6. This alga was collected at Akkeshi in Hokkaido in June and was carefully selected to avoid contamination with any traces from animal sources.
7. All melting points listed are uncorrected.
8. All optical rotations were measured in chloroform at 25°C.
9. The algae were collected at Shirahama in Shizuoka Prefecture.

15 July 1957

Prenatal Protection of Mice by Yeast Antibiotic (Malucidin)

We prepared a complex protein with antibiotic properties from brewer's and baker's yeasts. This material, when injected into animals in doses of 1 to 10 mg/kg of body weight, protected them against infections caused by a number of organisms, including several species of Gram-positive and Gram-negative bacteria, fungi (including *Candida albicans*), and *Shigella* endotoxin (*1*). In many respects this material is different from other antibiotics; it has a very wide spectrum of activity and a long-lasting effect. Mice injected with larger doses of this new agent were refractory to inoculation with *Proteus* OX19 for at least 1 mo. This observation stimulated our interest in investigating the effect on their offspring of treatment of pregnant mice with Malucidin.

The mice received injections of Malucidin in the later stage of pregnancy and 2 to 3 days later gave birth to litters. Injections of Malucidin were given intravenously or intraperitoneally; since there was no difference in the results after injection of Malucidin by either route, the data were combined (Table 1). Young mice were tested for resistance to *Proteus* infection when they reached the age of 2 to 3 weeks, in which stage they continued to be suckling. Results are summarized in Table 1.

Table 1. Protection of mice by prenatal injection of Malucidin. Numerators indicate the number of survivors; denominators indicate the number of mice used.

Group No. and treatment of mother	No. of Proteus organisms injected into suckling mice			
	250 M	750 M	1.5 B	3 B
Experiment with mice 3 wk old (av. body weight, 7 g)				
1. Control—no treatment	3/4	0/7*	0/2	0/2
2. Injected with 5 mg of Malucidin on 2 consecutive days	2/2	9/12*	2/4	0/6
Experiment with mice 2 wk old (av. body weight, 5 g)				
3. Control—no treatment	0/5	0/6		
4. Injected once with 10 mg of Malucidin	3/4	0/6		
5. Injected twice with 10 mg of Malucidin 24 and 48 hr after birth of offspring	0/5	0/6		

* The difference between these two groups was statistically significant: $P < 0.01$.

As can be seen from the table: (i) pregnant females treated with Malucidin produced progeny more resistant to *Proteus* infection than those of normal, untreated mice; and (ii) as group 5 indicates, the resistance was not transmitted with the milk, since the offspring of mice treated with Malucidin after delivery were not more resistant than normal, untreated mice.

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28 June 1957

Volcanic Activity and Alaskan Spruce Growth in A.D. 1783

In the absence of historical accounts, tree-ring chronologies have provided considerable data for reconstructing climate of the past. This report is an attempt to explore further the association between a specific series of climatic phenomena, volcanic eruptions, and anomalies in Alaskan tree-ring patterns for the year A.D. 1783. The effects of major volcanic activity upon world climate were amply dramatized by the significant drop in world temperatures following the eruption of Tomboro in 1815, of Krakatoa in 1883, and of Katmai in 1913 (*1*). It now seems possible that, under certain conditions, previously unrecorded volcanic eruptions can be detected by their effect on the annual ring records of white spruce [*Picea glauca* (Moench.)] in western Alaska.

When J. L. Giddings began his northern Alaskan tree-ring studies, he noted that the final growth cells for the year A.D. 1783 were obscure, particularly in ring records of spruce growing at tree line and at the biological limit of the species. At the time the ring sealed off for that year, a distinctive layer of thin, faintly visible cells was added, rather than the customary dark late cells; this layer has been designated "faint latewood" (*2*). The 1783 faint latewood is common to many, but not to all, northern Alaskan white spruce which have been sampled and which are of sufficient age to contain it. The unique ring occurs sporadically in tree-line spruce of the Copper and Kuskokwim rivers and is common in the Yukon River spruce (*3*).

On the basis of recent inquiries it appears probable that the unique characteristics of the 1783 ring bear a direct relationship to certain widespread natural phenomena that occurred during the summer of 1783 in Europe, Japan, and the United States. In the eastern United States, at least, this was a year without a summer. Benjamin Franklin (*4*) commented upon the climate for this particular year and noted:

"During several of the summer months of the year 1783, when the effects of the sun's rays to heat the earth in these northern regions should have been the greatest, there existed a constant fog over all Europe, and great part of North America. This fog was of a permanent nature; it was dry, and the rays of the sun seemed to have little effect toward dissipating it, as they easily do a moist fog, arising from water. They were indeed rendered so faint in passing through it that, when collected in the focus of a burning-glass, they would scarce kindle brown paper. Of course, their summer effect in heating the earth was exceedingly diminished.

"Hence the surface was early frozen.

"Hence the first snows remained on it unmelted, and received continual additions.

"Hence perhaps the winter of 1783–4 was more severe than any that happened for many years."

Franklin further stated that smoke from a volcanic eruption in Iceland might have been carried by winds to various parts of the world, which would explain the abnormally cold summer. The Skaptar Jokull eruption in Iceland was the one to which he referred, and it was most active on 8 and 18 June of 1783. Symons (*5*) noted that a "dry fog" appeared over all of Europe on 17 June 1783 and that it was world-wide in its distribution.

In a recent study of summer temperature and Scandinavian tree growth, Schove (*6*) remarks that Finland had a bad harvest during 1783, while central Europe had a great deal of heat and excessive south and southeasterly winds. He states further that the narrowness of the tree-rings in northern Europe for that year may have been due to the dust-haze that followed the volcanic eruptions, and he also comments upon the peculiar nature of this ring in Alaska.

