3 and 4. Poor egg production on days 6 to 11 was traced to difficulties in mitosis and differentiation. Improvement on later days was a reflection of the unsusceptibility of interphase oogonia. Multiple sublethal doses that interfere with successive waves of differentiation are necessary to eliminate egg deposits after the 15th day.

Similar patterns of damage were obtained from other metabolite analogs. These include 6-diazo-5-oxo-L-norleucine, aureomycin, and halogenated deoxyuridines, suggesting that in the adult holometabolous insect the gonad is the target for interference with either protein or nucleic acid synthesis.

Difficulties in embryonic development, reflected as a low hatchability, are an excellent indication of nucleoprotein abnormality. For example, in the methotrexate experiment, hatchability was reduced to about 40 percent, while in the arsenite experiment, hatchability was consistently above 90 percent, not differing significantly from control values. As a destructive measure for insects, death of offspring can be even more important than a temporary numerical decrease in gametes or adults. Von Borstel (*4*) has repeatedly emphasized the importance of induced genetic lethals, particularly those of the dominant type, for promoting population collapse of insect pests.

Although not generally appreciated, genetic lethals have been used successfully in the eradication of the screwworm. This is implied by Knipling when he writes about "sterile" sperm competing with normal sperm (*5*). Accordingly, current attention in the search for potent chemisterilants, which need not be broadcast for pest control, seems properly concentrated upon the antimetabolites, and also upon alkylating agents which may have a related mode of action (*6*).

DANIEL S. GROSCH
Marine Biological Laboratory, Woods Hole, Massachusetts, and
Genetics Department, North Carolina State College, Raleigh

References and Notes

1. A. D. Pickett and N. A. Patterson, *Science* **140**, 493 (1963).
2. N. Mitlin, B. A. Butt, T. J. Shortino, *Physiol. Zool.* **30**, 133 (1957); N. Mitlin and Anne M. Baroody, *J. Econ. Entomol.* **51**, 384 (1958); *Cancer Res.* **18**, 708 (1959).
3. E. D. Goldsmith and I. Frank [*Am. J. Physiol.* **171**, 726 (1952)] were the first to use folic acid antagonists to inhibit development of gametes.
4. R. C. Von Borstel, *Science* **131**, 878 (1960).
5. E. F. Knipling, *Sci. Am.* **203**, No. 4, 54 (1960).
6. A. B. Borkevec, *Science* **137**, 1034 (1962).

24 June 1963

Salt Incorporation in Natural Ices

During a mid-January (1963) cold spell at Socorro, New Mexico, the freshly frozen ice on several small, shallow lakes had a surface appearance similar to that observed by Knight (*1*) on a number of Arctic lakes. Some areas of the ice surface appeared quite white or milky, possibly because of entrained air bubbles, presumably with the *c*-axes of the ice crystals vertically oriented, while the remaining portion appeared to be relatively clear ice of a darker color with the *c*-axes horizontally oriented.

Ice grown in the laboratory against a cold metal freezing block will invariably have the *c*-axis of the crystal oriented perpendicular to the block and parallel to the direction of the thermal gradient. The growing surface of such ice selectively incorporates ions from the melt into its developing structure (*2*).

Under carefully managed conditions, this incorporation of ions maintains, in the nascent layers, a space charge sufficient to develop a potential barrier of over 200 volts across the water-ice interface. Although such electrical manifestations are not likely to be observed in relatively impure terrestrial waters, the advancing *a-b* plane of an ice crystal, under a great variety of conditions, is effective in the transport of ions into the ice (*3*). These considerations led us to suspect that the lake ice with *c*-axes vertical would have a larger salt concentration than the lake ice with *c*-axes horizontal.

Pairs of ice samples were taken from two lakes which appeared to have very pronounced patterns of both types of ice. The samples of ice were rinsed four times with cold distilled water immediately after collection and were allowed to melt gradually at room temperature. The results of a chemical analysis for the major ions in the melted ice (Table 1) show that the ice grown under conditions of a vertically oriented *c*-axis contained more salt (2.5 to 10 times) than the other sample. The ice from Lake I appeared to be uniformly 6 cm thick in the areas sampled. The lake water had originated from a 18.3-m (60-ft) well about 3.3 km (2 miles) from the Rio Grande River. Lake II was formed by waters of the Rio Grande, and the ice was approximately 4 cm thick. Since the pairs of ice samples gathered were from ice of the same thickness, the rate of ice growth may be assumed to be the same.

Table 1. Analyses of ice samples from two lakes (in milliequivalents per liter). In clear ice, the *c*-axis is horizontal; in milky ice, the *c*-axis is vertical.

Ion	Lake I		Lake II	
	Clear	Milky	Clear	Milky
$Ca^{++} + Mg^{++}$	0.04	0.14	0.20	0.38
Na^{+}	.02	.33	.14	.34
K^{+}	.002	.012	.008	.016
HCO_3^{-}	.02	.30	.14	.36
Cl^{-}	.015	.12	.053	.11
SO_4^{--}	.02	.44	.13	.45
Total solids*	.05	.84	.34	.83

* Estimated by conductivity.

The increased salt content in the ice grown with a vertically oriented *c*-axis can only be explained on the basis of high surface energy and unsatisfied bonding, as indicated in the effect of Workman and Reynolds.

The results give further evidence that the freezing of terrestrial waters is an important geochemical process (*4*).

ALAN W. COBB
New Mexico Institute of Mining and Technology, Socorro

References and Notes

1. C. A. Knight, *J. Glaciology* **4**, 319 (1962).
2. E. J. Workman and S. E. Reynolds, *Phys. Rev.* **78**, 254 (1950).
3. Unpublished work, in preparation.
4. E. J. Workman, *Science* **119**, 73 (1954).

27 May 1963

Electronarcosis and Evoked Cortical Responses

Abstract. *Evoked response data and electrocorticograms were recorded in macaque monkeys under the influence of electronarcosis currents sufficient to render the animals unresponsive to peripheral nerve stimulation. The data were obtained from chronically implanted electrodes in the sensory cortex as well as depth electrodes directed to thalamic and reticular loci. At the levels of current used, the amplitude characteristics of the evoked response data were not appreciably modified.*

Electronarcosis can produce sufficient unresponsiveness to stimuli to permit surgical procedures and has been used with success in both animals and man (*1*). However, the influence of electronarcosis on the electroencephalogram and upon evoked cortical responses has not been assessed previously because the currents used to produce anesthesia have a magnitude several hundred times greater than those