The unutilized salts are discharged into sea water below.

The season sequence governing plant growth is as follows: During winter months, as a result of rapid freezing, nutrients and seed diatoms are enclosed in new ice, which is soon covered with snow. During spring, with the decrease of snow cover and onset of radiation, enough light is transmitted to the bottom portion of the ice to allow the photosynthetic diatoms to grow, or a colored layer to develop. With increasing radiation during summer, melted ice forms pools of water on the surface of the ice, while at the base of the ice the colored layer absorbs solar energy selectively, and is then sloughed off into the surrounding sea water.

The extensive growth of diatoms in surface snow layers of sea ice in the Antarctic (*1*) is not found in the Arctic, probably because of the low precipitation and rapid ablation of snow cover in the Arctic (*8*). However, the Arctic ice habitat at Barrow resembles the Antarctic diatom community at the bottom of thicker sea ice near the shelf ice studied by Bunt (*3*) in its fragile water-in-ice microstructure, chlorophyll-*a* content, and diversity of dominant species, although individual species are not the same.

Judging from similarity of the process of formation in the Arctic and the Antarctic, the ice habitat is believed to exist in other ice-covered districts. Because of its light-absorbing efficiency and freedom from grazing, the ice habitat is more suitable for diatoms than the sea water below.

The average chlorophyll-*a* content of sea ice off Barrow reaches about 24 mg/m^2 by a rough calculation based on the average thickness of the layer and its average chlorophyll content. If the same size of plankton layer exists in other Arctic districts, the primary production of the Arctic Ocean is not the smallest of any ocean region, and in considerable part it may occur in sea ice, especially in spring and early summer.

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Sceloporus occidentalis: Preferred Body Temperature of the Western Fence Lizard

Abstract. *Given equal thermal opportunities during four seasonal test periods, western fence lizards active above ground preferred constant body temperature throughout the year. Lizards recovered from subsurface retreats in the fall exhibited a mean body temperature significantly lower than that for sequestered lizards recorded during winter, spring, and summer.*

Mean preferred body temperatures of lizards active on the surface of the ground have been reported for a large number of species (*1, 2*). Nearly all such reports are based on field temperatures collected during one portion of the year. Hence they give no indication of the degree of constancy of the mean throughout the year. In addition, there has been little work on preferred temperatures of buried or sequestered lizards (*2, 3*).

Mayhew obtained field body temperatures for the granite spiny lizard (*Sceloporus orcutti*) during 11 months of the year and reported (*4*) a significantly lower preferred mean in winter (January and February). He suggests that there may be a lowering of the preferred body temperature during winter and that lizards emerging from hibernation in late winter have to acclimate to higher spring temperatures. Stebbins, however, reported no significant shift in the preferred body temperature of surface-active striped plateau lizards (*Sceloporus virgatus*) (*3*); he tested these lizards in the laboratory on runways with photothermal gradients during winter, spring, and summer. The experiments discussed in my paper were designed to ascertain whether the preferred body temperature of the western fence lizard (*Sceloporus occidentalis*) remains constant throughout the year if the animals are given a choice of temperature during four seasonal test periods.

A 34-gauge copper wire noose attached to an 8-foot (2.5-m) flyrod was used for capturing lizards. Cloacal temperatures were taken within 20 seconds after capture with one of two calibrated Schultheis thermometers. The same two thermometers were used throughout the study. Laboratory tests were conducted in runways, 113 cm long and 15 cm wide, provided with a sand substratum 2.5 cm deep. A 100-watt light bulb with reflector was placed at each end of these runways, and all lights were turned on from 10 a.m. to 5 p.m. each day. A gradient of sand surface temperatures ranging from 50°C directly beneath the lights to about 20°C in the center of the enclosures persisted while the lights were on. A light gradient also existed between the center and ends of each runway but was not measured. During the 17 hours of each day when the lights were off, the sand substratum assumed the air temperature of the cold room in which the runways were kept (18°C). Food (*Tenebrio* larvae) and water were available in the center of each runway.

All lizards were obtained within a 50-mile (80-km) radius of Berkeley, California. Animals were transported to the laboratory on the day of capture and were placed in the runways at densities of four to six animals per enclosure. Each group was maintained undisturbed for 3 days. Then cloacal temperatures were taken over a second 3-day period during the latter two-thirds of each photothermal day. This was done by noosing each animal from its position on the surface of the sand substratum. If other lizards in the runway changed their position on the surface during a capture, no further capture of surface-dwelling animals was attempted for at least 1 hour. Before another runway was sampled, the sand substratum was searched for lizards, and a second set of cloacal temperatures were recorded. In this manner, preferred body temperatures were recorded for groups of adult fence lizards of approximately equal sex ratio captured during the four seasons of the year.