In addition to the major volcanic activity in Iceland, there was also the eruption of Asama in Japan, on 4 Aug. 1783, which has been termed "the most frightful eruption on record" (*5, 7*).

Spruce increment borings were taken recently by the writer in western Alaska during the growing season, and these may serve as a gross index of the period of growth in western Alaskan spruce.

Indications are that radial growth begins as early as the middle of June and extends as late as the latter part of August, with most growth in the month from 5 July to 5 August. If the spruce in western Alaska grew at the same time of year in 1783 as they grow at present, they might have been adding cells at the time of the major Iceland eruptions but would have been approaching the latter stages of growth during the great Japanese eruption. To judge from a comparison between the ring size for 1783 and the size of adjacent rings, it seems likely that the faint latewood was added toward the end of the growing season. An abrupt drop in temperature in Alaska, such as would seemingly accompany these eruptions (*1*), could account for the sudden cessation of growth in the middle-late growing season and for the thin latewood layer.

It would appear to be more than mere coincidence that two great volcanic eruptions, low summer temperatures in North America, and the unique faint latewood all occurred in the summer of 1783; these phenomena could hardly have occurred simultaneously without being significantly linked.

One important fact that emerges from the association of the 1783 ring and great volcanic activity for this year is that, if the above assumptions are correct, the precise year-to-year accuracy of the tree-ring chronology for western Alaska, at least as far back as 1783, is verified.

Further inquiry into the relationship between volcanic activity and tree growth was undertaken in the summer of 1954 in the Katmai National Monument area of the Alaska Peninsula under the sponsorship of the Katmai Project of the National Park Service. An analysis of a limited sample of ten increment borings of white spruce indicated that similar ring anomalies were produced during summers of historically documented great volcanic activity in this area.

It seems probable that intensive studies of tree-ring records in spruce of the Alaska Peninsula region—an area in which there are eruptions recorded during the summer growing season—would afford enough control data to make apparent certain earlier but previously unrecorded eruptions in the Aleutian arc.

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2 August 1957

Regeneration of Adult Mammalian Spinal Cord

Recent research by Windle shows that axons can regenerate across gaps in completely transected spinal cords of animals treated with Piromen (*1*). This observation stimulated a modification of the peripheral nerve regeneration technique (*2*) that was evolved in our laboratory to approach the problem of paraplegia. In brief, the method consists of encasing the proximal and distal ends of the severed portion of the feline sciatic nerve or the spinal cord with a nylon tube (*3*) impregnated with cellulose acetate (Millipore) (*4*). A sling stitch is used between the severed ends to maintain them within the tube.

The H.A. formulation of Millipore has 80% of its volume occupied by 0.45-μ pores. This physical characteristic provides the proliferating neural and supporting elements adequate nutrition by diffusion of body fluids, while protecting the regenerating nerve from invasion by mesenchymal cells in the tissue bed. The plastic is extremely inert in tissues and rapidly becomes surrounded by a pseudosynovium. No foreign-body response is found (*5*).

Complete spinal transection at the third thoracic level in a series of adult cats produced gaps of 4 mm as the segments of the cord retracted. Thirty days after transection, the proximal and distal ends of the spinal cord were united by a firm bridge of tissue (Fig. 1, top). Microscopic examination of histological sections of material from cords 30 days after transection showed an orderly, linear regeneration of axons in the gap without overproliferation of glial tissue or of the pia-arachnoid complex (Fig. 1, bottom).

It is tentatively postulated that peripheral and central neural elements are induced to regenerate in an orderly fashion as the result of the scaffolding provided by the Millipore tube. In addition, the sling stitch may orient the fibrin and other proteins into a pattern favorable for linear regeneration. Experience with peripheral nerves shows that the technique requires a single sling stitch, rather than the multiple filaments advocated by Alexander, Matson, and Weiss (*6*).

Return of function has been verified 70 days after the creation of a 2.5-cm gap in peripheral nerves. However, more time is required before an evaluation of functional return in the transected spinal cords can be made (*7*).

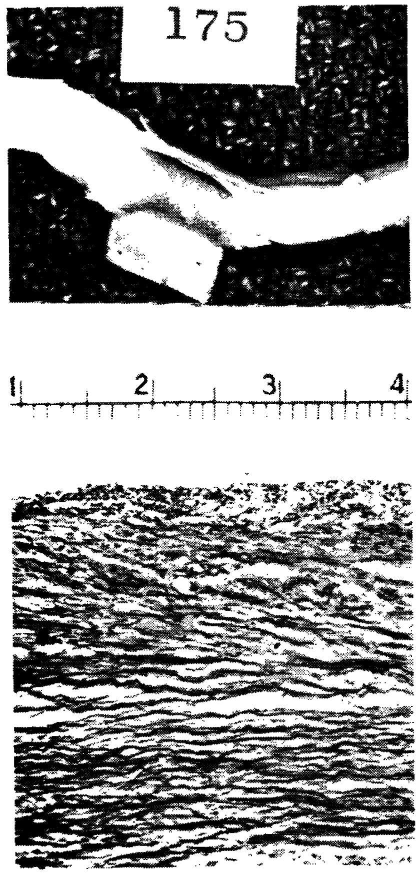

Fig. 1. (Top) Feline spinal cord 30 days after transection, Millipore tube opened (Formalin-fixed); (bottom) axons at the level of transection, 30 days, Bodian (× 200).

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