Relative Dimensions of the Red Blood Cells of Vertebrates, especially of Birds.

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DURING the course of an examination of smears of blood from Australian birds for parasites, we noticed with much interest that the red cells of one of the *Ardeiformes*, *Notophoyx novæ-hollandiæ*, were distinctly larger than those of other birds we had hitherto examined belonging to the *Passeriformes*. As the first-named is a presumably older group phylogenetically, it occurred to us that it might be of value to systematically measure the red cells of the various vertebrates that we had an opportunity of examining. This work was already in progress when we noticed a statement in *The Sleeping Sickness Bulletin* (vol. ii., No. 19, 1910, p. 245) * as to the sizes of the red cells in blood ingested by tse-tse flies (*Glossina palpalis*), and the inference therefrom as to the source of the blood. The following standards were taken :—

"Standard amphibian (crocodile) [*sic*], 15.4 microns.
Standard avian (Hornbill), 13.1 microns."

The average measurements of the red cells in 20 flies are given. Of these 2 were over 15, 11 between 14 and 15, 6 between 13 and 14, and 1 was 10.6 mic. Those under 14 were attributed to birds. This agrees perfectly with our findings, as it is only occasionally in odd cells that we have found a reading under 14 mic. in the blood cells of reptiles. We have, however, especially in water-birds, such as Grebes, Herons, and *Charadriiformes*, found red cells reaching to 15 mic., and as these birds would, we presume, frequent the lake-shore, where the flies were caught, it is possible that the number of cases in which birds' blood was present was under-estimated—in fact, it is not beyond the bounds of possibility that they all owned this origin. This is perhaps accentuated by the fact that the average reptilian corpuscle, in our hands, is usually well above 15 mic.

It must be clearly understood that our measurements were taken from dried blood-films stained by Giemsa's solution, and not from films treated by the better-fixed wet methods. Several cells were measured in each case, but time would not permit of a long series of measurements, with more accurate average results. In the case of well-prepared slides of mammals and birds this is of little consequence, as all the cells are practically of an identical size. In the cases of reptiles and batrachians considerable variations, however, occur. The object of this paper is to indicate what we believe are useful additional means for showing the relationships of groups of vertebrates to each other. Our actual figures, however, must not be accepted as fully accurate until confirmed by many more observations.

* Bruce, Hammerton, and Mackie, "Proceedings Roy. Soc.," 1910, B. 558, pp. 490, 497.

Before discussing their significance it may be well, first of all, to briefly indicate the results of our examinations. It may be stated here that all the measurements are in micromillimetres. The largest red cells we have met with are those of *Ceratodus forsteri* (39 x 23 to 25). These, in size, link in on the one hand to the Elasmobranch fishes, amongst which *Chiloscyllium* has red cells of 23 x 13.5, whilst in *Dasybates kuhli* and the hammerhead shark (*Sphyrna tudes*) the red cells only reach 18 x 12.5 to 14.5. The Teleostean fishes have red cells very much smaller, varying from 6 to 7 (almost round) to 9 x 7 and 10 or 12.5 x 9. On the other hand, *Ceratodus* links on with the Batrachians, where the size is generally from 18 to 19.5 x 12.5 to 14, and with the reptiles, amongst which Chelonians have cells of 17 to 21 x 12.5 to 14.5, snakes 17 to 20.5 x 9.5 to 12.5, and lizards usually 15 to 17.5 x 7 to 11. Amongst birds, we find the largest red cells in the *Ardeiformes* (13 to 16 x 8 to 9); then come the *Charadriiformes*, usually 13 to 14.5, occasionally 15, x 7 to 8; the *Galliformes*, up to 14 x 7 to 8, &c.; whilst the smallest are the *Passerines* (9 to 12.5 x 6 to 7).

FISHES.

Amongst the fishes, the *Dipnoi*, or lung-fishes, have cells of monstrous size, being, next to those of some amphibians, we believe, the largest known. In *Ceratodus* they measure 39 x 23 to 25, whilst in *Proteus* they are given * as 58 x 35, and in *Amphiuma* as 77 x 46. Of the three Elasmobranchs examined, we find an interesting and important difference. *Chiloscyllium* has cells 23 x 13.5, whilst *Sphyrna tudes* and *Dasybates kuhlii* have cells of only 18 x 12.5 to 14. The cells of Teleostean fishes are much smaller and usually rounder, sometimes almost spherical. There seems to be a good deal of variation, from 6 to 7 (about the usual size of mammalian red cells) to 12 or 13. Future research may show whether any groupings, indicating degrees of remoteness from Elasmobranchs, may be found in the various orders or families.

