at the same time by all the cells are added together to reach potentials of up to 600 volts.

To describe the functional differences between the two membranes, Xu and LaVan use the well-known Hodgkin–Huxley model — traditionally used to depict the formation of action potentials in the simpler giant squid axon system — to describe the innervated membrane, and the Goldman–Hodgkin–Katz current equation to model the ion flux in the non-innervated membrane. By including some existing knowledge about the system, such as the different ion channels present on both membranes, Xu and LaVan were able to determine the physiological parameters needed for the above two models, with the remaining unknowns determined numerically by optimization procedures. The resulting model predicts the details of the generation of action potentials with remarkable accuracy. Furthermore, using the computer model, an 'artificial cell' was designed and optimized to form a simplified version of the naturally occurring cell that can, surprisingly, supply power on demand more efficiently than the electrocyte itself.

The general model described by Xu and LaVan is significant for two reasons. First, it identifies a new method for studying complex biological systems by relating the molecular components to the function at the macroscopic level. Second, it could lead to new sources of energy that will enable various medical devices and implants to be powered in the same way as the living system.

In the near future, the evolution of this kind of approach will be driven both by the progress in traditional biophysical microscopic models and by the availability of fast computational resources. It is only a matter of time before intelligent nanomachines that can perform complex cell functions 'on demand' become a reality.

References

1. Xu, J. & LaVan, D. *Nature Nanotech.* **3,** 666–670 (2008).
2. Hille, B. *Ion Channels of Excitable Membranes* 3rd edn (Sinauer Associates, 2001).
3. Southern, J. *et al. Prog. Biophys. Mol. Biol.* **96**, 60–89 (2008).

ERRATUM

Nano-selenium captures mercury

NICHOLAS RALSTON

Nature Nanotechnology **3**, 527–528 (2008)

In this News & Views article, the final sentence on page 527 should have begun "With just 14% of the surface area of the stabilized form…".