

## UNESCO – KALINGA PRIZE WINNER – 1968

### Sir Gavin Rylands de Beer, FRS



#### British Zoologist & Evolutionist

[Born : November 1, 1899, Malden, near London, England

Died : June 21, 1972, Alfriston, Sussex, England]

Each ontogeny is a fresh creation to which the ancestors contribute only the internal factors by means of heredity.

...*Gavin de Beer*

## Sir Gavin Rylands de Beer, FRS (1899-1972)

### A Biographical Profile

Born 1899; educated at the Ecole Pascal, Paris, Harrow School and Magdalen College, Oxford, 1917; Grenadier Guards and Army Education Scheme, 1918-1919; Magdalen, 1919-1921; graduated with Zoology degree in 1921; fellow of Merton College, 1923-1938; taught in the University Zoology Department until 1938; reader in embryology, University College London, 1938; Professor, 1945-1950; World War-II work in intelligence, propaganda and psychological warfare; Fellow of the Royal Society, 1940; President of the Linnean Society, 1946-1949; Director of the British Museum (Natural History), 1950-1960; knighted, 1954; retired, 1960; lived in Switzerland, 1965-1971; died 1972. Publications : Growth (London, 1924); Early travelers in the Alps (London, 1930); Vertebrate zoology (London, 1932); An introduction to experimental embryology (Oxford, 1934); De Beer and Julian Sorell Huxley, Elements of experimental embryology (Cambridge , 1934); The development of the vertebrate skull (Oxford, 1937); edited, Evolution. Essays on aspects of evolutionary biology presented to Professor E S Goodrich on his seventieth birthday (Oxford, 1938); Alps and elephants. Hannibal's march (London , 1955); Darwin's Journal (London, 1959); edited Darwin's notebooks on transmutation of species (London, 1960); Charles Darwin: evolution by natural selection (London, 1963); Atlas of evolution (London, 1964); Jean-Jacques Rousseau and his world (London, 1972).

**Sir Gavin Rylands de Beer FRS** (1899-1972) was a British evolutionary embryologist, director of the British Museum (Natural History) and president of the Linnean Society.

#### Biography :

Born on November 1, 1899 in Malden, Surrey (now part of London), de Beer spent most of his childhood in France, where he was educated at the Parisian École Pascal. During this time, he also visited Switzerland, a country with which he remained fascinated for the rest of his life. His education continued at Harrow and Magdalen College, Oxford, where he graduated with a degree in zoology in 1921, after a pause to serve in the First World War in the Grenadier Guards and the Army Education Scheme. He soon became a fellow of Merton College and began to teach at the university's zoology department. In 1938, he was made reader in embryology at University College, London, and served in the Second World War in intelligence, propaganda and psychological warfare. Also during the war, in 1940, he was elected Fellow of the Royal Society<sup>[1]</sup>.

In 1945, de Beer became professor of zoology and was, from 1946 to 1949, president of the Linnean Society. This was followed by his directorship of the British Museum (Natural History) (now the Natural History Museum), from 1950 until his retirement in 1960. He was knighted in 1954.

After his retirement, de Beer moved to Switzerland and worked on several publications on Charles Darwin<sup>[2]</sup> and his own seminal Atlas of Evolution. He returned to England in 1971 and died at Alfriston, Sussex on June 21, 1972.

#### Work :

De Beer's early work at Oxford was strongly influenced by J.B.S. Haldane and Edwin S. Goodrich (one of de Beer's teachers). This work concerned experimental embryology, and some of it was co-written with Julian Huxley, who would go on to be one of the leading figures of the modern synthesis. However, while Huxley went on to include aspects of population genetics in his work, de Beer turned to comparative embryology and evolutionary embryology.

