Calories/gm. in Species of Animals

ANIMALS of seventeen species, representing six phyla, were burned in a miniature bomb calorimeter[1]. The data are presented as calories/ash-free gm. in Table 1 and as a histogram, Fig. 1.

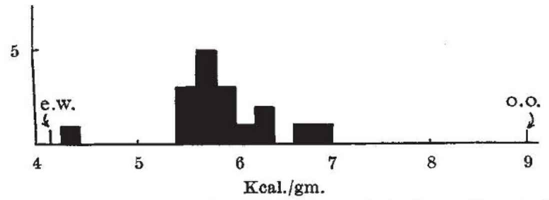

Fig. 1. Frequency distribution of the data in Table 1. The caloric values of egg white (e.w.) and olive oil (o.o.) have also been indicated.

Given a haphazard collection of species, any one of three mutually exclusive frequency distribution patterns might have been expected. These are listed below with the rationale of each :

(1) A normal, symmetrical distribution. This might be anticipated from the known biochemical similarities between animals. The variance would be related to slight biochemical differences and to errors of measurement.

(2) A skewed distribution with the modal frequency at or near the lower range limit. This might be anticipated, since there has always been selection for maximum number of reproducing progeny, but only sporadic selection for high-energy content/gm.

(3) Fairly great differences between major taxonomic groups with essentially normal distributions within each group. Many other properties of animals are common to a taxonomic category and differ between categories. Cal./gm. might be one such property.

The biological implications of the three possible distributions differ. The first distribution would imply that there is an optimal value of cal./gm., any deviation in either direction being selected against.

The second distribution would imply that there is some unique combination of components, characterized by a particular range of cal./gm., which just permits animals to maintain themselves. These components are essentially the same for all animals, and any combination with a lower cal./gm. value is non-viable. Higher values would be expected in animals that have temporarily accumulated fat, either because of unusually high food availability or as preparation for some period of fasting or stress.

Table 1. CAL./ASH-FREE GM. OF SEVENTEEN SPECIES OF ANIMAL

Common name	Species	Mean cal./ ash-free gm.	± 95 per cent confidence limit of the mean (corrected for small sample size)
Ciliate	*Tetrahymena pyriformis*	5,938	± 207
Hydra	*Hydra littoralis*	6,034	± 146
Green hydra	*Chlorohydra viridissima*	5,729	± 247
Flatworm	*Dugesia tigrina*	6,286	± 338
Terrestrial flatworm	*Bipalium kewense*	5,684	± 124
Acquatic snail	*Succinea ovalis* (without shell)	5,415	± 6
Brachiopod	*Glottidia pyramidata*	4,397	± 2,140
Brine shrimp	*Artemia* sp. (nauplii)	6,737	± 863
Cladocera	*Leptodora kindtii*	5,605	± 584
Copepod	*Trigriopus californicus*	5,515	± 277
Copepod	*Calanus helgolandicus*	5,400	± 197
Caddis fly	*Pycnopsyche lepido*	5,687	± 530
Caddis fly	*Pycnopsyche guttifer*	5,706	one determination
Spit bug	*Philenus leucophthalmus*	6,962	± 510
Mite	*Tyroglyphus lintneri*	5,808	± 446
Beetle	*Tenebrio molitor*	6,314	± 516
Guppie	*Lebistes reticulatus*	5,823	one determination

The third distribution would imply that cal./gm. is a secondary property in the evolution of animals and that the cal./gm. in any animal is a by-product of other selective requirements. This would be expected if, and only if, energy has generally not been limiting during the course of evolution.

So far as we have gone, the results suggest the second alternative distribution listed. Twelve of the seventeen determinations give results of 5,400–6,100 cal./gm. The one low value is from a moribund brachiopod (*Glottidia*). Two of the four high values were from animals that were about to go through a fast, the *Artemia* nauplii, since they were unable as yet to feed, and the *Tenebrio* larva, since it was about to pupate. The other two were from very well-fed situations, the *Dugesia* being from a laboratory stock culture fed on *Artemia* nauplii and the *Philenus* being taken from the field in late summer. The *Philenus* specimens included egg-laden females, but, unfortunately, they were not sexed on collecting. It seems likely that many herbivorous insects normally have superabundant food available[2].

Cal./gm. may provide an index of nutritional condition of animals in the field which would be considerably cheaper and as reliable as the elaborate sampling programmes now required.

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Manganese and Magnesium in the Grey Speck Syndrome of Oats

IT is generally recognized that the grey speck syndrome in oats is caused basically by manganese deficiency[1]. Opinions differ, however, on whether grey speck symptoms are due directly to manganese deficiency[1–3], or whether manganese deficiency functions indirectly by rendering the roots of the plant more susceptible to infection by rhizosphere organisms the toxic products of which give rise to the visual symptoms[4].

In consequence, the possibility of selecting breeding material resistant to grey speck is complicated, despite the variation in resistance reported by several investigators[5–7]. The present work is concerned with the investigation of possible differences in the critical levels of manganese in tissues of varieties of oats susceptible and resistant respectively to grey speck. For this purpose, the hexaploid oat variety Star (susceptible) and the diploid variety *S*.171 (resistant)[8] were used and grown in sand culture with a modified Shive solution and six levels of manganese, 0·0, 0·1, 0·2, 0·5, 2·0 and 5·0 p.p.m. Washed sand, de-ionized water and 'Analar' chemicals were used, but no elaborate precautions were taken to eliminate all manganese from the zero treatments.