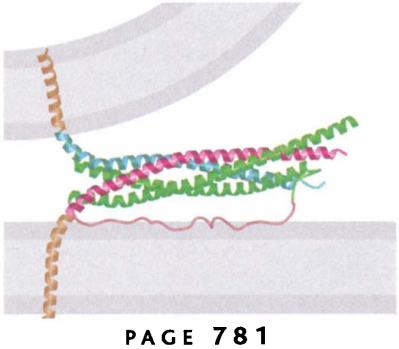
Neuroscience: A Vibrant Connection

Communication is crucial between organisms and within organisms—down to the scale of cellular and subcellular structures. It is particularly important for the nervous system, which is devoted to information processing. In addition to other more general ways of information exchange with their neighbors and their environment, nerve cells have special structures called synapses for communication with each other as well as with target cells such as muscles.

Ever since their first description, synapses have caught the attention and imagination of neuroscientists. Some of the finest minds in the neuroscientific community have devoted much of their energy to furthering our understanding of the basic mechanisms and the fine-tuning of synaptic transmission, information flow, and plasticity, as well as synapse formation and development. In recent years, enormous progress has been made in the unraveling of every level of these phenomena. The picture emerging is that the synapse, far from being a static entity, is one of the most dynamic structures in the nervous system. This is true not only during its development and formation but throughout the lifetime of an organism. This special issue of *Science* presents a synopsis of some of the recent developments in this core area of neuroscience. We have also aimed to show where our understanding is still incomplete and where the emphasis of future research might lie.



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Cohen-Cory (p. 770) reviews the classic and more recent findings in the field of synaptogenesis and their relationship to activity-dependent processes from both a cellular and a systems neuroscience point of view. Sheng and Kim (p. 776) present the most recent results on molecular interactions and activated biochemical pathways on the postsynaptic side. They describe mechanisms that lead to synaptic plasticity and modulated synaptic transmission in response to different patterns of synapse activation. By comparing the exocytotic events in chromaffin cells and in neurons, Rettig and Neher (p. 781) review the presynaptic machinery involved in exocytosis. Their overview shows that much can be gained from the right choice of a useful model system. In their Viewpoint, Dustin and Colman (p. 785) compare the neuronal and the immunological synapse, showing that there is more than semantics to the use of this term and that both neuroscientists and immunologists can gain much from the progress being made in the understanding of phenomena in these complementary fields. And finally, in another Viewpoint, Selkoe (p. 789) presents a case for synapses being the initial targets in Alzheimer's disease, because it appears that subtle alterations in synaptic function are the earliest features of this disease. Understanding the basic mechanisms of Alzheimer's may also be helpful in our efforts to tackle many other neurodegenerative disorders. –PETER STERN

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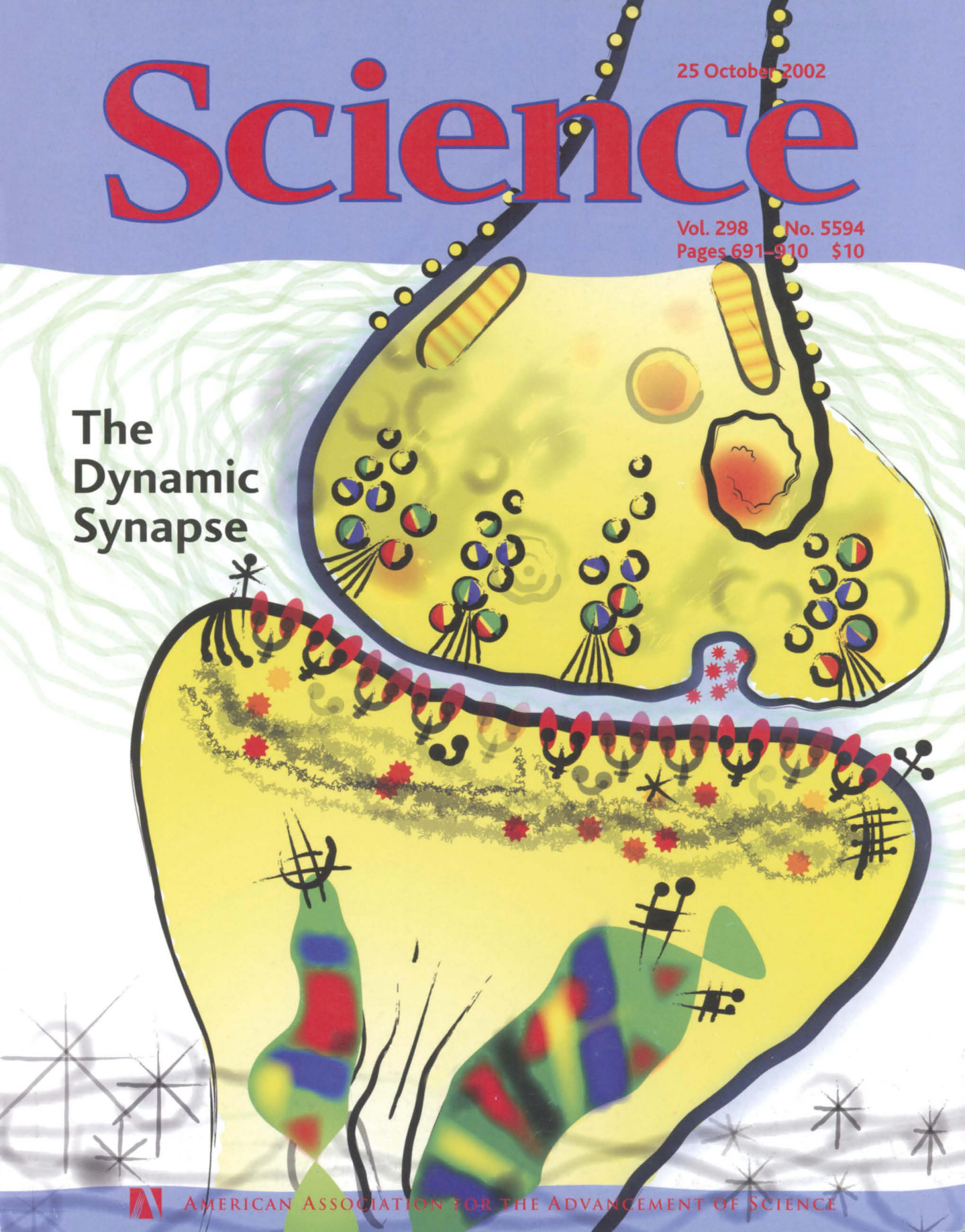
The Dynamic Synapse



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