



A conversation with
Steven Rose, London

“We need to get that dynamism back.”

Steven Rose belongs to a rare species: he is a political biologist and a critic of science. Karin Hollricher met him at the conference “Genes, Brain/Mind and Behaviour” organised by EMBO in Heidelberg, where he carried on his usual business, talking about social implications of modern brain research and neurotechnology.

Brain studies are very in vogue. Modern genomics tells us about the differential expression of genes in the brain. Modern brain imaging enlightens us about the activity of neural networks connected to behaviour. Are we living in a neurocentric world?

Steven Rose: Our world-view seems to be beginning to show a division between a neurocentric and a genocentric one. If you look in the newspapers, you find coverage of genes for everything going on now. In addition, if you look for brains you will find brain processes for everything. The two, of course, are coming together in the sense that there are many arguments that our brain processes are simply the unrolling of the genetically programmed scripts. Most neuroscientists, philosophers and psychologists would deny that. The problem started with the huge simplification that came at the time of the initial claims about the human genome programme. However, today there is a much better understanding of the ways in which brain development builds from the genes. We heard Pierre Roubertoux at the meeting....

Pierre Roubertoux is the man who studied Psychology and Biology and is now working as a geneticist in France?

Steven Rose: Yes, he pointed out the combinatorial explosion that happens between 25,000 genes and 100 Trillion synapses. Here you see scientists begin to understand the complexity of the system.

There is another interesting issue as well. Molecular biology focuses almost solely on static things, on genes, protein sequences, spots on the gel. However, life is not static. Frederick Gowland Hopkins, one of the founders of biochemistry, in the 1920s defined life as a dynamic equilibrium in a polyphasic system. Moreover, dynamism is lacking in the fixed models that you get. We need to get that dynamism back.

How far have we come along that way?

Steven Rose: If you go back ten or so years, you can find many arguments amongst psychologists, behavioural geneticists and some neuroscientists that we were to a considerable degree genetically specified – that programming of our behaviour is already in our genes. Now even the mainstream neuroscientists are no longer so committed to such a genocentric view of the world. Over Christmas, I read a book written by Gerald Edelman...

Gerald Edelman who won the Nobel Prize in Physiology or Medicine in 1972 for his work on the immune system and who for the last twenty years or so has worked as a neurobiologist?

Steven Rose: Yes, he has written a number of books about consciousness. He is very clear in his commitment to rebutting the idea of either a genetically determined set of brain processes or evolutionary constrained or computational models of the brain – the three

ways in which people have thought about the brain in the past. We have to understand the brain much less as a computer language and much less as a gene-centred language.

However, even at this conference, we have heard a lot about genes influencing behaviour including genes for this or that. On the other hand, we heard that the very old discussion about nature versus nurture is dead. How does that fit together?

Steven Rose: The nature versus nurture discussion came from the dichotomizing way of thinking that goes back to the birth of modern science in the seventeenth century. It is time we got rid of it. The discussion should be dead but it will not lie down – people go on talking about genes as if there are ‘genes for particular things’. We need to replace dichotomies of nature and nurture or genes and environment by a central concept of a developmental system. A concept of an organism that develops, a concept of self-development and self-creation of the organism out of the raw material given by the genes and the environment. That is what we call autopoiesis. The centre of biological thinking should not be the gene, the genotype versus the phenotype, but the organism.

Autopoiesis is a concept originally developed by Humberto Maturana and Francisco Varela, and today Developmental Systems Theory, a term introduced by Susan Oyama, a New York philosopher of biology may describe it. Those are the fertile ideas; those are ways of transcending these dichotomies. In fact, if you talk to more

sophisticated molecular geneticists, they will say the gene does not exist; the gene is simply a figment of the imagination. It is the genotype, the entire genome that exists, whose expression the changing cellular environment during development controls. We need to talk about complexity at that level.

Can you tell me about the mind? Is the mind and the brain the same?

Steven Rose: No, certainly not, in my view, though even Edelman has concerns and argues that mind is simply an epiphenomenal expression of brain processes. I do not like the word mind as a noun. The English philosopher Gilbert Ryle at the beginning of the last century said we have to understand minding as a verb, as an activity rather than a static phenomenon, as a noun. What I want to make clear is that minding, mental processes and consciousness emerge at the interface of individual human beings, their social, cultural and historical context. Therefore, the mind depends on the brain

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in the same way as we depend on our legs for walking. Walking is a function of the whole person in context not solely a function of the legs. In the same way mind is dependent on but not solely part of the brain. Mind is a part of the whole person.

What then is consciousness?

Steven Rose: That is a difficult word because it means different things to different people. Some people like Edelman or Francis Crick regard consciousness simply as not being asleep. Most neuroscientists’ theories say consciousness is being awake rather than being asleep, it is being aware of your surroundings; it is having a coherent, unified view of the world around you at any time. I ask what happens to all the classic ideas of consciousness under those circumstances including the Freudian concept of consciousness, feminist consciousness, and class’ consciousness. The way we understand the world can undergo transformation because of a book we read or an experience we have. Consciousness is

much more complicated than simply being awake. I think to reduce it so much provides something that is easier for neuroscientists to study – but it is like studying the window frames in a building when you should be studying the architecture of the entire building.

