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Contributions should be addressed to the Editor, A. d'A. Bellairs, St. Mary's Hospital Medical School, London, W.2. Articles should be typed in double spacing on one side of the paper only. Figures should be drawn in Indian ink on plain white paper or preferably bristol board.

Contributors of main articles only will be supplied with 25 free copies of the Journal; additional copies may be ordered at cost price.

EDITOR'S NOTE

The Editor would welcome more articles on the keeping of reptiles and amphibians in captivity, and on general topics such as hibernation.

OBITUARY

DR. MALCOLM ARTHUR SMITH, F.L.S., F.Z.S.



Malcolm Smith

With the death of Malcolm Smith at the age of eighty-two, on the 22nd July, 1958, science has lost nearly the last of those great amateur naturalists who, their professions taking them to a foreign country, devoted their spare time to a specialised study of its flora or fauna.

The youngest but one of a family of nine, Malcolm was born at New Malden, Surrey, then a small village surrounded by fields, some years after his father had returned from India, where he had worked as a civil engineer. At a very early age Malcolm had shown an interest in his particular chosen branch of natural history, and his elder sister, still living, tells how she had to make fishing nets for him to catch tadpoles and how he could generally be found carrying a snake in his pocket. This practice sometimes caused his parents some embarrassment if a snake suddenly appeared when they were entertaining visitors, but they did not disapprove of his hobby and allowed him to use a shed at the bottom of the garden to house his treasures. He retained this devotion for keeping living specimens all through his life.

After four years at Charing Cross Hospital, where he took his M.R.C.S., L.R.C.P. in 1898, Malcolm Smith was appointed medical officer to the British Legation in Bangkok. He has published an account of his experiences there under the title "A Physician at the Court of Siam" (Country Life, 1947). In this book he placed on record "a phase in the life of the Court of Siam that has now passed away and will never return"—but which, incidentally, has recently been popularised by musical comedy and the cinema.

Soon after his arrival in Siam he found a common interest in the natural history of this, then little known, country with W. J. F. (afterwards Sir Walter) Williamson, and together they formed the Natural History Society of Siam and soon had seventy members, who met in each other's houses for papers and discussion.

The Second Ordinary General Meeting was held in Malcolm Smith's house on 25th June, 1913, when he read a paper on "Some common species of snakes found in Bangkok". This was published in Part I of the Journal of the Society and in Part II Dr. G. A. Boulenger, of the British Museum, described a new species of snake "*Hypsirhina smithii*" in his honour. He had started work on the reptiles and batrachians of the country when the first World War upset all their plans.

Malcolm was elected President of the Society in 1922, but not long afterwards returned to England and started work at the British Museum (Natural History) as a voluntary worker, afterwards called Honorary Associate. In 1926 the Museum published as their catalogue his "Monograph of the Sea Snakes". He re-wrote the volumes of the "Fauna of British India" on the crocodiles, tortoises, lizards and snakes, between 1931 and 1943. In addition he undertook the work of compiler for his section of the "Zoological Record" from 1929 to 1945, and was Editor of the whole volume from 1938 till 1949.

Outside his work at the Museum, where he was a prolific writer on morphology and classification, he was Zoological Secretary to the Linnean Society from 1938 till 1949, where he was able to render invaluable service in safeguarding the Linnean collections on the outbreak of the Second World War.

He became Founding President of the British Herpetological Society in 1947, and in 1951 Collins published in their New Naturalist Series his "British Amphibians and Reptiles" which has become the standard work on the subject, both for the specialist and the field naturalist.

In 1927 Malcolm Smith had been instrumental in obtaining two of the remarkable giant lizards, known as Komodo Dragons, which were deposited in the Regent's Park Zoo and lived for many years, becoming as tame as dogs. The cast of one of them is now exhibited in the Reptile Gallery at South Kensington. It is quite probable that, but for his renown as a herpetologist in the East Indies, these animals might not have been seen in this country until many years later.

During his long and active life his energies were by no means confined to his desk or his collections. He was continually interested in his fellow men and undertook the running of dining clubs and other social functions. Most of his contemporaries have already departed this life, but those who remain have loving memories of a very interesting and charming companion and, with his younger friends, extend their deep sympathy to his widow and two surviving sons.

W. P. C. TENISON.

Mr. J. C. Battersby of the British Museum (Natural History) also writes :

Dr. Malcolm Smith was representative of the era of herpetologists of which G. A. Boulenger was the pattern. He was an enthusiast who had the opportunity to pursue his hobby, both in the field and in the British Museum of Natural History. His ability as a systematist and as an observer of natural history is apparent in the high standard of his many publications.

Malcolm Smith was associated with the Museum for nearly 40 years. During this period I had every opportunity of appreciating the energy with which he approached his studies and the immense volume of work entailed in making his own collection of amphibians, snakes, lizards, chelonians and crocodiles. The catalogue of this collection, consisting of four bound volumes of nearly 600 pages, contains the identification, specimen tag number, locality data and other information of each specimen and, throughout, the writing shows remarkable uniformity.

In latter years his attention turned more to the biology of reptiles and less to the systematics. As the specialist on the Herpetology of India and Malaya, he will be missed for a very long time, but his works will continue to be the classic references upon which other herpetologists may base their own work.

This short appreciation cannot wholly convey the great regard for Malcolm Smith felt by so many persons with whom he had contact.

MALCOLM SMITH'S CONTRIBUTION TO HERPETOLOGY

By

A. D'A. BELLAIRS

Reptiles, and to a lesser extent amphibians, are creatures which tend to evoke a strong emotional response in many people. This reaction, which was so well expressed by D. H. Lawrence in his famous poem on a snake, appears to go very much deeper than one would expect if it was merely based on reasonable fear of a possibly dangerous animal. The fact that reptiles occupy such an important place in folklore and primitive religion, and also figure in the dream-symbolism of psychiatric literature, is further evidence that these animals have a special significance in the human imagination.

