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Book Review

Neuronal Recognition

Ed. S. H. Barondes

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A colleague convinced me, several years ago, whilst discussing the possible existence of God, that it is necessary to operate from a baseline of one's own working hypothesis, even if (especially when) the subject is largely unknown and unexplored. It seems logical to adopt the same approach to the text of neuronal specificity, the nature of which I judge to be somewhat obscure and nebulous at this time. The testing and modification of one's working hypothesis is vastly aided by examining reviews related to the hypothesis. To this end, I recommend *Neuronal Recognition*.

A broad conceptual overview of the processes which may constitute selective synapse formation has been provided by C. W. Cotman and G. S. Lynch. Their chapter describes reactive synaptogenesis from remaining afferents to a given area of C.N.S., which has been previously subjected to a partial removal of its nerve supply. Reinnervation is first examined in general principles; then, the organization patterns of axonal sprouting is detailed in rat dentate gyrus (the system studied in particular by these authors); finally the possible mechanisms are explored which might account for the initiation of the reactive response, the growth of axons, and the formation of synapses in terms of molecular assembly. That reinnervation occurs in adult C.N.S. could mean that remodelling of brain circuitry extends beyond development into normal adult life. In addition, such phenomena of growth plasticity may mimic normal developmental synaptogenesis.

The choice of the remaining topics selected for review in this volume fall into place if you believe, *à la* Sperry (and as outlined by M. Jacobson in a chapter on neuronal recognition in the retino–tectal system) that neuronal cells are individually specified – probably by membrane markers – very early in development. The recognition process between two prespecified cells (such as a retino–tectal pair) would then constitute the underlying basis for the formation of specific neuronal connections. In this context, R. Merrell, D. I. Gottlieb and L. Glaser discuss their evidence for the presence of a system of surface adhesive determinants on chick retinal and tectal cell surfaces which might serve as membrane recognition markers. The dependence of their observations upon precise methodology, and the assumptions which need to be made in order to arrive at meaningful conclusions from the results obtained, are aptly stressed. A. A. Moscona describes the chick *retina-specific* cell aggregating glycoproteins which he has isolated. If a differentiated series of various of such glycoproteins could be shown to be present on each partner of a retino-tectal pair of cells, the adhesion between such (presumed-to-be) complementary cell ligands might account for the specific cell-cell adhesion (recognition) process. Two such classes of contact site (membrane carbohydrate-binding proteins and oligosaccharide receptors) have been shown, in fact, to exist on different regions of the *same surface* in aggregating slime moulds – as described by S. H. Barondes and S. Rosen in the last chapter of this book. Thus the developmental phenomenon in lower vertebrates, that most dorsal retinal cells link with most ventral tectal cells, and *vice versa*, could possibly be explained by the presence of gradients of similar types of contact site.

Selective adhesion between most dorsal retina and most ventral tectum *in vitro* is described in this volume by S. Roth and R. B. Marchase. These authors propose similar classes of models to that outlined by Barondes and Rosen. However, since their assay tests for selective adhesion between the extracellular matrix overlying the tectum and retinal cells, the specificity of adherence is here called upon to explain a possible specific guidance of retinal axons (towards and) over the tectal surface during development. K. H. Pfenninger and R. P. Rees bear in mind the possible necessity to explain selective pathway guidance in addition to cell recognition when describing their observations on the membrane properties of travelling growth cones and earliest formed synapse. They are therefore surprised to find a paucity of intramembranous particles and other morphological cell specializations in growth cones possibly destined for neural recognition mechanisms. B. P. Toole examines the contributions that the glycosaminoglycans within the intercellular space might make to cell migration, adhesion and phenotypic modulation.

Many of the above authors admit to making assumptions in order to correlate meaningfully their observations with the phenomena and putative mechanisms of selective synaptogenesis. Certain authors report that specificity of synaptogenesis has not yet been found within the systems they are studying. D. M. Fambrough, for example, states emphatically in his excellent review, that in mammals 'there is little or no evidence for correct regrowth of nerves to their muscles'. In the examples of specific regeneration of neuromuscular junctions reported in the lower vertebrates, the possibility that the nerves make functionally silent – but morphologically normal – synapses with incorrect muscles, always exists. I. G. Morgan and G. Gombos, biochemists who ask whether specific synaptic components exist, are forced to conclude that we do not yet know enough to answer such a question. In tissue culture experiments, although synaptic specificity has been demonstrated, R. P. Bunge comments pointedly that there still remain certain puzzling results: cholinergic synapses are established between populations of predominantly adrenergic neurons in culture, for example.

Almost all the reviewers in this volume stress that present studies leave us far from the desirable goal of understanding neuronal recognition: nevertheless, they remain optimistic about future experiments.

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