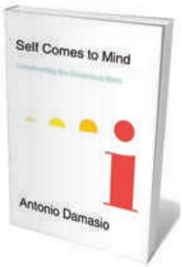

Self Comes to Mind: Constructing the Conscious Brain
ANTONIO DAMASIO
Pantheon: 2010. 384 pp. $28.95, £25

experience. We seek to explain how consciousness arises from the brain and body and, through evolutionary biology, why it was selected for, emerged and became ubiquitous. Damasio's views on these issues are not fleshed out. As for the mechanism, he recounts the accepted picture that the brainstem, thalamus and posteromedial cortices play a big part. His 'just-so' answer on the evolutionary function of consciousness is unconvincing.

Damasio gives familiar descriptions of experiences that require an organism but do not require a 'self'. Most basic is simple sensory consciousness, as when an animal experiences pain or pleasure, hunger or thirst (which Damasio calls the protoconsciousness). Then there are more extended experiences, as when a raccoon foraging at a stream takes in the sights, smells and sensations of its surroundings (Damasio's core consciousness). And there is self-consciousness — possibly unique to humans — that includes awareness of self-referential feelings such as anxiety, or the story of one's life or character (autobiographical consciousness).

Present in all these types of consciousness, he says, is a 'self process'. This may be involved in the 'self as witness' or the 'self as protagonist', but it is not clear why it is necessary for the 'self as experiencer'. In fact, Damasio explicitly excludes dreaming — in which the sleeper has experiences but lacks self-awareness — from the set of conscious experiences. This is obviously unwarranted. We have experiences when dreaming and while under anaesthetic, even though aspects of our awareness disappear. Dreaming does not require a self process, so consciousness does not either.

Just because 'self' is in our vocabulary does not mean that it has any explanatory role in a science of the mind. Damasio says nothing convincing as to why, in addition to our fully embodied conscious beings, we ought to add the self, or self processes, to the ontological table of elements. ■

Owen Flanagan *is James B. Duke Professor of Philosophy and professor of neurobiology and of psychological and brain sciences at Duke University, Durham, North Carolina 27708, USA.*
e-mail: ojf@duke.edu

NEUROSCIENCE

Mind your head

Josie Glausiusz enjoys a thought-provoking exhibition.

Brain: The Inside Story
American Museum of Natural History, New York. Until 15 August 2011.

To step into the human brain is like being plunged into a pulsating bowl of psychedelic spaghetti. At least, that is the sensation visitors experience on entering the *Brain* exhibition at the American Museum of Natural History in New York. Bursts of light rush along a gigantic jumble of salvaged wires that hang from a ten-metre-long walkway. The installation, by artist Daniel Canogar, simulates the frenetic activity of neurons as they fire electrical impulses.

The real human brain — a plastinated example of which is on display — seems puny after such a dramatic artwork. Yet this complex organ, weighing only 1.4 kilograms and filled with 100 billion neurons, has enabled humans to colonize the planet, create great works of art, build robots and rockets, calculate and cogitate, fall in love and be conscious of our own existence. The exhibition covers all this and more.

An enchanting video captures many of the brain's functions. As a graceful young dancer performs pliés and pirouettes in an audition, a large-scale replica of the brain lights up different regions as they become active. Her cerebellum coordinates movement and balance; her limbic system triggers emotions and memories; her auditory cortex interprets music; and her motor cortex sends messages to her muscles. When she is nervous, her amygdala triggers regions of her brainstem to send signals to her heart, speeding its beat. Using her prefrontal cortex, she consciously controls her breathing to calm herself down. When she learns she has passed her test, her hippocampus allows her to save the happy memory in long-term storage.

Brain **highlights the Kiki and Booba experiment: 98% of people agree on which name matches which shape, regardless of their native language.**

AMNH/D. FINNIN

Emotions play a big part in how our brains work, often overriding rational decision-making. There is a reason for that, says Margaret Zellner, a behavioural neuroscientist at New York's Rockefeller University and a consultant to the exhibition. "A lizard brain is a very reflexive, automatic system," she says, pointing to a stuffed green iguana on display. By contrast, the mammal brain makes us much more flexible, thanks to our limbic system. It generates emotions that are key to our everyday survival and forms memories. If the limbic system is damaged, "our social interactions are disrupted, and we are much more impaired than if we lose the ability to speak," explains Zellner.

A panel shows some of the latest medical advances to help those who have other kinds of brain impairment. Deep brain stimulation, in which a battery-powered, implanted neurostimulator triggers electrical activity in areas of the brain that control movement, has been used to treat more than 80,000 people with Parkinson's disease. Transcranial magnetic stimulation, the fastest-growing non-drug treatment for major depression, uses a large electromagnetic coil placed against the scalp to generate painless electric currents that stimulate brain cells involved in mood control. It could some day be used to treat schizophrenia and bipolar disorder. Other devices use electrodes to restore sight by stimulating neurons in the retina, or allow people with limb paralysis or no limbs to move a cursor on a computer simply by thinking about it.

Even more awe-inspiring is another dangling tangle of copper wires, again courtesy of Canogar, depicting the developing infant brain *in utero*. In the first five months of fetal development, an astonishing 500,000 neurons form every minute. Millions of connections continue to be made in the first few months of life, and each new skill stimulates the growth of neural links — even into adulthood and old age. Such development is the goal of exhibition curator Rob DeSalle: "I want people's brains to change as they go through this exhibition — for the better," he says. ■

Josie Glausiusz *is based in New York City.*
e-mail: jg@planetjosie.net