It is not surprising, I think, that most herpetologists seem to have been attracted to their subject in the first instance for primarily emotional reasons which have little to do with practical matters such as helping people to recover from snake-bite, or exploiting a source of leather. For the most part herpetologists are born and not made, and this was certainly the case with Malcolm Smith.

Smith's interest in reptiles and amphibians clearly dates from his childhood, as Colonel Tenison, who illustrated much of his work, has described in the obituary. He qualified in medicine because, as he once told me, it seemed at the time to offer a better chance of studying and collecting these animals in countries where they are most numerous and exciting than did academic zoology. In this respect Smith followed a tradition established by generations of naturalists before him. As Miall* has written, "Until our own times the dissecting-room and the lectures of the medical school furnished the only regular training for the naturalist, while he found in the medical profession the likeliest means of earning his bread".

Some years after he qualified, Smith settled in Bangkok and achieved rapid professional success, becoming Medical Officer to the British Legation and Physician to the Siamese Court. So successful was he that he found himself in a position to retire when he was about fifty years old, and was able to devote the remainder of his life to herpetology. He returned to this country around 1925 and was made a research associate at the British Museum (Natural History) where he continued to work for the rest of his life.

It is perhaps understandable that at a time when the attention of so many biologists is directed towards physiological problems, the naturalist, with his preoccupation with animals rather than processes, should tend to fall into professional disfavour. Nevertheless, I think it is regrettable that Smith should never have received official recognition from any university; to the end of his life the Conjoint Diploma in Surgery and Medicine was his only academic qualification.

* Leonard Miall. *The early naturalists: their lives and work*. Macmillan. (1912). p.13

At the time when Smith began his scientific work, G. A. Boulenger was in charge of the collection of reptiles and amphibians at the British Museum. Boulenger was an amazingly prolific writer; between 1881 and 1896 he published 279 articles in various journals,* in addition to his enormous catalogues of the amphibians and reptiles in the Museum (1882-96) and one or two other books. These catalogues constitute a kind of classified list of virtually all the species known at the time. Their compilation involved extensive revision of previous systems of classification and nomenclature, and they are still invaluable as reference books for the systematist.

Smith had the opportunity of collaborating with Boulenger during the latter's last years at the Museum, and there is little doubt that their association had a major influence on much of Smith's work. Boulenger's catalogues and his monograph on the Reptilia and Batrachia of the Malay Peninsula (1912) in a sense formed the basis of Smith's subsequent account of the reptiles of the oriental region. Boulenger died in 1937 and Smith wrote an obituary of him in the journal *Copeia* (1938).

While he was in Siam, Smith wrote a long series of papers in the *Journal of the Natural History Society of Siam* and elsewhere on the classification and distribution of oriental reptiles and amphibians, and described several new species. Interspersed among his purely systematic articles are a number of papers of more general interest on the breeding and other habits of reptiles. Engaged as he was in a busy medical practice, Smith had to rely to a large extent on the services of paid collectors, but he was able to make several expeditions, including one to the island of Hainan, in search of specimens. He also studied the material in all the principal museums in the East and visited the United States, where he was able to examine the large herpetological collections in the Museum of Comparative Zoology at Harvard, and various other museums.

Smith's first major work was his *Monograph of the Sea Snakes* (1926), which was based on his own very complete collection of these animals which he presented to the British Museum. It is almost entirely a systematic treatise, but clearly shows evidence of his great interest in zoogeography. In the introduction he emphasises the essentially coastal distribution of most species and points out that the large oceans have apparently acted as barriers against their dispersal.

The three volumes on reptiles in the *Fauna of British India* series (1931-43) are probably Smith's most important contribution to herpetology. Though primarily systematic in approach, they are written from a much broader point of view than is usual with such works and show that Smith's interests extended into many other aspects of his subject besides taxonomy. The first volume on crocodylians and chelonians contains a brief but masterly survey of the herpetological zoogeography of the oriental region and a clear introduction to the salient facts of reptilian structure. It also contains a series of interesting and sympathetic portraits of the earlier herpetologists in India, many of them doctors and army officers. The much bigger second and third volumes deal with the lizards and snakes respectively and each

* K. P. Schmidt. Herpetology. In *A Century of progress in the natural sciences—1853-1953*. California Academy of Sciences (1955).

contains a long introductory section on the anatomy and life-history of these animals. Smith's observations on the courtship display of certain agamid lizards anticipate the more detailed studies of American workers who have shown that the social behaviour of some lizards is almost as elaborate as it is in birds.

I believe that Smith had originally planned to produce another volume in the same series on the amphibians, but never proceeded very far with this task. In fact the bulk of his published work is devoted to reptiles, though he once told me that he regarded the Amphibia, with their complicated life-histories, as the more interesting group.

While these volumes were in preparation, Smith produced a number of articles on various aspects of herpetology in addition to further taxonomic work. In 1931 he published the results of some experiments on the action of snake venoms in collaboration with Dr. E. Hindle. Another interesting paper (1938) deals with the curiously degenerate condition of the middle ear found in certain agamid and iguanid lizards. This condition is, of course, well known in snakes and burrowing lizards, but its occurrence in tree-living agamids is surprising and leads one to question the view that all evolutionary change must have an adaptive significance. In another article (1938) Smith describes a series of glands in the dorsal skin of certain colubrine snakes, an account which suggests that cutaneous glands may be more widely distributed in reptiles than is generally supposed.

One of Smith's main anatomical interests was in the nature of the transparent spectacle or brille which covers the eyes of snakes and certain lizards in place of movable eyelids. He showed that in some other lizards the lower eyelid contains a small transparent "window" and suggested that this might represent an early stage in the evolution of the fully spectacled condition.