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## Glossary on Kalinga Prize Laureates

Much of de Beer's work stressed the importance of heterochrony<sup>[3]</sup>, and especially paedomorphosis in evolution. According to his theories, paedomorphosis (the retention of juvenile features in the adult form) is more important in evolution than gerontomorphosis, since juvenile tissues are relatively undifferentiated and capable of further evolution, whereas highly specialized tissues are less able to change. He also conceived the idea of *clandestine evolution*, which helped to explain the sudden changes in the fossil record which were so at odds with Darwin's gradualist theory of evolution. If a novelty were to evolve gradually in an animal's juvenile form, then its development would not appear in the fossil record at all, but if the species were then to undergo neoteny (a form of paedomorphosis in which sexual maturity is reached while in an otherwise juvenile form), then the feature would appear suddenly in the fossil record, despite having evolved gradually.

De Beer worked on paleornithology and general evolutionary theory, and was largely responsible for elucidating the concept of mosaic evolution, as illustrated by his review of the *Archaeopteryx* family in 1954. De Beer's work also included a review of Haeckel's concept of heterochrony, with particular emphasis on its role in avian evolution, especially that of the ratites, in 1956<sup>[4]</sup>. ***Dedicated to the popularization of science, he received the Kalinga Prize from UNESCO.***

In addition to his scientific works, de Beer also wrote a series of books about Switzerland and the Alps.

### Books by Gavin de Beer :

- Growth – 1924
- An introduction to experimental embryology – 1926
- The comparative anatomy, histology and development of the pituitary body-1926
- Vertebrate zoology – 1928
- Early travelers in the Alps – 1930
- Embryology and evolution – 1930 (later editions bore the title Embryos and ancestors)
- Alps and men – 1933

- The elements of experimental embryology- 1934 (co-written with Julian Huxley)
- The development of the vertebrate skull – 1937
- Escape to Switzerland – 1945
- Alps and elephants. Hannibal's march – 1955
- The first ascent of Mont Blanc- 1957
- Darwin's journal – 1959
- Charles Darwin: evolution by natural selection – 1963
- Atlas of evolution – 1964
- Homology an unsolved problem – 1971
- Jean-Jacques Rousseau and his world – 1972

### Quote :

- Each ontogeny is a fresh creation to which the ancestors contribute only the internal factors by means of heredity.

### References :

1. ^ Lists of Royal Society Fellows 1960-2004 (<http://www.royalsoc.ac.uk/page.asp?id=1727>). Retrieved on April 3, 2006.
2. ^ The History of Science and Technology 1801-1914 (<http://www.kcl.ac.uk/depsta/iss/library/speccoll/host/debeer.html>). Retrieved on April 3, 2006.
3. ^ Brigandt, I. (2006) Homology and heterochrony: the evolutionary embryologist Gavin Rylands de Beer (1899-1972) (<http://www3.interscience.wiley.com/cgi-bin/abstract/112467522/ABSTRACT>).  
Journal of Experimental Zoology (Molecular and Developmental Evolution) 306B:317-328. [preprint ([http://www.ualberta.ca/~brigandt/de\\_Beer.pdf](http://www.ualberta.ca/~brigandt/de_Beer.pdf))]
4. ^ Evowiki:Gavin de Beer ([http://www.evowiki.org/index.php/Gavin\\_de\\_Beer](http://www.evowiki.org/index.php/Gavin_de_Beer)). Retrieved on April 3, 2006.

**Retrieved from "[http://en.wikipedia.org/wiki/Gavin\\_de\\_Beer](http://en.wikipedia.org/wiki/Gavin_de_Beer)"**



## De Beer, Gavin Rylands

[Born Nov. 1, 1899, Malden, near London, England

Died June 21, 1972, Alfriston, Sussex, England]

### World Famous Embryologist and Evolutionist

#### A Profile

English zoologist who made important contributions to embryology and evolution. He disproved the germ-layer theory and developed the concept of paedomorphism (the retention of Juvenile characteristics of ancestors in mature adults).

De Beer was born in London, studied at Oxford and lectured there. In 1945 he became professor of embryology at University College, London, then was director of the British Museum (Natural History) 1950-60.

