Superseding the Synaptic Network: How Cellular Complexity Transcends the Digital Neuron

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Latest book: Nonscience Returns (2020). Fellow of Cardiff University since 1986. Independent research biologist, author, and lecturer, publishing on scientific issues for the general public. Television personality for over 50 years. An international authority on the microscope. Was recently awarded the Ernst Abbe medal awarded by the New York Microscopical Society, honorary fellowship of the Royal Microscopical Society, and Fellowship honoris causa by the Linnean Society of London.

Abstract: *Current digital models of cerebral function conceive of neurons as simplistic go- or no-go gates. They are regarded as organic transistors. My investigations over the decades have drawn a very different conclusion; namely, that the neuron is a largely autonomous cell of unimaginable complexity. Whereas current conceptions treat of neural networks, insisting that the centers of data processing lie with the synapses (and the large numbers of possible permutations which govern how they connect), my view is that data-processing is essentially intracellular. Rather than being discrete components in a grander network, neurons are envisioned as thinking for themselves. Examples of complex cognitive and sentient behavior drawn from the microbial realm substantiate the conclusion that cells are complex, and are far from the simple processing units we currently claim. It is not the brain that we can compare to a computer, the neurons being analogous to transistors. Rather, each individual neuron is far more sophisticated than the most advanced computer we know.*

Professor Brian J Ford began by vividly showcasing the sentient activities of cells through high-quality videos and photos. Some videos revealed ciliate microbes selectively choosing to consume certain items while rejecting others and Dinoflagellate algae unraveling an appendage called a flagellum to slowly and methodically regulate where it swims, while other recordings show white blood cells chasing bacteria, capturing them, and consuming them, such as the one taken in 1959 by David Rogers from Vanderbilt University. All of these prove that single cells are capable of intentional, purposeful, cognitive activity. Microscopists even observe single-celled algae like Uroglena possessing red eye spots that, when sectioned, show a curved retina. So, some cells can even see what they are doing. Other unicellular algae like *Spirogyra* and many diatoms engage in sexual reproduction utilizing mechanisms that are not understood. It is a mystery how mating diatoms sense and identify each other — where a protrusion emerges from each individual that touches the other and allows the two diatoms to fuse — and how they dissolve the cell wall which is necessary for such an act to occur.

Professor Ford criticized current textbooks for describing mating *Spirogyra* as simply putting out a conjugation tube, while the cognitive capacity of the algae to sense that they are near each other and determine which is male and which is female, and the mechanism behind how the conjugation tubes are formed and the cell wall is dissolved, are not addressed at all. He was also critical of the overly simplistic and inaccurate representations of cells, calling them “jelly bean models,” that a large majority of academic institutions use to educate students and the public. Such models mislead people into thinking that cells are amenable to mechanistic descriptions, which reinforces the bias of modern science that everything is reducible to physics. If authentic images and videos of cells were utilized instead of jelly bean models, then the overwhelming complexity of living cells would be seen in truth and naive attempts of creating computer models of cells would be set in a proper context. Attempts to create digital models usually attract large sums of grant funding, however, so many scientists feel compelled to ignore real cells in favor of overly simplistic and inaccurate models. Establishing that modern science lacks proper knowledge of relatively simple single-celled organisms served as a solid foundation for Professor Ford to show that science is completely at a loss for understanding neurons, or single nerve cells, which he postulates

are “the most complicated and highly evolved cell in the universe.” He critiqued modern neuroscience for focusing on neural synapses, where neurons meet but do not touch, instead of the nerve cell itself. Individual neurons do not just fire and send signals, they are self-regulated, autonomous, and cognitive entities in their own right. The synapses are basically just road junctions on a map; the focus should be on the people who live in the towns the roads connect.

Pulling from a chapter that he contributed to *Brain, Mind, and Medicine: Neuroscience in the 18th Century* (2007), Professor Ford explained that in 1674, Antony van Leeuwenhoek was the first microbiologist to ever study nerve cells under the microscope. Nerves began to be depicted as mechanical devices, tubes filled with fluid, throughout the end of the 17th and beginning of the 18th century. Microscopist Johannes Evangelista Purkyně (1787-1869) was also a prominent individual who studied neurons under the microscope. The Purkinje cell was named after one of his detailed drawings of neurons, which were motivated by interest in dendrites coming out of the neuron beginning to lose focus while under the microscope. The drawings of Santiago Ramón y Cajal accurately depicted the complexity of dendrites branching out of a single neuron and even included major parts of the brain inclusive of each neuron and the pathways of its dendrites. Professor Ford emphasized caution when confronted by claims of modern neuroscience, as there are clear cases where knowledge claims were embellished to ensure funding of large-scale projects. Examples include (1) Artechouse’s “Life of a Neuron” exhibit, produced in partnership with the Society for Neuroscience, which claimed to depict the entire life of a neuron and reveal mysteries of the human brain, although the vivid artistic computer renderings did not factually deliver on that promise, and (2) the Human Brain Project, which cost €1 billion funded by the European Union, producing many publications and professional gatherings that all suffer the defect of telling very little about the way living neurons actually function. The presentation concluded by advocating humility among scientists, suggesting that academic courses dedicate Fridays to considering what is not known about particular subjects, rather than what we do, to inspire humility in teachers and creativity in students.