

importance to the biologist; the wide geographical range of some of the species (as at present determined), recent and extinct, is also of interest to the naturalist; and in the distribution of the fossil *Estheriæ* amongst the freshwater and estuarine passage-beds of the great successive formations, the geologist will find a fruitful field of research; for, at least, these little fossils will prove to be useful indicators of even transient changes of fresh and salt-water conditions, either in shallow water on coasts, or in inland lakes, where evaporation and the influx of river-water, each varying in amount periodically, may have produced freshwater, brackish, and saline deposits alternately.

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XXV.—NOTE ON THE FERTILITY, INTER SE, OF HYBRIDS OF DIFFERENT SPECIES OF THE GENUS GALLUS. By S. J. A. Salter.

DURING the last two years some interesting experiments have been conducted at the Gardens of the Zoological Society, under my observation, in reference to hybrids of different species of the genus *Gallus*; their production, in the first place, from distinct species, and their subsequent continuance by breeding *inter se*. The results of these experiments have been very different from what I hoped and expected. The object which was in view in conducting them—to produce persistent races of hybrid fowls, was not accomplished; at least the results were so unsatisfactory as to make it obvious that, with all the care which artificial rearing could afford, the few progeny of these hybrids would not maintain a race—there being evidently a physiological veto against their continuance.

Before describing these experiments and detailing results I would premise a few remarks respecting the subjects of them.

I take it for granted, in the first place, that the different *Galli* upon which these observations were made, are distinct and veritable species according to the most orthodox interpretation of that term; secondly, that the domestic fowl is one and only one of those species; prolific of its kind, and from its domestic habits very manageable, and for these reasons best suited as the female parent of the first generation of hybrids. The different species employed in these observations were *Gallus Sonnerattii*, *G. furcatus*, and *G. Bankiva*; assuming that is, that the domestic fowl, in all its varieties, is the latter, an opinion universally received by ornithologists. The domestic form of *Bankiva* employed was the *game* fowl, the nearest approach to the wild parent stock: full-sized game hens were associated with *G. furcatus*, and bantams with *G. Sonnerattii*.

These efforts at breeding hybrid fowls were commenced in 1861. Previous attempts had been made, many years ago, at the Zoological Gardens, and some of the older keepers, though not giving any very accurate or particular accounts of their history, indicate similar general results to those which have been recently obtained.

In the spring of 1861 a healthy cock *Indian Jungle Fowl* (*G. Sonnerattii*) was associated with several bantam hens. A profusion of eggs resulted; these were very prolific, and yielded chickens in nearly as large a proportion as the eggs of an ordinary poultry yard. The chickens produced from these eggs were numerous and healthy. There appeared nothing in this first cross to militate against the idea of its continuance. One point in reference to the plumage of these birds is worthy of note. The hen birds were all exactly alike, and so were the cocks, but neither could be considered to exhibit the mean average plumage of the two parent stocks—the hen birds most closely resembled those of their male parent; the young cocks were most like the males of their female parent. The pullets, indeed, were so closely similar to hens of true *G. Sonnerattii* as to be scarcely distinguishable from them. The cockerels certainly differed from the bantam cocks of their maternal race, but still only slightly in plumage. The voice, however, was very different, the crow being short, harsh, and discordant. All these hybrids were exceedingly wild. These birds were so numerous that many were disposed of, but sufficient were kept to follow out further the question of hybridising and the fertility of the hybrids. So much for the Sonnerat-bankiva hybrids in 1861.

In the spring of the same year the Zoological Society became possessed of a fine hybrid cock, in which the Jungle-fowl element was that of the species *furcatus*. This bird was evidently bred between *G. furcatus* and domestic *Bankiva* of the variety known as the "Duckwing game." *Gallus furcatus* is very seldom met with in zoological collections, and I was anxious if possible to perpetuate this hybrid as nearly as could be managed by continuing him as the progenitor, and gradually bringing the hens, by successive generations, nearer and nearer to the simple and direct cross. For this purpose I associated some game hens with him, so as to obtain, in the first generation, chickens  $\frac{1}{4}$  *furcatus* and  $\frac{3}{4}$  *Bankiva*, in the next generation a progeny nearer the jungle-fowl, being  $\frac{3}{8}$  *furcatus* and  $\frac{5}{8}$  *bankiva*, and so on till in effect the disproportion in favour of *bankiva* was bred out or rather reduced to a very small element. This attempt answered fairly in the first season: two small broods were hatched, and the chickens were reared without much difficulty. As the hens roamed at large and made their nests in some secluded spot in a shrubbery, the number of eggs laid, the proportion hatched, and the condition of the unhatched eggs, were not ascertained. The progeny varied much in plumage. The cocks were destroyed, and three of the most evenly-marked hens were retained for association in the next year, with the half-bred cock, their sire.

