

soul, for the growth of the mind!

The butterfly has also been a sign for immortality: “As changing from the mundane caterpillar, through the state of dissolution, to the celestial winged creature, it is rebirth, resurrection” (Cooper 1978). Also the young maiden Psyche, whose name means (in Greek) both soul and butterfly, is a symbol of immortality. Through the centuries Psyche has been portrayed in paintings and sculpture as a beautiful girl with butterfly wings. These students at the Ross School knew well the exquisite myth of Psyche and Cupid, but now they could build a second metaphor about butterfly wings and living neurons, a new visual metaphor they will remember forever because they were deeply involved in this exciting task for many weeks. Incidentally, this convergence gave them, from the very start, the idea of plasticity: ever changing shapes, enchantment, morphing, life, joy, music, and dance. This is not a very common teaching or learning experience. When we read a text of neuroanatomy, the images are certainly beautiful but they are static, dead. Instead in this video the neurons live and fly along with the butterflies. I think this dynamical view is the best way to explore the mysteries of the human mind, the living mind in all of us. Plasticity is a typical MBE new concept. The images you will see give us a sense of adventure, of project and purpose. As the philosopher Paul Ricoeur (1977) said: a metaphor is a “unified process of understanding that is at once, cognitive, imaginative and emotive”.

This video is the result of this magic synthesis. It is a work of love by student Bronwyn Roe and teacher Marie Maciak.

– *Antonio Battro, Scholar-In-Residence*

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Mysterious Butterflies of the Soul

This text is about a video. Normally we don't need to explain by writing what is shown by the video, but in this case we need an explanation because it relates to an experiment in education. It is an experiment in "mind, brain and education," a project that coordinates different views of the modern cognitive neurosciences within the focus of education. We call it, for short, the MBE project. It is essentially a triad of the disciplines of psychology, neuroscience and education.

In search of a metaphor Many years ago, during my training in neuroanatomy, I learned to use the wonderful Cajal techniques to dye the neurons of the brain with gold and silver (Battro, 1961). The beauty of these pictures in the microscope made a great impact in my life (Battro, 1994). As young medical students many of us read the famous book of Santiago Ramón y Cajal *Recuerdos de mi vida* (1923, 1988), a very influential text for budding scientists. In this book I found the inspiration for this video. The founding father of modern neuroanatomy looked on neurons as the mysterious butterflies of the soul that some day might unravel the secrets of mental life. The perfect metaphor for a MBE project at the Ross School! I transcribe now this inspiring text in his elegant Spanish:

"Como el entomólogo a caza de mariposas de vistosos matices, mi atención perseguía, en el vergel de la sustancia gris, células de formas delicadas y elegantes, las misteriosas mariposas del alma cuyo batir de alas quién sabe si esclarecerá algún día el secreto de la vida mental" (Ramón y Cajal, 1923, 1988).

"As the entomologist chasing butterflies of bright colors, my attention was seeking in the garden of gray matter, those cells of delicate and elegant forms, the mysterious butterflies of the soul, whose fluttering wings would someday—who knows?—enlighten the secret of mental life".

The search for butterflies and neurons All metaphors create a bridge between signs. In the words of Cicero (De oratione): "a metaphor is a brief similitude contracted into a single word; which word being put in the place of another, as if it were in its own place, conveys, if the resemblance is acknowledged, delight..." In this case two words, and two worlds, became delightfully connected: cells (neurons) and butterflies. The contemporary philosophers Georg Lakoff and Mark Johnson in their remarkable book *Metaphors We Live by* (1980) have expressed the same function as following: "Conceptual metaphors are mappings of structure from one domain of experience (the source) onto another domain of different kind (the target)." In Cajal's metaphor the butterfly is the source, the neuron is the target. And the conceptual structure of the metaphor conveys the meaning of both life and mind. The scientific purpose is to discover, some day, "the secret of mental life".

Some metaphors can be transformed into art or into scientific models. In this case we have chosen images and sounds instead of a scientific explanation about the neurons and the mind. The words of Cajal would lead us to the pursuit of butterflies and neurons. The student who did this video went to the Zoo to shoot images of butterflies and went to the Web to see how neurons were represented. She discovered that neurons and butterflies had a lot in common; both are beautiful, with bright colors, intermingled with the flowers and leaves of the gardens of the cerebral cortex, as Cajal suggested. And most important, they have found that neurons are living creatures, growing and moving in fantastic dances. In fact they have discovered that the images of neurons in artificial cultures, extending their axons, following different paths, growing new synaptic buttons, crossing each other in complex networks, were mirroring the flight of the butterflies in a magical way. What a profound metaphor for the life of the