You are urging for a grand unifying theory of neuroscience. However, how can science develop this when there is not even a widely accepted theory of consciousness?

Steven Rose: There is no one neuroscience. The single word embraces many different disciplines from the molecular to the systems. At present, we lack a theory that enables us to go between the levels; therefore, there is almost no possibility of discourse between someone talking about coherence phenomena and someone talking about the modification of synapses because of the neural cell adhesion molecule N-CAM. Look for example at two books both with the title ‘memory’ one written by the molecular neurobiologist Yadin Dudai and the other by Alan Baddeley, a hu-

man psychologist, both work on memory and both are distinguished experts in their field. However, if you look at the books and their references in the back there is almost no cross-correlation between them. The human psychologists' concept of working memory, bears no relationship to the concept of short-term – or memory used normally by those studying molecular processes in animals. The problem is that the Anglo-Saxon scientific tradition has become dominant worldwide – scientists are very empirically based, uninterested in theory – certainly in grand theory – extremely uninterested in either the history or the philosophy of our subject. A broader, much more theoretically concerned tradition used to exist in Europe, in the former Soviet-Union but that has been largely lost today..

You spent many years dissecting the molecular sequence of events involved in synaptic modification in learning. What do we understand about learning and memory?

Steven Rose: What we understand are the processes that occur in the brain when learning takes place, when new information is stored. That has been studied in a large number of experimental animals and it is very clear that when an animal learns some

new task, particular regions of the brain are activated and new synaptic connections are made between one nerve cell and another. There are good reasons to believe that the molecular reactions that we observe in the animals are the same as those going on in humans. However, we do not understand the processes of retrieving and finding that memory. We investigate, for instance, what happens when a rat learns to turn left rather than right or whether a chick refuses to peck at a bead of a particular colour because when it did so previously the bead tasted bitter.

Nevertheless, I do not know what is involved when a chick thinks I am going to avoid that silver bead but I will peck the yellow bead. We do not know how the processes of retrieving memory take place, either in animals or in humans. We cannot tell what is going on when somebody remembers an experience, when someone remembers his fourth birthday party. The only thing we can say is that we know from imaging studies the brain regions that are involved when, for instance, I remember some event from my past.

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You mean we know where memory is located.

Steven Rose: No, the images do not tell you the areas where memories are stored. They only tell you that in certain regions there are a lot more cells that are active at the particular moment of image taking than in some control condition.

What makes nonsense of the idea that there are particular regions, which are involved in memory storage, is an experiment we have done. In this experiment, we asked people to look at sets of images of supermarket products and to choose one that they would like to buy based on past memories, and imaged their brains using a technique called magnetoencephalography. When they made the choice – which takes about two seconds – a whole sequence of different brain regions became more active. It started in the visual cortex, and then involved the infratemporal cortex and other regions as well. There was a dynamic flow of activity between one region and another in those two seconds before people registered their choice but that was not important. The most important thing was the control experiment, in which we showed the same images again and asked them to say which of the three items in each set is the tallest. In that case, which is not asking a question about memory, the visual cortex does not light up so strongly. So how active even the visual cortex is depends on whether the person is to make a judgement depending on memory, or one that is not memory dependent. My point is that the idea that memory is localised in a particular region rather than within a dynamic interaction between many different brain regions cannot be right.

How then do memory pills help for example people suffering from Alzheimer disease?

Steven Rose: That is something different. These pills are not memory pills but learning pills. The idea is that if you take your pill in the morning you will later remember what you have done in the course of the day. Such a pill directly engages in the molecular processes involved in learning. However, that is different from remembering what happened when I was ten years old or something similar.

Let us change the topic and talk about yourself for a while: You are and have been a very political scientist. For example, for



Steven Rose was born in London in 1938. He studied biochemistry and in 1969 became professor and chair of the department of biology at Britain's then newly-formed Open University in Milton Keynes (UK). He established and has directed ever since the Brain and Behaviour Research Group and has focussed his research on understanding the cellular and molecular mechanisms of learning and memory. In 2006, he retired from this position. Rose is not only a brilliant biochemist and neuroscientist – he published some 300-research papers and 15 books. However, he has always been a political (left-winged) person too, seeing beyond the end of his nose, standing back and asking what science is doing. For him social causes have the same importance or are even more important in human affairs than biological ones. His wife, the sociologist Hilary Rose is involved in that development. As a political scientist Rose belongs to a dying breed. He speaks plainly, he attacked evolutionary psychology and adaptationism (Ultra-Darwinism) and – lately – Israel for its behaviour in the conflict with the Palestinians. In 2002, he and his wife founded a boycott of Israeli academics and science. That is why people consider him anti-Zionist despite the fact that he himself is Jewish.

quite some years you fought innumerable debates with Ultra-Darwinians like Richard Dawkins. However, those discussions seem to have calmed down.