These results are of great interest. They show that under the one general term "fishes" are grouped vertebrates with red corpuscles varying as greatly as do those of amphibians or reptiles from those of birds.

Another interesting point is that in one of the oldest vertebrate groups known, the Elasmobranch fishes, the red cells are of large size, and that we have found that amongst these again in one (*Chiloscyllium*) they are much larger than in the other two examined, and this genus seems hence intermediate between these two and *Ceratodus*. *Ceratodus*, from its red cells, links on to certain of the Amphibians. These results suggest, perhaps, two separate lines of evolution from the smaller-celled Elasmobranchs—one with *Chiloscyllium* and then *Ceratodus* as offshoots from a stem with red cells of increasing size, which eventually

* Schäfer, "Essentials of Histology" (6th ed.), p. 37.

gave rise to the Batrachians and reptiles, and these latter to the Aves ; the other with cells of decreasing size, giving rise to the Teleostean fishes. In both cases we see that, with higher specialization, the red cells decrease in size. The interesting question arises—Is this decrease in size merely a coincidence attendant on favourable variation, or was it a necessity for such evolution ? Did the ancient vertebrates of enormous size and reptilian character possess extremely large red cells ? Did the extinction of these forms in part depend on their inability to form smaller red cells which could, with greater ease, supply oxygen uniformly to all the tissues ? And why, in the oldest forms of vertebrates that we have examined, do we find such large cells ? It would be of great interest, in this connection, to examine the lampreys as examples of another old group, and see whether there is evidence that the original red cells were much smaller. Again, what are the mechanical and physiological advantages or disadvantages of increase of size in the red cells ? Large cells require large capillaries, and these would, we presume, be fewer in number, and hence oxygenation in distant cells would be less complete than in those nearer the capillaries. Would increased efficiency follow, therefore, decrease in size ?

BATRACHIANS.

The red cells of Batrachians vary a good deal amongst themselves, the average size being about 18 to 20, the extremes we have met with being 14 and 23.5. No generic significance seems attachable to the sizes.

REPTILES.

Amongst the reptiles we again find considerable variation. Snakes usually average about 17 to 20, with extremes of 15 and 21.5 ; lizards average apparently a little lower, from about 16 to 18, with extremes of 11.5 and 20.5 ; whilst Chelonians average about 18 to 20. The figures are very variable, but perhaps the red cells of snakes and Chelonians are a little larger than those of lizards.

BIRDS.

Most of our bird slides have naturally been made from Passerines. In many of the other orders the number of specimens examined is few, and this fact must be borne in mind when weighing the conclusions we form. Amongst the largest cells we have met with have been those of three members of the *Ardeiformes* (included in the *Ciconiiformes* by Evans.)* These cells varied from 13 to 16 x 8 to 9. A single specimen of *Sphenisciformes* gave 14.5 x 9 to 10 ; one of the *Podicipediformes*, 13.5 to 14.5 x 7 to 9 ; one *Pelicaniformes*, 14 x 7 to 8 ; five *Charadriiformes* varied from 11.5 to 15, being usually 13 to 14.5 ; one *Lariformes* gave 12.5, probably a low figure. A Megapode, belonging to the *Galliformes*, ran from 11 to 14, averaging nearer the latter figure. Amongst the *Coraciiformes*, *Dacelo* and *Halcyon* ranged from 12

* Evans, "Cambridge Natural History—Birds."