Towards the end of his life, Smith's interests turned increasingly to the fauna of this country, and culminated in his book, *The British Amphibians and Reptiles*, which first appeared in 1951, when its author was about seventy-five. This book will probably remain the most widely read of all his work. Besides giving an admirable account of the habits and distribution of all our species, it is noteworthy in being the first of several recently published books by various authors in which the general student can find an account of some of the very interesting advances in herpetology which have been made during the last thirty years. Among the most striking of these are the studies made by the late G. K. Noble and his collaborators in the U.S.A. on the function of the organs of Jacobson in lizards and snakes, which play an important part in tracking prey and in sex recognition.

A revised edition of Smith's book appeared in 1954, embodying one of his last important pieces of work, an account of the importance of climatic factors in the distribution of the British amphibians and reptiles. He had plans for a third edition but unfortunately did not live to complete it.

In addition to his own scientific work, Smith rendered many other services to herpetology and zoology in general. For many years he played an important part in the production of the *Zoological Record*, that invaluable bibliography which lists and classifies nearly all the zoological papers published in the world literature each year. He served on the Council of

the Linnean Society of London and for a short time acted as Curator of the Reptile House at the London Zoo. He was primarily responsible for the foundation of the British Herpetological Society, and was its first president, from 1947 to 1954.

Like most naturalists, Smith thoroughly enjoyed field work. Collecting reptiles with him in Dorset was quite an experience. He had an amazingly sharp eye for lizards and would pounce on them with a swift darting movement. He also had an entirely characteristic method of catching adders, lifting them with the side-piece of his spectacles.

I can speak from experience of the kindness and encouragement which Malcolm Smith gave to many young workers. My first piece of research, on the head glands of snakes, was done under his guidance and was published in collaboration with him (1947). It was characteristic of him that even when our views differed, as they did over the interpretation of the eye-covering of geckos, he continued to help and supply me with material.

Smith's devotion to his subject was whole-hearted and lifelong; his most important contributions were probably in the fields of taxonomy and zoogeography, but he did much to advance other branches of his subject. Perhaps the best appreciation of his work is contained in his own succinct words, written in his study of Nelson Annandale of the Indian Museum: "He saw clearly the need of detailed systematic work, but it was only as a means to an end. Of the broader aspect of zoology, the relationship of a creature to its environment, the study of the fauna of an area or country as a whole, he never lost sight".*

BIBLIOGRAPHY OF THE WORKS OF MALCOLM ARTHUR SMITH by R. H. Ahrenfeldt.

NOTE.—This bibliography is intended by the compiler as a personal tribute to Dr. Malcolm Smith, from whom he received on many occasions considerable assistance and advice concerning various herpetological problems. It will, it is hoped, serve as a permanent record of the magnitude and importance of Dr. Smith's life work and contribution in this field, as also of the very great debt which is owed him by zoologists and herpetologists throughout the world.—R. H. A.

Items are listed by year of publication, from 1914 to 1957. For each year, they are placed in alphabetical order of the initial letter of the full title (irrespective of the chronological order of publication during that year); with the exception of joint publications, which are listed at the end of each year, in alphabetical order of authors.—A list of works edited or compiled by Dr. Smith, and of obituaries and reviews written by him, is given in an appendix.

Where present nomenclature of genera and species differs from that appearing in the titles, it is given in square brackets immediately following the name in question. Abbreviations of names of periodicals are, in general, those of the World List of Scientific Periodicals, 3rd ed., London, 1952.

* *The Fauna of British India. Reptilia and Amphibia.* 1, (1931), p. 12.

1914—

1. Distribution of *Ancistrodon rhodostoma*, the Malayan Viper, in Siam. *J.nat.Hist.Soc.Siam*, 1 : 57-8.
2. Large Banded Krait. *J.nat.Hist.Soc.Siam*, 1 : 58-9.
3. Note on a rare lizard, (*Lygosoma isodactylum*) [= *Riopa isodactyla*]. *J.nat.Hist.Soc.Siam*, 1 : 127-8, 1 pl.
4. Occurrence of the Krait (*Bungarus candidus*) and the Small-spotted Coral Snake (*Callophis maculiceps*) in Siam. A new colour variety of the latter. *J.nat.Hist.Soc.Siam*, 1 : 123-5.
5. On the breeding habits of *Hypsirhina enhydis* [= *Enhydis enhydis*] and *Herpeton tentaculatum* (the Tentacle Snake). *J.nat.Hist.Soc.Siam*, 1 : 126-7.
6. The snakes of Bangkok. *J.nat.Hist.Soc.Siam*, 1 : 5-18, 3 pls. [See No. 13].
7. BOULENGER, G. A., (& SMITH, M. A.). Descriptions of new reptiles from Siam. With notes by Malcolm Smith. *J.nat.Hist.Soc.Siam*, 1 : 67-70, 1 pl.

1915—

8. A new snake from Bangkok. *J.nat.Hist.Soc.Siam*, 1 : 255-6.
9. List of the snakes at present known to inhabit Siam. *J.nat.Hist.Soc.Siam*, 1 : 211-5.
10. Notes on some snakes from Siam. *J.Bombay nat.Hist.Soc.*, 23 : 784-9, 1 fig.
11. On the breeding habits and colour changes in the lizard, *Calotes mystaceus*. *J.nat.Hist.Soc.Siam*, 1 : 256-7.
12. Reptiles and batrachians. *In*: K. G. Gairdner & M. A. Smith, List of the mammals, birds, reptiles and batrachians obtained in the Ratburi and Petchaburi districts. *J.nat.Hist.Soc.Siam*, 1 : 153-6.
13. The snakes of Bangkok [conclusion]. *J.nat.Hist.Soc.Siam*, 1 : 173-87, 4 pls. [See No. 6].
14. SMITH, M. A., & KLOSS, C. B. On reptiles and batrachians from the coast and islands of South-East Siam. *J.nat.Hist.Soc.Siam*, 1 : 237-49.

