

## **John Samuel Budgett : biographical sketch / by Arthur E. Shipley.**

### **Contributors**

Shipley, Arthur Everett, 1861-1927.  
Tweedy, John, 1849-1924  
Royal College of Surgeons of England

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Wellcome Collection  
183 Euston Road  
London NW1 2BE UK  
T +44 (0)20 7611 8722  
E [library@wellcomecollection.org](mailto:library@wellcomecollection.org)  
<https://wellcomecollection.org>

R. J. Tuxedy  
fr. Arts.

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JOHN SAMUEL BUDGETT:

BIOGRAPHICAL SKETCH BY ARTHUR E. SHIPLEY, F.R.S.



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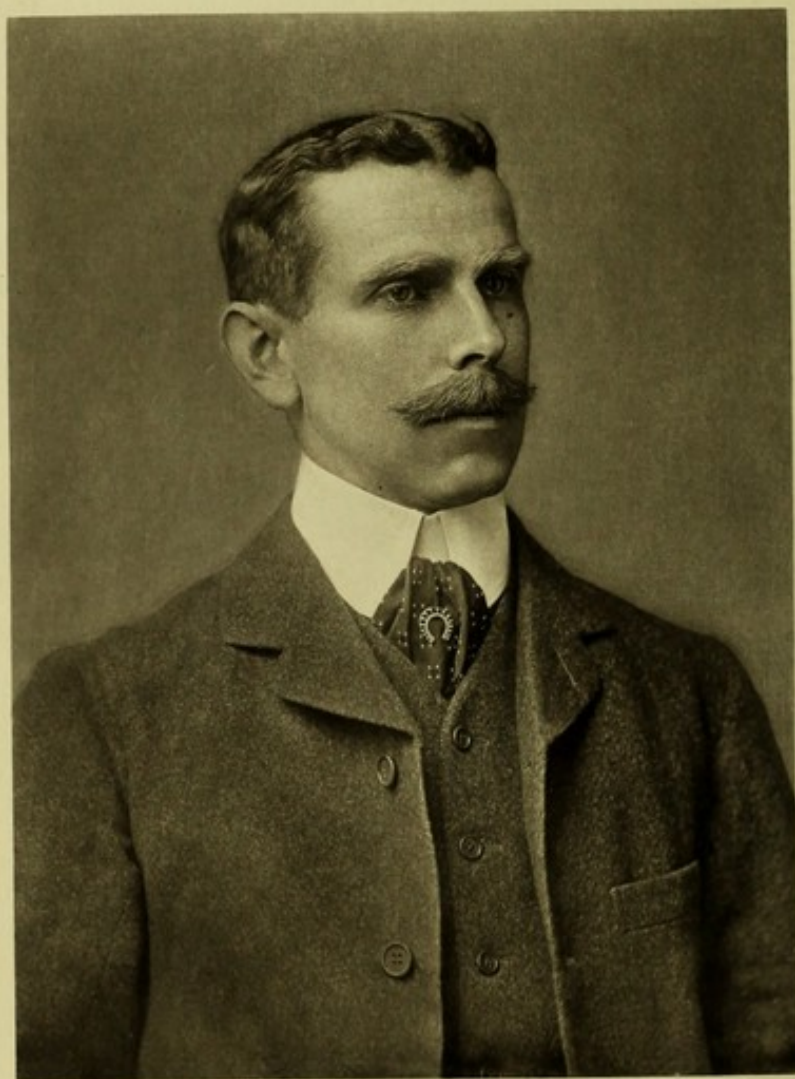














## JOHN SAMUEL BUDGETT

WHEN John Samuel Budgett joined Trinity College in the autumn of 1894 he brought with him letters of introduction from Mr S. H. Reynolds of University College, Bristol, which at once introduced him to the circle of Zoologists at Cambridge. These letters dwelt on two matters, both of them eminently characteristic of our friend. One was his great modesty, a modesty which at times amounted almost to wholly unnecessary self-depreciation, the other was his quite extraordinary skill in making anatomical preparations.

J. S. Budgett was born at Redlands House, Bristol, on 16th June, 1872. Two years later his father moved to Stoke House, Stoke Bishop, and here the greater part of his life was spent. His first school was a kindergarten, from which he entered Clifton College, but he had to leave there when he was about fourteen years old, as he was suffering from a severe form of headache, the result of an accident. He continued his studies, however, with private tutors, and finally joined University College, Bristol.

As a boy he lived with his parents in the charming old stone house with stately carved portal in the pretty village of Stoke Bishop, at that time much more in the country than now, when the houses of Clifton threaten to draw near it. Here in the spacious grounds he was allowed to build aviaries and adapt out-



houses for the shelter of his numerous pets. Here also he acquired some of his skill as a dissector, and a carpenter's shop in which the children had learned carpentry was gradually turned into a Laboratory and a Museum in which stuffed birds, skeletons of a cow, of a deer, and of the children's Shetland pony, and many wonderfully minute dissections were displayed. Budgett as a boy was fully abreast of modern methods, and used to make many preparations with natural surroundings, such as a stuffed swallow with its nest under a bit of tiled roof. He was a frequent visitor at the Clifton Zoological Gardens, and there he learned much. He always enquired attentively after any sick animals, not, it has been suggested, with a view to prolonging their life. In the summer he used often to go for long walks at 3 a.m. to enjoy the sunrise and to watch the awakening bird and beast life.

Mr W. H. Budgett, our friend's father, was a keen microscopist and a member of the Bristol Microscopical Society. He was also on the Council of the Bristol Museum, and was keenly interested in many branches of Natural History, a keenness he was eager his children should share.

Whilst Budgett was a boy his father's house was visited by many men of science. Amongst these, Professor W. K. Parker, who for twenty-three years in succession spent a fortnight at Stoke House, undoubtedly exercised a strong influence on the boy. At this period the Professor was advanced in life, and to quote his son's admirable biography<sup>1</sup> of him, "His habits became more retired, and almost his only outing was an annual visit to his friend Mr W. H. Budgett, at Stoke House, Bristol"; still, to the last, Professor Parker was brimming over with enthusiasm, and he can hardly have failed to fascinate the young zoologist. Professor Parker was remarkable for his skill in the preparation of delicate skeletons, such as those of tadpoles and of the minutest birds, and I have often thought that Budgett's extreme cleverness in making all sorts of anatomical preparations owed

<sup>1</sup> *William Kitchen Parker*, a Biographical Sketch by T. Jeffery Parker, London, Macmillan & Co. 1893.



much to the example of his elderly friend. Another visitor, the Rev. Dr Dallinger, well known for his great gift of exposition, must often have stirred the interest of the keen and eager lad.

After leaving school he still continued to study Zoology, and received much help from the Principal of University College, Bristol, Dr Lloyd Morgan, and from Mr (now Professor) S. H. Reynolds, but he was in a great measure self-taught. His knowledge of bird-life, his acquaintance with the methods of mounting objects, and his skill in keeping animals in captivity healthy, could not have been acquired in the Lecture-room. It must have been about this time that he began to design a new microtome which he laid aside for some years. During the last few months of his life, after his return from the Niger, he again took it up and had hopes that it would prove an effective instrument. He also devised a scheme of his own for making models of structures by cutting them into sections, drawing the sections on cardboard, cutting the drawings out, and sticking them together, one behind the other, in series.

His thorough knowledge of Natural History made him many friends on his arrival in the University, both among the senior and the junior members, and he was elected to the Cambridge University Natural Science Club in his first year, a somewhat unusual honour.

In 1896, at the end of his second year at Cambridge, he took Part I of the Natural Sciences Tripos. His University career was interrupted in his third year by a voyage to South America.

In 1890, when on the Page Expedition to the Pilcomayo, Mr Graham Kerr, now Professor of Natural History at Glasgow, had from a soldier the account of a fish dug up from the mud and eaten, and from the description given he suspected it to be *Lepidosiren*. This was confirmed in 1894 by the German Naturalist Bohls who first obtained this fish from the Gran Chaco<sup>1</sup>. The expedition came to an untimely end, the leaders of it either died

<sup>1</sup> According to an article in *Die Thierwelt*, vi. Jahrg. 16 Sept. 1896, the Gran Chaco habitat of *Lepidosiren* was first proved by Ternetz, "vor 3 bis 4 Jahren."



or deserted. The river disappeared and left their small steamer stranded in a dried-up bed. Mr Graham Kerr, as he then was, with the remnant of the expedition succeeded in reaching the coast and, returning to England, he joined Christ's College in 1892 and took his degree four years later. But during the time he spent as a student at Cambridge the haunt of the *Lepidosiren* was ever before him. In the autumn of 1896 he was able to start for the Gran Chaco of Paraguay, and he took Budgett with him.

Budgett was always a delightful travelling companion, considerate, thoughtful of others, very clever with his fingers, resourceful, and a good sportsman.

His knowledge of the fauna, particularly of the bird-fauna, was considerable, and he made a special study of the Anurous Amphibia of the swamps of Central South America, a study which resulted in his "Notes on the Batrachians of the Paraguayan Chaco." He kept very complete diaries. These were never meant for publication, and were written in every conceivable circumstance of discomfort, but I have reproduced passages from them practically as they stand, with only a very few verbal alterations where the sense seemed obscure. Several passages from that of his South American journey are worth quoting. They all show an eye alert for natural phenomena of every kind. On the 7th September, 1896, steaming up the great La Plata river on their way to Asuncion, he writes:

"Sky overcast, lightning and thunder at daybreak. Steaming through the delta all day, mostly hugging the western bank where the edge of the pampas formed a cliff about 60 ft. high. The channel by which we went up was as a rule about one mile in width, though the true eastern bank of the river was at least 50 miles distant. Perfectly flat shifting islands filled up the whole of the river at this part: they were covered with low but rich vegetation, and teemed with all kinds of wild fowl. We passed two settlements, San Nicolas and Villa Constitucion; at the latter place the manager had a very large English house. Lucern seemed to be the chief product here.

*Birds*: the most abundant *Milvago chimango*, perching in trees and on the ground. *Phalacrocorax brazilianus*, differing only from the British species in its yellow beak. *Euxenura maguari*, flying with legs straight out behind,



wings dipping only slightly below the horizontal; six beats and then floating on the air for some distance, and then six beats again and so on. *Aechmophorus major*, somewhat larger than the British great crested grebe, mostly of a chestnut colour, with white secondaries. *Ardea cocoi*, tall herons, standing with neck outstretched, but at angle of  $15^{\circ}$  from the vertical. *Dendrocycna fulva* (the tree-duck), one flock; *Mareca sibilatrix* (a widgeon), one flock. *Polyborus tharus* (the Carancho or Caracara), two perching on distant tree.

Ran aground 5.30 p.m., trying to get to pier at Rosario, water very low. 100 tons of cargo to go to Rosario, hope she will then float."

### Again:

"September 9th, 1896. Dull morning and close. 1 p.m. reached La Paz. The river is rather uninteresting to-day. About 3 p.m. regular Pampero thunderstorm, with violent wind from south-west, and rain in torrents. At first there was a black bank of cloud lying near the horizon, from which flashes of lightning passed to the earth, five or six in rapid succession. These series of flashes came at almost regular intervals. Other flashes extending almost right across the sky came more irregularly. Then the sky immediately above the horizon became brilliant yellow and streaked with clouds of sand; suddenly the storm burst upon us, lashing up the water and driving off the tops of the waves in clouds of spray. Then down came the rain in heavy torrents."

### Near Las Palmas he notes that:

"The ground was bright with patches of red, blue, and pink verbena and innumerable other flowers. The most striking thing was the noise the frogs made; a regular chorus of little bells<sup>1</sup> was continually going on, while here and there we heard a noise like two cats mewings<sup>2</sup>; we did not, however, discover what species made these. Many very brightly coloured birds were seen, among which were the Carancho, some Picui Doves, and a pretty Snipe. I heard for the first time the oft-repeated call of the Martineta. A rabbit, or Brazilian hare more likely, bolted from beneath my feet. I noticed a nest of the Termite and also of the Oven bird, which it somewhat resembles."

Budgett had a keen eye for beauty, and in unadorned language was often able to reproduce the scene to those who perforce must remain at home. On 27th September, 1896, at Concepcion, he writes:

"'Laguna' was covered around the edges with several beautiful kinds of

<sup>1</sup> Probably *Bufo granulosus*, Spix.

<sup>2</sup> Probably *Paludicola fuscomaculata*, Steind.



Camaloté<sup>1</sup> in fine bloom. The foliage and flowers were most luxuriant; beautifully plumaged birds flew here and there, gorgeous butterflies, and flimsy, delicate dragon-flies made the scene charming. A shower of rain refreshed the flowers and caused the gaily coloured Kingfishers to renew their angling efforts. We brought back our little bottle of spoil and did our first piece of scientific investigation with the microscope in South America. Soon crowds of natives shut the light out from our windows, among whom were some Lengua Indians. These are always to be seen wandering about the town or paddling across to the Chaco bank opposite."

### And three days later:

"Started in the canoe about 7.30 a.m., intending to paddle up stream two leagues and down the Chaco side of the island which lies opposite Concepcion. We found, however, that the stream and wind were too much for us, so turned back and floated some distance down stream. At a rather likely place for snipe we went ashore with a few No. 7, and after walking inwards until we came to a lagoon, we saw on a little island a flock of about fifty Whistling Ducks. After a very cautious stalk I got within forty or fifty yards of them, trying if possible to get near enough to shoot a brace through the head, before they rose, but it was not to be. I was discovered too soon and up rose the flock, after which I sent two or three ineffectual shots. On the same little bit of water we bagged four nice Sand-snipe with the remaining cartridges; and then of course we had around us numbers of Snipe, Jaçanas, a large flock of Ibises and other birds. How could they know we had shot our last for that morning?"

### His interest in the Frogs is shown by his diary for 13th October, 1896:

"Started out for walk at 6 a.m. with gun. Shot several birds and found some queer insects. Came back at 10 a.m. On the way passed two or three hundred vultures sitting on the palings of a slaughter house. Read newspapers till breakfast. After breakfast skinned three birds. Then went down to pool by river and discovered a beautiful little green frog<sup>2</sup> on the Camaloté. On almost every piece of Camaloté there was one. The males keeping constantly calling to one another. On the way back I found by much searching two new species of frogs. The Mosquitoes have been worse to-day than ever before.

<sup>1</sup> Budgett writes this word Camelota. Mr S. A. Skan has kindly suggested to me that it is probably the Camelote mentioned by Hieronymus in his *Plantae Diaphoricae Argentinae* and by Bettfreund in his *Flora Argentina* as the native name for the *Eichhornia azurea*, Keenth.