to 14.5, usually being about 14, whilst *Merops* averaged decidedly less, being 11 to 12.5, and thus approximating to the *Coccyges*, which varied from 11.5 to 13. Nine species of the *Psittaciformes* varied more amongst themselves, the average being about 12.5, but measurements of 11 to 13.5 were not uncommon, and occasionally 14.5 was noted. The cells of *Cacatua leadbeateri*, given as 16 to 17, were almost certainly artificially enlarged. Seven species of *Columbiformes* gave on the whole very uniform results, being in most cases 12.5 ; occasional ranges to 14.5 were noted, and in two specimens of *Ocyphaps lophotes* the readings were 14 to 15, but we must consider this as due to some artefact increasing the size. Amongst the *Passeriformes* we find some remarkably constant results and some interesting grouping. The *Campophagidæ* and *Corvidæ* were the largest, usually being 12.5 to 13, but varying from 11 to 14. The families *Timeliidæ*, *Artamidæ*, *Prionopidæ*, *Laniidæ*, *Sittidæ*, *Certhiidæ*, and *Ploceidæ*, rarely varied outside 11 to 12.5. *Sylviidæ*, *Oriolidæ*, *Dicruridæ*, and *Ptilonorhynchidæ* seemed to exhibit a slightly smaller size, 10.5 being a frequent minimum. One *Hirundinidæ* gave 11, and it may perhaps be associated with the *Muscicapidæ*, which varied from 9 to 11.5, and occasionally 12·5. Nine species of the *Meliphagidæ* gave on the whole very uniform results, usually being from 10.5 to 11.5, occasionally more.

As birds own a reptilian ancestry, in the most archaic forms we would expect to find the largest red cells. This seems to be the case. In the sequence of orders given by Evans, we find the first one we have to deal with is that of the *Colymbiformes*, in which he places *Podiceps*. Evans says this order is very archaic and holds a somewhat isolated position. It stands high on our list (only one bird was examined) as regards size. Evans's next order is the *Sphenisciformes* (Penguins), one of whose nearest allies is the order *Colymbiformes* ; *Sphenisciformes* stands second on our list. In Evans's *Ciconiiformes* are included the *Ardeiformes* and *Pelicaniformes*, standing first and fourth on our list—though there is really little difference between these upper groups. Next comes the *Falconiformes* of Evans, which our figures would place further on. His next order, *Galliformes*, fits in with our findings, though perhaps the *Charadriiformes* (in our sense) should precede them in point of size. Evans places in the *Charadriiformes*, *Lari* and *Columbæ*, as well as *Limicolæ*. As regards *Columbæ*, our findings distinctly remove them from this group. The *Coraciiformes*, as regards the genera *Dacelo* and *Halcyon*, come before the *Cuculiformes*, to which latter *Merops* is perhaps more closely related. The *Psittaci*, which Evans groups with the *Cuculiformes*, agree with their position. After these we would place the Pigeons. Finally, we come in both cases to the Passerines. Amongst these some interesting results are seen. The largest cells appear to be in the families *Campophagidæ* and *Corvidæ*. These two families are third and twenty-fifth respectively in Mathews' list ; Evans places them as 12 and 23, but, in speaking

of the former, he says :—" The ' Cuckoo-Shrikes ' are commonly placed near the *Laniidæ*, but are possibly connected with the *Muscicapidæ* or the *Corvidæ*." Our findings would place them near the *Corvidæ* and not far from the *Laniidæ*, but remote from the *Muscicapidæ*. Amongst the families with red cells of smaller size are the *Turdidæ* (in which are included the *Sylviidæ*), *Dicruridæ*, *Oriolidæ*, and *Paradiseidæ* (including the *Ptilonorhynchidæ*). Evans says the last-named is undoubtedly related to the *Corvidæ*, which our figures (from one species) do not seem to support. The smallest cells appear to be those of the *Meliphagidæ* and the *Muscicapidæ*.

MAMMALIA.

Our figures for mammals, consisting only of bats and marsupials, are few. The former seem to vary a little, usually being from 4.5 to 7. Amongst the marsupials the red cells of *Phascolarctus* were large for mammals, those of *Æpyprymnus* (9) a little smaller, and those of *Macropus*, *Dasyurus*, and *Trichosurus* 5 to 7. Nucleated red cells were not uncommon in the marsupials—perhaps an archaic trait.

MEASUREMENTS OF RED CORPUSCLES.

(NOTE.—The first column, x x y, refers to the length (x) and breadth (y) of the red cell, the second column referring similarly to the dimensions of the nucleus.)

FISH.

DIPNOI.

Ceratodus forsteri ..	39 x 23 to 25 ..	14 x 9 to 10.5

ELASMOBRANCHII.

Chiloscyllium sp. (dog shark)	23 x 13.5 ..	9 x 7
Sphyrna tudes (hammer-head shark)	18 x 12.5 ..	7 x 5.5
Dasybates kuhlii (ray) ..	18 x 14 ..	7 x 5.5

TELEOSTEI.

