

Acknowledging Libbie Hyman – An Inspiring Zoologist*

Tribute to a Self-effacing But Brilliant Zoologist

Ravindranath G

Libbie Hyman, born in Chicago in 1988, nudged by a school teacher to enrol in College, ended up writing several books on invertebrate zoology that are held in high esteem even now. She was awarded the Linnean Medal and was the first woman zoologist elected to the National Academy of Sciences.

When we were in our third year studying zoology, our teacher Prof. Ms Desai, introduced us to ‘Miss Hyman’. She told us that Hyman had written several volumes in zoology and that these could be collectively called the Bible of zoology. She also always stressed the fact that she was ‘Miss’ Hyman. It was probably considered unusual for a lady to remain unmarried in the early eighties!

Here is a requiem to a scientist whose life and contributions to zoology are probably unseen and under-recognised but, in fact, a source of tremendous inspiration. Libbie was born in Iowa, USA, on 06 December 1888; about 130 years now.

Libbie Henrietta Hyman was an extremely modest person who undervalued herself. During her time, society was even more male-dominated and patriarchal than today. In her autobiography, written along with Hutchinson, Hyman said she was constantly scolded at home. In the above article, Hyman’s autobiography is the first part—about six pages (only!), followed by Hutchinson’s biography, which is jointly presented. The well-known Hungarian photographer Eder Gabor took her picture on her 70th birthday. This photo is also part of the autobiography.



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Keywords

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Figure 1. A young and happy Libbie Hyman at about age 17 before she joined Chicago University. (From Winston, J. E., ed. (1999), *L. H. Hyman, Life and Contributions*, American Museum Novitates, 3277; with permission from American Museum of Natural History.)



Her distinctive signature in cursive handwriting is scrawled under it—slightly shaky because she was suffering from Parkinson's disease by then. Unfortunately, nobody seems to know who owns the copyright for that photograph, so it cannot be legally published.

Early Period

Young Libbie loved the outdoors, especially flowers—for their variety and beauty.

Hyman was an assumed name. Libbie's parents were Jewish, her mother from Germany and her father from Poland. They migrated to the US to escape hardship. Her father, who had worked as a tailor, opened and ran a garment store fairly successfully. Young Libbie loved the outdoors, especially flowers—for their variety and beauty. However, she was not encouraged to study and nurture her interest. She was angry that she was treated differently from her brothers. She loathed her mother for making her do all housework even though she had two brothers; she colourfully ex-



pressed it, saying her mother was “...infiltrated with the European worship of the male sex.”

After finishing high school, eighteen-year-old Libbie Hyman was pasting labels in an oats cereal factory. She could have scarcely imagined that about 50 years later, she would be awarded the Linnean Medal by the Linnean Society of London. Her high school teacher Mary Crawford was responsible for triggering this transition. Recognising her ward’s potential and spark, Ms Crawford persuaded and prodded Libbie to enrol into college for a degree. An appropriate example of mentoring! Hyman remarked, in her autobiography, that it never occurred to her to attend college and pursue higher studies, astoundingly reminiscent of the situation in India!

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Hyman graduated in zoology in 1910 from the University of Chicago. Her guide there was Prof. Charles Manning Child, who developed the axial gradient theory of development. This theory received a lot of criticism but is now being seen more favourably. While graduating from Chicago, Hyman worked as a teaching assistant. During this period, she realised that instruction manuals were not up to the mark. She, therefore, wrote one! A classic example of “find the need and fill it”, if there was any! The book titled *Laboratory Manual for Elementary Zoology* was a success.

Meanwhile, in 1915 (she was 26), she received a PhD for her dissertation on ‘Analysis of Process of Regeneration in certain Microdrilous Oligochaetes’. By 1922 she published *A Laboratory Manual for Comparative Vertebrate Anatomy*. In 1942, while she was in New York, she wrote the second edition of the book (although she never liked vertebrates!) titled *Comparative Vertebrate Anatomy*. She wrote many papers on the taxonomy of coelenterates (mainly Hydras) and flatworms. These contributions made her the leading light, a torchbearer for studies in invertebrate zoology—writing six volumes, a treatise on invertebrates. She was considered an authority on flatworms. Many young researchers were motivated to do research on invertebrates. Unfortunately, popular zoology textbooks very often blatantly copy diagrams from this treatise without acknowledging Hyman or other