<sup>2</sup> *Pseudis limellum*, Cope.



*Frogs.* No. 1<sup>1</sup> and No. 2 were male and female of a frog<sup>2</sup> which seems to be more common than any at Concepcion. The male has a characteristic call, beginning on a rather low note, and ending on a higher one. It is very common and at sunset is everywhere in one's path. Its back is striped with parallel ridges of the skin. It is marked with black blotches on a greenish grey ground; the most characteristic mark is the triangular black patch between the eyes. The external ear is a very conspicuous tympanum.

No. 3 is a male. It makes a call similar to No. 1, but lower and softer. If it is chased, contrary to the usual rule, it still continues to call loudly, and thus does not easily escape the collector. This frog has a clumsy appearance, and its general shape is toad-like. The markings are distinct, chiefly black and green and a little yellow; the eyes are prominent. Very difficult to find in the grass, but with each croak it reveals itself by causing the yellow skin of the chin to become visible at the sides of the head.

No. 4. A very small brown frog<sup>3</sup>, almost impossible to see against a background of earth. It has a shrill, sharp call, kept up constantly unless approached, when it immediately ceases. It is very agile and extremely shy. It is marked with small black spots on a yellowish-brown, dark ground. Pale yellow underneath. When many of these frogs are croaking the sound produced is nearly continuous. The tympanum is evident. Found in damp waste ground outside Concepcion.

No. 5. A species of *Rana*, with dark brown markings on a greyish brown ground. A good deal of yellowish marking about it. Tympanum evident. Broad part of back without markings. Female.

No. 6. Female<sup>4</sup>. Abundant on the Camaloté leaves at Concepcion. Capable of changing its colour greatly, from bright green to dull brown. Underneath silvery. Two white streaks run backwards from the eyes. The call is a succession of sharp croaks or vibrations resembling the sound made by castanets and caused by the inflation of the throat. Until one is accustomed to the sight they are difficult to see, so well does their colour and small size protect them, but once seen, they are everywhere. They are very lively and hop quickly *on the surface* of the water by means of their hind feet, which are webbed right up to the tips of the toes. I found a small Gasteropod partially digested in the stomach of one of them.

No. 7. Male of same."

And again two days later:

"After coffee went out for a walk in the camp north of Concepcion. Found all the country under water from last night's storm. Soon heard a pretty note.

<sup>1</sup> These numbers refer to the jars or bottles in which the specimens were preserved. The quotation shows the accurate and minute care which Budgett took in collecting specimens.

<sup>2</sup> *Leptodactylus ocellatus*, L.

<sup>3</sup> *Leptodactylus bufonius*, Blgr.

<sup>4</sup> *Pseudis limellum*, Cope.



I could not tell at first whether it were bird or frog. The continual repetition from the same quarter told me that it was the call of a frog (No. 8<sup>1</sup>) which I had not heard before. I stalked him for a considerable time, and at last saw, climbing over the blades of grass which were left sticking out of the water, a minute black frog with yellow and red spots. I stalked some more, but did not succeed in finding any but the two I had at first heard. On the way back I shot a fine brilliantly-coloured lizard. In the afternoon we walked across the island to the Mission Station. Cleaned guns and had tea. As we were passing homewards we saw the Indians catch two large Skates or Sting-rays<sup>2</sup>, which were among the Camaloté. While they were lying on the bank speared through the spinal cord the large one gave birth to fifteen minute skates, with external gills, which were long and filamentous. We secured them and then started off round the island with the canoe, arriving at 8 p.m. by moonlight. On my way up from the boat we caught another frog hopping across the street by moonlight.

*Frogs.* No. 8. Found in street after dark."

Collecting in the Chaco was not all fun; there was a good deal of discomfort, wet and storm; and beautiful and interesting as many of the creatures were, many of them were the reverse of attractive. On 27th October, 1896, he writes:

"We had been walking all the afternoon in water and long grass, and when we got within sight of the camp a violent storm of wind, lightning and rain came on; we had just time to shove all our things under cover when down came the rain, and huddling round the fire we ate our rice and got thoroughly soaked. The storm soon cleared off, and after a good warming I curled up under my mackintosh sheet and should have slept soundly but for a new pest, the *polvorinos*<sup>3</sup>.

I was getting accustomed to mosquitoes and not to mind them so much, but these are too fearful for words, smaller than the midge at home and infinitely more painful. They attack one in thousands, and make one think that Dante might have got some useful hints for his *Inferno* by coming to the Paraguayan Chaco. Mosquitero is useless, one can only wrap one's head up in one's rug."

He took great interest in the natives, and recorded in the pages of his diary many observations on their habits and appearance. He also wrote down native vocabularies whenever he could get them. Writing about the Lenguas, a tribe who inhabit the Chaco, he says on 28th October, 1896:

<sup>1</sup> *Phryniscus nigricans*, Wigm.

<sup>2</sup> *Taeniura dumerilii*.

<sup>3</sup> *Simulium* sp.



"There seems to be a great scarcity of boys about 16 years old, though a good many of about 12. The Indians often kill their babes for no apparent reason. If one of the community die the Toldo<sup>1</sup> is removed. The dead are buried where they die with knees to chin. The doctors are great tyrants. If a man is ill food is kept from him; this together with the baby slaughter seems to effectually prevent their becoming a dominant race.

All the Lenguas wear round discs of wood in their ears. In the first place they are mere twigs, which are frequently replaced by larger ones.

The women are all small and fat and sometimes nice-looking. The race as a whole is very tame and do not fight, neither are they intelligent, but quite childlike, especially in their improvidence. The boys are very sharp and jolly, quite like nice English boys.

While we have meals or write there are always some of these Indians sitting round watching us. Their only garment is the woollen woven poncho; these are very well made, and will fetch in the market 20s.—30s.

They are of course very fond of beads, of which they only wear red and white. Their necklaces are made of various things, often pieces of *Bulimus* shell strung together or Cierbo<sup>2</sup> teeth. The men generally have the central part of their hair bound round in the shape of a stiff stick, which may lie forwards or backwards."

The life in the camp was very varied, and, owing to his keen interest in the anatomy and structure of all kinds of animals, Budgett spent much time in dissecting and in making many microscopic preparations. On 28th November, 1896, the following entry occurs:

"More bullock marking, continued dusty north wind and high temperature. The old bull gave a good deal of trouble, nearly hanging Mr Sibbet with the end of the lasso. Repaired camera, cleaned guns. Dissected young *Ceratophrys*, showing beautifully immature ovary and oviduct. Also the nervous system was exquisite, the sympathetic ganglia showing up bright orange. After tea went out with gun across the swamp and had a fearful time, rushes had grown high, some had fallen horizontally, so that at each step one's feet were sawn across by the fine teeth running along the under-surface of the midrib; socks were soon gone to shreds, and skin began to go. After half an hour's walk of this sort I reached the bird island, but was welcomed by such an attack from the garrison stationed there that I immediately turned and fled into the swamp

<sup>1</sup> More correctly "Toldoria." Toldo is a hut or shelter: toldoria is a collection of huts or an encampment.

<sup>2</sup> *Cariacus paludosus*.



again, fighting my way back to the Toldo, until I arrived pretty well exhausted, having only shot one small bird."

### And two days later:

"Damp day, I walked round the Monte early. Found camera out of order; spent all morning and part of afternoon overhauling it. Mounted six slides in the afternoon. Mouth parts of *Tabanus*, Antennae of Dragon-fly, Mosquito male, Polvorino and larva of some kind of beetle. Had two *Ceratophrys* brought me, also a beautiful caterpillar with orange skin and black tufts of hair. Philip brought me a fine chrysalis. We discovered that the 'bicho' which has been heard splashing in the pool is the glorious green frog<sup>1</sup>. I must catch him.

1st December, 1896. At night before 6 p.m. the green Tree-frogs<sup>2</sup> caught by the pool laid white eggs with abundance of firm jelly. Spent the whole day preserving eggs in various stages of segmentation in Corrosive Acetic, Flemming's, Perenyi's, and Van Beneden's Fluids and in Formalin. In siesta time I photoed my laboratory and myself, developed in the evening.

2nd December, 1896. Preserved more eggs of green Tree-frog, but they appear to have died at the closing of the blastopore. Collected several Myriapods and began to make preparations of their external genital organs. After tea rode out on the black horse with Kerr, and had a fine bath, Tabanos very bad. At night a beautiful *Mantis* was brought in. Wind strong from north, it obliged me to put up awning. Beautiful specimens of leaf-mimicry in locusts came on to table at night.

3rd December, 1896. Wet morning, preserved more frog embryos, only a few apparently still alive, but in the afternoon discovered that I had still another batch tightly wrapped up in a leaf. These are all developing splendidly, and clear up the doubt as to how they are laid in nature, no water has had access to them, and yet they had developed far better than those to which I had allowed water and air free access. Apparently after the closure of the blastopore the epiblastic layer sinks downward, a milky fluid passing up through it. From this sunken area arises the blastoderm as a simple swelling, later stretching back to the swelling at the edge of the blastopore. Eggs are prominent and early developed. The neural canal closes over very gradually. The yolk sac became constricted off, the embryo curling over it, no tail is formed and rudiments of limbs are formed at once. Preserved one of the tree-frogs at night.

4th December, 1896. Preserved embryos of tree-frog in morning and dissected one also at 10 o'clock in the morning. External gills are well developed, and the circulation is going on, limbs not yet formed, tail now develops rapidly. Heart beating, optic involutions quite like chick. Auditory pits large; at 3 p.m. the first pair of gills greatly developed at expense of second pair. Blood red,

<sup>1</sup> *Pseudis paradoxa*, Linn.

<sup>2</sup> *Phyllomedusa hypochondrialis*, Cope.



tail much longer. A specimen of each in Formalin. Three fine frogs of a new species were brought in from swamp. Found another tree-frog on grass. At night fine frog caught by the pond, much like the ordinary fishing frog, and also much like the common frog found at Concepcion."

One more quotation from the South American diary must suffice. It was written on the 27th March, 1897, on the return of the expedition to Asuncion on their way home:

"At 6 a.m. we started on again through six leagues of Picada<sup>1</sup>, passing under giant trees which almost shut out the light and kept us pleasantly cool, smaller trees of every description grew beneath these giants, while below these again was a very great variety of ferns, the tree-ferns standing sometimes eight or nine feet high. Sometimes we would have a long stretch of fairly level ground with nice soft sand where we could gallop; but more frequently we were clambering up and down steep water-courses with little rivulets running along the bottom of the gully. Sometimes even we had to lead our horses up and down these.

All the way along we were accompanied by scores of beautiful butterflies, often from one piece of dung we would disturb five or six great blue *Morphos*; these would then easily and gracefully flap their brilliant wings and circle round us as we rode.

But when we came to the little streamlets in the gullies, at first I could not believe my own eyes, for here and there were great flocks of butterflies sitting about over the rocks in masses of colour according to their species. There would be perhaps a patch two yards square literally covered with a large yellow butterfly, something like a Brimstone, only twice as large, the males being of a bright orange colour. Then a yard or two away there is another patch, perhaps more compact, composed of a fine species of a rich brown colour with a double bar of white and orange, stretching right across the four wings and the body. A little further there would be a patch less densely but uniformly populated with a variety of species, from a brilliant little fellow, red and blue above with concentric circles of sulphur below upon a black ground, to the huge *Morpho* with his blue wings measuring six inches from tip to tip. The large sulphur patches were perhaps more frequent. Then as one looked down into the gully, besides this Lepidopteran carpet of idleness covering the rocks, the air would be alive with more busily engaged individuals, partly of those already mentioned, but certainly also of the flashy energetic *HELICONIIDAE* with their brightly striped wings of black and red or orange; their mimics the *DANAIDAE*<sup>2</sup> were also there. But when I walked my horse into the stream, and dismounted to let him drink,

<sup>1</sup> A path cut through the forest.

<sup>2</sup> The South American Danaidae are now separated as Ithomiidae. The Ithomiidae have colour resemblances with both Heliconiidae and Pieridae.



the air seemed filled with the flapping of flimsy wings which gently fanned my face, and, as I waited a moment or so, they began to resume their basking, the social species collecting in their flocks, while the more varied assemblages settled everywhere. Twenty-five were perched upon me at one moment, the smallest measuring more than two inches across the wings, six were upon my gun barrels, my horse too was pretty well covered, while a great *Morpho* had alighted upon his forelock.

Truly one felt here, among the luxuriant fern foliage and clouds of coloured wings, almost overwhelmed with the abundance of life.

We came out about midday at the far end of the picada, and felt the heat of the sun in the last, shadeless, part of our ride very much. After another three hours' ride over some steep hills we arrived at Caa Guazú, the village of call for the Yerba<sup>1</sup> tramps. It is a most uninteresting place, and we felt glad that Caa Guazú itself was not what we went out for to see. The village consists of a solitary square upon a hill, with its four sides of attached thatched houses looking rather like farm buildings. The church (a thatched barn) stands in the centre of the square with its little belfry close by. This is all there is to say about the place. We were made fairly comfortable in a little store or public place, and started for Villa Rica again next morning at 7 a.m."

The expedition returned to England in the summer of 1897. It had been brilliantly successful. It brought back a large supply of fully grown specimens of *Lepidosiren paradoxa*, up to this date a fish so rare as to be seen only in a few Metropolitan Museums, and for which as much as £50 a piece had been paid but shortly before the expedition started. It also brought back a complete series of *Lepidosiren* eggs in all stages of development and a collection of the various phases which the larval *Lepidosiren* passes through. It was a remarkable feat. To go straight as an arrow to the place where this almost unknown fish lives, to arrive at about the time of the breeding season, quite unknown before, and to collect and preserve all the delicate and varying stages of development within some seven months, places the expedition in the first rank of Zoological exploration. But there is another factor which makes it even more remarkable, and that is the wonderful condition of the material when it arrived. Every zoologist knows the difficulty of preserving animals and eggs, which have not been worked at before, in the best way to render

<sup>1</sup> The so-called "Tea" or Maté of Southern South America.



permanent the minute details of microscopic structure. Even in the laboratory with every reagent and appliance around one, one often fails. The difficulty in improvised rooms, worried by all sorts of insects, by torrential rains and occasionally floods, by inquisitive and highly suspicious natives who have no glimmering as to what you are after, not forgetting the care of the horses and the need of provisioning the camp, must have been enormous, but it was overcome. The material brought back was preserved so that the finest histological details were revealed and this is true not only of the *Lepidosiren* but of the Amphibian collection which had been Budgett's special care. The success in this respect was certainly partly due to his skill in manipulation and his peculiar knowledge of the use of reagents.