Konosirus erebi (bony bream)	12.5 x 7 ..	4.5 x 2.5
	10.5 to 13 x 9 ..	4.5 to 5.5 x 2
Krefftina adspersus ..	10 to 11 x 9 to 9.5 ..	4 to 5.5 (rounded)
Trachystoma petardi (fresh-water mullet) ..	10.5 x 7 ..	3.5 x 2.5 to 3
	9.5 to 10.5 x 7 ..	3.5 to 4 x 2.5
Galaxias findlayi ..	10.5 to 11.5 x 9 ..	5.5 x 3.5
Seriola lelandi (king-fish)	10.5 x 7 ..	4.5 x 2.5
Scolopsis vosmaeri (big-eyed bream)	10.5 x 7 ..	6 x 3.5
Echeneis naucrates (sucking-fish)	9 x 7 ..	4.5 x 2.5
Plectorhynchus punctatus (sweetlip)	9 x 7 ..	4.5 x 2.5
Lethrinus chrysostomus (emperor-fish) ..	9 x 8 ..	5.5 x 3.5
Terapion unicolor ..	6 to 7 x 6 to 7 ..	3.5 x 3.5

SNAKES.

Acanthophis antarctica (death adder) ..	18 to 21.5 x 10 to 11.5 ..	5.5 x 5.5
Notechis scutatus ..	20 to 20.5 x 10 to 12.5 ..	7 x 3.5
	18 to 20.5 x 11 to 13.5 ..	7 to 8 x 4 to 5.5

Pseudechis porphyriacus	18 x 10.5	5.5 to 7 x 3 to 3.5
Denisonia nigrescens	15 to 17 x 8 to 8.5	
Furina occipitalis (ring-snake)	18 to 20.5 x 9.5 to 10.5	8 x 2.5 to 3.5
Python variegatus / *Python spilotes*	17 x 9 to 9.5	4.5 to 5.5 x 3.5

LIZARDS.

Varanus gouldii	13.5 to 16 x 7 to 9.5	5.5 to 7 x 2.5 to 3.5
	15.5 to 17.5 x 7 to 10.5	
Varanus varius	15 to 16 x 9	5.5 x 3.5
	16.5 to 18.5 x 9 to 10	4.5 to 6 x 3.5
Amphibolurus barbatus	18 x 9	6 x 2.5
	16 to 18 x 10.5	6 x 2 to 3.5
	16 to 17 x 10 to 10.5	6 to 7 x 3.5
	11.5 to 16 x 8 to 10	3.5 to 5 x 3
Amphibolurus muricatus	14 to 18 x 9	5.5 to 7 x 2 to 3.5
	19 to 20 x 9 to 11	6 to 8 x 2.5 to 3.5
Egernia whitei (3 specimens)	14 to 16.5 x 8	
Egernia striolata (3 ,,)	16 to 16.5 x 10	
Tiliqua scincoides	18 x 9 to 11.5	6.5 x 3.5
Lygosoma tæniolatum	15.5 to 16 x 8 to 9	5.5 to 7 x 2.5 to 3.5
	12.5 to 14.5 x 6.5 to 7	
	13 to 14 x 7 to 8	6.5 x 2
Lygosoma trilineatum	15.5 to 16 x 8 to 9	5.5 to 7 x 2.5 to 3.5
Lygosoma fasciolatum	14.5 to 17.5 x 8 to 10	6 x 3
Lygosoma lesueurii (3 specimens)	13.5 to 15 x 8 to 10	
Lygosoma (*Liolepisma*) *lichenigerum*	15 to 20 x 9 to 11	
Lygosoma (*Hinulia*), sp. nov.	16.2 to 18 x 9	6.5 to 9 x 3.5
Lygosoma verreauxi	14 to 16.5 x 7 to 8.5	5 x 2.5
Phyllodactylus guntheri (gecko)	20 to 20.5 x 11 to 12.5	
Gehyra variegata (gecko)	16 to 19 x 10	6.5 x 4
Gehyra australis	15 to 18 x 9.5 to 10	6.5 x 3

TORTOISES.