In Introduction to Experimental Embryology 1926, DeBeer observed that certain cartilage and bone cells are derived from the outer ectodermal layer of the embryo. This finally disproved the germ-layer theory, according to which these cells are formed from the mesoderm. Paedomorphism was first described in Embryos and Ancestors 1940, refuting the theory that the embryonic development of an organism repeats the adult stages of the organism's evolutionary ancestors.

De Beer's studies of the fossil Archaeopteryx, the earliest known bird, led him to propose mosaic evolution – whereby evolutionary changes occur piecemeal – to explain the presence of both reptilian and avian features.

**O**riginal researches on the segmentation of the head and development of the skull in all groups of vertebrates provided de Beer with abundant material on which to study such general morphological principles as stereometric constancy of topographic relations among blood vessels, nerves, cartilages, and bones; identity of morphological units (two bones in one form homologous with one bone in another); relations of skull to brain; details of evolutionary succession; and bone phylogenetically older than cartilage.

De Beer also investigated afresh the comparative anatomy, development, and histology of the pituitary in all groups of vertebrates, which led to collaboration with L.T. Hogben on the localization of active pituitary principles in different vertebrates. With H. Grüneberg he investigated the action of the gene responsible for dwarfism in mice, which prevents differentiation of eosinophil cells in the anterior pituitary – evidence that these cells secrete growth-promoting hormones, and an example of how genes produce their effects by controlling development processes.

Taking up an idea of W. Garstang—that Haeckel's theory of recapitulation was fundamentally unsound—de Beer studied the relations between embryos and ancestors in all groups of animals and some plants, and showed that in many cases adult descendants retained characters of youthful stages of ancestors - the reverse of recapitulation. This principle, paedomorphosis, applies to all cases where a particularly successful and markedly different descendant type evolved from its ancestors (insects, chordates, humans). A consequence of this mode of evolution was that in eventually successful groups the preliminary states of the evolution took place in young stages, unlikely to have been preserved as fossils because of their soft tissues. This de Beer called "clandestine evolution," not revealed in the fossil record, which explains why precursor stages of such groups (insects, chordates) are poorly represented.

Experiments on removal of neural crest from amphibian embryos were known to result in absence of visceral cartilages, thought to be of mesodermal origin, whereas neural crest is ectodermal. This apparent disregard of the germ-layer theory precipitated a crisis in morphology. The orthodox could only accept it on the view that experimental conditions upset the norms of development. It was therefore necessary to establish the developmental fates of the germ layers without experimental manipulation. Taking advantage of the presence of black pigment in ectoderm and yolk in endoderm, de Beer showed that ectoderm (neural crest) did produce visceral cartilages, odontoblasts, and osteoblasts of dermal bones. He also showed that the enamel organ of teeth could be formed either from stomodaeal ectoderm or gut endoderm, whichever was beneath the odontoblasts. This

disproved the germ-layer theory and discredited the classification of tumors based on it.

A Complete reinvestigation of the fossil *Archaeopteryx* using ultraviolet and x-rays revealed the sternum which had eluded discovery for a century (it is flat). Some of the features of *Archaeopteryx* are completely reptilian, others completely avian, whence de Beer propounded the theory of mosaic evolution—piece-by-piece complete conversion from one type to the next—which he also showed in transitional forms between fish, amphibia, reptiles, birds, and mammals.

The reptilian structure of the cerebellum in *Archaeopteryx* and its carinate structure in Ratites enabled de Beer to show that the Ratites certainly evolved from former flying birds. Other features showed that *Archaeopteryx* was incapable of flight (it could only glide) and that it was adapted to climbing trees and perching on branches. This provided proof of the arboreal origin of flight.

De Beer's study of Darwin's Note-books (previously unpublished) showed that Darwin had independently thought out the principle of natural selection before he read Malthus's *Essay on Population*, from which he derived only the inevitably heavy toll of mortality. Close study of Mendel's paper and of his copies of Darwin's books showed that Mendel was not opposed to evolution and that he hoped that his discoveries would fill the gaps in Darwin's theories, which they did.