1916—

15. A list of the crocodiles, tortoises, turtles and lizards at present known to inhabit Siam. *J.nat.Hist.Soc.Siam*, 2 : 48-57.
16. Descriptions of five tadpoles from Siam. *J.nat.Hist.Soc.Siam*, 2 : 37-43, 2 pls.
17. Descriptions of three new lizards and a new snake from Siam. *J.nat.Hist.Soc.Siam*, 2 : 44-7, 1 pl.
18. Note on a rare sea snake (*Thalassophis anomalus*) from the coast of Siam. *J.nat.Hist.Soc.Siam*, 2 : 176-7, 1 pl.
19. On a collection of reptiles and batrachians from Peninsular Siam. *J.nat.Hist.Soc.Siam*, 2 : 148-71.
20. On the frogs of the genus *Oxyglossus* [= *Ooeidozyga*]. *J.nat.Hist.Soc.Siam*, 2 : 172-5, 1 pl.

21. BOULENGER, G. A., (& SMITH, M. A.). Description of a new frog from Siam. With ... a note by the collector [M. A. Smith]. *J.nat.Hist.Soc.Siam*, 2 : 103-5, 1 pl.
- 1917 —
22. A list of the batrachians at present known to inhabit Siam. *J.nat.Hist.Soc.Siam*, 2 : 226-31.
23. A new frog from Bangkok. *J.nat.Hist.Soc.Siam*, 2 : 256.
24. A two-headed snake. *J.nat.Hist.Soc.Siam*, 2 : 255-6, 1 pl.
25. Descriptions of a new snake and a new frog from Siam. *J.nat.Hist.Soc.Siam*, 2 : 276-8.
26. Descriptions of new reptiles and a new batrachian from Siam. *J.nat.Hist.Soc.Siam*, 2 : 221-5, 2 pls.
27. On tadpoles from Siam. *J.nat.Hist.Soc.Siam*, 2 : 261-75, 2 pls.
28. Preliminary diagnoses of four new sea snakes. *J.nat.Hist.Soc.Siam*, 2 : 340-2.
- 1918 —
29. Description of a new snake (*Opisthotropis spenceri*) from Siam. *J.nat.Hist.Soc.Siam*, 3 : 13, 1 pl.
- 1919 —
30. *Crocodylus siamensis*. *J.nat.Hist.Soc.Siam*, 3 : 217-21, 3 pls.
31. Remarks on Col. Wall's identification of *Hydrophis cyanocinctus*. *J.Bombay nat.Hist.Soc.*, 26 : 682-3.
32. The lizards of the genus *Tropidophorus* in Siam, with descriptions of two new species. *J.nat.Hist.Soc.Siam*, 3 : 223-8.
- 1920 —
33. On sea-snakes from the coasts of the Malay Peninsula, Siam and Cochin China. *J. F.M.S. Mus.*, 10 : 1-63, 1 pl., 1 map.
34. Reptiles and batrachians collected on Pulo Condore. *J.nat.Hist.Soc.Siam*, 4 : 93-7, 1 pl.
- 1921 —
35. A new name for the frog, *Rana pullus* [= *R. tasanae*]. *J.nat.Hist.Soc.Siam*, 4 : 193.
36. New or little-known reptiles and batrachians from Southern Annam (Indo-China). *Proc.zool.Soc.Lond.*, 1921 : 423-40, 2 figs., 2 pls.
37. Two new batrachians and a new snake from Borneo and the Malay Peninsula. *J. F.M.S. Mus.*, 10 : 197-9, 1 pl.
38. SMITH, M. A., & PROCTER, J. B. On a collection of reptiles and batrachians from the Island of Ceram, Indo-Australian Archipelago. *Ann.Mag.nat.Hist.*, ser. 9; 7 : 352-5.
- 1922 —
39. Notes on reptiles and batrachians from Siam and Indo-China—(No. 1) *J.nat.Hist.Soc.Siam*, 4 : 203-14, 1 pl. [See No. 44.]
40. On a collection of reptiles and batrachians from the mountains of Pahang, Malay Peninsula. *J. F.M.S. Mus.*, 10 : 263-82.
41. The frogs allied to *Rana doriae*. *J.nat.Hist.Soc.Siam*, 4 : 215-25, 1 pl. Addendum, 227-9.