Chelodina longicollis	18.5 to 19.5 x 12.5	5.5 x 3.5 to 4.5
Emydura krefftii	17 to 21.5 x 12.5 to 14.5	4 to 5.5 x 3.5 to 5.5

BATRACHIANS.

Hyla cœrulea	19.5 x 14	7 x 3.5 to 4.5
	18 to 19.5 x 12.5	7 to 7.5 x 3.5 to 5.5
Hyla citropus	20 to 23.5 x 13.5 to 16	5.5 to 8 x 4.5 to 5.5
Hyla rubella	14 to 20 x 10 to 11.5	6 x 3
Lymnodynastes fletcheri (9 specimens)	14.5 to 18 x 10.5 to 11	5.5 to 6.5 x 2.5 to 3.5
Lymnodynastes dorsalis	18 to 19.5 x 12.5	7 to 8 x 4.5 to 5.5
Pseudophryne bibroni	20 to 22 x 13 to 15	10 x 5
Uperoleia marmorata	18 to 20 x 11.5 to 15.5	8 x 5
Crinia signifera	19 to 21.5 x 12.5 to 14.5	5 to 6.5 x 3.5 to 5.5
Phrætops australis	18 x 12.5 to 13.5	6 to 6.5 x 4.5 to 5.5

BIRDS.

(The figures in parentheses before the name of the species refer to the number in Mathews' Hand-list of the Birds of Australia—*vide The Emu*, vol. vii., Jan., 1908, Supplement.)

ORDER II.—GALLIFORMES.

(7) *Catheturus lathami*	12.5 to 14 x 7	5.5 x 2 to 2.5
	11 to 14 x 6.5 to 8	7 x 2.5

ORDER IV.—COLUMBIFORMES.

(24) *Ptilopus swainsoni* ..	12.5 x 7 to 7.5	.. 5.5 x 2.5
(33) *Geopelia humeralis* ..	12.5 x 6 to 6.5	
(34) *Geopelia placida* ..	12.5 to 14.5 x 7 to 7.5	.. 6 to 7 x 2.5
	12.5 to 14.5 x 7 to 8	
	12.5 x 7	.. 5.5 x 2
(37) *Phaps chalcoptera* ..	12.5 x 7 to 8	.. 5.5 to 6 x 2
	12.5 to 13 x 7.5	.. 5.5 x 2.5 to 3.5
	12.5 to 13 x 7	.. 5.5 x 2
(42) *Geophaps scripta* ..	12.5 x 7	.. 6 x 2
	12.5 x 7 to 7.5	.. 5.5 x 2
	12.5 to 14.5 x 7 to 9	.. 6.5 x 2
	12.5 x 7	.. 5.5 x 2
	10.5 to 12.5 x 7.5	.. 5.5 x 2
(46) *Ocyphaps lophotes* ..	15 x 7 to 7.5	.. 7 x 2
	14 to 15 x 8	.. 7 to 7.5 x 2

ORDER V.—RALLIFORMES.

Ocydromus sylvestris ..	14.5 x 7	.. 5 x 3.5

ORDER VI.—PODICIPEDIFORMES.

(65) *Podiceps novæ-holl...*	13.5 to 14.5 x 7 to 9	.. 5.5 to 6.5 x 2 to 3.5

ORDER VII.—SPHENISCIFORMES.

(71) *Eudyptula minor* ..	14.5 x 9 to 10	.. 4 to 6 x 2.5

ORDER IX.—LARIFORMES.

(135) *Micranous leucocapillus*	12.5 x 5.5	

ORDER X.—CHARADRIIFORMES.

(145) *Hæmatopus fuliginosus*	12.5 to 13 x 7 to 8	
(151) *Charadrius dominicus*	14.5 to 15 x 7	.. 7 x 2.5
(158) *Ægialitis melanops*	11.5 to 12.5 x 6 to 7	.. 5.5 x 2.5
(164) *Numenius cyanops*	13 to 14.5 x 7 to 7.5	
(190) *Burhinus grallarius*	13.5 to 14 x 7 to 9	.. 6 x 2 to 2.5

ORDER XII.—ARDEIFORMES.

Herodias timoriensis ..	13 to 15 x 8	.. 6.5 x 2.5
(204) *Notophoyx novæhollandiæ* ..	14 to 16 x 9	.. 7 x 2 5
(205) *Notophoyx pacifica*	15 x 8	.. 6.5 x 2

ORDER XIV.—PELICANIFORMES.

