

Preface

Alessia has been my friend for several years, and I have been aware throughout our friendship of her interest in the inheritance of memory. My own professional interest has been a study of the chemistry of life, in particular the mechanisms of inheritance. But Alessia and I did not discuss our work in detail until a chance conversation in a café in Paris made each of us aware that we had a shared interest.

I have approached the challenge of understanding inheritance through an understanding of the molecular biology of the cell. This discipline has made me sceptical of any claim that memory can be inherited from a previous generation. And I believe that this sceptical view of the inheritance of memory is common to the majority of scientists. When Alessia first mentioned her research I was unsure of the value of this work, or even if the work was more than an exploration of the extreme fringe of psychology. But one observation that Alessia made – that the inheritance of memory appeared to be dominated by maternal experience – intrigued me and caused me to review the literature related to the inheritance of memory.

To my great surprise, I discovered that the subject of inherited memory had been considered by Charles Darwin as long ago as 1877 when he exchanged letters with a colleague discussing the possibility of the inheritance of memory in the common Nautilus and electric eels. The subject of whether memory can be inherited

has caused controversy among scientists ever since.

In 1955 Thompson and McConnell appeared to show that memory could be inherited in a series of experiments in which planarian flatworms were taught to respond to light and electric shock. Trained worms were then cut in half – a process that generates two flatworms. The tail half grows a new head, the head grows a new tail. McConnell discovered that both halves of the worm remembered the training they had received. Later McConnell demonstrated that if trained flatworms were ground up and fed to untrained flatworms that the untrained flatworms learned the experience faster than worms fed on untrained flatworms.

Unfortunately, although at the time the experiments appeared to show conclusively that memory has a biochemical basis and later experiments appeared to confirm that RNA carried memory, the experiments have remained controversial and difficult to reproduce. Few scientists will accept that memory can be transferred as McConnell thought, and research into the subject appears to have ceased. This still leaves many questions open, and without conclusive evidence of success or failure there is the tantalising possibility that McConnell's observation was correct.

During our conversation Alessia also asked me if there was any scientific basis for a trait to be inherited only from one parent, because her research had suggested that memory was inherited predominantly from the maternal line. This instantly aroused my interest because maternal inheritance is a well known phenomenon in genetics. Maternal inheritance arises through two mechanisms. The mother supplies more genetic material to the embryo than the father because the mitochondria in the cytoplasm of the cell contain DNA and the cytoplasm also contains RNA.

Because the oocyte (the egg cell) has much more cytoplasm than the spermatozoon (the sperm cell) the ratio of inheritance of

maternal mitochondrial DNA to paternal mitochondrial DNA is approximately 1000 to 1. Furthermore the cytoplasm contains RNA transcripts from the mother that have a significant effect upon the early development of the embryo. For some character traits it is possible to see physical inheritance predominantly through the maternal line.

The wider question of inheritance of behaviour also has some supporting evidence in animal behaviour. For example, several species of birds (e.g. weaver birds and bower birds) construct complicated nests and will show this behaviour even if they have never observed the construction of a nest by another bird. Even stranger is the migration of the Monarch butterfly, this butterfly cannot survive a cold winter. In autumn each year millions of butterflies migrate from their summer grounds up to 5,000 kilometres to the south. They return each year to exactly the same place, often to exactly the same tree. But the butterflies that return each year are the great, great grandchildren of the butterflies that flew north in the spring. This transmission of a "memory" of a location over four generations is a startling event, that raises questions about the nature of memory and inherited behaviour that have not yet been addressed by science.

When we turn to the question of the inheritance of human memory, we face a more difficult question. In place of the gross dynamics of a population which could be explained away as "instinct", we have to address the problems of how to verify individual, subjective experience. Because of the long life span of human beings, it seems impractical to set up experiments in training humans then examining the possible inheritance of that training by their remote descendants. Science is not, at present, ready to face the challenge of operating experiments over a period of hundreds of years.

I must therefore admit to being sceptical about the chances of any experiment ever revealing the existence or nature of inherited

human memory. It seems superficially as if the egg and sperm are too small to carry the information of the experience of past generations. And there is the ever present problem of "false memory syndrome" and the suggestibility of human subjects, especially under hypnosis, to consider.

I therefore approached the reading of this book with many concerns, concerns which I set aside to read the book uncritically and with as open a mind as possible. I found this book to be remarkable. It is an open and moving account of personal exploration and a history of a process of investigation. It is also the exploration of a deep question to which we still have no firm answer – can the experience and memory of past generations be inherited?

I hope that other people will read this book as I did, firstly with an open mind, without criticism of the subject matter. The book can then be appreciated as a record of personal experience with a dream-like quality, a moving exploration of the inner space of the human mind. Then I recommend approaching the book again, this time the reader should engage their intellect to question not only the nature of reality and experience distilled into this investigation but also their personal experience of memory and sense of place. And of course throughout all to simply enjoy the book, which is a unique and moving account of an experience that few of us will have the courage to explore for ourselves.

STEPHEN FIRTH, WINCHESTER UK, 2004.