The possibility of using natural science to solve historical problems was applied by de Beer to prehistoric inhabitants of western Europe (genetics of blood groups and hair color); the origin of the Etruscans (blood groups and skull shape); Hannibal's route across the Alps (physiography,

meteorology, glaciology, astronomy, pollen analysis); identification of the “Iktin” of classical authors with St. Michael’s Mount, Cornwall (C-14, pollen, mineralogy of Neolithic axes); Gibbon’s illness (pathology, psychology).

Search for and discovery of manuscripts enabled de Beer and T. Graham Brown to reconstruct in detail the first ascent of Mont Blanc in 1786 by M.G. Paccard and to show the speed of ascent from one identified place to another. Other studies on Voltaire, Rousseau, Gibbon, Byron, Shelley, Mme. Roland, and Mme. De Staël, and on relations between British and French men of science while Great Britain and France were at war, established the background of opinion in the 18<sup>th</sup> century. He also showed that the tables used for converting French Republican Calendar dates to the Gregorian Calendar were wrong.

Son of an English gentleman, de Beer was educated in Paris, at Harrow, and Magdalen College, Oxford. From 1923 to 1938 he was a fellow of Merton College, Oxford. He was professor of embryology

at University College, London, from 1945 until 1950, when he became director of the British Museum (Natural History). Knighted in 1954, he received among other scientific honors the Royal Society’s Darwin Medal in 1958 “in recognition of his distinguished contributions to evolutionary biology.” He served in the Grenadier Guards in both world wars, landing in Normandy in 1944 in charge of psychological warfare.

De Beer published over 300 works, including *Vertebrate Zoology* (1928), *Development of the Vertebrate Skull* (1937), *Embryos and Ancestors* (1940), *Charles Darwin* (1963), and *Atlas of Evolution* (1964).

**For background information see:**

ANIMAL EVOLUTION; ARCHAEOORNITHES; EMBRYOLOGY, EXPERIMENTAL; GERM LAYERS; PITUITARY GLAND (VERTEBRATE) in the McGraw-Hill Encyclopedia of Science and Technology.



## Sir Gavin de Beer

### Legendary Paleontologist and Curator at the British Museum of Natural History

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### The De Beer Collection

**Gavin de Beer**, legendary paleontologist and curator at the British Museum of Natural History. De Beer's work consisted of some of the most brilliant insights into paleornithology and general evolutionary theory ever offered, and indeed, it was de Beer who was largely responsible for elucidating the concept of "mosaic evolution." De Beer was in no small part inspired in his discussion of this pervasive trend in evolutionary change by his extensive review of the *Archaeopteryx* material, with particular emphasis on BMNH 37001, in a 1954 monograph which still holds pride of place amongst the literature of avian phylogenetics. The work of de Beer also included a review of Haeckel's concept of heterochrony, with particular emphasis on its role in avian evolution. Drawing on this work, de Beer published a masterful tome on the ratites in 1956 in which he argued:

- a) Paleognathae is synonymous with Neognathae and the paleognathous condition is neotenic in birds.
- b) Ratites are not a holophyletic assemblage

Though they were met with widespread approval by his contemporaries, it has only been recently that de Beer's basic arguments concerning ratite phylogeny have come back into vogue, after a spectacular series of failures in the attempt to prove Ratitae holophyletic.

**Sir Gavin de Beer** was born in Surrey in 1899 and studied zoology at the University of Oxford going on to teach zoology there. From Oxford he moved to University College London as a reader in embryology, going on to become professor of embryology there in 1945.

In 1950 De Beer became Director of the **Natural History Museum** where he worked for the next 10 years. While there, he was able to make use of the vast knowledge of evolution he had developed throughout his career by organizing the exhibits on evolution in the main hall. After leaving the Natural History Museum he wrote his authoritative *Atlas of Evolution*, published in 1964, and spent the last years

of his life living in Switzerland, a country he had become fascinated by after visiting as a child.