(241) *Phalacrocorax melanoleucus*	14 x 7 to 8	.. 6 to 7 x 2
	11.5 to 13.5 x 6 5 to 8	

ORDER XV.—ACCIPITRIFORMES.

273) *Baza subcristata* ..	13 x 7 to 8.5	.. 5 5 x 2
279) *Hieracidea orientalis*	12.5 x 7 to 9	.. 5.5 x 2.5

ORDER XVII.—PSITTACIFORMES.

301) *Trichoglossus novæhollandiæ* ..	12.5 to 14.5 x 5.5 to 7	.. 5.5 to 6.5 x 2
	11 to 12.5 x 6 to 7	.. 6 x 2
(304) *Psitteuteles chlorolepidotus* ..	11 to 12 x 7	
	10.5 to 12.5 x 7 to 8	.. 5.5 to 6 x 2 to 2.5
(309) *Glossopsittacus pusillus*	11 to 11.5 x 5.5 to 6	
	10.5 to 11.5 x 6 to 6.5	.. 5.5 to 6.5 x 2
	12.5 x 7	.. 5.5 x 2
	12.5 x 7	.. 5.5 x 2
	10 to 11 x 5 to 6	

(321) *Cacatua leadbeateri*	16 to 17 x 8 to 10 ..	5.5 x 3
(324) *Cacatua roseicapilla*	11.5 to 13.5 x 6.5 to 7.5	4.5 to 5 x 2 to 2.5
	13 to 14.5 x 7 to 8.5 ..	4.5 to 5 x 2.5
(332) *Aprosmictus cyanopygius* ..	12.5 to 13 x 7 to 9 ..	5.5 to 7 x 2
	11.5 to 13 x 6 to 8 ..	6 to 7 x 2 to 2.5
(339) *Platycercus pallidiceps*	11 to 12.5 x 7 to 7.5 ..	7 x 3
(343) *Platycercus eximius*	12.5 x 7 ..	5.5 to 6 x 2
Amazon or Mexican Parrot	14.5 x 8	

ORDER XVIII.—CORACIIFORMES.

(386) *Dacelo gigas* ..	14 x 9 ..	6.5 to 7 x 2.5 to 3
	14 x 8.5 to 9 ..	5.5 to 7 x 2
(387) *Dacelo leachi* ..	12.5 to 14.5 x 7 to 9 ..	5.5 x 2.5
Halcyon vagans ..	12 to 14.5 x 7 to 8 ..	7 x 2.5
(396) *Merops ornatus* ..	11 to 12.5 x 7 ..	5.5 x 2
	12.5 x 7 ..	5.5 x 2

ORDER XIX.—COCCYGES.

(407) *Cacomantis flabelliformis* ..	11.5 to 13 x 6.5 to 7 ..	6 x 2
	12.5 x 7 ..	5.5 x 2.5
	12.5 to 13 x 7 ..	5.5 x 2
(412) *Chalcococcyx plagosus*	12 to 12.5 x 7 ..	5 5 x 2

ORDER XXI.—PASSERIFORMES.

SUB-ORDER ACROMYODI.

B.—Passeres Normales.

Family I.—Hirundinidæ.

(429) *Hirundo neoxena* ..	11 x 5 to 6 ..	3.5 x 2

Fam. II.—Muscicapidæ.

(433) *Micræca fascinans*	11 to 12.5 x 6 to 7	
	11 to 12.5 x 7 ..	4 to 5.5 x 2.5 to 3
(449) *Smicrornis brevirostris*	9.5 to 11 x 6 to 6.5 ..	4 to 5.5 x 2
	11 to 12.5 x 5.5 to 6 ..	5.5 x 2.5
(476) *Rhipidura albiscapa*	9 to 11 x 6 ..	5.5 x 2
	11 to 11.5 x 7 ..	4 x 2
	11 to 11.5 x 6.5 to 7 ..	5 x 2
(487) *Rhipidura tricolor* ..	11 x 6.5 to 7 ..	3.5 to 5 x 2
(499) *Piezorhynchus gouldi*	9 to 10.5 x 6.5 to 7	

Fam. III.—Campophaginæ.