- 1923 —
42. A review of the lizards of the genus *Tropidophorus* on the Asiatic mainland. *Proc.zool.Soc.Lond.*, 1923 : 775-81.
43. Narrative of a journey to the interior of Hainan. *J.nat.Hist.Soc.Siam*, 6 : 185-94, 2 pls.
44. Notes on reptiles and batrachians from Siam and Indo-China — (No. 2). *J.nat.Hist.Soc.Siam*, 6 : 47-53, 1 pl. [See No. 39.]
45. On a collection of reptiles and batrachians from the Island of Hainan. *J.nat.Hist.Soc.Siam*, 6 : 195-212, 2 figs.
46. The poisonous land snakes of Siam. *J.nat.Hist.Soc.Siam*, 6 : 55-64, 1 pl.
- 1924 —
47. Descriptions of Indian and Indo-Chinese tadpoles. *Rec.Indian Mus.*, 26 : 137-44, 1 pl.
48. New tree-frogs from Indo-China and the Malay Peninsula. *Proc.zool.Soc.Lond.*, 1924 : 225-34, 1 fig., 3 pls.
49. The tadpole of *Tylostrotiton verrucosus* Anderson. *Rec.Indian Mus.*, 309-10, 1 pl.
50. Two new lizards and a new tree frog from the Malay Peninsula. *J. F.M.S. Mus.*, 11 : 184-6, 2 figs.
- 1925 —
51. A new Ground-Gecko (*Gymnodactylus*) from the Malay Peninsula. *J.Malay.Br.Asiat.Soc.*, 3, Pt. 1 : 87.
52. Contributions to the herpetology of Borneo. *Sarawak Mus.J.*, 3 : 15-34, 1 fig.
53. On a collection of reptiles and amphibians from Mt. Murud, Borneo. *Sarawak Mus.J.*, 3 : 5-14, 1 pl.
- 1926 —
54. Monograph of the Sea-Snakes (Hydrophiidae). London : Brit.Mus. (Nat.Hist.). xvii + 130 pp., 35 figs., 2 pls.
55. "Spolia Mentawia": Reptiles and amphibians. *Ann.Mag.nat.Hist.*, ser.9; 18 : 76-81.
56. The function of the "funnel" mouth of the tadpoles of *Megalophrys* [= *Megalophrys*], with a note on *M. aceras* Boulenger. *Proc.zool.Soc.Lond.*, 1926 : 983-8, 2 figs.
- 1927 —
57. Contributions to the herpetology of the Indo-Australian region. *Proc.zool.Soc.Lond.*, 1927 : 199-225, 4 figs., 2 pls.
- 1928 —
58. Description of a new species of *Draco* from the Indo-Chinese region. *Ann.Mag.nat.Hist.*, ser. 10; 2 : 248.
59. The status of some recently described genera and species of snakes. *Ann.Mag.nat.Hist.*, ser.10; 1 : 494-7.
60. Two vipers new to Siam. *J.Siam. Soc., Nat.Hist.Suppl.*, 7 : 194.

1929 —

61. Amphibia. *In*: List of the Vertebrated Animals exhibited in the Gardens of the Zoological Society of London, 1828-1927; Centenary edition; Vol. 3: Reptiles, Amphibia, Fishes. London: Zool.Soc. pp. 273-309.
62. Descriptions of a new Skink from Christmas Island and a new frog from Annam. *Ann.Mag.nat.Hist.*, ser.10; 3: 294-7, 1 fig.
63. On a collection of amphibians and reptiles from the Upper Reaches of the Br̄hmaputra. *Rec.Indian Mus.*, 31: 77-80, 1 fig.
64. Remarks on three rare reptiles from the Indo-Chinese region. *J.Siam Soc.,Nat.Hist.Suppl.*, 8: 49-50.
65. The survival of the Gavial (*Gavialis gangeticus*) in Burma. *J.Bombay nat.Hist.Soc.*, 33: 995-8, 3 figs.

1930 —

66. Ovoviviparity in sea-snakes. *Nature,Lond.*, 126: 568.
67. The Reptilia and Amphibia of the Malay Peninsula from the Isthmus of Kra to Singapore including the adjacent islands. (A supplement to Dr. G. A. Boulenger's "Reptilia and Batrachia", 1912). *Bull.Raffles Mus.*, No. 3: xviii + 149 pp., 13 figs.
68. Two new snakes from Tonkin, Indo-China. *Ann.Mag.nat.Hist.*, ser. 10; 6: 681-3, 1 fig.

1931 —

69. Description of a new genus of sea-snake from the coast of Australia, with a note on the structures providing for complete closure of the mouth in aquatic snakes. *Proc.zool.Soc.Lond.*, 1931: 397-8, 1 pl.
70. The Fauna of British India, including Ceylon and Burma.— Reptilia and Amphibia; Vol. 1: *Loricata, Testudines*. London: Taylor & Francis. xxviii + 185 pp., 42 figs., 1 map. [See Nos. 82 & 101.]
71. The herpetology of Mt. Kinabalu, North Borneo, 13,455 ft. *Bull. Raffles Mus.*, No. 5: 3-32, 1 fig., 2 pls.
72. SMITH, M. A., & HINDLE, E. Experiments with the venom of *Laticauda*, *Pseudechis* and *Trimeresurus* species. *Trans.R.Soc.trop. Med.Hyg.*, 25: 115-20.

1932 —

73. Appendix: Reptiles and amphibians. *In*: Kingdon Ward's "Exploration of the Burma-Tibet Frontier". *Geogr.J.*, 80: 479.
74. Some notes on the Monitors. *J.Bombay nat.Hist.Soc.*, 35: 615-9, 1 pl.

1933 —

75. Remarks on some Old World Geckoes. *Rec.Indian Mus.*, 35: 9-19, 7 figs.
76. The type locality of the Gecko, *Hoplodactylus duvaucelii* Dum. and Bibr. *Rec.Indian Mus.*, 35: 377.

1934 —

77. Amphibians and reptiles. *In*: Kingdon Ward's "The Himalaya east of the Tsangpo". *Geogr.J.*, 84: 393-4.
78. The classification of snakes in accordance with their dentition and the evolution of the poison fang. *Proc.R.Soc.Med.*, 27: 1081-3.
79. SMITH, M. A., & DERANIYAGALA, P. E. P. A new genus of Gecko. *Ceylon J.Sci.,[Spolia zeylan.]*, B, 18: 235-6, 2 figs.

1935 —

80. On a collection of reptiles and amphibians from Perak, Malay Peninsula. *Bull.Raffles Mus.*, No. 10: 61-3, 1 fig., 1 pl.
81. The amphibians and reptiles obtained by Capt. Kingdon Ward in Upper Burma, Assam and S.W. Tibet. *Rec.Indian Mus.*, 37: 237-40.
82. The Fauna of British India, including Ceylon and Burma.—Reptilia and Amphibia; Vol. 2: *Sauria*. London: Taylor & Francis. xiii + 440 pp., 94 figs., 1 pl., 2 maps. [See Nos. 70 & 101.]
83. The sea snakes (*Hydrophiidae*). *Dana Rep.*, No. 8: 1-6, 1 fig., 1 map.