The proceedings of 1862 in regard to these hybrid *Galli*, though conducted with the greatest care and attention, led to results quite upsetting all hopes that these races could be practically continued; though at the same time they showed that in a few exceptional instances progeny could be obtained by the breeding of these hybrids

*inter se*. The experiments, however, disappointing as they were, gave physiological indications of interest and significance.

The birds intended to be bred from were associated in this order:—

I. Pure *G. Sonneratii* cock, with half-bred (Sonnerat-bankiva) hens :

II. Half-bred Sonnerat-Bankiva cock, with similar hens :

III. Half-bred *furcatus*-Bankiva cock, with hens  $\frac{1}{4}$  *furcatus*  $\frac{3}{4}$  Bankiva.

In all cases the mating of the birds appeared to be satisfactory, and the cocks performed their marital duties with vigour. An enormous number of eggs were obtained; but few chickens were hatched, and of those a very small proportion survived. Out of some 500 eggs set under hens, only 12 chickens were reared, and of these only three were from hybrids breeding *inter se*, the other nine being the produce of a pure-species cock with hybrid hens.

The nature of these failures was pretty much the same in all three combinations of cocks and hens above indicated, though the proportion differed somewhat. The character of the results may be stated summarily as follows:—The majority of the eggs showed that they had been fertilized. A large minority gave no such indication, being addled. A majority of the fertile eggs underwent partial development, nearly to maturity, and then aborted; or, being mature, the chickens failed to escape from the shell. Of the chickens hatched the very great majority (more than four-fifths) died within the first few days, or few weeks at latest, *without any obvious cause*, apparently from a mere inability to live. Very many of the chickens were deformed: all such died early.

266 eggs were set under hens at the Zoological Gardens: nearly the same number were sent to the country, and there incubated. The results at the Gardens were carefully noted, and were as follows—the numbers I., II., and III. corresponding with the combinations of the birds as before indicated:—

	Eggs set.	Chickens hatched.	Chickens living.	Dead.	Partly developed.	Eggs addled.
I.	228	45	9	36	43	95
II.	20	1	1	0	8	10
III.	18	3	2	1	5	7

From the eggs sent to the country not one chicken was reared. In other respects the results were much the same as those at the Gardens. I only received numerical records of three settings, which consisted of all three kinds of eggs mixed promiscuously in about equal proportions. The following was the result:—

Eggs set.	Chickens hatched.	Chickens living.	Dead.	Partly developed.	Eggs addled
39	4	0	4	25	10

I may mention that of the four chickens hatched one was *furcatus*-Bankiva, three were Sonnerat-Bankiva.

The one striking point of these experiments (which, I believe, has never been noticed before) is that a large proportion of these eggs from hybrid birds, breeding *inter se*, have failed to produce young, not from absolute sterility, but from sterility in degree—from an amount of vitalization insufficient to carry out the whole result of reproduction; or, where the young individual has been completed, leaving it with vital resistance too feeble to maintain life and cope with common and customary external influences.

These phenomena have a singular parallel in the circumstances attending parthenogenesis, when it occurs exceptionally in certain Articulata that do not normally reproduce their kind in this manner. In a note published by Mr. Lubbock, in the 7th number of the Natural History Review, p. 345, an epitome is given of some researches conducted by M. Jourdan respecting non-sexual generation in the Silk-worm moth; and it appears that, though some few of the unimpregnated eggs from this insect produced young larvæ, many others underwent the early stages of embryonic development and then stopped. And further, Mr. Lubbock informs me that in some other cases where virgin-reproduction is exceptional, the young thus produced are stated to have perished without obvious cause. Whether any of these young are, under these circumstances, deformed, is a point upon which, I believe, there is no evidence. It seems clear, however, that both in the hybrid-breeding of birds and in exceptional parthenogenesis there is the same kind of defect; that the sterility is not absolute but in degree; and that the stimulus, whatever it may be, which starts the embryonic changes is feeble and imperfect rather than wholly wanting.

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XXVI.—ON THE BRAIN OF THE SIAMANG. (*Hylobates syndactylus*, Raffles.) By William Henry Flower, Conservator of the Museum of the Royal College of Surgeons.

It has been observed by Professor Huxley that, “if the *Primates* “were arranged according to the development of their posterior “cerebral lobes, we should have some such descending series as “the following:—*Chrysothrix*, *Cebus*, *Troglodytes*, Man, . . . . “*Myctes*—a series which sufficiently illustrates the classificatory “value of these structures.”\* The extended observations which have been recently made on the subject have afforded a more complete elucidation of this remark. The various genera hitherto examined may, I think, be placed approximatively in the following order:—an

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\* On the Brain of *Ateles paniscus*. Proc. Zool. Soc. June 11th, 1861.