined to hold a grudge for long, reconcilations eventually occured.

Crick dipped into the sixties. There were wild parties at his home, famed all over Cambridge, and no doubt there were touches with drugs, that goes without saying. Still it did not touch deeply and he was unaffected by the political correct kind of views that stemmed from the decade. His attitude was elitistic. The breeding of the unfit was of some concern to him, and also the opposition to ideas about racial difference in intelligence puzzled him. When it came to government he proposed that the real experts with brains

should have the say, views which caused embarrassment among the more enlightened of his colleagues.

In his last twenty years he devoted himself to the study of the brain, with the ultimate ambition of solving the riddle of consciousness as he had before been instrumental in solving the riddle of life. Yet, this is an undertaking frought with deep philosophical problems of self-reference, and unlike the case of life and inheritance, it is far from clear what form a solution would have. Crick came out of a family whose male members usually died early from heart disease, both his grand-father and his younger brother did not make it into their fifties. In his late seventies Crick himself had to undergo extensive bypass operations, but his demise in his late eighties was due to the spread of a colon cancer.

A book like this puts the science in the limelight, unfortunately without really explaining anything. Technical accounts being out of the question, the alternatuve chosen is too often simple watering-downs which at best leave the reader confused, at worst decieves him into beliving he has seen a real explanation. Admittedly there is no good solution to the problem, except to some extent a philosophical one. It is possible to set a new perspective, one which would also be interesting to the scientists themselves, thus sidetracking the technical difficulties and getting to the cores without too many chores. But to do so demands much more than a cursory acquaintance with a subject, it requires real intimacy, and thus one doed not expect those to come from a journalist or a biographer, but to isse from equinine mouths.

March 10, 2007 **Ulf Persson:** *Prof.em, Chalmers U.of Tech., Göteborg Sweden* ulfp@chalmers.se