1937 —

84. A Bangkok Python. *J.Siam Soc.,Nat.Hist.Suppl.*, 11: 61-2.
85. A review of the genus *Lygosoma* (Scincidae: Reptilia) and its allies. *Rec.Indian Mus.*, 39: 213-34, 5 figs.
86. Breeding habits of the Indian Cobra. *J.Siam Soc.,Nat.Hist.Suppl.*, 11: 62-3.
87. Description of a new species of agamid lizard from Upper Burma. *J. Bombay nat.Hist.Soc.*, 39: 755.
88. *Draco blanfordi* and its allies. *Bull.Raffles Mus.*, No. 13: 75-6, 1 pl.
89. The names of two Indian vipers. *J.Bombay nat.Hist.Soc.*, 39: 730-1.
90. Un nouveau lézard de Cochinchine. *Bull.Mus.Hist.nat.,Paris*, ser.2; 9: 366.

1938 —

91. Evolutionary changes in the middle ear of certain agamid and iguanid lizards. *Proc.zool.Soc.Lond.*, B, 108: 543-9, 8 figs.
92. The nucho-dorsal glands of snakes. *Proc.zool.Soc.Lond.*, B, 108: 575-83, 5 figs., 1 pl.

1939 —

93. A revision of the Acrochordinae (Snakes). *Ann.Mag.nat.Hist.*, ser.11; 3: 393-5.
94. Evolutionary changes in the eye coverings of certain lizards. *Proc. Linn.Soc.Lond.*, 151: 190-1.

1940 —

95. A facsimile of R. H. Beddome's articles on Indian reptiles 1862-1870. [Introduction by M. A. Smith.] *J.Soc.Bibl.nat.Hist.*, 1: 273-334, (reprod. of 10 orig. pls.).
96. A new snake of the genus *Anomochilus* [= *Anomalochilus*] from the Malay Peninsula. *Ann.Mag.nat.Hist.*, ser. 11; 6: 447-9, 1 fig.
97. Contributions to the herpetology of Afghanistan. *Ann.Mag.nat.Hist.*, ser.11; 5: 382-4.
98. The amphibians and reptiles obtained by Mr. Ronald Kaulback in Upper Burma. *Rec.Indian Mus.*, 42: 465-86, 1 pl., 1 map.

1941 —

99. The herpetology of the Andaman and Nicobar Islands. *Proc.Linn.Soc. Lond.*, 153: 150-8, 2 maps.

- 1942 —
100. Remarks on the nasal pit in snakes. *Copeia*, 1942 : 256.
- 1943 —
101. The Fauna of British India, Ceylon and Burma, including the whole of the Indo-Chinese Sub-Region.—Reptilia and Amphibia; Vol. 3 : *Serpentes*. London : Taylor & Francis. xii + 583 pp., 166 figs. [See Nos. 70 & 82.]
- 1946 —
102. Cobras and King Cobras. *Zoo Life*, 1 : 39-42, 4 figs.
- 1947 —
103. A Physician at the Court of Siam. London : Country Life. 164 pp., 5 figs., 23 pls., 1 map.
104. SMITH, M. A., & BELLAIRS, A. d'A. The head glands of snakes with remarks on the evolution of the parotid gland and teeth of the Opisthoglypha. *J.Linn.Soc. (Zool.)*, 41 : 351-68, 27 figs., 2 pls.
- 1949 —
105. A new species of Pit Viper from South India, *Trimeresurus huttoni* sp.nov. *J.Bombay nat.Hist.Soc.*, 48 : 596.
106. British Reptiles and Amphibia. (King Penguin Books, 47.) Harmondsworth, Middlesex : Penguin Books. 34 pp., 5 figs., 16 pls.
107. Notes on a second specimen of the Skink *Dasia subcaerulea* from Southern India. *J.Bombay nat.Hist.Soc.*, 48 : 596-7.
108. Reproduction and behaviour of the British amphibia and reptiles. *New Nat.*, No. 5 : 19-24, 5 figs., 2 pls.
109. The Edible Frog and the Marsh Frog in England. *Zoo Life*, 4 : 55-8, 5 figs.
110. The Midwife Toad (*Alytes obstetricans*) in England. *Brit.J.Herpetol.*, 1 : 55-6.
- 1950 —
111. Further notes on the Midwife Toad (*Alytes obstetricans*) in England. *Brit.J.Herpetol.*, 1 : 89-91.
112. Neoteny in British newts. *Brit.J.Herpetol.*, 1 : 91-2.
- 1951 —
113. On a collection of amphibians and reptiles from Nepal. *Ann.Mag.nat.Hist.*, ser.12; 4 : 726-8.
114. The British Amphibians and Reptiles. (The New Naturalist Ser.) London : Collins. 1st ed. xiv + 318 pp., 88 figs., 16 col. pls., 16 monochr. pls., 1 map. [See No. 124.]
115. The Wall Lizard (*Lacerta muralis*) in England. *Brit.J.Herpetol.*, 1 : 99-100.
116. Unusual size of the Slow-worm (*Anguis fragilis*) and the Adder (*Vipera berus*) in the British Isles. *Brit.J.Herpetol.*, 1 : 100.

