tive and negative free-energy contributions for a perfect agglomerate. Agglomerates of this 'critical' size should neither grow nor shrink, and it is therefore plausible that such agglomerates should be found to predominate over those both bigger and smaller, which should be changing in size. However, as Gregory points out, this is a maximum of free energy and does not correspond to a stable equilibrium configuration, unless there is some as yet undiscovered perturbation that endows stability, as in the argon-clustering experiments of Hoare *et al.*².

Gregory states that "the common-sense view [is] that strong inter-particle attraction leads to large aggregates". Such a view is misguided. It is known that weak inter-particle forces lead to large, well structured aggregates. Many experiments have shown that uniform polystyrene spheres, when weakly flocculated, grow into close-packed domains of a few millimetres in diameter displaying opalescence, whereas strong flocculation causes the polystyrene to form small disordered aggregates which do not show opalescence.

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Stereo suggestion

SIR—Tucker¹ and Wilson² suggest how publishers might alleviate one drawback to 'direct viewing' of stereo-pairs. But, even with years of practice (I acquired the technique unwittingly as a child by staring at repetitive wallpaper patterns), it requires an effort to achieve and maintain the stereoscopic view, and the depth of perception is never so clear as when a stereoscope is used.

Stereoscopes, however, are not easily obtained or cheap, and are too bulky to carry everywhere. I have recently found that a good substitute for a conventional stereoscope is to view the stereo-pair through two flat plastic Fresnel lenses, of the type which are now sold widely as magnifiers for reading. These lenses are not expensive, and two together have the shape and size of a credit card. The optical quality is surprisingly high, and the stereoscopic images are at least as good as those produced by the common folding stereoscope with moulded plastic bi-convex lenses.

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Size of aquatic endotherms

SIR—Downhower and Blumer¹ derive a lower size limit of 'aquatic endotherms' of 6.8 kg. This conclusion fails to account for the survival of smaller endotherms, such as adult little blue penguins (*Eudyptula minor* ~1.0 kg)² and newborn sea otters (*Enhydra lutris*, 2.0 kg)³, which spend considerable time in water.

In calculating the lower limit of body size in aquatic endotherms, Downhower and Blumer implicitly assume that the rate of heat loss by an endotherm is controlled by rate of convective heat loss from its surface. Furthermore, their model assumes that when an endothermic homeotherm enters water, the temperature difference between its surface and the environment remains the same as in air.

These assumptions are not valid for aquatic endotherms, most of which are surrounded by a layer of insulating blubber, fur or feathers that can reduce conductive heat loss so that surface temperature can be maintained close to the environmental temperature. Clearly, the rate of heat loss from the surface by convection in water is controlled by the rate of conduction from the animal's core, through its insulating layer, to the surface. Consistently, the rate of heat loss by aquatic endotherms in water is only 1.6–4.5 times greater than in air^{3–5}, not 90.8 times, as suggested by Downhower and Blumer.

When realistic values of heat production (metabolic rate), thermal conductance and temperature differences between the core and the aquatic environment are used in appropriate calculations, predicted minimum sizes of aquatic endotherms are much less than the 6.8 kg suggested by Downhower and Blumer, as the empirical evidence requires. Of course, factors other than thermoregulation may limit the sizes of endotherms encountered in nature.

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DOWNHOWER AND BLUMER REPLY—In calculating the lower limit of body size in aquatic endotherms¹, we adopted the view that the same considerations for the lower limit of body size in terrestrial endotherms⁶ would hold for aquatic ones. Aquatic endotherms should be larger than terrestrial endotherms because rates of heat loss are greater in water than in air. We estimated the magnitude of that difference by comparing the convective heat transfer coefficient in air with that in water, holding size, temperature differentials and fluid velocity constant⁷. We coupled that difference with Pearson's estimate for the lower limit on body size in terrestrial

endotherms⁶, and an allometric equation relating conductive heat loss to body size (in terrestrial endotherms) to estimate the minimum size of a terrestrial endotherm that would remain a competent endotherm in water. Because cetaceans satisfy our requirement of being obligately restricted to water, we compared calculated lower limit of body size for aquatic endotherms with known weights of the smallest cetacean neonates.

Innes and Lavigne suggest there are smaller aquatic endotherms than those we considered, by equating the term 'aquatic endotherm' with any endotherm that spends time in water, rather than restricting it, to competent endotherms obligately restricted to a life in water. Thus, we do not include water shrews (8–18 g)⁵, little blue penguins³ (1–2 kg), harbour seals⁴ (22–34 kg, larger than our lower limit), or sea otters³ (neonates, 2 kg).

Water shrews remain immersed for less than 60 s, dry their wetted fur by grooming, and drop their body temperature by 1–2 °C per 30 s during immersion⁵. In measuring conductive heat loss in little blue penguins, Stahel and Nicol³ say such measures may not adequately reflect the difficulties of thermoregulation in water: "given the same surface temperature in air and water penguins must withstand a rate of convective heat transfer that is two or three orders of magnitude greater in water than in air (Mitchell, 1974)". Although penguins and seals breed on land, sea otters do give birth in water, and spend much of their lives in water. But their young rest (out of water) on their mother², and are weaned at weights greater than 8 kg (J. Estes, personal communication). Their weight at weaning exceeds our predicted lower limit for body size.

Finally, Innes and Lavigne suggest that "realistic values . . . in appropriate calculations" would predict a lower minimum size for aquatic endotherms than we have calculated. But this requires that we ignore the increasingly important roles played by behaviour⁴, elevated metabolic rates³, limited times of immersion^{2,5}, degree of immersion² and hypothermia⁵ that are correlated with the severe thermoregulatory complications of invasion of aquatic habitats by endotherms smaller than our calculated lower limit.

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