On his return to Cambridge Budgett had to take up the task of reading for the Second Part of the Natural Sciences Tripos. He was never a good subject for examinations. His natural modesty made him distrust himself, and on such occasions he did not do himself justice. His reading had of course suffered during his visit to South America, although he took with him a number of standard zoological works, and diligently perused them in the Chaco; he also added much to his knowledge by constant dissection and careful observation. Still he had many drawbacks; and when the class-list came out in June, 1898, and his name was in the Second Class, his friends and he himself were pleased.

He almost immediately set to work upon his collection of South American frogs, some of the results of which appeared later in the year under the title "Notes on the Batrachians of the Paraguayan Chaco<sup>1</sup>," the memoir already named.

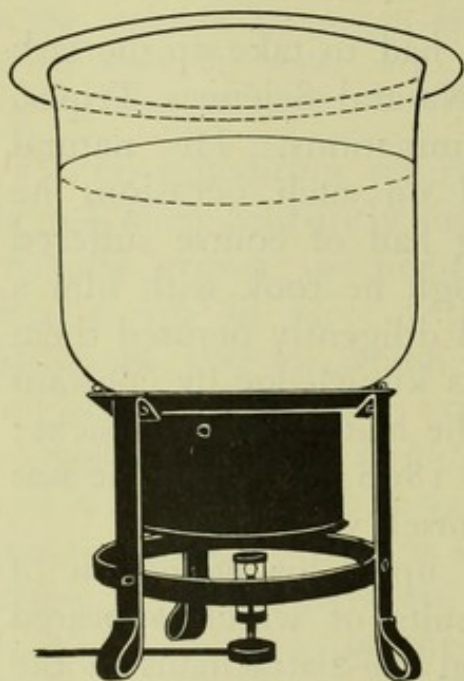
Budgett was a gifted draughtsman, and the figures which illustrated his various memoirs were both artistic and accurate. At times he made the most charming water-colour sketches, and

<sup>1</sup> The full title is "Notes on the Batrachians of the Paraguayan Chaco, with Observations upon their Breeding Habits and Development, especially with regard to *Phyllomedusa hypochondrialis*, Cope. Also a description of a new Genus." It appeared in the *Quarterly Journal of Microscopic Science*, Vol. 42, N.S. 1898.



two I possess of scenery on the Gambia show a great artistic power of depicting water and sky.

It was about this time that he made several improvements in an apparatus originally designed by Professor Graham Kerr for reconstructing solid figures from microscopic drawings. The principle of this apparatus consists in drawing each section on a plate of ground glass whose thickness bears a definite relation to the thickness of the microscopic section. Then the square plates of glass are placed one behind the other in a series, and the whole is immersed in a bath of oil which eliminates the opaqueness caused by the roughened glass, and allows a solid figure to appear which represents an enlarged view of the object cut into sections. Put thus shortly the matter seems simple enough but in practice



Tropical Aquarium.

there are many difficulties. Budgett showed his usual ingenuity in constructing devices to centre the glasses—a very important but a very difficult matter—and his exceptional knowledge of reagents in trying to find an oil which permits the maximum of light to pass through the bath. He also devised a Tropical Aquarium which has recently been figured and described by Mr E. J. Bles<sup>1</sup>, of Glasgow University, who has used it with great success in the rearing of *Xenopus*.

But all this time, and indeed long before, when he was in the swamps of Paraguay, his thoughts had turned to one of the great unsolved problems of Zoology. There are a couple of remarkable fishes called *Polypterus* and *Calamichthys* found only in the rivers of Africa, the sole survivors of a vast group which flourished in the Palaeozoic and Mesozoic Periods. We knew little about them, little of their anatomy, nothing of their habits,

<sup>1</sup> *Transactions Roy. Soc. Edinburgh*, xli. 1905, p. 794.



and nothing of their development which might throw much light upon the origin and upon the relationship of fishes. This problem Budgett determined to attack, and for the next five years, in spite of delay, in spite of every kind of discouragement, he followed his quest with dauntless courage, and in the end he succeeded. The measure of his success is written in this volume, but by another hand than his.

He at first thought of the Nile as the best river for his purpose, but at the suggestion of his friend, Mr P. L. Sclater, he chose the Gambia as the scene of his first exploration. He made careful preparations, and had a number of excellent figures of *Polypterus* prepared by our well-known Cambridge artist, Mr E. Wilson, which he afterwards used in explaining to the natives the fish he sought. On the 19th October, 1898, he sailed from Liverpool on the s.s. *Dahomey* for Bathurst at the mouth of the Gambia, which he reached on 3rd November. As usual he kept a diary, and though travelling alone, thousands of miles from anyone who sympathized with, or even understood, his aims, the diary contains no word of complaint, and hardly a mention of the dangers and difficulties he underwent. During his stay on the Gambia, which lasted over eight months, he made his headquarters at McCarthy Island some 150 miles from the mouth of the river. Here he met with much kindness from the officials, especially from the late Mr P. Wainewright, Travelling Commissioner, with whom he stopped at the Government House which he thus describes:

"The house itself lies back from the river and near it lie two or three ruins of the barracks of former days. All is now waste and overgrown with bushes and jungle. There are but four stone houses at McCarthy, the African huts lie further back."

As usual he paid great attention to the local fauna, and such entries as this are common:

"Walked out, passed the Cemetery, after early tea, and saw vast quantities of birds. Three sorts of Jays, one of which I shot, innumerable Finches. Shot one Pigeon for the pot on the way back. I noted the call of the English



Redstart, and there he was. I am not shooting birds for skins yet, as my supply of cartridges has not arrived.

The rest of the day I spent in unpacking boxes. In the evening I walked out with gun and shot a fine Spurwing Plover and a Pigeon. Missed right and left at Partridges. I walked along the edge of the swamp where the Mud-fish was said to abound. Here two small boys promised to bring me the same of every size. A man begged the leg of my Plover of me, as I returned, to use as 'medicine.'

When having my bath I caught in it three small *Hylas*. Skinner, the B.T.C.<sup>1</sup> man, brought me in the evening a small *Gecko* caught in the house. This creature has the reputation of being very poisonous, and of coming to one's mouth while asleep in order to obtain moisture, thus poisoning the saliva. Skinner had charred the head in order to kill it, so that it is valueless as a specimen."

The first mention of finding the *Polypterus* is I think that of 15th November, 1898:

"When I got back I found that a very fine *Polypterus* had been brought for me, and was now in my aquarium. He was about eighteen inches in length, and spread his great pectoral fins on the bottom, using them like a seal's paddle. He snapped up greedily two beetles floating on the surface; but shortly after slowly died. The natural colour is a dirty straw colour with shadings of black above. While alive in my aquarium he was extremely lethargic."

There are numerous other references to the "Sayo" as the natives call the *Polypterus*, but these will appear later in Professor Graham Kerr's article.

From time to time he accompanied Mr Wainewright on his tours through the district under his charge, and lived under all sorts of varying conditions. Thus on 24th November, 1898, he writes:

"The village of Nianimaru is the first African village that I have really lived in after the fashion of a native. The compounds are all placed close together, and the passages left between them constitute the streets of the town. The walls of the compound on either side of the street are six-foot wattles. Many of the huts look quite picturesque, being covered with the green leaves of climbing vegetable marrows."

At times things were dangerous:

"About 11 o'clock at night a man tried to get into the hut where we slept, but stumbled over the native boy who slept at the door.

<sup>1</sup> Bathurst Trading Company.



Then Wainewright heard two men at the other door, which was lightly barricaded, discussing the possibility of killing the white men. So we got the interpreter to sleep outside the hut, and we held our pistols in readiness, and passed the rest of the night in quietness."

On 12th December, 1898, when on one of these expeditions, he nearly got lost, as he records in his diary :

"Started away from McCarthy at daylight, and soon after leaving Larima Kota had the offer of horses to ride, which we readily accepted, and put on our own saddles. We passed through sparsely wooded country, now covered with canes about ten feet high, which later in the season die down and turn the country into magnificent game country. Passing through Fetu we had some fine cow's milk, and had to take on fresh carriers. About 11 a.m. we got to Dem Fai and were well received. Wainewright and I had a long talk after breakfast, and then I slept, and did my writing. At 5 o'clock I went out shooting, and on the way back lost my bearings, and almost made up my mind to spend the night in the bush. But listening I heard the sound of an ass, and made my way towards it; then I heard a cow low and made for this; and at last struck a road which led me to Dem Fai, but not the one I wanted. One of the people, however, led me to the right one, and I was much rejoiced to see Wainewright's lamp."

Whilst seeking for the breeding places of *Polypterus* Budgett had many opportunities of observing and collecting other fish. He brought back considerable collections, especially of the mud-fish or *Protopterus*, called by the natives "Cambona," whose habits he carefully studied. On 12th January, 1899, he writes:

"Two Cambona cocoons which I had put into the pond were dissolved this morning and the Cambona are swimming about as lively as possible.

I tried to kill one to-day, but found it tremendously tenacious of life. The mark on the tail, where the mouth of the cocoon is sealed, remains for some time upon the side of the fish's tail. Twelve Cambonas have been brought me in all."

And again on the following day :

"More Cambonas brought me, about fifteen altogether. Put a small one into the *Polypterus* tank, but it scared them so that I had to remove it. For a long time they remain without moving, the limbs being glued to the sides by mucus. When freed they remain hanging vertically in the water with mouths at the surface. When first opened from the cocoon they will give a very sudden bite if handled roughly. I have turned three into my pond."



And later :

"14th April, 1899. Went out with men digging Cambonas. I learn that the largest Cambonas are found in the lower parts of the island where the ground is damp. Here they do not make a regular cocoon, but have the epidermis of the head only slightly dried, the tail does not even cover the head. At the beginning of the rains the holes will be found filled with water, while the surrounding ground is only moist.

From experiment I find that under these conditions the Cambona frequently glides up the hole to the surface of the water to breathe air. When the ground is flooded the Cambona quickly leaves its hole and swims freely in the water. If the water dries up it again makes a new hole. Shortly after the ground is well flooded the Cambona lays its eggs, not in a hole in the ground, but merely on the bottom of the swamp, having first made a shallow nest by clearing the grass.

The smaller Cambonas found in the rice swamps in dryer parts of the island make a regular cocoon by a secretion from the epidermis; this is very tough and air-tight, the only opening being into the mouth by a tube, formed from the cast of the mouth.

Where the Cambona has dried up very much, the tissues seem to undergo a regular degeneration. In some cases a large portion of the tail overlying the head and also the front part of the head are entirely absorbed. In this case when set free in water the tissues appear to be gradually regenerated."

And :

"14th May, 1899. Put two Cambonas in aquarium. Re-arranged latter. A Cambona which I have had alive in the pond for a long time, and which had had its limbs chopped off, has regenerated them all, and one which came out of its chrysalis with the fore-part of the head absorbed, and also a large slice of the tail, has completely regenerated them."

And on 1st June, 1899 :

"Had more Cambonas brought, but cannot get more than one to live at a time in the tank; they always 'go for' one another, but when put in a place where there is plenty of mud it is all right. Had a tortoise brought me.

After the rain, all over the ground are countless winged termites and workers. As fast as they came up they were devoured by large *Scolopendras*. Find that the Cambonas which were put in water a fortnight ago had all developed eggs.

Labelled birds. Quite impossible to work by lamp in the evening because of the quantities of insects; termites, beetles, Homoptera.

Max. temp. 36° C. dry.

Min. temp. 26° C. dry."



In February, 1899, he came down to Bathurst, and was received, as he always was, in the kindest way, by the Governor, officers and other residents. On his return voyage to McCarthy Island on 15th February, 1899, he writes:

"At Nianimaru I found that my canoe had been recovered, and I sent the fisherman ashore in it. From here the river struck me as more beautiful than I had seen it before; the water-side shrubs seemed to look very fresh and green, while many of them, as well as the palm-trees, had assumed a most brilliant variety of tints.

At Sukatoa the contrasts of colour were very striking. Three vast pyramids of ground-nuts were piled in the clearing, up which the natives were clambering with their loads, clad in white, blue and red flowing pangas, tall monkey-bread trees formed a pinkish grey background, with here and there a towering cotton-tree; on either side of the clearing the banks were lined with laurel-like shrubs whose terminal groups of leaves were red as in the *Poinsettia*; behind, a row or so of a quaint branching palm of small growths, which bear a fruit that is said to cause a conflagration by spontaneous combustion. Behind them again the graceful Piaswa palm from which a valuable fibre is obtained, and, finally, a dense belt of forest and tangled undergrowth and creepers from which at intervals there rises up a waving majestic Rung palm.

Three smart cutters lay at anchor in front of the wharf, discharging their cargoes of nuts, and giving the finishing touch of brilliancy, by their characteristic painting of blue and white, to what to me was a fascinating picture. This place I have passed many times before, but have never been so struck.

Arrived at McCarthy I went ashore with Tuke of the "Magicienne." Showed him the ruins of the Barracks, and sent him over to Tamu Koti to see an ancient burial ground."

Towards the end of April he made an expedition up the Gambia as far as Netebulo, the highest navigable point, with a couple of English mineralogists, Mr Rey and Mr Picard, and Mons. Irimel, a French prospector, all of them seeking gold. One or two extracts from his diary at this time give some idea of the sport to be obtained on the Gambia:

"22nd April, 1899. Went ashore early for a little at Beru. Put my hammock up in the bows where it was beautifully cool and there was a fine view. Now and again we would pass through a range of hills where were high cliffs overhanging the river. In one such place we saw a large antelope of



a very light fawn colour. We found a dead Dakoi or Roan Antelope<sup>1</sup> in the river, also some vast 'Hippos.'

We got to Yabutenda about 3 p.m. and stayed there until after dinner. I went ashore and got a couple of Sand Grouse. Then we started on in the lighter and left the "Madge."

A beautiful moonlight night, not a sound but the splash of the oars. We talked until late and then slept soundly, to wake up on

23rd April, 1899, at the wharf of Netebulo. We found that the town was four miles away, so decided to camp by the river side. This is the highest navigable point of the river. There is a very sharp bend with precipitous cliffs overhanging the river, and at the curve of the bend there is a grassy level. This is a famous place for shooting game as they come down to the river to drink.