Seasonal mean body temperatures of lizards captured above ground in the field exhibit a wide range (30.4° to 35.9°C); the most striking deviation occurs in the winter (Table 1). In winter over half the cloacal temperatures taken in the field fell below 28.0°C, whereas during the other three seasons no cloacal temperatures were below this point. Furthermore, the mean cloacal temperature of lizards captured above ground in winter is significantly lower ($P = .001$) than an average of cloacal temperatures taken in the field during the other three seasons. This datum taken by itself might warrant support for Mayhew's hypothesis that there is a lowering of the preferred body temperature in winter which is then followed by an acclimation to higher temperatures in spring. However, in the light of the normal (35.0°C) preferred mean body temperature recorded for the same lizards tested in runways 3 days after capture, the lower body temperatures obtained in the field must be viewed solely as a product of generally lower available ambient temperatures. Furthermore, there has been no report to date of acclimation of lizards to higher preferred body temperatures as a result of higher ambient temperatures. Indeed, the opposite is true (*5*).

Table 1. Seasonal mean preferred body temperatures of lizards in laboratory thermal gradients and in the field. Dates: Spring sample, 29 April–2 May 1963; summer sample, 3–8 June 1963; fall sample, 21 Aug.–28 Sept. 1963 and 18–20 Oct. 1964; winter sample, 2 Feb. 1963 and 31 Jan. 1964.

Season	Lizards (No.)*	Temperature (°C)	
		Seasonal mean	Range
	Field, surface-active		
Spring	52	34.3	28.2–37.9
Summer	50	35.1	31.2–38.9
Fall	40	35.9	32.6–38.6
Winter	29	30.4	19.0–35.8
	Laboratory, surface-active		
Spring	47	34.9	31.1–38.4
Summer	41	34.1	28.6–38.7
Fall	56	34.6	30.7–38.8
Winter	28	35.0	31.7–37.3
	Laboratory, buried		
Spring	38	33.0	25.8–38.7
Summer	43	33.1	26.4–38.6
Fall	72	30.9	20.3–37.9
Winter	27	33.1	20.2–39.7

* One temperature per lizard.

Thus it appears that, in winter, western fence lizards will emerge if temperatures in the hibernacula rise above the threshold for coordinate neuromuscular activity above ground. However, ambient temperatures in winter rarely permit a lizard to obtain or rise above its mean preferred body temperature for surface activity, and only with the advent of warmer spring temperatures may the preferred body temperature range be readily attained and maintained.

The only significant deviation in preferred mean body temperature under laboratory conditions occurred in lizards buried in the sand substratum in the fall sample. This group exhibited a mean 2.2°C ($P = .001$) lower than the means for animals retrieved from buried positions during the other three seasons. One-third of the animals in this group had temperatures below 30.0°C, whereas only a few in the other groups did. It is possible that some sort of prehibernatory behavior is reflected here in which lizards tend to seek out cooler retreats in the fall than in spring and summer. Stebbins demonstrated a significant decrease in preferred mean body temperature of buried striped plateau lizards under laboratory conditions during the fall months (*3*). In addition, he found that the coolest burial sites in the runways were selected about twice as often in fall as in spring. Selection of lower temperatures in fall animals may possibly be of high adaptive significance. A lizard which seeks out a cool retreat in mid or late fall may not experience ambient temperatures high enough to elicit emergence until favorable spring conditions are present. Mayhew suggests that lizards which emerge at the first sign of warm weather are ones which are unable to find a suitable retreat when a sudden cold period occurs (*4*). Furthermore, a cool retreat in fall when ground surface temperatures are still high might be at a sufficient depth or sufficiently well insulated to remain above freezing temperatures in winter. An animal lacking such behavior may run a far greater risk of being caught in a shallow or poorly insulated retreat and freezing to death.

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Pleistocene Age Determinations from California and Oregon

Abstract. *Mollusks have been collected from Pleistocene marine deposits at Tomales Bay, California, and Cape Blanco, Oregon. Dating by the carbon-14 and thorium-230–uranium-234 methods suggests that the shells are at least 33,000 years old. The more probable age of the Tomales Bay locality is* $\geqq$ *50,000 years.*

The Millerton formation was named by Dickerson (*1*) from a section exposed on the north shore of Millerton Head on the east side of Tomales Bay, California, about 3 miles (5 km) northwest of Point Reyes Station, and about 40 miles north of San Francisco. Dickerson defined this formation as the fossiliferous deposits unconformably underlying the Tomales formation, which he also named. The fauna consists mainly of marine mollusks which have been studied by Weaver (*2*) and Johnson (*3*). A fossil flora has been studied by Mason (*4*).

All the molluscan species found are known to be living in the waters of San Francisco Bay, with the exception of *Tagelus californicus*, which lives south of Monterey Bay. The Millerton formation has been regarded as of Pleistocene age, but it has not been correlated with any particular phase of that epoch. Its outcrops lie