(504) *Coracina robusta* ..	12.5 to 13 x 7 ..	5.5 to 7 x 2 to 2.5
	12.5 to 14 x 7 to 8 ..	5.5 to 7 x 3.5
(507) *Coracina mentalis* ..	12.5 to 13 x 7 to 7.5 ..	5.5 x 2.5
	11 x 7 to 7.5	
(510) *Lalage tricolor* ..	11 to 12.5 x 5.5 to 7 ..	5.5 x 3
(509) *Edoliisoma tenuirostre*	11.5 x 6 to 7 ..	6 x 2

Fam. IV.—Timeliidæ.

(515) *Cinclosoma punctatum*	11 x 7 ..	5.5 x 2
(516) *Cinclosoma castanonotum*	11 to 13.5 x 6 to 7 ..	5.5 x 2
(526) *Psophodes crepitans*	11 to 12.5 x 6 to 6.5 ..	5 x 2
(529) *Pomatorhinus frivolus*	11.5 x 7 ..	4 x 3
	11.5 to 13 x 7 to 9 ..	5 to 6 x 2.5
	11.5 to 12 x 7.5 to 8	
	12.5 x 7 ..	5.5 x 2

Fam. VI.—Sylviidæ.

(568) *Acanthiza pyrrhopygia*	12 to 12.5 x 5.5 to 7 ..	5.5 x 2
(569) *Acanthiza lineata* ..	10.5 x 7 ..	6 x 2
(575) *Acanthiza reguloides*	10.5 to 12.5 x 6 to 6.5 ..	5.5 x 2
(593) *Malurus cyanochlamys* ..	11.5 x 7 ..	6 x 2
(610) *Stipiturus malachurus*	11 x 6.5 ..	5.5 x 2

Fam. VII.—Artamidæ.

(624) *Artamus leucogaster*	11.5 to 12.5 x 7 to 8 ..	5.5 x 2
(634) *Artamus tenebrosus*	11 to 12.5 x 5.5 to 7 ..	5.5 to 6 x 2.5
	11 to 12.5 x 6.5 to 7 ..	5.5 x 2
	12 x 7 ..	5.5 x 2

Fam. VIII.—Prionopidæ.

(636) *Collyriocichla harmonica* ..	12.5 x 7 ..	5.5 to 6 x 2 to 2.5
	11 to 12.5 x 6 to 7 ..	5.5 x 2
(646) *Grallina picata* ..	11 to 12.5 x 7 ..	6 to 7 x 2

Fam. IX.—Laniidæ.

(654) *Cracticus nigrigularis*	11 to 11.5 x 6 to 7.5	
	10 to 12 x 6 to 6.5	
(658) *Cracticus destructor*	11.5 to 12 x 6 to 6.5	
(674) *Pachycephala rufiventris* ..	11 to 11.5 x 5.5 to 6	
	11.5 to 12.5 x 6 to 7	
(676) *Pachycephala gilberti*	12.5 x 7 ..	4.5 x 2.5
(684) *Eopsaltria chrysorrhoa*	11 to 12.5 x 6 to 7 ..	5.5 to 6 x 2

Fam. XI.—Sittidæ.

(697) *Neositta pileata* ..	12 to 12.5 x 5.5 to 6 ..	5.5 x 2
(699) *Neositta leucoptera* ..	11.5 to 12 x 6 ..	4 to 5 x 2.5

Fam. XII.—Certhiidæ.

(705) *Climacteris pyrrhonota*	12.5 x 7 ..	5.5 x 2
Climacteris scandens	11.5 to 12.5 x 7 to 7.5 ..	5.5 x 2.5

Fam. XIV.—Dicæidæ.

(726) *Pardalotus punctatus*	10.8 x 6 ..	4 to 5 x 2.5

Fam. XVI.—Meliphagidæ.