Figure 2. The University of Chicago Department of Zoology faculty and students, 1926, at the dedication of Whitman Laboratory, from left (4th row): Lincoln V. Domm; Malsom D. Brode; Jesse F. Schuett; William Castle; Charles D. Van Cleave; (3rd row): Gregor T. Popa; Charles M. Child; B. H. Willier; F. R. Willier; F. R. Lillie; Sewall Wright; Warder Clyde Allee; Carl R. Moore; H. H. Newman; A.M. Holmquist; (2nd row): William C. Young; Barbara Valentine (Castle); Marie A. Hinrichs; Dolores Brockett; Dorothy Price; Magnhild Torvik (Greb); Walburga A. Peterson (Dalton); Libbie H. Hyman; Margaret R. Murray (Lokki); B. R. Weimer; (1st row): Elliot C. Yuh; Y. K. Hiraiwa; H. A. Roxas; S. Esaki; J. P. E. Morrison; J. P. Lahr; Fred Appel; Thomas E. Hunt. (Credit: University of Chicago Photographic Archives, (apf1-05622), Special Collections Research Centre, University of Chicago Library.)



sources. Scores of teachers have used her treatise on invertebrates as an invaluable reference; we cannot thank her enough for this. She continued to work with Prof. Child at Chicago until his retirement in 1931. There is a group photograph (reproduced below) where both Dr Child and Libbie Hyman are present, along with other well-known biologists such as Thomas Hunt and Sewall Wright. The photograph was taken when the zoology laboratory was dedicated to Charles Otto Whitman, a zoologist specialising in ethology and embryology.

Her Most Successful Period

Libbie Hyman left Chicago soon after her guide's retirement. She toured Europe for some time, and, in 1936, she settled in New York at the American Museum of Natural History. She was an unpaid Research Associate of the museum. She was, however, provided with an office. All this was courtesy of Mr G. K. Noble—Head of the Herpetology and Experimental Biology division. She was 48 years of age then. There, she wrote the famous six-volume treatise on invertebrates published by McGraw Hill, New York. The entire treatise addressed very comprehensively, questions on comparative morphology, systematics, reproduction, evolution and

development, apart from the ‘architectural plan’ of invertebrates.

Regarding the writing of these, she said, “I feel as if this invertebrate treatise was a really important project of great value to teachers of zoology and that it is more worthwhile in the long run than any research I might produce in the same time.” Ronald A. Jenner, the invertebrate zoologist, called the treatise a compendium and further emphasised that her contributions to embryology have not been given due credit. The treatise comprised the following:

1. *Volume I: Protozoa Through Ctenophora*: Published in 1940, containing 696 pages. There are nearly 1300 illustrations in this volume itself; most of these were self-drawn. She coined the term ‘spongocoel’ that is used for Porifera. This replaced the earlier term ‘gastral or cloacal cavity’ to which she objected. She suggested that the terms ectoderm and endoderm be used only with reference to development. Adult tissues may be termed as being epidermal and gastrodermal.
2. *Volume II: Platyhelminthes and Rhyncocoela*: This was published along with volume III in 1951. It means that she took seven years to write these three volumes. According to her, bilateral symmetry arose from the planula larva, i.e., from radial symmetry. She, however, erred in insisting that tapeworms show “true segmentation or metamerism” after brilliantly explaining the concept. Metamerism has evolved separately among animals at least twice. The functional significance of metamerism—locomotion—was not considered by her. The ‘segments’ in a tapeworm are not used for locomotion (it is a parasite) but used rather for reproduction.
3. *Volume III: Acanthocephala, Aschelminthes and Entoprocta*
4. *Volume IV: Echinodermata*: Her sense of humour is revealed here when she says that echinoderms are a ‘noble group designed to puzzle zoologists’.
5. *Volume V: Smaller Coelomate Groups*: This was published in 1959, and it is 700 pages long with about 1000 illustrations. This

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– Libbie Hyman



was a kind of review of the earlier volumes. Here, she comments that ‘alternation of generation’, a common phrase teachers use to describe the life cycle of *Obelia* (a hydrozoan coelenterate), is a ‘nonsensical’ idea. She preferred to think of it as a continuous and cyclical process.

6. *Volume VI: Mollusca*: This was published in 1967, but it remained incomplete in the sense that only a part of Mollusca was dealt with. She was suffering from Parkinson’s disease and was 78 years old.

She wrote in her autobiography that she wanted to ‘stimulate the study of invertebrates’ with the treatise. She certainly did much more than that! It was amazing how she managed to write the entire six volumes all by herself in 33 years. She was good at Russian, German and some other languages. She could, therefore, read all the original articles and papers, many being in European languages. We know that Mendel’s paper on inheritance was written in German in a not too well-known journal and was brought out from obscurity much later.