Rey and Irimel went up to the town, Picard and I went out shooting. We saw Antelope in the distance and stalked them a long way; they turned out to be Roan Antelope, and just as we got within shooting distance they twigged our white helmets and started off.

We came back to breakfast. Just finished, and back came Rey and Irimel with the king's son. We were to wait until the next day for porters to carry up the loads.

All the baggage was put on shore and we spent the afternoon on the top of the cliff under shady trees.

Pitched tents by river side. After dinner we went out to try to get some game. Heard a lion coming towards us and slipt up trees till moon went in, saw nothing and came back.

24th April, 1899. Hot morning. The king came down and all the baggage was fetched up to the town. The town is large and compact, the king's house is made of very high mud walls. We were put into a comfortable compound and many delicacies were brought us.

The king and his son soon paid us a formal call, bringing fresh milk, etc., etc. It was most amusing. We returned his call, and he showed us all round his establishment and harem.

25th April, 1899. We were to have gone out early, but the huntsmen did not turn up until the sun was up. However, we soon came across a fine Senegambian Hartebeest<sup>2</sup>, I had two shots at him, and then gave chase; as he passed quite close to us he fell down. I followed him up for some way, but he escaped wounded. Shortly afterwards we came across a large herd of the same, just returning to the hills, but they snuffed us and were off.

Then we saw two small deer, but the sun was too high, and we had to go back. Tracks everywhere of every kind of Antelope. I got a fine pair of horns of *Tragelaphus spekei* in the town.

<sup>1</sup> *Hippotragus equinus*.

<sup>2</sup> *Damaliscus corrigum*.



The king's son has been educated at St Louis, he talks French well and seems a very nice fellow. They both came in again to-day after breakfast and we exchanged signatures. He requested me to make known to the traders in the Gambia that he was most pleased for them to come over the border and trade, and that they would get every protection.

I intend starting back the day after to-morrow. The gold-seekers hope to start the next day, and have about a month's bad travelling.

In the evening we all went out shooting and saw several antelopes, but could not get near them. Came back to get a few hours' sleep.

Max. temp.  $41^{\circ}$  C.

*26th April, 1899.* Started off an hour before daylight with huntsmen. We soon came across a herd of Hartebeest, and stalking up to them I got a very good chance, but had a bad cartridge in. We then went on and soon came across three Tankong, waiting for them they came fairly close and I fired at one and the huntsman at the other, without stopping them.

I then saw a very small Antelope, but could not get near it. Again a solitary Senegambian Hartebeest. The sun was up now and I wended homewards. Hunted a flock of Guinea hen, but did not get them. Last night I picked up a fine skull and horns of the Senegambian Hartebeest.

The town of Netebulo is by the side of a series of springs forming in the dry season an underground stream.

I gave Sandian my red blanket for present. We changed films and took 'photos' of the castle.

Very pleasant evening. I am to carry many letters back.

Max. temp.  $39^{\circ}$  C."

As the wet season came on and the heat increased, the entries in the diary became shorter, and his work became more difficult to pursue. The frequent illness of his friend Mr Wainewright caused him constant anxiety.

On 27th May, 1899, he writes :

"Worked in the swamp between the showers of rain. Read and wrote. Wainewright better in the evening. Went out shooting first at a bush fowl flying overhead, and this immediately gave rise to a perfect pandemonium, for Jatto started off after it, and then thought I was after the dog-faced baboons, for we were, I saw then, surrounded by two or three hundred monkeys, some of them gigantic brutes. They began to go for the dog, and he then ran towards me, dropping his tail. I walked quietly on, the brutes following me a little way. I was very glad to leave them behind. Some rain again at night.

Max. temp.  $26^{\circ}$  C. dry.

Min. temp.  $23^{\circ}$  C."



During the month of June he dissected many specimens of *Polypterus*, and although their ovaries contained ripe eggs, and although in spite of rain and heat he sought diligently in the streams and backwaters, nowhere could he find the developing ova.

On 4th July, 1899, he tried to fertilize artificially the eggs of his fish, having some dozen Cambonas and twenty Sayos (*P. lapradii*) with ripe ova to work with, but on the following day he writes "Artificial fertilization has failed. Am a little bit seedy to-day. Not able to do much."

He was also trying to keep the fish in large wire cages or enclosures in the river and lagoons, but they failed to breed, and about this time he had the additional disappointment of mistaking the eggs of another fish, which subsequently turned out to be probably a species of *Hyperopisus*, for the eggs he sought. Toward the end of July he was again ill and confined to bed with fever; and on the 28th of that month he started for the coast, and having stayed about a week at the Government House at Bathurst he sailed for home.

He had not succeeded in his quest but he had acquired much useful experience and had made many valuable contributions to our knowledge of the fauna of the Gambia. During the autumn of 1899 and the spring of 1900 the following three Papers (i) "Observations on *Polypterus* and *Protopterus*<sup>1</sup>"; (ii) "General Account of an Expedition to the Gambia Colony and Protectorate in 1898-99<sup>2</sup>"; (iii) "List of the Fishes collected by Mr J. S. Budgett in the River Gambia," by G. A. Boulenger, F.R.S., F.Z.S., with notes by J. S. Budgett, F.Z.S.<sup>3</sup>, were published on the results of his expedition.

Although Budgett had not succeeded in bringing back the material he sought, he had determined the time when the *Polypterus* breeds, and with great courage he again revisited the Gambia in the rainy season of 1900.

He reached McCarthy Island on 6th June and was astonished

<sup>1</sup> *Proceedings of the Cambridge Philosophical Society*, Vol. x. 1899.

<sup>2</sup> *Proceedings of the Zoological Society of London*, Nov. 1899.

<sup>3</sup> *Ibid.* May, 1900.



to find "the country as dry as a bone." He set about constructing floating cages and wire enclosures, and very soon had them stocked with fish. The country was in a disturbed state, and he records a sad tragedy on 19th June, 1900:

"News has arrived that poor Sitwell and Silva have been ambushed and shot with their interpreters, cooks, Sergeant Cox and nine policemen. Details are not forthcoming, but plenty of rumours. There is some uneasiness here about the natives of Wuli and Sandugu.

In the early morning I made a fourth enclosure.

Mardeke called this morning to give the news. Iamei Ujorka called this morning, he seems straight.

I had two *P. lapradii* brought this evening.

Min. temp. 24° C.

Max. temp. 34° C.

20th June, 1900. A cutter has come up saying that the Commissioners were holding a palaver at Sankandi, when there was a sudden uproar and they were all set upon and slaughtered to a man, including the police force. The bodies were burnt with grass and the town destroyed by fire, the people all clearing over to the French country. All their throats were cut.

One Frenchman has died of yellow fever. Ingman is down with it.

The M.K.<sup>1</sup> has not come up. No mails and no news.

Dembo Dausa the messenger of Musomola says we are quite safe here."

For the next three months he worked incessantly, and in spite of the heavy rains and consequent floods he achieved much. He traced the development of *Gymnarchus niloticus* and made innumerable observations on other fish and on his favourite frogs, on mosquitos and on other insects. He added to his knowledge of *Protopterus* and collected material for the study of its development. On 1st August, 1900, he writes:

"Light rain in morning. Went over large specimens and made up new spirit. About midday Sory came to say he had found a Cambona nest. I went out immediately to the far swamp, and there, where water had entirely dried up, were several holes in the mud amongst the grass full of water. In one of them the tail of a Cambona was ceaselessly lashing to and fro, thus causing the surface water to penetrate the nest, which was a long hole coming to the surface again some feet off.

<sup>1</sup> The "Mansah Kilah," the river steamer.



On being startled, he fled off down the hole. The entrance to the hole was full of larvae identical with those of *Lepidosiren* only about half the size.

Four plumose pairs of external gills were placed just anterior to and above the budding limb. Pigment was beginning to appear about the head region.

The water in the hole was very muddy, and the larvae could only be seen occasionally, as they swam up to the surface. I collected a large number from three similar nests, all where there was no surrounding water. They were all in the same stage. The mudfish in the hole, tending the eggs, was a male.

The circumstances under which these nests were found were, I think, exceptional, since for nearly three weeks we have scarcely had any rain, and the water where the holes were found was a foot deep a week ago. I hope shortly to get eggs now that the nests have been seen.

The rain is now coming down in sheets, and the thunder is crashing. I preserved another batch of the "Suyo" larvae<sup>1</sup>, the external gill filaments grow quite as much as the body. They are now a perfect sight, the yolk sac being an inch and a half long with an anterior and posterior efferent and afferent blood vessel, while the gill filaments are a quarter of an inch long. The body is about an inch and a quarter long, the tail absolutely diphyercal and showing no sign of the whip-like appendage of the adult. Pigment is abundant on the head, and the jaws may now be seen opening and shutting.

Max. temp. 31° C.

Min. temp. 27° C.

2nd August, 1900. After very heavy rain last night, light rain this morning. Cleaned out aquarium and put in rain water. The larvae do not like it.

Made drawing of larval *Protopterus*. Preserved six more *Protopteri*. Fed fish in evening, got caught in rain. Brought in twelve more larvae of the Suyo, they now begin to look quite like small *Gymnarchi*, though the external gills are still increasing in length. The swim-bladder has appeared. The larvae keep fairly well, and tend to cling temporarily to the side of the glass.

Max. temp. 31° C.

Min. temp. 26° C."

### And again on 6th August:

"Went out to swamp with Sory; hunted for Cambona and Suyo eggs. Found two Cambona nests, one with advanced larvae, the other apparently not yet laid.

These nests were both in quite shallow water, not more than six inches. From the deeper water a way led up to the hole where the grass was brushed aside at the end of the way, a small hole running some distance underground and coming to surface again a yard off. One of them branched.

<sup>1</sup> These subsequently turned out to be larvae of *Gymnarchus niloticus*.



In the afternoon I brought away a large number of larvae. They do well in a jam jar half full of water, where they cling to the side of the glass. They hold their gills at right angles to the body, when at rest, very elegantly."

And two days later:

"The Cambona larvae when in glass vessel hang on to the sides with their suckers and keep their gills out at right angles to the body and bent slightly forwards."

The last entry in his journal on the trip is on 12th August, 1900, and reads as follows:

"Preserved Cambona eggs. Went out to the nest and got a fresh lot. The gill-folds are now becoming conspicuous, the eye and pronephros, also the folds of brain, are visible.

The fishermen came back, five of them not having caught one Suvo in two days.

This year though in all 127 *P. senegalus* and 36 *P. lapradii* have been got by me, yet by far the greater number were got by bailing little inlets from the river; a certain number in my trap, and a few in the basket. Last year, at one particular time, hundreds were caught in the last way.

This opportunity has not presented itself. It is now practically impossible to get Suvo. I do not think it is that they have not come up, but I think that they have spread away far more gradually this year, and having once got into the swamp cannot now be caught.

I had wanted to try artificial fertilization on freshly caught specimens. I shall now wait to see if my fish in the enclosures spawn, and as in last resort, shall try artificial fertilization on them.

Max. temp. 30° C.

Min. temp. 23.5° C."

On Budgett's first return from the Gambia to England in the autumn of 1899 he found the country on the eve of the South African war. He had always been very patriotic, and, as in so many cases, his love for his country was strengthened and deepened by what he had seen abroad. At the outbreak of hostilities he felt very strongly that he ought to go out to the front as a volunteer, and he had precisely the character and the aptitude essential to the making of a soldier. At the same time he was far from strong, and was liable to recurring attacks of malaria



acquired in the American and African swamps, so that his friends felt greatly relieved when finally he abandoned the idea of volunteering for the front. But he felt the urgent necessity of training men for the defence of their country, and he joined the Mounted Infantry section of the Cambridge University Volunteers. For the next three years the care of the "M.I." or "Mounted Infants" as they are called, was that to which he devoted all his spare moments.

My friend, Lieutenant W. St A. Warde-Aldam of the Coldstream Guards, has kindly written the following account of his work with the section:

"Budgett was a very good example of the saying that the  
"busiest people can find time for everything. In the middle of  
"all his scientific work, he was one of the most proficient and  
"hard-working members of the University Volunteers. He joined  
"the Mounted Infantry section when it was first formed in 1900;  
"his character and experience at once showed his value; and in  
"July, 1901, he took over the command of the section, becoming  
"its first commissioned officer. This command he retained till  
"the time of his death. During these two and a half years he  
"developed the organisation and efficiency of the Mounted  
"Infantry in a very marked way: he helped to institute an  
"annual volunteer Gymkhana, in connexion with which he  
"started a Gymkhana Club; he organised funds for hiring and  
"insuring horses; he arranged fortnightly field-days, and annual  
"route marches; he trebled the number of members attending  
"camp; moreover he established the section on a permanent  
"basis as a University institution.

"In connexion with the 'M.I.' Budgett made many friends  
"among the Inns of Court Rifle Volunteers, to whose Mounted  
"Infantry Company he was attached for a week's camp in August,  
"1901. In the following April he spent a month at the Yeomanry  
"School at Aldershot with a class of some twenty Yeomanry  
"officers. Thus he lost no time in studying the professional duties  
"of his new commission.



“His character was perhaps more prominently brought out by his objects and methods than by their results. His objects are best given in his own words: ‘1. To foster and turn to a useful purpose the love of riding in members of the University. 2. To train those members, who are fond of riding, to be efficient soldiers. 3. To induce a large number of members of the University to join the Auxiliary forces on “going down.”’

“His method was the deliberate and gradual ‘building up’ of a social system; he was just the man to be the heart of such a system. His travels had enhanced the value of his natural gifts of tact, method, broad-mindedness, capacity for work, and capability to command; they had also given him a large knowledge of men, and a practical experience of many of a soldier’s duties.

“Budgett applied all these gifts to his new interest with a keenness balanced by forethought; it was characteristic of this latter, as well as of his modesty, that he was continually trying to avoid centering anything on himself; he often used to explain how the section ought to be worked automatically, and without his guidance being necessary.

“He was a personal friend of every member of the ‘M.I.,’ and always welcomed them and their friends to his rooms; he always endeavoured to keep up this friendship after they had ‘gone down’; on the day he sailed from Liverpool for the last time, he wrote, ‘Whether I am connected officially or not in the future with the “M.I.,” I shall do my utmost to get together at least annually as many as possible of those excellent fellows who have worked together so well.’ It was this spirit that gave so much force to his example, the reality and value of which were so thoroughly brought home to his ‘M.I.’ friends by his untimely death.”

Budgett was always an enthusiastic member of the Cambridge University Natural Science Club, a somewhat exclusive body whose members are limited to twelve undergraduates and a few graduates.