De Beer was an expert on the life and works of Charles Darwin and devised a card index from which he could tell what Darwin was studying at any point in his life. After he died in 1972 De Beer's personal library of books by and about Darwin were sold to Chelsea College, these books becoming part of King's College London's Library when Chelsea later merged with King's.

This library, which we now refer to as **the De Beer Collection** at King's, contains a complete set of Darwin's major publications from the first edition of *On the origin of species* (1859) onwards, all in their

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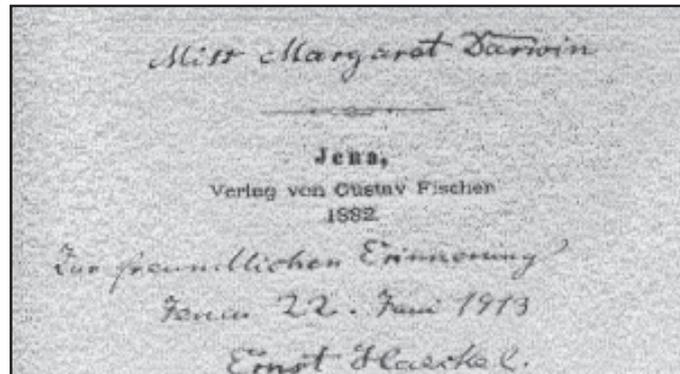
## Glossary on Kalinga Prize Laureates

original binding. As well as works by Darwin, De Beer also collected works that had influenced Darwin. These include a first edition of Charles Lyell's *Principles of geology* (the first volume of which was published in 1830, Darwin reading this book prior to his 1831 – 1836 voyage on the *Beagle*) and *Oeuvres complètes de Buffon* (1839), which contains many fine colour illustrations of birds and mammals.

De Beer also accumulated a unique collection of papers about Darwin and evolution published in journals and pamphlets, often sent to him inscribed from their authors. The image below is an inscription from one of these pamphlets which provides the collection with a personal link to the Darwin family. The pamphlet, by the German naturalist Haeckel

(the pamphlets and articles are from all over the world and are in a variety of languages) is about Haeckel's fellow naturalists Darwin, Goethe and Lamarck. On the title page there is an inscription from Haeckel to one of Darwin's granddaughter's Margaret, which says 'For remembered friendliness'. Another of the articles in the collection, written by another of Darwin's granddaughter's Nora Barlow, explains that this item was presented to Margaret Darwin by Haeckel when she saw him crowned with a wreath of laurels in Jena on his 80<sup>th</sup> birthday in 1913.

**A full list of the books in the De Beer Collection can be found on the library catalogue of King's College, London.**



## Sir Gavin de Beer, FRS

### Nature Obituary

Sir Gavin De Beer, who died suddenly on June 21, 1972, was a zoologist in the great tradition of Ray Lankester and Goodrich; essentially a comparative anatomist and embryologist, always evolutionary in outlook. His research was rigorous, never trivial in aim but adjusted to clarify important issues. His writing was scholarly and lucid, mainly addressed, in its scientific aspects, to specialists or to undergraduates reading for honours at a university. He was, however, author of one of the best elementary textbooks on vertebrate zoology (Sidgwick and Jackson, 1928) ever written.

Gavin Rylands de Beer was born in 1899. He married Cicely Glynn, daughter of the Reverend Sir Hubert Medleycott, Bt, who survives him. He was educated at the Ecole Pascal, Paris, at Harrow and at Magdalen College, Oxford, where he was a Demy, and served as a Lieutenant in the Grenadier Guards in 1918-19.

