COMPOSITION OF A KIWI EGG

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A fresh egg of the North Island Kiwi *Apteryx australis mantelli* that had not lost any water through evaporation weighed 434.6g. The dry shell weighed 22.9 g. or 5.3% of the total weight. The contents were separated, dried at 50-60°C. in a hot air electric steriliser until no further weight loss occurred, and the following data obtained (Table 1). These data, when compared with similar data from eggs of other species, further enhance the achievement of the Kiwi if this particular egg is accepted as typical. Its egg is not only proportionately larger than the eggs of most other birds; it also contains proportionately more yolk and less water than other eggs (Table 2).

Differences in the relative and in the total amounts of organic substances in eggs of various species are determined mainly by the proportion of yolk to albumen in the eggs; and by the water content of these components. On a dry weight basis the chemical composition of the components of most eggs is fairly similar — yolk contains about 31% protein, 65% fat and 2% carbohydrate; while albumen is about 86% protein and 8% carbohydrate (Romanoff and Romanoff, 1949). If it is assumed that the Kiwi egg is no exception and conforms by having a similar water-free composition, then it has the highest gross energy value per unit fresh weight of any egg for which dry weight determinations have been made (Table 3).

The gross energy values were obtained by multiplying the protein and carbohydrates by 4.1 and the fat by 9.2 (see footnote). Calculations suggest that eggs laid by most altricial species (that hatch naked, blind, helpless young) have an energy value of between 1.0 - 1.2 cal/g. while eggs of most precocial special (that hatch alert, mobile, down-covered chicks) contain between 1.7 - 1.9 cal/g. The one kiwi egg that was dried had an energy value estimated at approximately 2.7 cal/g.

The 29 kg (64 lb) female Emperor Penguin and the 2.5 kg (5.5 lb) Kiwi lay eggs of comparable size but the Kiwi egg contains proportionately more yolk (Table 4) and has an estimated energy value of about 1100 calories. The energy in the Emperor egg is calculated (from dry weight data for Adelie penguin eggs, Reid 1965) at about 600 calories. Certain differences in the development and growth of these two species are thought to be influenced by the different yolk (and energy) levels in their respective eggs:—

(a) Incubation time for the Kiwi is approximately 15 days longer; 76 compared with 61 days. (Some Emperor eggs take 66 days to hatch but the shortest period is considered the real incubation time and any extension is thought to result from periods of chilling, etc. In this respect the interval between minimum and

Footnote: When burned in oxygen in a Bomb Calorimeter carbohydrates produce 4.1 cal/g and fats produce 9.3 cal/g. Proteins yield 5.6 cal/g to the bomb but only 4.1 cal/g if burned only to the extent that relatively harmless substances (urea and uric acid) found in animals are produced.

Table 1. Fresh and Dry Weights of the Contents of a 434.6g Kiwi Egg.

	Yolk	Albumen	Total
Fresh Weight (g)	251.4	160.3	411.7
Dry Weight (g)	142.5	19.4	161.9
Water (g)	108.9	140.9	249.8
Percent Water	43.3	87.9	60.7

Table 2. Yolk, Albumen and Water Content of Eggs.

Species	% Composition Yolk	% Composition Albumen	Water Content (%) Yolk	Water Content (%) Albumen	% Composition Water	% Composition Solids
Kiwi (1 Egg)	61.1	38.9	43.3	87.9	60.7	39.3
12* max.	44.6	63.6	51.8	87.9	73.6	26.4
Precocial min.	36.4	55.4	43.3	86.5	69.7	30.3
Species mean	40.0	60.0	48.2	86.8	71.4	28.6
19* max.	28.1	86.8	58.0	90.2	83.3	22.6
Altricial min.	13.2	71.9	55.7	89.0	77.4	16.7
Species mean	21.3	78.7	57.1	89.5	80.9	19.1

* Mainly from Romanoff and Romanoff, 1949.

Table 3. Inferred Approximate Organic Composition and Calculated Energy in Kiwi and in 'Average' Precocial and Altricial Eggs.

Species	Percent Solids Total	Yolk	Albumen	Approx. Composition Prot.	Fat	Carb.	Calc. Energy Cal/g.
Kiwi	39.3	34.6	4.7	14.7	22.5	1.1	2.7
Precocial	28.6	20.7	7.9	13.2	13.6	1.0	1.8
Altricial	19.1	10.0	9.1	10.9	6.6	0.9	1.1

Table 4. Comparison of the Contents (in grams) in an 'Average' Kiwi and Emperor Penguin Egg.

	Total	Shell	Albumen	Yolk	Contents
Kiwi	435	27	159	249	408
Emperor*	470	74	276	120	396

* Prevost, 1961.

maximum incubation time generally seems to be greater in those species breeding in cold or wet environments. The wide range in incubation time for the Emperor probably reflects the adaptive capacity of the embryo to survive sub-optimum conditions which would prove lethal to some species but merely retards the rate of development in others).

(b) The Emperor chick emerges covered with down but the Kiwi embryo grows feathers and these are retained throughout its first year.

(c) To survive, Emperor chicks must be fed within two or three days of hatching but Kiwi chicks remain in their burrow and do not feed until about six days old. It is thought that some may fast during the first 10 or 12 days after hatching (Robson 1958) without apparent ill effect. A Kiwi chick killed outside its burrow (and, therefore, thought to be at least six days old) weighed 281g. and this weight included 54g. of enclosed yolk.

LITERATURE

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SHORT NOTE

A WRYBILL IN CENTRAL OTAGO

In October, 1965, while assisting members of the Wildlife Service in their census of birds of the upper Waitaki River catchment, it came as a surprise to me to find a few Wrybill *Anarhynchus frontalis* as far south as the Ahuriri riverbed near Omarama. I noted that their breeding habitat requires extensive areas of uncluttered shingle, and so it occurred to me at the time that perhaps a few stragglers could also be found on the larger shingly riverbeds of Central Otago. For the past four years I have been conducting a census of those areas in late spring, without however recording any Wrybills. Perhaps the most likely riverbed (being closest in direct line to the Ahuriri) was the Hunter, above Lake Hawea, but about eight miles of the broadest shingle stretches were flooded by the raising of the lake level in 1959 by some 60 feet for hydro-electric storage. My survey of this riverbed above the new lake level, conducted on 11 and 12/9/69, revealed no Wrybills. Perhaps I was too early.

On 2/9/69, while searching for a Spur-winged Plover's nest near the mouth of the Matukituki River, west Lake Wanaka, I spotted a single Wrybill about ¾ mile above the mouth. It was busily feeding among brownish algal-covered stones beside the river, and among a scattered flock of 23 Black-billed Gulls and 4 Banded Dotterels. The Wrybill was in breeding plumage and was occasionally harassed by one of the gulls so that it tended to keep very much to itself. Not wishing to disturb it I did not approach closer than about 20 yards so did not establish its sex, although from the sharp delineation and blackness of the pectoral band I should say it was a male.

— PETER CHILD