He was elected in 1895, his first year, and was a constant attendant at their Saturday evening meetings, where immemorial custom limits the refreshments to coffee and anchovies on toast, which long-established tradition compels us to call whales. He was Secretary to the Club in the Michaelmas Term, 1897, Vice-President in the Easter Term, 1898, and President in the Michaelmas Term, 1899. He read the following four Papers before the Club:

- "The Monotremata" .....on 8th Feb. 1896.
- "A Zoological Journey in South America" .....27th Nov. 1897.
- "Fishing in the Gambia" .....4th Nov. 1899.
- "Natural History of some West African Fishes"...10th Nov. 1900.

He was also a member of the Cambridge Cruising Club, which he joined in December, 1897, and took keen interest in the periodical sailing matches which the Club holds from time to time on the Ouse, but I believe he never attended any of the Annual Meetings on the sea-coast. He was placed on the Committee, and elected Librarian in February, 1901. He read one Paper before this Club entitled "Life on a Gambia Cutter" (12th February, 1900) which was reproduced with illustrations in the "Yachtsman," 15th March, 1900. Latterly, too, he joined the Pitt Club, and after taking his M.A. Degree usually dined there. During his absence on the Gambia in December, 1898, he had been elected a Fellow of the Zoological Society and in February, 1901, he was elected a Fellow of the Cambridge Philosophical Society.

In May, 1901, he was appointed Assistant Curator in the Zoological Museum, and during the year that he held this post he made the wonderful series of preparations which add so greatly to the beauty of the University collections. To him an anatomical preparation was a work of art, and no trouble was for him too great if in the end he could make it tell its story simply and completely. He was constantly devising new methods, and experimenting with new reagents and materials, and would mount



an object over and over again until it satisfied his high standard. During the following year (1902) he used to give two or three hours in each day to this task, while the rest of his time was spent in working up the valuable material he had collected on the Gambia. He published the following four Papers on his results, though the last of them did not appear until six months after he had left for Uganda.

- (i) On some points in the Anatomy of *Polypterus*<sup>1</sup>.
- (ii) On the Ornithology of the Gambia<sup>2</sup>.
- (iii) On the Breeding-habits of some West African Fishes, with an Account of the External Features in Development of *Protopterus annectens*, and a Description of the larva of *Polypterus lapradii*<sup>3</sup>.
- (iv) On the Structure of the Larval *Polypterus*<sup>4</sup>.

During the Lent Term, 1902, Budgett delivered a course of lectures on "The Geographical Distribution of Animals" for Professor Newton, who had recently given up lecturing. He had much first-hand knowledge of the Vertebrates of South America, Africa and his own country, and the course was greatly appreciated by the comparatively few students who study this subject.

About this time he became acquainted with the Rev. John Roscoe, of the Church Missionary Society, then resident in Uganda. Mr Roscoe, who was spending the winter in Cambridge, was unusually well-informed both as to the natives and the natural history of the country in which he had been so long a resident, and he was convinced, and succeeded in convincing Budgett, that his best chances of procuring the developing eggs of *Polypterus* was to visit the Albert Nyanza and the neighbouring streams.

In March, 1902, he was elected to the Balfour Studentship, which may be regarded as the Zoological blue ribbon of

<sup>1</sup> *The Transactions of the Zoological Society of London*, Vol. xv. April, 1901.

<sup>2</sup> *The Ibis*, July, 1901.

<sup>3</sup> *The Transactions of the Zoological Society of London*, Vol. xvi. August, 1901.

<sup>4</sup> *Ibid.* October, 1902.



Cambridge. The income of the Studentship, aided by a grant from the funds in the hands of the Managers, and by a further grant from the Zoological Society, made the projected trip possible, and after the most careful preparations he started at the end of May, sailing for Mombasa from Naples on the 6th June.

He reached Mombasa on 24th June, 1902, and at once "called on Sir Charles Eliot, who had not had instructions concerning me, but was very agreeable." His impressions of the seaport are interesting:

"The town of Mombasa is rather picturesque, though I think it lacks trees. What surprises me most is the apparent smallness of the trade here, just a few stores to fit out caravans for the interior and that is all. Bathurst on the Gambia is an imposing city compared to this. The number of officials' residences is great, and they are nicely situated overlooking the sea. The whole place is very gay with bunting for the 26th" [the date at first settled for the King's Coronation].

He travelled part of the way up to Victoria Nyanza with Sir Charles Eliot, the Commissioner of British East Africa, and crossed the lake to Entebbe with him, where the Commissioner was received with a salute of ten guns. The next nine days were occupied in arranging his "safari," a Swahili word which seems to serve both for a caravan and for a trek or march.

In addition to procuring the eggs of *Polypterus* the expedition had a second object, which was to see if anything could be done to procure a live *Okapi*, and for a time this greatly occupied Budgett's thoughts, but finally it had to be given up.

Whilst at Entebbe Mr Walter G. Doggett, a son of the well-known naturalist at Cambridge, who was shortly afterwards drowned in the Kagera river, called upon him, and they discussed the *Okapi*, Doggett being most anxious to accompany him on his expedition.

On the 11th July, 1902, the "safari"

"Started with forty porters, four askaris, two headmen and four boys. I started on the 'bike' an hour later by the bicycle road, and overtook the porters and went on, waiting for them where the two roads crossed. Passed through varied country, in places patches of luxuriant forest."



Next day an entry appears which is the first of those indicating that the search for the *Okapi* may perhaps be given up:

"The fact that from all accounts the *Okapi* does not live in British territory, that males and females have been got, and that *Polypterus* is apparently much more plentiful in the swamps of the Upper Nile, has induced me to make a trial of the north end of the lake first, then back to the Semliki."

On 14th July, 1902, the "safari" started on an eleven days tramp to Hoima, which lies east of Albert Nyanza, about half-way along the lake. Wherever he could he rode his bicycle, which attracted a good deal of notice from the natives, many of whom had never seen one.

"Started for Hoima 7.30 a.m. I started an hour and a half later. Curving round the Protestant Mission Hill the road passed the Tomb of King Mtesa and then went straight N.N.W. through almost endless elephant grass, in the lower parts Palm groves and Papyrus swamps. Here and there the road was almost unrideable on the 'bike,' being a very narrow track with deep ditches on either side, and often I had an exciting shave of going roly-poly into the ditch. Towards the end of the day's march the road was so steep that the 'bike' had to be carried up and down some of the hills. The crests of some of these hills are covered with a mass of loose and jagged boulders, evidently produced by denudation. We camped at a place where there are a few native huts and a mule shed. I have my tent pitched across the road, it being the only decently clean place.

Soon after I had had my lunch we had a terrific thunderstorm and a downpour of rain. It has rained every afternoon for the last week."

### And on

"18th July, 1902. Started by 7 a.m. Arrived at the Maanja River about 8.30 a.m. The road all the way led through low meadows and swamps teeming with life. I noticed as I rode along numbers of *Vidua principalis*, the Serena and their sombre little wives; a large yellow-shouldered, black weaver bird; *Scopus umbretta*, the Hammer-head, and a black and white Shrike, taking the place in West Africa of *Corvinella corvina* in its habit of associating in groups and following or preceding the caravans. From the bridge over the Maanja I made a sketch of the view, which was certainly very pretty.

I then caught up my safari at a pleasant camp on top of rising ground; here we stop for the night. Very short march, in by 10 a.m.



We have had visitors all the way, and they have brought plenty of food. The chief usually pays his visit about sunset or just after tea, bringing ten to twenty loads of bananas or sweet potatoes, neatly tied up in banana leaves. These are laid out in a row in front of my tent, the more important men shake hands, and then leave the headman to sit down and have a chat. Generally I 'asked for more' in the way of milk and eggs for myself. Then we would talk of the game in the country. In Uganda the chiefs were always clothed, generally simply in white calico and a turban of the same, sometimes in quaint odds and ends of European clothing. Always they took a great interest in the 'bike,' many never having seen one before."

The following pages from his diary give a vivid idea of life "on a safari":

"It took the boys several days to get drilled into packing up camp, tent, etc., cooking breakfast, so that no one was kept waiting by anyone else.

Salim (small boy, very sharp, clean, and hard as nails) woke me at daylight or just before, put water in my basin, and set out my clothes. Men laid table outside for breakfast. Two whistles then brought Bafirawala to pack bedding and camp furniture, while the four askaris undid the tent ropes.

As soon as I was dressed, breakfast of porridge (poriki), eggs (magai), and potted meat (nyama kidogo), and tea (chai), was served.

Meantime tent packed by Bafirawala and the four askaris, all porters tied their own kit to their own particular load. Pipe lit, three whistles brought Abdulla with 'bike' well cleaned. Mackintosh, glasses, baccy, and sketching apparatus, camera and collecting gun adjusted.

Meantime kitchen-box packed. All loads placed in a row, porters behind each. Headman Simba called 'Tayari?'

'Tayari Owana.' Three-quarters of an hour.

On reaching camp, Salim unpacks table and chairs. Spot for tent chosen. If necessary twenty porters set to work to pull the grass and level and clean the ground. Four askaris and Bafirawala pitch the tent, five porters go for water, five for wood, ten gather good clean grass, which lines the tent and the verandah to tent.

Meanwhile Salim has set up the bed, mosquito-net and camp furniture, and got the bath ready.

At the same time Ali the cook and Abdulla have begun to get 'déjeuner' ready. After the bath Salim is whistled for, he searches for jiggers, empties bath, takes away clothes to dry and air, lays table for déjeuner.

Whiskey and bitters. Bacon, eggs. Curried fowl. Fried cod roes. Stewed peaches or rice pudding. Coffee (kawa), cigarette.

At night Simba comes in to ask for orders as to where we camp to-morrow."



ROYAL SOCIETY  
REC<sup>d</sup> 26 AUG. 1808  
ANG<sup>o</sup>

*Adm. in M. Hall. Cl. 17  
7th St. John's Terrace*

VNIVERSITATI · BERNENSI ·

S. P. D.

SOCIETAS · REGALIS · LONDINENSIS ·

SCIENTIAE · NATURALIS · PROMOVENDAE ·

CAUSA · INSTITUTA ·



**Q**VOD diem natalem ALBERTI VON HALLER, viri doctissimi atque praeclarissimi, abhinc ducentos annos nati, auctumno proximo estis celebraturi, de re tam laeta vobis omnibus ex animo gratulamur. Iuvat gloriam vobiscum extollere viri insignis, et inter socios nostros quondam spectatissimi. Cum igitur litteris vestris nos invitaveritis ut gaudiis caerimoniisque vestris intersimus, ubi effigiem in cuius vestri memoriam positam inauguraturi estis, id grato animo pollicemur, ideoque unum e sociis nostris, Arthurum Gangsee, ad vos legauimus, qui nostra vice agat.

ALBERTVS enim ille, adhuc adulescens, admodum praecox animi, doctrina singulari informatus et aequalium suorum eruditione stabilitus, necnon propter facultatem res anatomicas, physicas, physiologicas inuestigandi, siue in animalibus siue in herbis, conspicuus, omnium in Europa oculos in se traxerat. Adeo quidem inclaruit ut anno MDCCXXVI post Christum natum rex Britanniae, Georgius Secundus, qui tum Hannoveriae imperium obtinebat, summi illius viri causa annum duodeticensimum iam nuper ingressi, ~~salam~~ professoriam anatomiae, botanices, medicinae, Gottingae institueret. Ibi xvii annos diligenter laborabat, et ~~anno~~ Kal. Nou. anno MDCCXXXIX Societati nostrae Regali socius adscriptus est.

Interea, dum officio suo ibi fungitur, ab Oxoniensibus, a Traiectanis inuitatus est ut rei medicae professor fieret: tamen pro ardenti illo patriae amore, quo Heluetii, si qui alii, praecipue afficiuntur, honores omnes sibi propositos ~~reusavit~~ summae dignitatis titulum sibi ab Hannoveriae principe oblatum remisit, munera ista tanta quibus Gottingae fungebatur eiuravit, in oppidum illud natale, quo nihil pretiosius iudicabat, ultro rediit: cui semper inseruiebat, vir rerum scientiae plane deditus, cuius egregius, legum scribendarum auctor: ibique anno MDCCXXXVII salutis nostrae mortem obiit.

Vir erat unice eruditus, et eas res ordinandi maxime capax quae in saeculi sui cognitionem uenerant. Tali doctrina institutus, rei physiologiae studio ita proderat ut nemo id uerbis exaequare posset. Rem confusam et vix inchoatam accepit: accuratam reliquit. Erat ante omnes laboris patientissimus, et plura hominibus meditanda proferre poterat quam post memoriam hominum fere quisquam alius. Corporis musculos docuit irritationi cuidam esse obnoxios: eosdem non nisi stimulis quibusdam a cerebro per nervos deductis solere contrahi: de formatione pulli in ovo multa disseruit: haec atque talia inuestigando monumentum ipse pro se erexit sempiternum, vir rerum naturae arcana scrutandi peritissimus.

Idem uero non physicis tantum rationes tractabat: in litteris etiam enitebat inter summos. Viuit diuque uiuet, quippe qui poetae elegantis laudem consecutus sit, in litteris Germanicis haudquaquam fauae expertus.

At, cum magistri insignis auctoritas in perpetuum uigeat, nos adeo quicquid praeclarum a Professoribus uestris discipulisque Bernensibus sit confectum intuentes, uel adhuc uitam incolumenque ALBERTI VON HALLER illius uim plane agnoscimus. Itaque, licet ipse pro se MONUMENTVM exegerit, ut ait Horatius, AERE · PERENNIVS, attamen proprium decorumque arbitramur quod in aduersa fronte Academiae uestrae nouae ponendam curaueritis, quae cunctos ad eandem patranda extimulet, siue iuniores siue seniores,—uiui illius effigiem, quem in litteris uestris praeclarissimum Bernae filium recte nominauistis. Valete.

Datum Londini et communi Societatis Regalis sigillo obsignatum, Consilio habito die ..... Mensis Octobris A. S. MCMVIII.

*R*

Societatis Regalis Praeses.

(25)

2019







And:

"Amused to find that Salim and Bafirawala have engaged a small 'Boyango' to do their cooking for them, for which he gets 1*d.* a month!"

On 25th July the "safari" reached Hoima which they found in rather a perturbed state:

"Four lions have been taking natives here every night, one was poisoned last night.

The headman of Butiaba, who was dressed in flowing white robes, and wearing a scarlet and silver mess-jacket, was here, and I had a talk with him. He accurately described *Polypterus*, and said they had eggs now.

