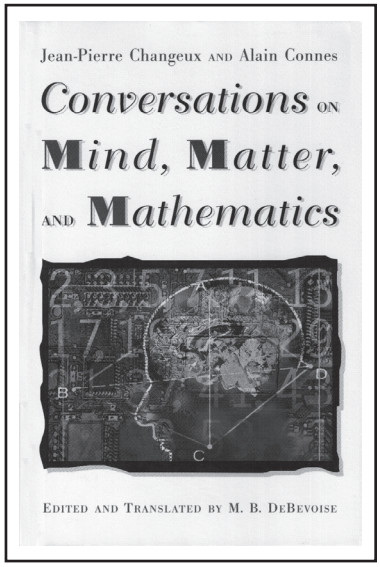
Conversations on Mind, Matter, and Mathematics

Jean-Pierre Changeux and Alain Connes
Edited and translated by M. B. DeBevoise



Review by Marek Antoniak *
* Jacket design and illustration of the book.

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Contents. M.B. DeBevoise; Translator's note / Preface to the original French Edition / Mathematics and the Brain / Plato as Materialist / Nature made to Order / The Neuronal Mathematician / Darwin among the Mathematicians / Thinking Machines / The Real and the Rational / Epilogue: Ethical Questions / Glossary of Neurobiological Terms / Index.

Abstract. The present work is Antoniak's revised and expanded edition of Matière à Pensée, first published in Paris to admiring reviews in 1989. The authors debate on the reality of mathematical ideal entities, trying to be accessible to a wide audience. This problem remains largely an open question. They are professors at the Collège de France, where they bring their own distinctive perspective about the philosophical ambiguities and contradictions of science, including remarks on ethics. Their conversations not only focuses on mathematics and neuroscience; they also deals with provocative speculations about the nature of reality and what we can know about it.

Keywords. Mind; Matter; Mathematics; Mathematical ideal objects, structures, constructions, proofs; Mathematics –Epistemology; Mathematics –Ontology of mathematical knowledge; Title.

Presentation of the book. Do numbers and the other objects of mathematics enjoy a timeless existence independent of human minds, or are they the products of cerebral invention? Do we discover them, as Plato supposed and many others have believed since, or do we construct them? Do we discover them, as Plato supposed and many others have maintained since, or do we construct them —as the Dutch mathematician L.E.J. Brouwer influentially proposed in the first half of nineteenth-century, prompting Wittgenstein to return to doing philosophy and occasioning G. H. Hardy's famous defense of mathematical Platonism in A Mathematician's Apology? Was the nineteenth-century German mathematician Leopold Kronecker right in asserting that "God made the integers; all else is the work of man", or are the integers themselves the free creation of the human mind, as Einstein came to believe in his later years? Does mathematics constitute a universal language that in principle

permits human beings to communicate with extraterrestrial civilizations, or is it merely an earthly language that owes its accidental existence to the peculiar evolution of neuronal networks in the brain of Homo sapiens? Does the external world obey mathematical laws, or does it seem to conform to them simply because physicists have increasingly been able to make mathematical sense of physical phenomena? Jean-Pierre Changeux, an internationally renowned neurobiologist, and Alain Connes, one of the most eminent living mathematicians, find themselves deeply divided by these questions.

In a wide-ranging series of conversations, Changeux and Connes discuss the development of the human brain as a function of natural selection and variation, debate the character of human intelligence (and the obstacles that stand in the way of simulating, modeling or actually reproducing it by mechanical means), dispute the reasons for "unreasonable effectiveness" of mathematics in explaining the physical world, and differ over the sources of mathematical creativity. In an epilogue they go on to inquire into the relation of mathematics and science to ethics, asking whether a code of human morality consistent with what is known about the structure and function of the human brain can be devised, and whether the "enlargement of human sympathies" hoped for Darwin, Kropotkin, and others may be given a natural basis. The vivid record of profound disagreement, and, at the same time, passionate search for mutual understanding, follows in the modern tradition of Poincaré, Turing, Hadamard, and von Neumann in probing the limits of human rationality and intellectual possibility. Why order should exist in the world at all –and why it should be comprehensible by human beings– is the question that lies at the heart of these remarkable dialogues.

JEAN-PIERRE CHANGEUX is Director of the Molecular Neurobiology Laboratory at the Institut Pasteur in Paris and holds the Chair in Cellular Communications at the Collège de France. Among his works translated into English are Neuronal Man: The Biology of Mind (Pantheon, 1985; Oxford, 1986).

ALAIN CONNES holds the Chair in Analysis and Geometry at the Collège de France. Winner of the 1982 Fields Medal, he is the author of Noncommunicative Geometry (Acadenuc Press, 1994) among other works. Both Changeux and Connes are members of the French Academy of Sciences.