Steven Rose: Oh dear, you mean the fundamentalists! Evolutionary psychology (EP) went through a very fashionable period a few years ago when Hilary Rose and I produced the book “Alas, poor Darwin.” which was a collective critique from many different disciplines of EP claims. At the moment ultra-Darwinians, evolutionary psychologists are a bit in retreat. That is why it is not so important to be engaged in discussions with them now. I mean, there is still a lot of evolutionary psychology around and they still teach it at some schools and universities, and a few people get very excited about it. In addition, there is always a sort of pornographic interest in books claiming that men are promiscuous and women prefer mating with men wearing Rolex watches or have better orgasms when being adulterous. The popular books are still there but the arguments are no longer valid, certainly in the Anglophone cultures now. Ultra-Darwinism is still a popular topic for lectures but people advocating these ideas have a much-reduced impact.

You seem to like straight discussions. Who are your “enemies” now?

Steven Rose (laughing): Enemies! Well, over the last year I have been mainly involved in practical issues about supporting the Palestinians and the development of the academic boycott of Israel. Four years ago, Hilary Rose and I called for a moratorium on European Union funding of research collaboration with Israel whilst it was in breach of so many UN resolutions and indeed the EU’s own human rights legislation. We said it was wrong to continue the cooperation between the European Union and Israel as if Israel was a normal state, as if Israel was a part of Europe – until it negotiates a just peace, recognizing the rights of the Palestinians. We wrote that in a letter published in the London newspaper “The Guardian”. A large number of people, academics and scientists signed that call for a moratorium, later called a boycott – but it is important to understand that the academic boycott is a boycott of Israeli institutions, not a boycott of Israelis or Jews. It is now very much international and it moved forward again a few weeks ago when a group

of well-known artists and writers called for a cultural boycott of Israel.

Your point of view is surprising taking into account that your upbringing was as an orthodox Jew.

Steven Rose: That may seem so. Members of my own family died in the concentration camps – and I remember as a child seeing some who survived with the brand marks still on their arms. One way of looking at it is to see that Europe, after the Second World War, had a so-called ‘Jewish problem’ and politicians solved it by exporting Jews to Palestine – another peoples’ country. Now instead of having a ‘Jewish problem’ they have created a ‘Palestinian problem’. I do know – we all know – that this issue is a particularly difficult problem in Germany. Nonetheless, we would say that in some senses it is important for Germans to recognize that the ways the Israeli State treats Palestinians is uncomfortably close to South-African Apartheid, if not worse.

How did the European Union react?

Steven Rose: The EU Commission is deaf to such human rights issues. Last year during the negotiations for Framework 7, several parliamentary colleagues proposed a very simple clause excluding from participation countries in breach of European human rights legislation. The Commission rejected this – to them research was more important than human rights. This is the current state, but we will continue to press for change.

Let us return to science. In the sixties when you did your PhD, neuroscience was in its infancy. Asked about that time you answered, “I thought the genetic code had been solved; protein synthesis had gone. The brain is the next big thing to understand, where can I go to understand the brain?” If you were a young scientist today, what would you work on?

Steven Rose (amused): What a lovely question, no one asked me that before. In some ways I suppose, if we are talking about organism-based questions rather than broader issues of ecology and environment, it is still the brain. Of course, there are so many wonderful new techniques. In many more ways, though, the key question about organisms may be development. To put the question crudely: If humans and chimpanzees share 98.6 per cent of their genome in common yet no one would mistake a chim-

panzee for a human, what are the regulatory processes which produce humans compared to chimpanzees? That is a profound unsolved biological question, which is at the forefront of current research.

You once also said, “Don’t work on questions that are so complicated that they cannot easily be solved.”

Steven Rose (laughing): You have read too much of what I have written. However, yes, you should not work on a question so difficult that there can hardly be a solution. That is what the Nobel Prize winner Peter Medawar said when he wrote his book “The Art of the Soluble”. Moreover, he is right. Let us look back. In 1961, I became very excited by some research from Holger Hydén in Sweden who claimed that he could study molecular changes going on during learning and memorising. I very excitedly went to my head of the department who was a Nobel Prize winner and said this is really, what I want to do. He answered, this is too complicated a study for a biochemist, you should not do it. Therefore, I had to do the experiments secretly without him knowing about it. Now the study of learning and memory is one of the hottest topics of science. If I were a young researcher now, I would look at a topic just within the reach of science and which my senior bosses tell me is too complicated. In addition, I would do experiments privately if they would not let me do them publicly, I would work at night!

What would you advise young scientists to do today?

Steven Rose: Firstly, recognise that the situation is very dangerous because there are not many permanent jobs. If you want to do something interesting, you probably have to be at an academic institute, you cannot be in industry. You will have a very difficult time; you may not have a job for years. You will find yourself constantly in competition when you ought to be in cooperation with your friends and colleagues. In addition, what you have to do all the time is to keep those fundamental questions in mind about what you are interested in and want to solve. Do not let trivialities distract you. That is very, very difficult. At present, the grants go to simple short-term questions. In addition, it remains inevitably the case that a simple experiment leading to clear-cut conclusions about a tightly focussed problem is more likely to get you to Stockholm than trying to approach the larger and more complex questions.