Here note the great difficulty of getting accurate information from natives. Although one may be very careful and avoid putting leading questions, yet the interpreter, knowing what the information desired is, twists the question into a leading form, and the result is that the information obtained is surprisingly like that desired."

After a couple of days' rest Budgett started for Butiaba with thirty-nine porters of his own and fifteen borrowed, and on

"29th July, 1902. Early in morning a lion roared round camp and came within forty or fifty yards, but before I could get out he had cleared away.

To-day the road was through deep wooded valleys. Soon after starting, I saw that Elephants had just crossed the road. Soon we saw, moving parallel to the road, about two hundred, many with large tusks. I tried several snap-shots with V. 3, 4, 5, and tried to intercept them. They crossed the road just in front, and were screened from view. It was a wonderful sight to see the moving mass of dark brown bodies throwing trunks into air, flapping ears, and smashing down trees and branches. A large flock of Guinea-hen rose just after, but I missed them. Soon we reached the top of the hills and beheld a magnificent view of the Albert Nyanza. Immediately below lay a great strip of grass land, about two miles wide and dotted over with low bush between the foot of the hills and the lake. A little to the south a long neck of land ran out into the lake, very narrow and sandy and curving to the north, partially enclosing a large sheet of water as a natural harbour. On the point of this spit of land there was a fair-sized fishing village. Another village lay opposite on the mainland side of the bay, and here could be seen several small lagoons cut off from the lake.

Far away, seven or eight miles to the north, another large lagoon, apparently connected with the lake, was clearly the lagoon I had been advised to work at;



across the lake a vast blue shimmering wall appeared, the Blue Mountains. Near the edge of this wall there could distinctly be seen many a waterfall and torrent apparently plunging straight into the lake.

Butyaba is on a hill-top overlooking the lake. Camped in compound. Row with porters because on arriving my small boy Salim came excitedly to me to say that a lion had taken one of my men on the road. Lion in Swahili is Simba. Simba is the name of my headman, and I soon found that Simba the headman had struck a porter in the wind and he promptly fainted. Had him carried in hammock. Not much the matter.

In the afternoon two sergeants from Gondokoro arrived by boat; we dined together; they are staying down at the lake-side (where I go to-morrow) until their porters arrive."

Almost immediately on reaching the shores of the lake he succeeded in procuring specimens of *Polypterus senegalus*:

"Was just starting to new camp by steel boat, my tent was packed, loads all tied up, and we had started towards the boat, when headman brought several fish, and among them *Polypterus senegalus*, seventeen inches in length, they said more common here than at the new camp, so am stopping a day or two. Female had eggs, but mostly shed.

When I got back had five more 'Intonto' brought, one female full of eggs, but evidently they have just laid. *The males do not seem to have milt.*"

The following extracts from the diary show the difficulties of shooting in the forest:

"Went out to shoot late, and, after a difficult stalk, shot a buck. He went down, and, as I went up to him, he suddenly sprang up and away into the thicket; we followed and tracked for half an hour and got torn to pieces. It is wonderful how easily apparently, and with how little noise a wounded antelope will clear a way for itself through the thickest tangle of aloes, acacias, euphorbias, etc., so that it is only possible to follow by practically cutting one's way, and even then getting the clothing torn off one's back. Shooting in the open, when the grass is as high as it was at this time, is a very disagreeable pastime. The seeds of the grass have hard, sharp, pointed bases, with hairs sloping backwards from the point, so that the seed lodging in one's shirt immediately makes inwards, and, protruding inside the shirt, prods one with its needle-like point with every movement. One cannot walk a quarter of a mile without having hundreds of these tormentors worrying one's already heated skin.

At last I felt done up and had to give it up. Sent back boys, who ran buck down and polished him off."

<sup>1</sup> The local name for *Polypterus*.



About this time it seems that he definitely made up his mind to abandon the search for the Okapi, and to press forward towards the north, where he heard that the *Polypterus* was in plenty and where its breeding season was later.

On 2nd August, 1902, he writes:

"In the afternoon went up to Boma to find details of sailing, etc., between here and Gondokoro. I have now made up my mind to try down the Nile. The Okapi is now no attraction. The birds of Toro are well known, and the prospects with *Polypterus* are better down the Nile than up here, for as far as I can see the season is earlier here than down the Nile.

Shot a Guinea-hen here this afternoon. Porters returned with twenty loads of food from Kajura."

And in the following words he concisely sums up his position:

"OBJECTS IN GOING TO TORO:

1. To work at *Polypterus* in Semliki.
2. To observe and catch Okapi.
3. To collect generally in Semliki valley.

POSITION AT PRESENT:

1. Season with *Polypterus* evidently advanced. Natives absolutely ignorant. Steel boats down Nile.  
About three weeks' journey to Semliki, where natives worse than here.
2. Okapi found in large numbers in Belgian territory; easy means of transport down the Congo.
3. Jackson's nephew, Archer, has shot all Toro.
4. Account of journey down the Congo, both as to difficulties and expense, hardly justifies attempt.

*Polypterus* the main object; without a doubt the Nile the best for this (working homewards), especially as the season here is earlier. £100 can be saved by this way home and refunded to Zoological Society<sup>1</sup>."

After which he had a wretched night:

"After turning in, thunderstorm burst, brought down tent and drenched everything. All transferred to shed. Up to this time my tent had weathered out all the storms safely, and I was beginning to rely on it as proof against wind and rain. Down here, however, there was little holding power in the sand

<sup>1</sup> This was done.



on which my tent was pitched. I had turned in about half-an-hour, when thunder and lightning began, then a great wind came rushing down from the hills towards the lake, with heavy driving rain. Some instinct told me this was more than my tent would stand. I leapt up. Tried to light my lamp, and called to my askaris, who were supposed to be on guard, and then seized the tent-pole, but it was no good, the tent-pegs were drawn, and in a few seconds my tent was in ruins and half blown away, myself and all my belongings exposed to torrents of rain. Luckily there was an old shed near by, which, though by no means safe, was still intact. Thither I fled in my drenched night garments. At first my scoundrelly servants paid little attention to me, not having seen what happened, for they were looking after their own belongings, their tents having already gone before mine.

Very soon, however, the whole camp got to work. A roaring fire was lit inside the shed, the miserable-looking men brought in article after article from the pouring rain with a most woe-begone air. Suddenly the comic side of the thing struck me, and I laughed, at which they all roared with laughter; the tragedy became a joke, and before long I was settled down for the night again in my new quarters by the fireside and slept soundly till the morning. Never again did I regain confidence in my tent; at the approach of each thunderstorm I nervously got up, lit the lamp, and kept my boys in the verandah of the tent constantly going round the pegs until the storm was over.

After this I set my porters to build a temporary house for me. This was much interrupted by my having to send back porters to buy food; at length it was finished: the sides were made of wattle fences and stout poles, and a roof of rather a low pitch was made sun and rain proof by binding quantities of grass to it. It was just finished, and I was on the point of moving into it, when, with a crash, the roof collapsed inwards. The sand gives so little hold to the side-poles, that if the roof has not a very high pitch the weight of the grass on the roof will drive the walls asunder and make it fall inward.

These houses have to withstand not only rain and wind, but also earthquakes, which are by no means uncommon in these parts. Down on the lake-shore I experienced two, the first being of considerable violence."

On 16th August, 1902, the caravan started for Masindi on the way to Fajao, near the head of Albert Nyanza, where the Victoria Nile enters the lake; on their way they saw a large herd of elephants crossing their path.

On the 18th August the following interesting entry occurs:

"6.30 a.m. start. 'Bike' carried hung from tent-pole. Tall grass and thin forest at first. Noticed all along the path a four-leaved plant about eight inches



across and lying quite flat on the soil. This plant was of the brightest green, and as it lay on the dark damp soil of the footpath it seemed almost to invite one to tread on it. It lay so flat on the soil that no injury was done to it by treading on it, and it certainly seemed as though specially evolved to live upon the pathway of human beings. More probably, however, it had taken refuge here as, being the only plant able to survive in such a situation, it was therefore out of the way of competition.

After an hour and a half the path became very hilly, and we entered real forest; at length coming to a deep ravine with pretty watercourse at bottom, lovely epiphytes and lianas everywhere, with the rubber-plant climbing up the trunks of the big trees; the going for the porters was very difficult because of the lianas, the rocks, and steep climbs. And yet it was wonderful to see the way in which these porters would glide along without hesitation, bending to this side and that with their 65 lb. load, often of unwieldy size, passing within a hair's breadth of some awkward obstacle, but very rarely touching it. These men seem to develop a sense of having their individuality extended into their loads, much as an omnibus-driver in London feels exactly the extent of the axles of his wheels. That this knowledge is something of great importance to the porter is seen by the fact of his clinging obstinately day after day to the load with which he started. He resents his load being changed, even for a lighter one. The first day of the march there is a terrific scramble for the light loads; once, however, he has had his load allotted, he will tie a little bit of rag or cord to it by which he may know it each day, and it is his to the end of the journey. I often used to recognise the porters and call for any particular one I wanted, more by the load he carried than by his own name. Human portage of this kind is the best possible for delicate apparatus, as long as the path is good underfoot. Occasionally, however, on a bad stony road a porter will trip, try to save himself, and then fall headlong, his load coming with a crash to the ground, which is well calculated to destroy anything of a breakable nature. Then we came on to high ground where the path was more open and better, and, half an hour before reaching camp, to a high rock with a charming view of the Albert Nyanza and mouth of the Nile.

Camped at 10 a.m. at Kitoro.

In the afternoon had brought me a very large Puff-adder 4 ft. 5 in. long. I tried to dissect the head, but it was much broken. Apparently the poison fang on each side is in a pouch, loosely attached by flesh only!

Four days later they came in sight of the Victoria Nile and the Murchison Falls.

"22nd August, 1902. Started 6 a.m. and 'biked' most of the way, road much as yesterday. Saw golden Oriole of sp.? and a new bird, blue above, white below.



Eventually the road ran out along a spur, flat-topped and of red conglomerate pebble. Coming to the edge a grand view of the Victoria Nile winding away in the distance. At the end of the spur suddenly we came in view of Fajao nestling below and the Nile swirling along speckled with foam.

Four or five miles before we reached Fajao I heard the roar of the Murchison Falls, not a continuous sound, but a pulsating, thunder-like sound, but now within half a mile we cannot hear a sound.

There is a hill about a hundred feet high in front overlooking the river, and commanding the most enchanting view I ever remember to have seen. Away to the right, the gorge and Falls are seen with clouds of mist rising up; winding round the foot of the hill is the surging, swirling, Victoria Nile, which to the left winds away to the Albert Lake.

The water swarms with splashing fish, crocodiles, and 'hippos,' while the banks and valleys running riverwards are covered with the most beautiful foliage. In some degree I am reminded of Schaffhausen, but I have not had a close view of the Falls yet. It seems a pity that the Fort on the top of this hill has been abandoned and burnt.

The fish mostly caught are of two kinds, one an *Alestes* got at Butyaba, but more brilliant in colour (bright blue above, silver below), and a fish I do not know; it reminds me of a red mullet. It is golden above, and each of the lower scales are dashed with brilliant red, while the ventral and pectoral fins are also bright red, as also the eye and lower part of the head. Many of the fish caught here were of a much more brilliant colouration than the same species caught in the lake.

The natives say they catch the 'Intonto' of large size here."

At Fajao they stopped several days, Budgett eagerly fishing. All the female "Intontos," as the natives call *Polypterus*, were "either laying or having laid eggs." He is certain that the *Polypterus* fry must swarm in the floating "sudd<sup>1</sup>," but he failed to trap them, though he caught the fry of many other species of fish. And artificial fertilization again proved a failure. It is pathetic to read on 27th August, 1902:

"No Intonto caught. Many young fry. All yesterday eggs proved unfertilized. The gelatinous envelope in those eggs which decomposed last was swelled up almost like frogs' eggs.

<sup>1</sup> The sudd is the floating vegetation which sometimes almost blocks the upper reaches of the Nile. The plants that form it are described in Sir William Garstin's *Report on the Bahr el Jebel* published in 1901 and in "Some Notes on the 'Sudd'-Formation of the Upper Nile." By A. F. Brown, Director of Woods and Forests in the Soudan. *J. Linn. Soc.* xxxvii. 1905, p. 51.



Have made a number of small fry-traps of specimen tubes and placed in the sudd. In placing these traps I got an uncomfortable wetting through the sudd giving way.

The 'hippos' were fighting to-day while I was hunting the waterweeds for eggs, a splendid sight.

The eggs here can hardly be placed in the decayed vegetation on the bottom, for this is always shifting and fresh layers being deposited.

The enormous mass of vegetation makes it impossible to be very hopeful of success, and yet I have felt here that there must be abundance of material within a few yards of me."

At Fajao he had another instance of the power of the bicycle :

" Had seven Intontos brought, all *females*, either laying or having laid eggs. Caught on the hook in the 'sudd.'

Spent afternoon making fry-traps. Evening went down to spiller again, many hooks gone, three *Clarias* caught. Set four traps in 'sudd.' Very beautiful on the river at sunset. Native Chief called, wanted me to interfere in some palaver; exhibition of bicycle; I found the bicycle of great use and not only for locomotion. When a chief was in a perturbed state about some grievance in which he wanted me to interfere, instead of having to tell him that I was not a government official, and could do nothing, I had only to ask him if he had ever seen a white man fly, and then I rode round on the 'bike,' and at once his troubles were forgotten.

*Polypterus* fry must swarm in the 'sudd,' no flooded lands to go to. Water perfectly clear. It seems an ideal place for getting the *Polypterus* material, but cannot catch the large Intonto as thick as the arm which the natives talk of catching."

On the 29th August, 1902, Budgett gave it up, and again set his face north, crossing the Victoria Nile with all his "safari" in one hour and five minutes. On the last of the month he reached Wadelai, having bicycled a considerable part of the distance. Here it became necessary to pay off a number of his porters who refused to go further, though whilst witnessing the flogging of one of their number they became so cheerful and good-tempered that many of those who at first hung back were



now ready "to go anywhere." Some of the porters were sent without loads north to Nimule at the junction of the Unyame with the Nile, whilst Budgett went with the baggage by boat. For the latter he had to wait till 8th September, when he started down the river in a boat with six oars and a sail, manned by a crew of the "Uganda Marines." The same day they passed Emin Pasha's old camp.

