BODY TEMPERATURES IN NESTLING WESTERN GULLS

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Although it has been known for over half a century (Pembrey *et al.*, 1894-95; Pembrey, 1895) that some kinds of young birds have only limited capacity to control body temperature, data on the ontogenetic development of temperature regulation is available for few species of wild birds, either altricial or precocial.

On June 22, 1950, while making a census of the pinnipeds of Santa Barbara Island, California, we took advantage of the opportunity afforded by a large breeding colony of Western Gulls (*Larus occidentalis wymani*) and with the help of Mr. Robert D. Collyer of the California Division of Fish and Game determined the body temperatures of over 60 nestlings of various ages.

The cloacal temperatures of the birds and the air temperatures were measured to the nearest tenth of a degree centigrade with a mercury thermometer. Because we had no means of weighing the birds, as an indication of relative age we used a simple linear measurement: tip of bill to end of pygostyle with bird in a prone extended position. Temperatures were determined in the middle of the day and again two to three hours after sunset. The birds measured ranged from individuals which were just hatching to those which were almost fully feathered.

There is a statistically significant correlation between body temperatures and air temperatures ($r = +0.72$). At all times body temperatures were far above those of the environment and, although air temperature varied through more than 13°C., a fluctuation of only slightly more than 6°C. was observed even in the smallest class of gulls (fig. 1).

The fact that the lowest air temperatures occurred at night, which is also the time of minimal activity for the young gulls, made it difficult to assess under field conditions the relative effects of environmental temperature and the diurnal cycle of activity on body temperatures at night.

During the daytime the correlation between body length and body temperature was not significant ($r = +0.02$). This lack of correlation suggests that even the smallest of the nestlings can regulate adequately in the range of daytime temperatures (19-28°C.) at which we made our measurements. At night the correlation between body length and body temperature was stronger ($r = +0.59$). Our data do not indicate, however, whether the nighttime body temperatures of the large nestlings were higher than those of the small ones because of a greater relative heat production or because of a smaller relative rate of heat loss associated with their lower surface-mass ratio.

The very small nestlings may compensate in part for their relatively large surface area by a behavioral response. At night in virtually every instance we found the smaller birds huddling, two or three close together, in well sheltered sites. That the huddling response conserves heat in birds has been shown by Kleiber and Winchester (1933), who found that baby domestic chicks by huddling together can reduce their metabolic rates as much as 15 per cent.

During the day the nestling gulls can of course supplement metabolic heat by the absorption of radiant energy. Should the heat of the sun become excessive, they may resort to shelter. Nearly all the Western Gull nests on Santa Barbara Island were at least partly shaded by rocks or vegetation. Similarly in the much smaller gull rookery on the extremely barren southwest side of San Nicolas Island, which we had visited in previous years, a high percentage of the eggs and downy young were under small overhanging rock ledges. The sheltered location of young and eggs also affords considerable protection from the wind. The newly hatched young remain in, or very close to, the nest while the larger young are less sedentary and in consequence much more exposed to the elements.

At 3:00 p.m. we found two pipped eggs which, because of our presence in the rookery, had not been incubated for the preceding 45 minutes. We opened the eggs and measured the cloacal temperatures of the young birds. The hatchlings' temperatures

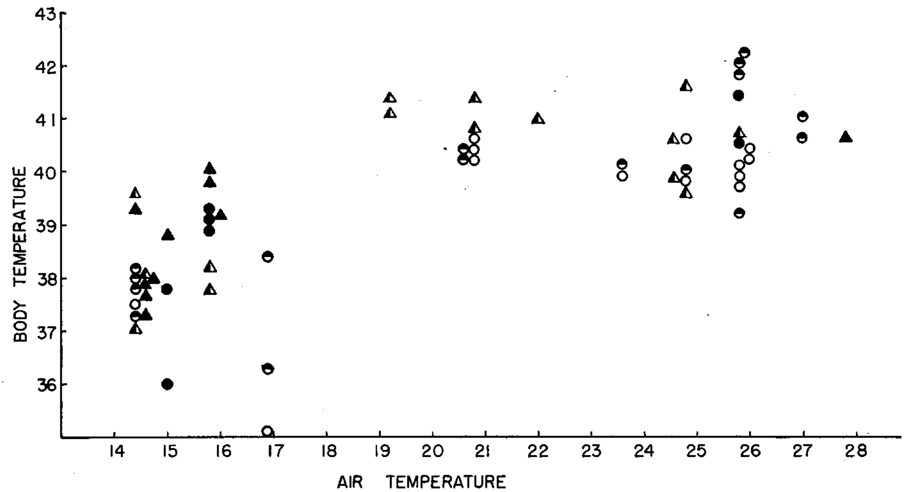

Fig. 1. Cloacal temperatures of nestling Western Gulls plotted against air temperature. All temperatures are in degrees centigrade. Environmental temperatures below 18°C. occurred only at night. The length of the body in inches from the tip of the bill to the end of the pygostyle is indicated by the following symbols: clear circles, 5 to 6⅞; half-black circles, 7 to 8⅞; black circles, 9 to 10⅞; half-black triangles, 11 to 12⅞; black triangles, 13 to 14⅞.

were 32.3 and 33.8°C. and the air temperature was 27°C. The importance of radiant energy in furnishing heat was in this instance reduced by a low overcast and the shelter supplied by tussocks of grass. These temperature measurements suggest that in the Western Gull as in the domestic chicken (Romanoff, 1941) some ability to regulate body temperature is present before hatching.

DISCUSSION AND CONCLUSIONS

Kendeigh (1939) has shown that the newly hatched House Wren (*Troglodytes aëdon*), an altricial bird, is practically poikilothermal. In the Western Gull, a precocial species, our data indicate that some capacity to regulate temperature is present before hatching. Shortly after hatching this capacity is sufficiently well developed that, in air temperatures between 19 and 28°C., there is little difference in body temperature between newly hatched and fully feathered individuals. Between 14 and 18°C., however, the smaller birds despite their huddling have more labile body temperatures than do the larger birds.

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