# Coma and impaired awareness

## (Satellite meeting of The Association for the Scientific Study of Consciousness 8th Annual Meeting)

25-28 June, 2004; Antwerp, Belgium

The eighth annual meeting of the Association for the Scientific Study of Consciousness (ASSC) took place in Antwerp, a beautiful Belgian city, major European port and home of the Peter Paul Rubens, 'the prince of painters and painter of princes'. It was preceded by a satellite meeting on 24th June devoted to 'Coma and Impaired Consciousness' organised by Steven Laureys of the University of Liege, funded by the Mind-Science Foundation of Texas. The satellite brought together many of the world's leading researchers on states of impaired awareness, under the presiding eye of Bryan Jennett, who of course described the vegetative state, in 1972, and devised the Glasgow Coma Scale. Jennett summarised and discussed the various contributions over the course of the day, building a bridge between the early work in the field, recent findings and future possibilities.

What was new? There have been advances on two fronts in particular: the classification of states of chronically impaired awareness and their investigation by functional imaging. The classificatory advance has been the definition, by Jo Giacino and others, of the 'minimally conscious state' (MCS). This is characterised by the presence of reproducible but inconsistent (or limited but definite) evidence of awareness, for example command-following. The MCS is often a transitional state in the course of emergence from the vegetative state (VS) to full awareness, but it can be the terminus of recovery. The definition of this syndrome may not sound like a dramatic development to those outside the field, but just as the definition of the VS by Jennett and Plum in 1972 made it possible to begin to collect information systematically about this tragic and eery state of 'wakefulness without awareness', so the definition of the MCS should allow us to learn more about the processes by which awareness recovers after a period in coma or the VS. It has already given rise to some important findings, as below.

Steven Laureys (who was later awarded the ASSC's first William James prize at the main meeting) summarised the results from his group's work in Liege. The key conclusions are that the brain's global metabolic rate is reduced by 40-70% in the VS, to levels comparable to those seen in slow wave sleep or under general anaesthesia; primary sensory cortices *can* be activated by appropriate stimuli in the VS, but this activity generally fails to propagate, in the usual way, to downstream sensory and association cortices; recovery of awareness need not be accompanied by any major change in overall brain energy consumption, but is associated with two other key changes – an increase in the activity of a network of association areas in the parietal and frontal lobes, and restoration of connectivity between remote brain regions. This may help to restore a 'global workspace' for consciousness, a model presented to the meeting by its originator, Bernard Baars. Patients in the MCS scanned so far resemble normal controls in these two respects, perhaps suggesting a step change in brain functioning with recovery of awareness. Nicholas Schiff's work, from Cornell, extends these observations. Occasional patients who appear otherwise to be in a VS produce isolated items of behaviour which turn out to correspond to preserved islands of cortical metabolism. Like the Liege group, Schiff's team are finding substantial evidence of cerebral recovery in the MCS. He discussed some grounds for hoping that focal brain stimulation may, in the future, prove able to nudge patients in the MCS back towards normal function.

The satellite provided an extremely rich day. Following introductory talks on the concept and models of consciousness (Zeman + Baars), James Bernat gave a useful overview of states of altered awareness, provoking a lively rebuke from Bryan Jennett with Bernat's suggestion that the diagnosis of brain death requires support from cerebral blood flow studies: Bernat retreated diplomatically under fire. Jean-Michel Guerit (Louvain) reviewed the use of evoked potentials in assigning prognosis. Adrian Owen summarised evidence obtained recently in Cambridge for implicit processing to the semantic level in a minority of patients in the vegetative state. Andrea Kubler from Tubingen, gave a fascinating account of the development of 'thought translation devices' which can enable wholly paralysed subjects to communicate by EEG-mediated brain-computer links. Pierre Fiset (Montreal) discussed functional imaging studies of general anaesthesia which are beginning to explore the common ground between anaesthesia, sleep and coma. Finally Jo Fins from New York provoked a storm of interested questions by his outline of a pragmatic approach to ethical medical decision-making.

The ASSC is keen to recruit new members: neurologists with an interest in the science of consciousness should visit the website (http://assc.caltech.edu/index.htm).

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