- 1952 —
117. The climate of the British Isles and its influence on the habits and distribution of the amphibians and reptiles. *Brit.J.Herpetol.*, 1 : 103-12.
118. The history of herpetology in India. *J.Bombay nat.Hist.Soc.*, 50 : 907-9.
- 1953 —
119. Description of a new species of frog of the genus *Philautus*. *Ann.Mag.nat.Hist.*, ser.12; 6 : 477-8.
120. The feeding habits of the Marsh Frog (*Rana ridibunda ridibunda*). *Brit.J.Herpetol.*, 1 : 170-2.
121. The shortage of toads and frogs : Is it due to the demands of hospitals and teaching centres? *Country Life*, 114 : 770-1 (Sept. 10), 3 figs.
122. SMITH, M. A., & BATTERSBY, J. C. On a collection of amphibians and reptiles from Nepal. *Ann.Mag.nat.Hist.*, ser.12; 6 : 702-4.
123. SMITH, M. A., BELLAIRS, A. d'A., & MILES, A. E. W. Observations on the premaxillary dentition of snakes with special reference to the egg-tooth. *J.Linn.Soc. (Zool.)*, 42 : 260-8, 3 figs., 2 pls.
- 1954 —
124. The British Amphibians and Reptiles. (The New Naturalist Ser.) London : Collins. 2nd (revised) ed. xiv + 322 pp., 91 figs., 16 col. pls., 16 monochr. pls., 1 map. [See No. 114.]
- 1955 —
125. Deaths from snake-bite. *Country Life*, 117 : 324-5 (Feb. 3), 3 figs.
- 1956 —
126. Marine Iguana. *Zoo Life*, 11 : 51-3, 4 figs.
127. These are the reptiles of British Guiana. *Zoo Life*, 10 : 116-9, 4 figs.
- 1957 —
128. Chameleons. *Zoo Life*, 12 : 51-7, 14 figs.

Appendix —

M. A. Smith was joint editor of the *J.nat.Hist.Soc.Siam*, Bangkok, during the entire period of its publication, viz., Vols. 1-6, 1914-24.

He was responsible for compiling the Section on Amphibia and Reptilia of the *Zoological Record*, Vols. 66 (1929) — 81 (1944), and Vol. 82 (1945) jointly with W. E. Swinton, which were published in the years 1930-47.

He wrote obituary notices on G. A. Boulenger (*Copeia*, 1938 : 1-3), S. S. Flower (*ibid.*, 1946 : 185-7), F. Wall (*ibid.*, 1951 : 113-4), and J. W. Lester (*Brit.J.Herpetol.*, 1957, 2 : 79). He also reviewed books by R. Mertens (*Brit.J.Herpetol.*, 1951, 1 : 100-1), and P. E. P. Deraniyagala (*ibid.*, 1955, 1 : 254-5).

OBSERVATIONS ON THE FEEDING HABITS OF THE
SMOOTH SNAKE

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These observations were carried out over a period of about 2½ years on three full-grown specimens of the Smooth Snake (*Coronella austriaca* Laurenti), originally obtained from Italy. They were made partly under natural conditions in a large outdoor reptiliary and partly in indoor cages. A wide range of food was made available at different times, with results which will be given below. By and large, these results were fairly consistent, but towards the end of the period the snakes had become extremely tame and it was found that habituation was having an increasing effect in altering what previously appeared to be the natural feeding habits. In fact, it was for this reason that the observations were finally discontinued.

The following types of food were invariably ignored completely and it would therefore seem safe to assume (subject to the qualifications mentioned above) that they do not normally form part of the natural diet of these snakes :-

Small frogs (*Rana temporaria*) and toads (*B. bufo*), various invertebrates such as beetles, crickets, grasshoppers, mealworms, gentles, caterpillars, earthworms; also nestling birds and small birds' eggs.

Newts (*Triturus vulgaris* and *T. helveticus*) were frequently offered, and when moving actively on land, were often approached as though the snakes were about to seize them, but after closer inspection were invariably refused.

Small freshwater fishes of various species were frequently made available, both alive in water and dead on land. With one exception, they were always ignored, this exception being an occasion when a Smooth Snake made three consecutive attempts to swallow a dead perch which had been placed in the cage for some larger fish-eating snakes (*Natrix sipedon*) temporarily sharing the same accommodation. The Smooth Snake at each attempt inspected the fish carefully and seized it by the nose but after a determined effort to swallow it, was forced to give up the attempt as the fish was too large. It is perhaps worth mentioning that these snakes frequently entered water voluntarily, including the fairly large pond in the outdoor reptiliary, and swam quite well on the surface; although I have read accounts to the contrary, I never saw them submerge, and they always kept their heads above water.

Small lizards (*Lacerta vivipara*, *L. sicula* and *L. muralis*) were taken readily, but larger species such as *L. viridis* were left alone. The lizards were usually ignored if they kept still, but the slightest movement attracted the attention of the snake, which either rushed at the lizard and seized it immediately, or stalked it very slowly until the snake's head was no more than an inch or two from the lizard. Then the snake drew up its body to form an S-bend of the neck and struck at the lizard from this position. In

general, active movement by the lizard produced an active response from the snake, but a lizard which had once attracted the snake's attention and then remained still was pursued by the stalking method. The lizard might be seized by any part of the head or body or sometimes by the tail, which would then be discarded by the lizard and swallowed by the snake. If seized by the head or anterior body, the lizard had little defence, but if taken by the posterior part of the body, its invariable reaction was to twist its body and seize the snake by the loose skin on the side of the neck. As the snake always moved its jaws along to one end of the lizard's body, usually the head, before commencing to swallow it, this reaction by the lizard made it necessary for the snake to break the latter's hold first. This was normally achieved by the snake throwing one or two coils around the body of the lizard, not tightly enough to constrict it, but sufficient to hold the body of the lizard more or less straight and enable the snake, though sometimes with considerable difficulty, to work its jaws towards the lizard's head and eventually force it to relinquish its grip. If this proved particularly difficult, the snake would often resort to twisting and rolling its body to assist in the process. Very small lizards (and a full-grown Smooth Snake would take even newly-born *Lacerta vivipara*) were swallowed immediately without the snake making any use of its coils. When a larger lizard seizes the snake's neck in the above-described manner, it hangs on most tenaciously and often leaves a noticeable scar on the snake's skin which may persist for as long as a week or two. It was interesting to note that when these three snakes were first acquired direct from Italy, presumably not previously having fed in captivity, two of them showed such marks on the neck and one of them, a day after it was obtained, regurgitated the remains of what appeared to be a full-grown *Lacerta sicula campestris*.