Rowing down the river, one day was much like another. The following is typical:

"10th September, 1902. All day gliding along through endless grass without variation. Shot a 'hippo' dead, but could not wait for him to rise. Rowing all day long, only reached our camp after sunset. Much difficulty in reaching the shore through the sudd. This sudd begins to be formed by the rapidly propagating *Pistia*. Seeds of a small floating rush then lodge in the roots and several plants of the *Pistia* become entangled. Next the tall water-grass lodges on the raft, which thus increases in size until it becomes a floating island. Very curious to watch these rafts as they glide past the fixed grasses. At times the sudd was so thick, we seemed to be stationary, as the whole of the water was choked with the vegetation which slid with us down the stream. Practically no bird life seen.

11th Sept., 1902. Approaching and rowing along the south side of the Nimule mountains. Lovely scenery with lagoons of water-lilies, foreground of *Pistia* and background of bold wooded hills. These were the same hills we had seen nearly all the way from Wadelai, from the south appearing a small isolated range; as we approached however, one solitary peak reared itself up into the clouds, forming a landmark for nearly 100 miles in every direction, while the range extended to the north in a series of lower mountains, forming the western bank of the Nile. We now seemed to be steering straight for this mountain, and indeed the Nile does make directly for this range and plunges right into the Nimule gorge, which cuts off its eastern spur.

Passed a large rock amid-stream with several 'hippos' standing on it. They dashed into the water before we could get near enough for a 'photo.' On the south bank we passed a low hill about 10 a.m. covered with vast monoliths of basalt in curious attitudes, reminding one of Stonehenge."

On 11th September, 1902, they passed Dufile the Belgian post at three in the afternoon, and an hour and a half later reached Nimule, where the porters had just arrived. Two days



later the caravan again started trekking north. On the 19th they passed Kiri, a considerable native town, where they were pleased to find plenty of milk, an unknown article in the Unyoro country where the cattle had been swept off by cattle-plague. The following entry on 21st September, as they were approaching Legu, records an adventure with an elephant:

"Started 5.30 a.m., wound up into the Legu hills, pretty scenery with fine distant views of various ranges. Then down into the same country we left the other side. After seeing elephant tracks for three hours all the way, there was a sudden panic with the advanced guard and all fled at top speed as we had come upon about a dozen elephants. The grass was so long I could not see them, so going up the nearest tree I saw them apparently not much disturbed, but moving off slowly. Taking B. and an askari, I went after a solitary old tusker lagging behind the rest and getting on to some rising ground, had a good view of him at 100 yards, not daring to get nearer as I could not have seen him through the long grass, so had a shot, but was vexed to see him start, throw up his trunk, and move slowly away. I went after him, hoping to get a nearer shot, but lost track of him.

Another three hours brought us down into sandy country, and at length to the Nile at the junction of another river with it. Crossing this we camped on the other side.

Saw some more Gambian birds, a bee-eater, *Merops nubicus*; several birds I have not seen before and do not know. I meant to get specimens, but was tempted to go on an unsuccessful water-buck shoot.

Serious loss to-day, one of my porters fell with fishing box and smashed my last bottle of formalin."

Gondokoro was reached the following day. Here he dined with the entire white population, and next day paid off his "safari," re-sorted stores, and sold his superfluous gear. The four days Budgett spent in Gondokoro were as usual spent in fishing, but with no success. On 27th September at 8 a.m. he left by the steamer "Abuklea," and within ten minutes stuck upon a sandbank. They

"Reached Lado about 1 o'clock. Monsieur René came on board, having heard that I was coming to the Congo Free State; he said that all the stations had been directed to give me every assistance. He also said that Coquilhatville was the best place to stay for fishing in May, June, and July (dry)!"



The journey down the upper waters of the Nile was uneventful. Budgett reached Fashoda on 5th October, and went on immediately to Khartum, where he arrived on 10th October.

In Khartum he inspected the fish-market and found there "almost all the fish" he had caught on Albert Nyanza, "also *Gymnarchus*." Whilst there he came across the servant of Mr Loate, who for some time before had been collecting the fishes of the Nile for the British Museum. This man told him that Mr Loate had taken "very great numbers of *Polypterus* at Fashoda." He immediately engaged this fisherman and some other servants, and with indomitable courage determined to retrace his steps up the Nile. He started back upon 17th October and reached Fashoda on 24th October, having lost a man overboard. On the last day of the month he reviews the whole situation in these words :

#### REVIEW OF POLYPTERUS QUESTION.

"BUTYABA, LAKE ALBERT, 31ST JULY—15TH AUGUST. Small numbers of *Polypterus* (20) caught in pool cut off from lake, in size up to 17 inches. Females mostly having laid eggs. Males without abundant milt. Not looking healthy. Netted two pools, lake and lagoon connected with lake, but got no fry. Fishermen very ignorant. Magungas only catch *Polypterus* in the pools.

FAJAO, VICTORIA HILL, 22ND AUGUST—29TH AUGUST. Small numbers of *Polypterus* caught on the hook in the sudd, laying or having laid eggs.

Here no flooded lands to go to, fry must swarm in the sudd, which near the falls is limited in amount. Here and in Lake Albert only *P. senegalus*.

Six *Polypterus senegalus* caught in one trap. Three females, three males. One female had about 50 eggs free in each oviduct, which were both much inflamed. Fertilization tried, but no really motile spermatozoa.

Sudd was then examined and hunted persistently for eggs or fry. Set many fry-traps in same place but took no fry. The river here formed a small bay, this was out of the force of the current and about 18 inches deep.

The eggs were coated with adhesive mucus, which swelled up and set with contact with the water.

The bottom of river here is soft, deep, vegetable debris, and it seems certain to my mind that the eggs are attached to the stems of the water weeds.



Fertilization unsuccessful, but with those eggs which decomposed last the jelly swelled up almost like frogs' spawn; that is 12 hours after laying.

The eggs are heavy, and if not attached would surely fall among the débris at the bottom.

WADELAI TO GONDOKORO, 31ST AUGUST—12TH SEPTEMBER. From Wadelai to Nimule enquired all the way about *Polypterus*, but seldom caught any; current very swift and few landing-places in the sudd. Near Nimule the river opens into wide shallows, which seem more suitable for *Polypterus*. At Nimule *Polypterus* hardly known. Overland to Gondokoro here were steep banks and very swift current. At this time of year impossible to catch *Polypterus*. Gondokoro to Khartum *Polypterus* very common in the sudd.

FASHODA, 25TH OCTOBER—5TH NOVEMBER. Here employed two Arab fishermen with casting net. Impossible to employ the natives, they are too wild; the government has little hold over them.

Several *Polypterus* caught with casting net. Females of *P. senegalus*, 18 inches long, almost all ova have been shed.

Male *P. endlicheri*, 26 inches long, abundant motile spermatozoa, with mulberry sperm-mother-cells, the first male *Polypterus* which I have ever seen in this condition. Caught about a dozen small specimens, 5—10 in., but no very small fry.

From what I have seen I have no hesitation in saying that there is no place above Khartum to compare with McCarthy Island on the Gambia, where the river rises and falls with the tide, and the *Polypterus*, apparently spawning, get stranded in pools at the side, and where the natives can help to catch specimens in large numbers.

Fajao the most favourable place, but here it is impossible to catch large numbers.

The main reason for going back to Fashoda is to try and trap the young fry, for here Loate (whose fisherman I have employed) caught large numbers of *Polypterus* in December, when the water had fallen in the channel nearest Fashoda.

Though a few are caught in my fry-traps, no great number, and no very small ones. Tried hard with tow nets, small trawl and lift-net; hundreds of fry of all kinds caught, but no *Polypterus* fry.

1. It must be possible to trap the young fry such as I caught with the limp net in the Gambia, if a sufficient number of traps are laid in the right place, *i.e.* shallows amongst grasses and out of the current.

2. Fertilization the best chance of getting the young stages.

Though breeding begins with the rains, it seems more probable that the fish of large size, the most abundant breeders, spawn at the height of the rains.

The ova accumulate in the oviducts before being laid up to about 100. The spermatozoa accumulate in the urino-genital sinus, and are found ripe and motile in a very small proportion of males caught at one time."



At the beginning of November he recognised that Fashoda, like McCarthy Island, the Albert Nyanza, Fajao, etc., was a failure as regards the obtaining of developing *Polypterus* ova, and on 6th November he took the boat to Khartum, where he arrived on the 10th. His visit coincided with that of Lord Kitchener, who was spending a few days at Khartum on his way to India.

His last entry in the Uganda diary is on the 19th November, when he visited Karnac. He was home by the end of the month.

It had always been Budgett's ambition to be associated with the Zoological Gardens in London. Even as a boy he had shown remarkable skill in keeping live animals and in keeping them healthy. When at home he was especially fond of spending his time in the Clifton Zoological Gardens, and thoroughly understood the management of animals in captivity.

Almost immediately after his return to England he was persuaded, rather against his habitual modesty, to apply for the post of Secretary to the Zoological Society, then vacated by his old friend Dr P. L. Sclater. He sent in a form of testimonial, with a list of his published Papers, and with testimonials from Professor Lloyd Morgan, Colonel the Hon. J. E. Lindley, late commanding the Imperial Yeomanry School, Colonel H. J. Edwards of the University Rifle Volunteers, who dwelt on Budgett's power of organization shown by his work with the Mounted Infantry, and from several of the Cambridge Zoologists. His application was carefully considered, and I have reason to believe his claims favourably impressed the Council, but in the end the Society not unnaturally preferred an older man.

Budgett, however, did not give up hope that he might in the end receive some post at the Gardens. During the year 1903 Mr de Winton was occupying the position of Resident Superintendent at the Gardens in Regent's Park, and it was understood that he did not propose to remain there permanently. If this post became vacant Budgett meant to apply for it. In pursuance



of this wish he and I paid a visit to the Continent at Easter, 1903, and inspected the Jardin des Plantes and the Jardin d'Acclimatation at Paris, and the Zoological Gardens at Frankfort, Leipzig, Berlin, Hamburg, Hanover, Amsterdam and Antwerp. During this short holiday I was much impressed with my friend's extensive knowledge of vertebrate life and habits, and the keen practical insight he possessed as to their housing, the arrangement of their cages, their food, and so on. He was particularly anxious to devise a better system of labelling the various exhibits. He wanted to introduce into the labels more information than is conveyed by the recital of a generic and specific name. Labels, telling a story, after the fashion of those with which the British Museum in South Kensington has familiarised us, were his aim. The only way to effect this seemed to have cheaply-printed and easily replaceable cards enclosed in a weather-proof frame. The difficulty was to find the latter, and on his return to Cambridge he began experiments in this direction which were only interrupted by his death.

During the Lent Term and the early part of the May Term in 1903 Budgett continued to work at his fishes, but he could not give up the idea of having another try to procure the developing ova of *Polypterus*. Some short time before Dr Ansorge had brought back specimens of the young larvae of *Polypterus* from the delta of the Niger. There was no doubt that the fish lived and bred there, but, though this must have been equally true of the Gambia and the Nile basin, there was always the chance that the material would be more easy to get at. Budgett at any rate felt the chance worth trying, and, although he was well aware of the danger he ran, he declined to talk much about it or dwell upon it.

An agreeable incident in connexion with Budgett's start must be here recorded. His first idea was to get a passage in a King's ship as far as Sierra Leone, and he wrote to the Prime Minister on the subject. Mr Balfour—whose interest in the success of the Balfour Studentship is well known—did all he could, and



when he found that the request could not be granted, most generously defrayed Budgett's passage from his own private purse.

He left Liverpool in the s.s. "Nigeria" on 27th June, 1903, and reached Sierra Leone on 7th July. After calling at Monrovia, Sekondi, Cape Coast Castle, Acra and Lagos on 14th July, they made the mouth of the Forcados River, the most westerly of the many streams into which the Niger splits. His plan was to go first to Assé, where Dr Ansorge obtained his larvae, and if the prospects were not good after a week or two, to go up the river to Lokoja and Dakmon, returning to Assé in September if unsuccessful at Dakmon.

He started first for Burutu, which he describes as "the most dreary spot I have seen, in the midst of mangrove swamps, consisting of a few tin huts, two rest-houses and the stores" of the Niger Company. It rained incessantly night and day. At Burutu he embarked on a stern-wheeler for Lokoja. Passing up-stream he was surprised at the great number of villages on both sides of the river, "the water swarming with canoes." He landed at Assé, but finding from the reports of the inhabitants that, although there were *Polypterus* in the river "as large as crocodiles," they could not catch them, he rapidly altered his plans and continued on the boat to Lokoja. At Onitsha, Mr Nelson, the Company's agent, told him that he had often seen scales an inch square, which Budgett thought "could be no other than those of *Polypterus*"; this seemed to corroborate the statements of the natives at Assé.

Between Ida and Lokoja they passed some fine scenery:

"19th July, 1903. At daylight in sight of the hills, soon the scenery became really very fine. High hills 500—700 feet, deep valleys, grassy slopes and rocky islands. Many of the hills topped with rugged crags. Sand-banks with fishing huts and canoes. Everywhere variety and change of interest. Very few water-birds. A few Egrets and Kingfishers.

Lokoja lies on a slope on the north bank of the Niger, opposite the Benue and under a long flat-topped hill. An island lies opposite, and here I am told *Polypterus* is caught. I have not yet interviewed the fishermen. It being



Sunday I had the old difficulty of getting porters to bring up my gear. Most of the necessary stuff is up now, however.

I rather fear there are too many white men here for me to get to know the fishing people much; if I do not find *Polypterus* plentiful here I think I shall go on to Dakmon, where I can get the whole village to work for me."

After inspecting the possible fishing places, and finding them not very promising, he determined to go further up the river to Dakmon, his reason being "that the river rises up there first, and later in Southern Nigeria" On 22nd July he notes:

"This country is much preferable to the Gambia and a collector's work here not a bad life.

The headman of the town came to court to-day in great style, all the horses covered with silver trappings and fine leather-work.

Watched the polo in the evening with Ryan, dined with Migeod, and played billiards all the evening."

On the 25th July he started up stream in the "Kampala," and was agreeably surprised to find that on the upper river they only had a few showers at night time, though it was the middle of the rainy season.

At Muriiji, which he reached on the evening of 27th July, he determined to stop a few days, as he had heard through Major Burdon and Mr A. H. Cheke that the *Polypterus* was plentiful there. He at once began to fish, but with comparatively little success, and he could gather nothing about the breeding habits of *Polypterus* from the native fishermen. Although the fish were shy they caught a couple of Manatees, but Budgett had no time to dissect them. He continued fishing for some days longer, and collected some thirty or forty different species, but "there is no means here...of getting large numbers of *Polypterus*, and I doubt whether they can get any small fry."

