HIGHLIGHTS

IN BRIEF

ION CHANNELS

Acid-sensing ion channel 3 matches the acid-gated current in cardiac ischemia-sensing neurons.

Sutherland, S. P. *et al. Proc. Natl Acad. Sci. USA* **98**, 711–716 (2001)

The authors found that acid-sensing ion channel 3 (ASIC3) is functionally similar to the pH-sensitive channel present in the sensory neurons that mediate angina — the pain that accompanies cardiac ischaemia. ASIC3 might therefore become a prime target for treating the chest pain that is commonly associated with coronary artery disease.

NEUROPATHOLOGY

Src deficiency or blockade of Src activity in mice provides cerebral protection following stroke.

Paul, R. *et al. Nature Med.* **7**, 222–227 (2001)

A primary cause of brain injury after stroke is brain oedema, which is partly caused by the release of vascular endothelial growth factor (VEGF) and an increase in vascular permeability (VP). Mice lacking Src kinase — a mediator of the VEGF response — do not show increased VP in response to VEGF administration. Here Paul *et al.* found that Src-knockout mice show a reduction in neuronal damage after stroke, and that treatment of wild-type mice with a Src kinase inhibitor as late as six hours following ischaemia has a similar effect. This raises the possibility that a similar intervention could halt the spread of ischaemic damage in stroke patients.

CELL BIOLOGY OF THE NEURON

Assembling the presynaptic active zone: a characterization of an active zone precursor vesicle.

Zhai, R. G. *et al. Neuron* **29**, 131–143 (2001)

Zhai *et al.* discovered that several protein constituents of the active zone are transported together to nascent synapses on specific organelles that lack synaptic-vesicle and perisynaptic proteins. These ‘granulated vesicles’ might participate in the assembly of the presynaptic terminal by sorting the components of the active zone before they reach the axon membrane.

TECHNICAL DEVELOPMENTS

“Fluorescent timer”: protein that changes color with time.

Terskikh, A. *et al. Science* **290**, 1585–1588 (2000)

Genes that encode fluorescent proteins are increasingly used as reporters to monitor promoter activity in living tissue. But as these proteins are very stable, they give little insight into the dynamics of gene expression. This paper reports the discovery of a mutant form of red fluorescent protein that changes its fluorescence from green to red with time. This allows a distinction to be made between active gene expression, which causes cells to fluoresce green, and the persistence of fluorescent protein after downregulation of the gene, which causes cells to fluoresce red.

SENSORY SYSTEMS

An amino acid tasting

“Fleurie seduces with its aroma of flowers and fruits: irises, violets, rose petals, peaches, blackcurrants and red berries”. I love wine but I have always distrusted the flamboyant descriptions that appear on the bottle. How can anyone distinguish in such a complex mélange so many different smells that are present in the minutest amounts? The problem is even worse when the smells are similar — how does the brain differentiate between blackcurrants and red berries? Although we don’t know yet, Friederich and Laurent have made a provocative finding related to this question. Studying the olfactory bulb of the zebrafish, they found that the representation of an odour across a population of mitral cells changes very quickly. So, the similarity of the responses elicited by related odours decreases with time.

Friederich and Laurent recorded the activity of individual mitral cells in response to 16 amino acids — one at a time — and measured changes in firing rate as a function of time. They observed that every mitral cell responded differently to each amino acid and that the firing pattern of each cell changed during the recording period — some cells decreased their firing rate, others increased it, others did not change much. Importantly, the changes did not reflect a sharpening of the initial firing pattern and the elimination of weak responses, but a redistribution of activity across the cell population.

They then did a correlation analysis of the responses across the whole population of neurons and found that, at the earliest time point, similar amino acids elicited similar responses. For example, the responses to the aromatic amino acids tryptophan and tyrosine correlated strongly, whereas the responses to aspartic acid and arginine (negatively and positively charged amino acids, respectively) correlated poorly. But if they measured the same correlation 500–800 ms later, the values changed such that the responses produced by similar amino acids no longer showed a good correlation.

These findings imply that, initially, the olfactory system might represent related stimuli in clusters, allowing for the formation of broad categories. But the representations can change within a fraction of a second to allow for the finer discrimination of related odours. Although this idea must now be tested with psychophysical experiments, it’s certainly appropriate to raise a glass to this remarkable insight into the nature of olfactory coding.

Juan Carlos López

References and links

ORIGINAL RESEARCH PAPER Friederich, R. W. & Laurent, G. Dynamic optimization of odor representations by slow temporal patterning of mitral cell activity. *Science* **291**, 889–894 (2001)

FURTHER READING Laurent, G. A systems perspective on early olfactory coding. *Science* **286**, 723–728 (1999)

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