tral nervous system and strychnine antagonises the hyperpolarising effects of glycine at spinal synapses. One plausible mechanism for the antagonism turns out to be correct; strychnine and glycine compete for the same synaptosomal binding sites. This is shown by dissociation of the tritiated strychnine-synaptic membrane complex by a large excess of cold glycine. The affinity of glycine for the specific receptors is three orders less than that of strychnine which fits in with the neurophysiological evidence for the dominance of strychnine over glycine.

Another piece of evidence supporting this contention is the almost identical regional distribution of endogenous glycine levels in the central nervous system—low in brain, medium in brain stem and highest in spinal cord, with the increasing capacity of synaptosomal fractions obtained from these regions to bind strychnine. It should therefore now be possible to pull out and identify the membrane components responsible for strychnine binding in the central nervous system and to compare these with the high affinity sites responsible for glycine uptake in nerve terminals that seem not to bind to strychnine.

MOOSE

Sodium Requirements

from our Plant Ecology Correspondent

SODIUM is an element which is required in far greater proportions by animals than by plants; in general plants tend to accumulate potassium from their environment rather than sodium. Since herbivorous animals rely on plants to a considerable extent for their ionic requirements, it is possible that in certain circumstances vegetation will fail to meet the sodium requirement of its herbivore predators.

This is precisely the situation which is described by Botkin, Jordan, Dominski, Lowendorf and Hutchinson (*Proc. natn. Acad. Sci. U.S.A.*, **70**, 2745; 1973) on the Isle Royale National Park, Lake Superior, Canada. In this isolated and undisturbed ecosystem, an equilibrium exists between the vegetation, the moose population and their predators the wolves. It is estimated that 1,000–1,200 moose occupy the 550 km^2 of mixed conifer and deciduous forest of the Isle Royale Park, but in spite of this very high population density there is no evidence of sodium deficiency among the animals. This is surprising, since the bulk of the food of the moose consists of the current year's growth of leaves and twigs of woody plants, which are shown by Botkin *et al.* to contain little sodium.

An annual total of 170 kg of sodium in the material suitable for moose consumption in Isle Royale was estimated, assuming a concentration of 10 p.p.m. within the browsed material. This assumption is not unreasonable; for example, determinations for sodium concentration in leaves gave *Abies* 2.8 p.p.m., *Betula* 15.8 p.p.m. and *Populus* 7 p.p.m. Allowing for the fact that only 10–20% of the available browse is removed, the total sodium input from this source into the moose population is 17–34 kg yr^{-1}. But it would seem, from calculations of the sodium content of new tissues minus sodium losses from the urine and faeces of the moose, that the population in Isle Royale has an intake of 243 kg yr^{-1}. The browsing of moose, which represents 90% of the animals' annual food intake, thus supplies only 7–14% of its annual requirement for sodium.

The question arising from these data is where do the moose obtain the balance of this requirement? One possibility is that the animals derive their sodium from the mud licks which they are known to use, but this is unlikely because these licks contain concentrations of only about 24 p.p.m. sodium, a value only twice as great as most of the leaf material.

During a period of about 8 weeks in the summer, moose feed extensively on aquatic plants which were found to contain very high concentrations of sodium; for example, some of the determinations by Botkin *et al.* were *Calla palustris* 1,713 p.p.m. of sodium, *Carex rostrata* 246 p.p.m., *Myriophyllum* 4,750 p.p.m. and *Utricularia* 8,048 p.p.m. These values are between twenty and eighty times greater than those obtained for terrestrial vegetation, and are greater in floating and submerged aquatics than in emergent species.

Calculations from the productivity of these aquatics show that some 2,500 kg sodium—ten times the annual requirement of the herd—is available for moose consumption each year in the park. Although this may account for the overall annual sodium budget, it does assume some mechanism for sodium retention in the moose during the 10 months of the year when sodium is scarce. The authors suggest that potassium may be substituted for sodium in certain circumstances, for example in parotid secretions, which would result in sodium conservation.

MICROEARTHQUAKES

Earth Tide Trigger

from our Geomagnetism Correspondent

ALTHOUGH there have been many attempts to show that tectonic and volcanic activity can be triggered by other much smaller forces, few have been entirely convincing. Moreover, this is a field in which apparently valid claims to have detected correlations are often shot down shortly after by equally, if not more, convincing explanations of the same data. One therefore tends to approach such claims warily, holding back any jubilation until other workers with similar interests have had time to make up their own minds. Having said that, however, there certainly seems to be something in a demonstration by Mauk and Kienle (*Science, N.Y.*, **182**, 387; 1973) that certain microearthquakes in Alaska are triggered by Earth tides.

This is not the first time that Earth tides have been proposed as trigger forces, although again there is a long record of failure to produce convincing evidence. Mauk and Kienle believe that the correlation between microearthquakes in an aftershock sequence and the principal diurnal tidal component, found by Ryall *et al.* (*Bull. seism. Soc. Am.*, **58**, 215; 1968), may be the one success as far as earthquakes are concerned; and Johnston and Mauk (*Nature*, **239**, 266; 1972) have reported a "definite" correlation between the eruption periodicity of Stromboli and the fortnightly tidal component. But apart from these and one or two other possible correlations involving volcanic activity there is very little else—a general failure which Mauk and Kienle think reflects not that Earth tides cannot act as trigger forces, but rather that, if they are to do so, three strict conditions must be satisfied.

The first of these is that the level of tectonic stress in the area must be high enough initially, and that the rate of accumulation of tectonic stress must be "sufficiently smaller than the periodicity of the tides", for the small-amplitude tidal perturbations to have an effect. Second, events must be closely grouped in space for there to be the chance of having a spatially homogeneous mechanism able to respond to the perturbations and thus trigger each event in a similar way. And, finally, events must be shallow enough to lie in regions where brittle fracture of the rock is important.

Each of these conditions is thought to apply to both aftershock zones and volcanic regions, and thus particularly to St Augustine volcano which has been investigated by Mauk and Kienle. St Augustine, which lies at the mouth of Cook Inlet in the Aleutian Islands, is an active composite volcano comprising an alternating series of outward-dipping pyroclastics and andesitic and dacitic lava flows and a central endogenous lava dome. Seismic monitoring since 1970 has indicated considerable microearthquake swarm activity during which the number of events per day may rise two or three orders of magnitude above the background level. That the shocks have extremely shallow foci is shown, first, by the determinations of focal positions; and Mauk and Kienle suggest