On 5th August he decided to go on to Dakmon, and after a difficult passage arrived there two days later:

"Though not a very good fishing spot it is very well situated and one might work well with the people. At the present time the water is well below



the bank, and there is not much chance of finding *Polypterus* spawning. The headman, a very intelligent Mahomedan, says that when the river overflows its banks many fish come up to spawn, including *Polypterus*, *Gymnarchus*, *Heterotis*, etc. He declares that he knows the egg of *Polypterus* but I fancy he thinks of toad's spawn. He knows well *Gymnarchus* and *Heterotis* nests.

A native brought me a nice specimen of *Xenopus*, which I am keeping alive, it looks somewhat different from those I have seen in England from the Cape.

I set the bolter with a few hooks, but only caught one fish, a *Synodontis*. In the afternoon I climbed the hill behind Dakmon and had a lovely view, there are large flats on the far side of the river partly flooded now, but the headman says it will be two months before the river will really overflow."

Dakmon also proved a failure, and he determined to return down stream to Assé, which he reached on 12th August. On the next day he writes:

"Early morning setting house in order. I have a fine verandah to work in, overlooking the Forcados River, an island in front, where are shallows and creeks of good prospect. A few light showers and sunshine in the afternoon. Took canoe up to small village, where I was much interested in the fish-traps and nets.

Very great ivory rings are worn as ornaments on the arms and legs. Apparently the natives on the river banks are Ijos, those in the bush Igabos. The latter are said to catch *Polypterus* in large numbers.

There is a large lagoon and village somewhere at the back, but it seems difficult to get to it at this time. I had some small specimens of *Ophiocephalus* brought in, and also a small fish with a head like a pipe-fish and long eel-like body, which I do not know.

The natives are of a very low type, but I think in a short time I shall get on with them all right.

The Niger Company have quite a good garden with oranges, mangoes, and plums. The river is nothing like up yet. Though I think the natives will probably bring me small specimens of *Polypterus*, I fancy I shall have to catch the adults myself, unless I can get to an Igabo village. *Hyperopisus* seems exceedingly common here, and I saw one *Gnathognemus* with brilliant yellow colouration. I hope to get small specimens alive.

It seems to be impenetrable forest all around, though there is open ground on the island.

On the whole I feel much more hopeful here than up river, chiefly I think because of the innumerable rain-water swamps here."



During his stay at Assé it seems to have rained all night and very nearly all day. In spite of the continuous downpour, he worked hard, both fishing and collecting and interviewing the native fishermen.

On 19th August he joyfully records the capture of "six *Polypterus senegalus*, between two and a half and three inches in length, with large external gills! Preserved in Bles' fluid."

On the 22nd August he visited a lagoon:

"Went down to see nest of *Gymnarchus*. Opposite Bari entered creek and then a small stream very winding, full of natives fishing and fish-traps. Took many *Polypterus* from canoes. After half a mile came to swamp choked with *Pistia* and floating grass. Here we found an old disused nest of *Gymnarchus*. Then crossing, entered another small stream, all the way through dense forest carpeted with ferns; after a quarter of a mile came to large lagoon free from sand. In a small creek from this, on the far side, we found a nest of *Gymnarchus* full of young ready to leave nest. Meanwhile I talked to the guide; he knows the eggs of *Polypterus*; has seen them spawning at the beginning and end of the rise of Niger, always at west end of lagoon, attaching eggs to stick under water in great quantity. He says they are hatched in two or three days. I must wait until water begins to go down. Have offered him £2. 0s. 0d. for eggs. In the evening had small *Polypterus senegalus* brought with huge gills."

On the 25th August he again tried artificial fertilization:

"In the afternoon I opened three female *P. senegalus*, each of which had the oviducts crammed. Two of them appeared to have been captured some days ago, and the ova had begun to decompose. The third one was quite healthy. I fertilized with teased testes and spread on the bottom of small glass dishes to which they firmly adhered. Fine day with a few showers.

26th August. The ova appear to be segmenting, about 60 per cent. have decomposed. The pigment seems to be redistributed irregularly. One egg I examined, as it looked more normal than the rest. The upper pole was covered with fine cells of a light brown colour, the lower pole cells were white and about twice the size. The upper cells easily visible with a  $\times 8$  Leitz lens. Round one half of the egg there is a deep constriction between the brown cells and the white cells. In attempting to free it from the envelope the egg broke, but I preserved it in formalin.

Later (*mid-day*) another egg was examined, the constriction surrounded the whole egg about  $\frac{1}{4}$  white  $\frac{3}{4}$  brown. Preserved in formalin.



4 p.m. Another examined; the white area is now a mere plug, evidently the 'yolk plug of the blastopore.' The shape of the egg is oval, the gelatinous envelope does not fit the egg closely, and is pretty firm. Preserved in formalin.

Most of the eggs appear to be backward or not properly fertilized. They are clearly segmenting but irregularly, the pigment is scattered in patches and streaks, chiefly following the segmental furrows.

At five to-day a Bari fisherman brought me two female *P. senegalus*, one had the oviducts full, the other had also a large portion of the ova free in the body cavity. I had two good males and tried to thoroughly fertilize them, then, spreading them on hatching tray, set them in hatch box, in the river. I noticed that many of the ova from the oviducts appeared to have begun segmenting, the body cavity was full of fluid, and I am inclined to think that there is internal fertilization.

The vent of the female was swollen and protruding, suggesting that the female receives the milt from the anal fin of the male, together with a certain amount of water, though there must also be sufficient serum added to prevent coagulation of the gelatinous envelope.

The tubules of the testis of the male used were greatly distended, and the sperm was clear and not opaque as in the other males.

Hot sunshine in morning, downpour of rain in the afternoon. Temp. mid-day, 28° C. Temp. of water in river 28° C. 8 a.m.

Am not making drawings until material more abundant and normal.

27th August. About 70 per cent. of the ova fertilized yesterday are developing.

At 8 a.m. the blastopore was just closed while the embryonic plate extended in a pear-shaped manner from the latter.

A series during the day were put in formalin.

First series at 10 a.m. showed first appearance of the embryo.

Second series at 2.30 p.m. showed uprising of neural folds around the plate.

Third series at 8 p.m. showed closing of the folds over the plate. Brown pigment is irregularly scattered, chiefly on the upper pole of the eggs. Much pigment sinks into the neural groove. The head portion of the neural plate is last closed in, and then it is a little broader than the body portion.

The yolk plug does not seem to be included in the neural groove."

For the next five days he was watching one of the most wonderful sights this world affords us, the development of an animal from the egg. After years of patience, after three unsuccessful journeys into the heart of Africa, he had at last succeeded where all others had failed, and as he watched under the microscope the gradual unfolding of the ovum, the formation



of the layers, the building up of the organs, he must have experienced a joy peculiar to men of science, and experienced by but few of them.

In a letter to Lieutenant Warde-Aldam, dated 9 September, 1903, he writes:—"Within a fortnight of getting here (Assé), I successfully brought off the artificial fertilization of about a thousand eggs, and accomplished that which I have been trying to do for the past four years. The interest to me of the following week, day by day, and hour by hour, I fear you can hardly appreciate, as I saw confirmed my views as to this extraordinary fish's relations to other animals. . . . I was not to have it all my own way however, for at the end of a week soon after hatching an infernal fungus attacked them, and they all died. Had they continued to live another week I should have had them packed up, and made the best of my way home. You will be amused when I tell you that I am bringing twenty little tubes that I would not part with for £20 a piece, . . . . It rains almost continuously, everything is mildew and rust. We are surrounded with dense tropical forest, and move nowhere except by canoes. The natives' respect for my 'ju-ju,' in that I made fishes' eggs live, is very amusing. The landing is crowded every afternoon with canoes with fish for me to examine. . . . I shall be really glad to turn my face homewards once more, the depression of this vapour-bath is almost unbearable, especially when Fortune closes her hand to me."

The several periods into which he divided the stages of the developing ova are described later in this volume. He carefully preserved some specimens of each, and made elaborate drawings. He succeeded in rearing a few young larvae, but these were very delicate, and were liable to be killed by a fungus which infested his jars and tanks. About this time he suffered much from the effect of formalin on his hands, and the sores thus set up troubled him for some weeks after his return to England.

Through the whole of September he continued to artificially fertilize the ova, and greatly increased his supply of material.



On the 23rd September he writes:

"Of the three larvae left in hatching frame yesterday only one found to-day. This was five days old, and in exactly the stage to which I reared the eldest of the original batch, and this died. So that I now have a continuous series."

The diary closes on the last day of September.

When Budgett returned to England it was evident that he was not well. He suffered from successive attacks of malarial fever, and his hands caused him much inconvenience, but he came up to Cambridge and began to work out his material.

Towards the end of the year his friend, Mr de Winton<sup>1</sup>, retired from the post of Resident Superintendent at the Zoological Gardens, a post Budgett would have dearly liked to have filled. But it fell out otherwise, and he bore the disappointment with his usual quiet courage, though it undoubtedly added to the depression which the malaria induced.

He spent a few days before Christmas with me at Englefield Green, and then went to Clifton to spend the remainder of his holidays with his mother, who wrote to me that he was in better spirits than she had seen him since his return from the Niger.

He returned to Cambridge early in January, and on the 9th had finished his drawings of the external features of the developing *Polypterus* ova. The same evening he was seized with blackwater fever, the symptoms of which he knew only too well. He was very ill, but for some days held his own. The last time I saw him he said, "I've pulled through. I'm going to get better," but although the blackwater fever had materially diminished, a bad attack of malaria supervened, and on Tuesday, 19th January, he died, the very day announced for his Paper at the Zoological Society on his recent success.

Robert Louis Stevenson has somewhere remarked that "to be wholly devoted to some intellectual exercise is to have

<sup>1</sup> Vide page 44.



succeeded in life." Never has been a student more "wholly devoted" to his subject than Budgett. The patient persistence of his quest for the eggs of *Polypterus* under crushing difficulties forms one of the most courageous episodes in the history of Zoology. He succeeded after years of toil, but in succeeding met his death.

It is difficult to describe anyone's character, almost impossible to describe a friend's. Budgett had all the features of the best type of Englishmen. He was courageous, courteous, long-suffering and absolutely loyal, patient when ill and cheerful under physical discomfort and suffering, very pertinacious, with a strong sense of duty and of personal honour, kind to a degree, but always considerately and quietly so. He hated advertisement, and always kept himself in the background. He was just the sort of man who makes the backbone of the governing classes of our Colonies and Dependencies, reliable, resourceful, the man whom we can trust. The Colonies of Great Britain are full of such men, "a people scattered by their wars and affairs over the whole earth, and home-sick to a man," as Emerson describes them; but each of them doing his duty. Whenever in his wide travels Budgett came across these makers of Empire, he was recognized as of their stamp, and everywhere he was welcomed and made at home.

Latterly he had a great influence with the Undergraduates, and he came across many in connexion with the Mounted Infantry. One of them writes to me that his influence was always welcomed and reciprocated, which is not always the case in the relations of an older man with youth. The same tact and courtesy which made him so successful a Commanding Officer in the "M.I." made him a successful leader of a "safari." The natives trusted him, they knew him to be just, and they knew also that he had a quick eye for shirking, and that he was a good judge of men. He further gained the respect of his porters by his sportsman-like abilities. He was a good shot, sat a horse well, and could sail a boat.



Budgett was a zoologist of the best type. He was a keen and accurate field-naturalist. He was no mere anatomist interested only in the structure of animals that had once been alive. He loved to watch their homes, their play and their habits. He had a wide knowledge; especially of fishes, frogs, and birds.

Mr G. A. Boulenger of the British Museum has kindly written for me the following paragraph upon Budgett's contributions to our knowledge of African fishes and frogs:

"The breeding habits of fishes living between the tropics are among the secrets of Nature which are most difficult to unravel, and which have most taxed the acumen and patience of zoologists. Collectors of zoological specimens there are in plenty, but they are seldom in a position to make observations on the breeding habits of the lower vertebrates. Several attempts had been made with the object of procuring the developmental stages of the African fishes *Polypterus* and *Protopterus*, but in vain. Budgett determined not to rest until he had attained the long-sought prize; he succeeded, but for this success he paid with his life.

"In pursuit of the breeding places of *Polypterus* and *Protopterus* he visited the Gambia, the Victoria Nile, and the Niger, and from each of these rivers he brought home not only most valuable notes on the habits of the fishes he came across, habits which were then totally unknown, and embryological material which has made his name famous, but very important collections of the fishes themselves, which it has been my privilege to name and describe. Several new species were discovered by him in the Gambia and in the Niger: *Marcusenius budgetti*, *Gnathonemus gilli*, *Clarias budgetti*, *Synodontis ocellifer*. He also paid attention to frogs and their larval stages, and a new species from the Gambia was described by me as *Rana budgetti*.

"Frogs had been the first subject on which he published. When accompanying Professor Graham Kerr to the Paraguayan Chaco in 1896-7, he made a very important collection of



“Batrachians, of which he published a list, accompanied by  
“interesting notes on the habits, and a description of the  
“nesting habits and development of the quadrumanous tree-frog  
“*Phyllomedusa hypochondrialis*. He also discovered on this  
“occasion a new frog which could not be referred to any of  
“the known genera, and for which he proposed the name  
“*Lepidobatrachus*.”

I have dwelt upon Budgett's gift in the setting up of Museum specimens; but he was equally skilful in the methods of the Laboratory. His knowledge of reagents and materials, and a certain mechanical turn which his mind possessed, led to endless experiments, most of which marked a distinct advance in the technique of the subject.

His original work is included in this volume. Much of his material has been worked out by others, but, in the short time that he had for research, he had already added substantially to our knowledge of Vertebrate Anatomy. We owe to him the first accurate account of the urino-genital organs of *Polypterus*, and the demonstration that the crossopterygian fin is really a uniserial archipterygium; besides a series of invaluable observations upon the life-history and breeding habits of many tropical frogs and fishes.

His work was characterized by an almost fastidious degree of accuracy; he had a somewhat critical respect for the work of others, and he always liked to satisfy himself by reinvestigation that things were really as they were described.

As Cowley wrote about the greatest of English physiologists, he

“sought for Truth in Truth's own Book  
The creatures, which by God himself was writ;  
And wisely thought 'twas fit  
Not to read comments only upon it,  
But on the Original itself to look.”

A. E. SHIPLEY.

CHRIST'S COLLEGE,  
CAMBRIDGE,  
1906.