On taking his final examination he was at once elected Fellow of Merton College, subsequently becoming SubWarden, and Demonstrator in the Department of Zoology at Oxford, where he was Jenkinson Lecturer in Embryology from 1926-38. From 1939-45 he served as Lt-Colonel in the Grenadier Guards, GSO Psychological Warfare. At the end of the war he became Professor of Embryology at University College, London, a position which he held until he was appointed Director of the British Museum (Natural History) in 1950. He resigned in 1960 and became a director of Thomas Nelson, Publishers. In 1967 he settled in Switzerland, whence at the time of his death he had just returned to live in England.

Among his honours may be mentioned Knight (1954), Fellow (and Darwin Medallist) of the Royal Society, DSc (Oxon), Hon. ScD (Cantab), Hon. D-ès-L (Lausanne), Hon. D de l'Univ (Bordeaux), Chev Lég d'Hon.

One of the most remarkable features of de Beer's work is the unfailing high standard of scholarship that he maintained in spite of the diversity and scale of his output. He wrote 16 books and 110 articles on zoology, 5 books and 40 articles on the history of science, 9 books and 52 articles of a biographical character, 9 books and 80 articles on Switzerland, 3 books and 12 articles on military affairs, modern and ancient, and 3 books and 18 articles on a series of varied topics. The industry and learning involved seem overwhelming, especially in a man who found time for wide artistic and general interests; he was a Trustee of the National Portrait Gallery and a Fellow of the Society of Antiquaries.

De Beer's researches on comparative anatomy and embryology were particularly concerned with the vertebrate head, especially its segmentation. To this subject he made notable contributions. They were much assisted by his method of producing large-scale models in plaster of Paris, each built up from a sequence of microscope slides. His collection of these reconstructions, representing different stages in development, not only threw light upon fundamental vertebrate anatomy but provided teaching material of great value. In particular, they demonstrate the developmental stages from the chondrocranium to the bony skull. In carrying out that work he especially studied a number of sharks, primitive and specialized bony fish and the shrew.

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## Glossary on Kalinga Prize Laureates

Related to the same subject was his investigation of the pituitary from the lamprey upwards, upon which is based the evolutionary sequence of that organ as accepted today.

More difficult to evaluate in its contribution to modern zoology was the rise of experimental embryology under the leadership of Ross Harrison and Hans Spemann, so fully described by de Beer in books and articles. It may be hard to realize how greatly that subject dominated zoological thought in the 1920s. Those establishing it then may perhaps have laid a foundation upon which the superstructure is in the main yet to be built.

During the decades when he was Director of the Natural History Museum, although deeply involved in administration, de Beer was bringing together the materials for his great Atlas of Evolution (Nelson, London). This, however, was not published until 1964.

Though comparative anatomy and embryology were the principal subjects of his research, he read widely and was keenly interested in all aspects of zoology and its history. In particular, he was fascinated by the work and writings of Darwin, upon which he threw much light; and he produced a reprint of the sixth edition of the Origin of the Species, the last to appear during its author's lifetime, to which he added a discriminating preface. He hailed the experimental study of evolution in wild populations, a subject developed during the last forty years or so, as the fulfillment of Darwin's hopes.

De Beer was essentially a man of culture; and he who was himself a distinguished scientist looked with no favour upon those whose interest is limited to science. Indeed, he personified a type more frequent in his youth, when the aim of education was to educate rather than to qualify candidates to pass examinations.

Among his many biographical, historical and other writings, those dealing with Hannibal's march into Italy have aroused special interest. They seem to have solved the age-old problem of the route by which the general brought his troops and his elephants across the Alps.

No assessment, however brief, of de Beer's life and character should omit reference to his outstanding ability as a linguist. He spoke German almost perfectly, his Italian was fluent and polished and, without raising a doubt, he could pass as a Frenchman in France.

Casual acquaintances tended to find his encyclopaedic knowledge poured out on the widest variety of topics rather daunting in conversation, unless they realized that his interest in their remarks, if worthwhile, could be as keen as in anything he was saying himself. Those who knew him well discovered that in his friendship they possessed something enduring, for he was always to be relied upon, always the same.

### Source :

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