



Francisco J. Varela (1946–2001)

Tribute by Evan Thompson

It is with great sadness that I record the death of Francisco Varela, who passed away at his home in Paris, on May 28, 2001. With his passing, the science of consciousness has lost one of its most brilliant, original, creative, and compassionate thinkers.

Francisco Varela was born September 7, 1946 in Chile. As a child and teenager, he received a strong classical education from the German Lyceum in Santiago, which instilled in him a deep and lifelong appreciation of literature, art, philosophy, and science. He received his MSc (Licenciatura) in Biology in 1967 from the University of Chile in Santiago, where he studied with the neurobiologist Humberto R. Maturana (well known for his classic work with Jerome Lettvin on the neurophysiology of vision in frogs and for his subsequent work with Varela on autopoiesis). According to the story Francisco was fond of telling, as a young undergraduate he one day burst into Maturana's office and enthusiastically declared that he wanted 'to study the role of mind in the universe'. Maturana responded, 'My boy, you've come to the right place.'

From 1968 to 1970 Francisco followed in the footsteps of his mentor Maturana by pursuing graduate studies in Biology at Harvard University. His doctoral thesis, 'Insect retinas: information processing in the compound eye', was written under the direction of Torsten Wiesel (who shared a Nobel Prize with David Hubel in 1981).

With his PhD in hand at the young age of twenty-three, Francisco declined a position as researcher at Harvard and another as assistant professor at another American university, choosing instead to return to Chile to help build a scientific research community. It was during these years of 1970 to 1973 that Varela and Maturana, now colleagues at the University of Chile, formulated their famous theory of *autopoiesis* (Maturana & Varela, 1973; 1980; see Varela, 1996a, for a personal recounting of this time and work).

According to this theory, living systems are autonomous systems (endogenously controlled and self-organizing), and the minimal form of autonomy necessary and sufficient for characterizing biological life is autopoiesis, i.e., self-production having the form of an operationally closed, membrane-bounded, reaction network. Maturana and Varela also held that autopoiesis defines cognition in its minimal biological form as the 'sense-making' capacity of life; and that the nervous system, as a result of the autopoiesis of its component neurons, is not an input-output information processing system, but rather an autonomous,

operationally closed network, whose basic functional elements are invariant patterns of activity in neuronal ensembles (see Varela, 1979). These ideas, dating back to the early seventies, not only anticipated but laid the groundwork for ideas that were to become prominent much later in the nineties, in scientific fields as diverse as the origins of life (Fleischaker, 1990), the chemical synthesis of minimal living systems (Bachman *et al.*, 1992), artificial life (Varela & Bourguine, 1991), theoretical immunology (Varela & Coutinho, 1991), dynamical neuroscience (Varela *et al.*, 2001) and embodied cognition (Varela *et al.*, 1991).

When Francisco returned to Chile, he arrived on September 2, 1970, two days before the election of Salvador Allende (the first Marxist politician ever elected in a free election). Three years later Chile was in turmoil, and Francisco, a strong supporter of the Allende government, was forced to flee with his family after the military coup of General Augusto Pinochet overthrew the Allende government on September 11, 1973. They fled first to Costa Rica, and then eventually to the United States, where Francisco took up a position as Assistant Professor at the University of Colorado Medical School in Denver. There he taught and pursued his research until 1978. In 1978–79, he spent a year in New York at the Brain Research Laboratories of the NYU Medical School and as scholar in residence at the Lindisfarne Association, and then returned to Chile in 1980, staying there until 1985 (with a year spent in 1984 as a Visiting Senior Researcher at the Max Planck Institute for Brain Research in Frankfurt). In 1986 he moved to Paris, where he was based at the Institut des Neurosciences and at CREA (Centre de Recherche en Epistémologie Appliqué). In 1988, he was appointed to be a Director of Research at CNRS (Centre Nationale de Recherche Scientifique), a position he held until his death.

Francisco's years in Paris, up until the very month of his passing, were remarkably full and productive by any standard; that he suffered from Hepatitis C from the early 1990s onward, including receiving a liver transplant in 1998, makes his life and work during this time truly wonderful and inspiring.

During these years Francisco pursued two main complementary lines of work: experimental studies using multiple electrode recordings and mathematical analysis of large-scale neuronal integration during cognitive processes; and philosophical and empirical studies of the 'neurophenomenology' of human consciousness (see Varela, 1996b).

