The AChR is, cell biologically speaking, well behaved. To guide it through the endoplasmic reticulum during synthesis, it has an amino terminal signal sequence of the standard type for an integral membrane protein of eukaryotes. The sodium channel is more of a maverick in that it lacks an amino terminal signal sequence, as do a few other integral membrane proteins including ion pumps[2,3], the red cell chloride channel[4], rhodopsin[5] and the enzyme, 3-hydroxy-3-methyl-glutaryl coenzyme A reductase[6].

Where do we go from here? The first and most important step — one which will not be long in coming — must be to demonstrate that the entity whose sequence Numa's laboratory has deduced can, in fact, function as a sodium channel. This proof of function will come from expression experiments of the sort described by Miledi and Parker[7]: mRNA from the cloned cDNA, obtained either by transcription or hybrid selection, will be injected into frog oocytes, which will make the protein and insert it into their surface membranes. If the protein produced is really a whole sodium channel, it will be detectable by electrophysiological techniques.

Another high-priority experiment will be to obtain cDNA clones of other sodium channels, especially the mammalian one, perhaps through their cross-reactivity with the eel cDNA. One interesting strategy will be to look for mRNAs that code for unusually long strings of glutamates — the eel sodium channel cDNA has nine in a row, starting with residue 942. (This approach may also be a route to other voltage-gated channels and a way to start defining family relationships.) The extension from eel to other species is important both for the comparative information that will result, and because the function of the eel channel is hard to study with modern methods, whereas mammalian channels are better understood and more easily studied.

Some aspects of the structural features of the channel deduced by the Numa group are unattractive. For example, it is known that the coupling between membrane field and channel-gating is achieved through a change in the protein's dipole moment associated with the transition between open and closed forms of the channel. This dipole moment change is unusually large (hundreds of Debyes for the sodium channel as compared with tens for the AChR) and must reflect some unusual structural feature of the protein that places movable charges within the membrane, where they will feel the electric field. Unfortunately, no such feature is discernible in the structure suggested by Noda *et al.* As with the AChR channel, early efforts will be directed towards exploring alternative structures more in accord with physiological constraints.

Finally, we can look forward to structure/function studies of the channel, by means of site-directed mutagenesis of the cDNA. Numa's laboratory has a report in press in *Nature* using this approach for the AChR channel, and several other laboratories are carrying out similar experiments. The methods developed for the AChR will find quick application once clones for the sodium channel become more widely available. These are exciting times indeed for those with any interest in how the channels that control neural function operate. □

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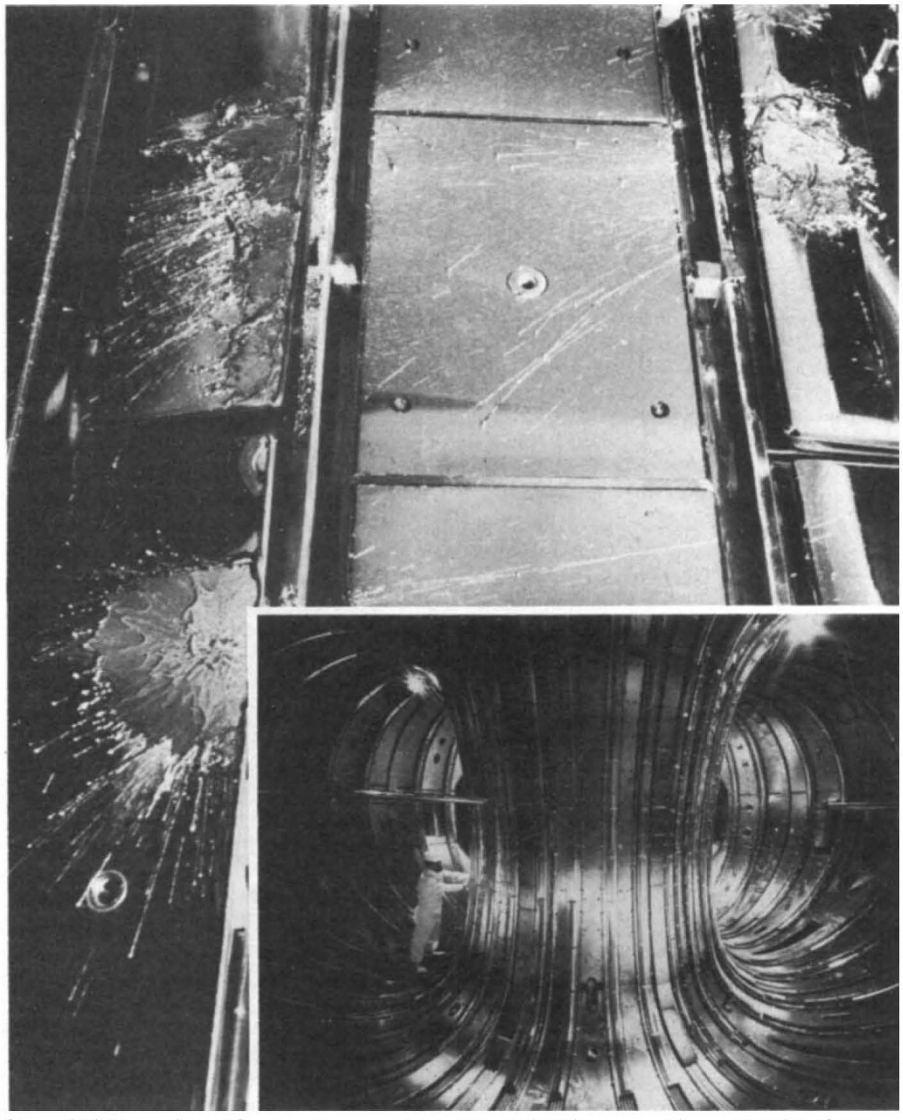
Charles F. Stevens is in the Section of Molecular Neurobiology, Yale University School of Medicine, 333 Cedar Street, New Haven, Connecticut 06510, USA.

Erratum

In Grant H. Thomson's article 'Details of Soviet cosmodrome from space shuttle photographs' (18 October, p.607), the words in italics in the following sentence were omitted: "Buildings and signs of construction activity in an area on the north side of the runway are thought to be *preparations for* the Soviet 'space plane'."



Some 260 times since March, plasma pulses at the Joint European Torus (JET) in Culham have ended disruptively. The spectacular effect, shown above, is instantaneous melting of the Inconelalloy wall of the vacuum chamber by a beam of electrons stripped from the plasma during the disruption. The beam circles the chamber around half-a-million times in near-vertical magnetic fields, picking up energies of a few tens of MeV, and finally hits the inner wall to dump kilojoules of energy in a few milliseconds. The molten and evaporated metal can 'poison' carbon limiters used to limit the outer radius of the plasma ring in later pulses. The damage may contribute to JET's 'impurity problem', when chromium and nickel ions in the plasma radiate energy in interaction with plasma electrons, and limit the degree to which the plasma can be heated for a given rate of energy input. However, JET has shown a better ability to recover from disruptions — returning to normal performance within two pulses — than other tokamaks that have suffered from the same problem and have sometimes required a matter of days to recover.