Slowworms and baby snakes (*Natrix natrix* and *Thamnophis sirtalis*) were readily taken, the technique being the same as for lizards, by using the coils and moving the jaws along to the head before swallowing, even though these victims did not attempt to defend themselves by biting. In swallowing such long-bodied prey, the snake made much use of its neck muscles to assist deglutition, in a manner very similar to that of the various *Lampropeltis* species when devouring other snakes.

Dead lizards, slowworms and snakes were ignored, except that, as mentioned above, the snakes eventually became very tame and could be picked up in one hand and offered dead food of this sort with the other, which they frequently accepted.

Baby mice were readily taken, but in this case the snake seemed to be attracted by the smell of the mice rather than by their movements. A pink mouse, even if moving actively, would be ignored by a snake well able to see it, unless placed quite near to the snake's nose, when it would be taken; the snake would often continue to investigate the same spot as though looking for more. The mice were seized by any part of the body and the jaws moved to one end before swallowing, but no use was made of the coils. They were not stalked or struck at, but seized only when the snake's nose was in contact with them. Young mice of any size were taken, from those just born to those which had acquired their fur and were about to

leave the nest, but active mice which had already left the nest were ignored.

From observation over a period, it seemed fairly obvious that mice were detected normally, if not always, by smell, and cold-blooded prey by sight. To test this further, the following series of experiments were carried out, using pink mice and lizards as the alternative types of prey :-

(a) A clear glass screen was placed between the snake and its prey. The only reaction was to moving lizards. There was no reaction to mice or motionless lizards, even when separated from the snake's head only by the width of the glass.

(b) The prey was introduced to the snake wrapped in cotton wool so as not to be visible. Lizards excited no response but mice were detected, obviously by smell, and the snake burrowed into the cotton-wool to find them. A litter of young field mice in a natural grass nest was likewise detected and extracted.

(c) An empty field-mouse nest, from which the young had just been removed, was introduced and aroused much interest on the part of the snakes, which investigated it thoroughly.

(d) A young mouse was placed on peaty soil in the cage for about five minutes, the snakes having been taken out. The mouse was then removed and the snakes put back into the cage. They all eventually showed great interest in the spot where the mouse had been, and nosed around in the peat for some time.

(e) Freshly-killed lizards placed in front of the snake's nose were ignored, but freshly-killed young mice were taken.

As already mentioned, the snakes eventually learned to take dead lizards from the hand, even to the point that they would take a portion of a lizard such as a cut-off leg or tail. Even at this stage, however, they showed no interest in dead lizards or pieces of lizard placed in front of them on the ground or the floor of the cage. When taking dead lizards from the hand, the snakes would sometimes nose them first as though smelling them, but just as often took them without further ado, often even striking at them from a distance of two or three inches.

Towards the end of the period of observation, the snakes appeared to develop to some extent a visual reaction to young mice, in that the mouse was seized more rapidly with little or no preliminary "nosing" of the prey. This was particularly apparent if several young mice were offered together—the first might be investigated before being seized, the others taken more rapidly. Whether or not this was due to habituation, however, the experiments as a whole seemed to indicate fairly definitely that these snakes normally react to cold-blooded prey by sight, and to warm-blooded prey by smell. It would seem reasonable to assume that in their natural state they catch lizards, young snakes and the like by sight, when these are above ground, but in conjunction with their burrowing habits actively search for nests of young mice and detect them under cover by smell.

It seems on the face of it rather strange that these three snakes would take young mice but consistently refused nestling birds, and mention has been made by other writers (though I have no references to hand) of their taking both nestling birds and various insects. These observations are limited by being confined to only three specimens, all full-grown and from one small part of the Smooth Snake's range, which is an unusually extensive one. It is possible that the food preferences of this snake vary with age or in different regions, and the writer would be very interested to know in this respect what experience others have had of the Smooth Snake from other parts of its range.

The sense of smell in snakes involves not only the use of the nose, but also that of the organs of Jacobson. These paired hollow structures are really portions of the nose which become isolated from the rest during embryonic development, and are supplied by a separate branch of the nerve of smell. They lie above the palate, one on either side near the tip of the snout, and each communicates with the mouth by means of a slender duct. It has been shown that they are important sense organs and serve in the appreciation of scent particles which reach them from the tips of the forked tongue. (See M. Smith, *The British Amphibians and Reptiles*, Collins, 2nd Ed., 1954.)

It is therefore of some interest to determine the relative importance of the nose proper, and of the organs of Jacobson, in the operation of which the tongue is also concerned. Observations on a number of species have convinced the writer that the nose proper, and the organs of Jacobson, are used in varying degrees by different species. In this respect, it is noticeable that the Smooth Snake makes less obvious use of its tongue than that of any other snake observed. *Natrix* species, for example, use the tongue far more actively, and many members of the genus *Elaphe*, when investigating motionless food such as eggs or constricted prey still held in their coils, investigate it with the tongue for a long time before seizing it in their jaws. The Smooth Snake, on the other hand, when investigating food or places where food has been, often appears not to extend the tongue at all, and carries out the examination with the snout firmly pressed against the object concerned. At times the extreme tips of the tongue were visible, but although it was not always possible to be certain, one had the impression that only the nostrils were brought into contact with the object as a rule.

A greater use of the tongue was observed when moving prey had aroused the snake's attention, but once it had located it, the use of this organ became less marked.