

itself and onto its nearest and next nearest neighbours, capable of carrying forward excitatory interactions. In addition, each circuit is connected to a single central neuron that is trained to induce inhibition.

When a circuit element (neuron) is stimulated independently, the response profile is seen to center on the stimulus and extend over a large fraction of the ring. Such distributed representations have indeed been seen in several brain areas while plotting the tuning curve of a cell, and are called population codes. In the circuit this is achieved by a balance between recurrent excitation and inhibition, which is built in. A remarkable achievement of the circuit takes place when a background is added. The

population response remains in the same location (neuron) and with similar shape, but with amplitude that varies with the total amplitude in an almost linear way.

While the response of the circuit is determined by the foreground and background stimulus, two localized stimuli compete to determine the response similar to the tuning curve. When the stimuli amplitudes are vastly different, the circuit always selects the larger stimulus. On the other hand, if they have roughly equal amplitudes, one of them is chosen because of bistability which allows the circuit to retain memory (similar to a Schmitt trigger). But why does digital selection exist with analogue response? This is because of dif-

ferential instabilities which is necessary for constrained selection, and the possibility of multistability.

Nature around us provides enormous examples of non-digital computing machines. The work of Hahnloser *et al.* demonstrates that we already know enough to build integrated circuits that compute like biology.

1. Richard, H. R., Hahnloser, Sharpshkar, R., Mahowald, M. A., Douglas, R. J. and Seung, H. S., *Nature*, 2000, **405**, 947–951.

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## Hughes medal for C. N. R. Rao

C. N. R. Rao of the Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore has been awarded the Hughes Medal of the Royal Society in recognition of his contributions to the field of materials chemistry, particularly in relation to the studies of the elec-

tronic and magnetic properties of transition metal oxides at high temperature superconductors.

The Hughes Medal is awarded in recognition of an original discovery in the physical sciences, particularly electricity and magnetism or their applications.

The Hughes Medal was awarded previously to C. V. Raman in 1930 for the discovery of the Raman Effect.

Rao will receive the Medal during the Society's anniversary day meeting on 30 November 2000.

## Volvo Environment Prize for Amulya Reddy

Amulya Kumar N. Reddy formerly professor at the Indian Institute of Science, Bangalore has been chosen for this year's Volvo Environment Prize. He shares the award with José Goldemberg, (Brazil), Thomas B. Johansson (Sweden) and Robert H. Williams (USA).

This year's awardees have been recognized for their outstanding collaborative achievement since the early 1980s of working out a new policy-driven approach to the technical analysis of world's energy needs and how they could be provi-

ded for the early decades of the century.

The Prize which is worth approximately 1.5 million Swedish Kroners will be awarded at a special ceremony in Goteberg in October this year.