(745) *Plectorhamphus lanceolatus* ..	11.5 x 6	
(756) *Glyciphila melanops*	11 to 12.5 x 6 to 6.5 ..	5.5 x 2
(765) *Stigmatops ocularis*	10 to 10.5 x 6 to 6.5	
(769) *Ptilotis fusca* ..	10 to 10.5 x 6.5 to 7 ..	5.5 x 2
	10.5 x 7 ..	5.5 x 2
(770) *Ptilotis chrysotis* ..	11 to 11.5 x 6 to 7 ..	5.5 x 2.5
	11 x 5.5 to 6 ..	5.5 to 6 x 2.5
(777) *Ptilotis fascigularis*	11 x 7	
(791) *Ptilotis penicillata* ..	12.5 to 13.5 x 5.5 to 7 ..	5.5 x 2.5
(797) *Meliornis pyrrhoptera*	11 to 12.5 x 5.5 to 6 ..	5 x 2
(804) *Myzantha garrula* ..	10.5 x 6 to 6.5 ..	4.5 x 2
	10.5 to 11.5 x 5.5 to 6 ..	5.5 x 2
	11 x 5.5 to 6	
(810) *Anellobia chrysoptera*	10 x 5.5 ..	4.5 x 2
(813) *Entomyza cyanotis* ..	11 to 11.5 x 7	
	11 x 7 to 7.5 ..	5.5 to 6 x 2
	12.5 x 6.5 to 7 ..	4.5 x 2

Fam. XVII.—Motacillidæ.

(822) *Anthus australis* ..	10.5 to 12.5 x 5.5 to 7 ..	5.5 x 2
	10.5 to 12.5 x 7 ..	4 to 5 x 2

Fam. XIX.—Ploceidæ.

(832) *Stictoptera bichenovii*	12.5 x 7	5.5 to 6 x 2
(838) *Ægintha temporalis*	11.5 to 12 x 6 to 8	5.5 x 2.5
(843) *Poephila cincta* ..	12.5 x 7	5.5 x 2
Passer domesticus (Sparrow) (3) ..	12.5 x 6 to 7	5.5 x 2 to 2.5

Fam. XX.—Oriolidæ.

(850) *Oriolus sagittarius* ..	10.5 x 7	5.5 x 2
	10.5 to 11.5 x 6 to 6.5	4 x 2
	12.5 x 7	5.5 to 6 x 2.5
(852) *Sphecotheres maxillaris*	10 to 12.5 x 6 to 7	5.5 to 6 x 2
	11.5 x 7.5	
	10.5 to 12.5 x 6 to 7	

Fam. XXI.—Dicruridæ

(854) *Chibia bracteata* ..	10.5 x 7	5 x 2
	9.5 to 11 x 7 to 7.5	4 to 5 x 2.5

Fam. XXII.—Eulabetidæ.

(855) *Aplonis fuscus* ..	11 to 12.5 x 7	5 x 2
Sturnus vulgaris (Starling) ..	11 to 12.6 x 7	

Fam. XXIII.—Ptilonorhynchidæ.

(861) *Chlamydodera maculata* (4 specimens)	10.5 to 12 x 6 to 7	5 x 2.5

Fam. XXV.—Corvidæ.

"Crow"	12.5 x 7	5.5 x 2
(872) *Corvus coronoides* ..	11.5 to 12.5 x 7 to 8	5.5 x 2
	10 to 11.5 x 6 to 6.5	
(875) *Strepera graculina* (4)	12 to 13.5 x 7 to 10	5.5 x 2.5
	11 to 12 x 5.5 to 7	5.5 x 2
(878) *Strepera versicolor* ..	11 to 12 x 6.5 to 7	5.5 x 2
(882) *Struthidea cinerea* ..	11.5 x 6.5 to 7.5	
	13.5 x 9	5.5 x 3.5
	12.5 x 7	5.5 x 2
(883) *Corcorax melanorhamphus*	12.5 x 7	5.5 x 2
	14 x 7 to 8	5.5 x 2

MAMMALS.

CHEIROPTERA.

Chalinolobus morio ..	3.5 to 5, generally 4.5.
Vespertilio australis ..	5.5 to 6.5.
Rhinolophus megaphyllus	7. Polychromatophilic red cells present.

MARSUPIALIA.

Macropus dorsalis ..	6 to 7. Blood platelets. Several nucleated red cells.
Macropus ruficollis ..	6 to 7.
Macropus parryi ..	6 to 7. Blood platelets.
Macropus thetidis ..	One nucleated red cell seen.
Dasyurus viverrinus ..	5 to 6.5.
Trichosurus vulpecula (phalanger)	6 to 7.
Æpyprimnus rufescens (?) (kangaroo rat) ..	8 to 8.5. One nucleated red cell.
Phascolarctus cinereus (native bear) ..	9. Nucleated red cells fairly numerous; one mitosing.