

In a related vein, I am somewhat surprised that biology has not found more useful concepts at the intermediate length scale. Engineering examples include the arch in architecture, which connects the componentry level of bricks with the overall outcome of cathedrals, and viscosity in fluid mechanics, which connects the componentry molecular interactions with the overall fluid responses to force. Without such intermediate concepts, one is in the position of trying to understand cathedrals by cataloguing the bricks. Several phenomena in biology such as the gel-sol transition accompanying animal cell crawling may not be

understood on the basis of individual molecules and their interactions, but may be understood in terms of an intermediate phenomenon, thixotropy for example.

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Was the solitaire of Réunion an ibis ?

SIR — The Mascarene islands were the home of an extinct family of birds, the Raphidae, which were large-sized, flightless Columbiformes. This family includes the Mauritius Dodo, *Raphus cucullatus* (Linné), and the Rodrigues solitaire, *Pezophaps solitaria* (Gmelin). These two forms are known by contemporaneous

downwards than the bill of the different species of that genus. Now in one of the most detailed descriptions of the Réunion solitaire, Dubois writes that "the beak is like that of a Woodcock but larger"^{3,4}, therefore it must have been relatively long and straight. This description of the bill does not match the description of the Raphidae-bill, but could correspond to a relatively short, straight ibis-bill (see figure).

The other external characteristics noted by the early travellers can also correspond to an ibis related to the sacred ibis, *T. aethiopicus*, or to the straw-necked ibis, *T. spinicollis*. According to the different authors the Réunion solitaire was white, or grey and white, or "white with the tips of the wings and tail black"^{3,4}. In the sacred ibis, the wing tips are black with metallic glints, and cover the tail,

which is white. In the straw-necked ibis the neck, underpart and tail are white, while the back and wings are glossy black. Moreover, Dubois writes: "The tail feathers resemble those of an ostrich". Now in the sacred ibis, during the reproductive period, the ornamental feathers situated on the back and at the wing tips, filiform, downturned, and longer than the tail, look more or less similar to the tail feathers of an ostrich. The solitaire of Réunion had a long neck and long legs. Together with the shape of the bill, these last two characteristics correspond to a bird that is very different from the Mauritius Dodo. Finally, the only indication concerning its food, given by Feuille: "Their food is but worms and filth (*saleté*) taken on or in the soil"^{4,5} corresponds much better to an ibis than to Raphidae; the latter were mainly frugivorous⁶.

The Réunion solitaire was observed by explorers between 1613 and 1708, and the

species probably disappeared around 1710-15 (ref. 5). According to what is known for the dates of disappearance of the Mauritius Dodo and the dates of the first description of the Rodrigues solitaire, it is likely that most of the travellers who gave an account of the Réunion solitaire did not have the opportunity to see these two forms personally. Moreover, after the disappearance of the genuine Dodo, the names "todaersen" or "dodo" were used to designate a very different bird⁵.

The main objection concerning the attribution of the Réunion solitaire to a member of the ibis family is the question of flight. Among all the writers who mentioned the solitaire, Castleton and Bon-tekoë described it as unable to fly, but Dubois indicates some ability to fly when he writes: "This bird has recourse to running, as it flies but very little". The other writers do not state precisely whether or not it could fly^{4,5}. Now, except for one characteristic, the skeletal remains of the Réunion ibis do not indicate a reduction of flying ability. Because several authors described it as very fat, it may have had a seasonal fat cycle, with a fat period when it was unable to fly, and a thin period when it could

In conclusion, we think that the solitaire described by the early travellers was not related either to the Mauritius Dodo, or to the Rodrigues solitaire, but was probably the extinct Réunion ibis. In this case we propose to designate it as *T. solitarius* (Sélys-Longchamps, 1848), new comb., of which *Borbonibis latipes* is a junior synonym.

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Comparison between the fragment of mandible of the Réunion ibis, from the Marais de l'Ermitage, and the mandible of a recent *T. aethiopicus*, the sacred ibis. The description by Dubois of the beak of the Réunion solitaire, "like that of a Woodcock, but larger", matches that of an ibis with a relatively short, straight bill, and is very different from the bill of the Raphidae, which is very strong, inflated at the end, with a sort of incurved, downturned hook^{3,7} (36% of original size).

descriptions and illustrations, by a few anatomical remains for the dodo, and by a large number of fossil remains for both species.

In Réunion there existed a bird called the solitaire, exclusively known by historical reports. Excavations recently carried out in Réunion did not reveal any remains of Raphidae, but remains of an extinct ibis, *Borbonibis latipes*^{1,2}, were found in three localities and were particularly abundant in the Marais de l'Ermitage. This species must have been relatively common; strangely, the early travellers never mentioned it, although they mentioned almost all the species that have subsequently been found in the different fossiliferous localities.

The osteological analysis of *Borbonibis* shows that it is closely related to the recent genus *Threskiornis*. However, a fragment of lower jaw, found in 1994, shows that its bill was much shorter and less curved