In a 1998 study published in *Nature*, Francisco and his colleagues in Paris showed for the first time that the human perception of meaningful complex forms (high contrast faces or 'Mooney figures') is accompanied by phase-locked, synchronous oscillations in distinct brain regions (Rodriguez *et al.*, 1998). In an important review article published one month before his death, in the April 2001 issue of *Nature Reviews Neuroscience*, Francisco and his colleagues presented a new viewpoint on what they call the 'brainweb': the emergence of a unified cognitive moment depends on large-scale brain integration, whose most plausible mechanism is the formation of dynamic links mediated by synchrony over multiple frequency bands (Varela *et al.*, 2001). In addition to these studies, Francisco published numerous technical, experimental and mathematical papers on the

nonlinear dynamical analysis of brain activity, including groundbreaking studies on the prediction of seizures in epileptic patients prior to the onset of symptoms (Martinerie *et al.*, 1998; see also Schiff, 1998).

Francisco also firmly believed, however, that such scientific research needs to be complemented by detailed phenomenological investigations of human experience as it is lived and verbally articulated in the first person. To this end, he published a number of original and innovative phenomenological studies of aspects of human consciousness (e.g., Varela, 1999; Varela and Depraz, 2000), including a profound and moving meditation on his own illness and the phenomenology of organ transplantation experience (Varela, 2001). He co-edited two important collections, one on phenomenology and cognitive science (Petitot *et al.*, 1999) and the other on first-person methods in the science of consciousness (Varela and Shear, 1999).

From the mid-seventies, Francisco was a serious practitioner of Tibetan Buddhist meditation and a student of Buddhist psychology and philosophy. His conviction that this tradition and Western cognitive science have much to gain from each other provided another, ultimately spiritual and existential dimension, to his work. This dimension was the subject of his 1991 book (co-written with Evan Thompson and Eleanor Rosch), *The Embodied Mind: Cognitive Science and Human Experience*. He was one of the key members of the Advisory Board of the Mind and Life Institute, which organizes private meetings between Tenzin Gyatso, His Holiness the Fourteenth Dalai Lama, and Western scientists (see Varela, 1997). The ninth and most recent of these meetings was held May 21–22, 2001, at the University of Wisconsin, Madison, on the theme of ‘Transformations of Mind, Brain, and Emotion: Neurobiological and Bio-Behavioral Research on Meditation’, directed by Professor Richard Davidson. This meeting was a dream-come-true for Francisco: the best of Western brain science and Buddhist meditative practice and psychology brought together in the context of cognitive neuroscientific research on the cognitive and emotional effects of meditation evident in long-term practitioners. Francisco was to present his studies and findings using EEG and MEG methods at the morning session of May 22, but sadly was unable to be there because of his illness. His PhD student, Antoine Lutz, presented the material in his stead, and a live web-cam was set up so that Francisco could watch the proceedings from his apartment in Paris.

Francisco was an active and enthusiastic supporter of many interdisciplinary groups devoted to the study of consciousness. In the seventies and eighties, he served on the faculty of the Naropa Institute in Boulder, Colorado, and was a Fellow of the Lindisfarne Association in New York City. He was a founding member of the Association for the Scientific Study of Consciousness (ASSC) and was actively considering hosting the 2002 ASSC meeting until shortly before his death. He was a strong supporter of the Center for Consciousness Studies at the University of Arizona at Tucson, and served on the Editorial Advisory Board of the *Journal of Consciousness Studies*. He was also instrumental in the creation of a new journal, *Phenomenology and the Cognitive Sciences*, and was to serve as its Consulting Editor.

Although the passing of Francisco, especially at a time when his rich and diverse research program was coming to such fruition, is an immeasurable loss, the spirit of his unique and exemplary style of research has never been stronger, and will continue to inspire many of us for years to come.

Francisco was calm and at peace when he died, in the loving embrace of his family, at 5.00 am on May 28, 2001. I visited him several days before, and was deeply touched by the serenity, kindness, and intelligence he continued to radiate. He leaves his wife, Amy Cohen Varela, and their son Gabriel, and his former wife Leonor, and their daughters Alejandra and Leonor, and son Javier. He will be deeply missed.¹

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