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Book Review

The Mutable Brain: Dynamic and Plastic Features of the Developing and Mature Brain. Edited by Jon H Kaas. Harwood Academic Publishers. 2001, 394 pages.

Reviewed by Roy Sugarman

Jon Kaas, Centennial Professor of Psychology at Vanderbilt, has put together this work following his desire to further the ends of studying the organisation of sensory perceptual systems in the mammalian brain, the development of neurological organisation in the brain, and its regeneration following injury.

This work consists of nine chapters, of which the best is probably the chapter on activity dependent plasticity of glutamatergic synaptic transmission in the cortex by Sawtell, Philpot and Bear.

Plasticity is not just the common ability of the brain to recovery, but underlies the way in which the brain makes sense of the world. *Underpins* is probably a better term. Fundamentally there is no light in the brain, it all stops at the retina, sound at the tympanum, touch, wind, rain, all stop at the dermis. Everything from there on is dependent upon the sensory capacity of the brain to associate external physical contact with the myriad of data impinging on the fast and slow circuits of the brain, and of course the ability of the brain to re-create a faithful representation of the outside world will enable the simulation of that world, or, more correctly, what we see as reality, or more correctly again, what we accept as a faithful representation of the consensual domain we call the world.

Plasticity of course then defines how we change the constitution of cells in the brain so as to enable the scripting or sculpting of information for later modification or recall.

It is this second chapter that is most appealing, as it covers many of the dark continental areas of neuroscience, the cells of the *cornus ammoni*, Ammon's Horn, the CA fields of the hippocampus, of the mesial temporal areas that process information. As 75% of what we take in will be en-plasticised here, and via the mossy fibres to the CA3, and to the CA1, subiculum, Schaffer collaterals and so on, under the influence of the biogenic amines, the glutamates and the GABA's, this is a regular Hogwart's School of changing scaffolds and cyclic AMP and messenger RNA.

This is of course fascinating only to neuroscientists such as Jon Kaas, and not to the mainstream psychologist for instance: most need to keep away from the dense descriptions of biogenic feedback systems in their cybernetic manoeuvres.

But for those of us who are fascinated, and by choice would spend their lives just reading

and unravelling what Mishkin and Bechavelier and others have gifted us, this is required reading.

Casagrande and Wiencken-Barger begin with developmental plasticity and focus on the visual system, a popular place in this kind of literature when evaluating the way the brain is moulded or altered across its development. Here, plastic alterations take place before sight is established, subject to modification later on when sight becomes viable, so certainly long before closure of the neural tube.

The above-mentioned chapter follows, focussing as mentioned on hippocampal plasticity, and of course then, long-term potentiation, with the defining forces of metaplasticity and other events leaving us still unable to evaluate and equate these processes entirely with memory, but more with the process of how the essential learning takes place.

Nicolelis and Fanselow follow with a discussion on the dynamics of neuronal ensembles, and the concept of short-term plasticity in the somatosensory system, somewhat aligned but different to the preceding chapter with its emphasis on long-term memory and the hippocampus, heavily dependent of course on the equipment used to evaluate this heavily conjoined area of the brain, the somatosensory cortex. Neural ensemble analysis indicates that the basis if deficits, such as in thalamic pain, lies in alterations in the spatiotemporal encoding of tactile information in the ventral-postero-medial nuclei.

Interested too in whiskers, this time in rats, Sachdev, Jenkinson, Zeigler and Ebner investigate sensorimotor plasticity again, this time in terms of use dependent or experience-dependency, and you can see where they are going, even in the dark. The highlight of this chapter is the informative section on what the vibrissae are used for, and the analysis of these sensors. Another very useful artifice is their Q& A section at the end of the chapter, and for those who do this, support must come from those who like me, struggle with some of the more dense philosophies of approach.

Kaas himself, with Sherre Florence, next tackle reorganisation of sensory and motor systems in adult mammals, this time after injury, looking at the disruption of normal maps of the brain and reorganisation. As with chapter one, there is some attention to subcortical systems, and again, attention to the visual system. Nearly 90 pages long, it's a mammoth work. It too has itemised conclusions, but would have benefited from the nice idea that Sachdev and co had with their ending formula. Again, it is the somatosensory system that provides the most compelling evidence for plasticity, with cortical and subcortical reorganisation, with limits to the latter.

Early blindness is the topic chosen by Rauschecker and Henning, not surprising as both have contributed to the literature in this field, the principal author more than the latter, and focussing on crossmodal compensation, with some attention paid to the deaf here as well. They chose this because it is here that compensatory plasticity can actually be demonstrated, with emphasis on its adaptational value.

Deadwyler looks at the behavioural evidence for hippocampal plasticity, again using ensemble analysis to complement imaging and other methods of research. This is a tight chapter, drawing on a vast body of research, with again predictable names, but an increasingly novel approach is to look at hippocampal actions together with those linkages to other areas of the brain in evaluating LTP and LTD, as well as other glutamate system-driven changes.

Birds again are the focus of the second last chapter from Striedter and Plummer, looking at vocal learning, and again, like the whiskers novelties, there is nice description of little birdies who get their parents songs wrong, and thus produce novel works, a kind of madrigal Darwinism. A close look at neurotransmission and neurophysiology sets this chapter a little apart, and causality is split from correlation to determine what changes are linked, and what are serendipitous.

The last chapter again looks to developmental plasticity, with Angelucci, Sharma and Sur taking research from ferrets to evaluate whether cortical, patterned activity has an effect as instructor to the establishment of cortical networks. This is done by directing visual projections at auditory pathways.

Overall a technical but readable book from mostly American authors, but some European authors, with complex but understandable and user-friendly experimental data, and good instruction on how this illuminates on a practical understanding of various plastic systems in both development and beyond.

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