Hyman played an important role in resurrecting the works—written in different languages, of the masters of zoology. Among them were the six-volume *Traite de Zoologie*, published in 1896 by the French zoologists Yves Delage and Edgard Herouard; the *Handbuch der Zoologie* by the German zoologists Willy Kukenthal and Thilo Krumbach consisting of eight volumes published from 1913.

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She often claimed that she merely compiled all the information available and never saw herself as a serious researcher except for the taxonomic work on flatworms. However, Stunkard, in his obituary, opined, “*The Invertebrates*—is more than a compilation: it incorporates incisive analysis, judicious evaluation and masterly integration of information”. An example of this is that Hyman rejected the theory supported by the famous German zoologist Ehrlich that pseudocoelomates arose by degeneration of coelomate parts. According to Hyman, the common ancestor of all bilateria is a non-coelomate organism. She also visited different marine research labs almost every year. She worked at the Hopkins Marine Station, California, Friday Harbor Laboratories, Washington, the Bermuda Biological Station, Bermuda, the Marine Biological Laboratory, Massachusetts, the Lerner Marine Laboratory, Bimini Island near Miami and the University of Sao Paulo, Brazil. She was a good swimmer, could dive, and also ride horses.

It was during her visits to the Hopkins Marine Station, California, that her association with Ed Ricketts deepened. Ricketts, also from Chicago, was an entrepreneur, having started the iconic ‘Pacific Biological Laboratories’ along with his friend Albert Galigher. Ricketts was, in some ways, mentored by Libbie Hyman (Dr Keith Benson, a science historian: personal communication).

In her preface to *Comparative Vertebrate Anatomy*, she said, “dissections were done at least twice for all representative animals in each system”. She wrote and dissected simultaneously. She reflected tellingly that “zoology is best learnt by actual experience with and handling of material”. In many places now, dissections have been banned from undergraduate classes!

“Zoology is best learnt by actual experience with and handling of material.”

– Libbie Hyman

Personal Life

Libbie Hyman liked classical music, especially the Finnish composer Sibelius and the Russian composer Stravinsky. She was fascinated by nature and flowers in particular. In one correspondence with Burkenroad, she told him that the plant they observed



Figure 3. Libbie Hyman teaching invertebrate development: Her influence on teaching and research in invertebrate zoology, M. Patricia Morse, from Winston, J. E., ed. (1999), *L. H. Hyman, Life and Contributions*, American Museum Novitates, 3277; with permission from American Museum of Natural History



together was a garden variety of nicotine and not the one used for making cigars and that she could tell the difference because of the colour of the flowers. In her early days, she would enjoy herself by observing the beauty and symmetry of flowers. “I believe my interest in nature is primarily aesthetic”, she said in her autobiography with Hutchinson. Oddly she did not continue with botany, apparently because the instructor disliked Jews. To borrow a line from a PG Wodehouse novel—zoology gained what botany lost.

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When Martin Burkenroad, a specialist in Crustacea, wrote to her that he was stimulated by her letter, she replied, “I hope the stimulation doesn’t die away with distance like an axial gradient”.

She wrote with precision, choosing her words carefully and had a wry sense of humour. When Martin Burkenroad, a specialist in Crustacea, wrote to her that he was stimulated by her letter, she replied, “I hope the stimulation doesn’t die away with distance like an axial gradient”. Her love for literature was probably due to her father. Among the books that her father had in his small library were Dante’s *Inferno* and the novels of Charles Dickens.

She suffered from sinus trouble and had to undergo surgeries, but they were not helpful. She also had ear problems and also perhaps dyspepsia. She did not marry. In one of her letters to Martin, she wrote that she was sorry that he suffered from sea sickness and said it (sea sickness) was worse than unrequited love! An odd metaphor! Nothing is written in her biographies about her personal life or why she chose not to marry. Chiding Martin for breaking off with a friend (Dorothea Rudnick), Hyman remarked,





Figure 4. Dr Libbie Hyman in her sixties. (Photo: Courtesy of the family of Dr John Corliss, Former President of the ASZ.)

“the male sex is that way; never show any sense about the women they select”. She died on 03 August 1969.

Contribution to Platyhelminth Taxonomy

It was Hyman’s suggestion regarding the spelling of the taxon that is now being followed. Even as modern methods of taxonomy, such as the use of DNA sequencing to refine taxonomy, are being followed, the basic classification given by Hyman stands vindicated. She identified 32 new genera. Indeed several reviewers acknowledge her stamp of authority in volume II of her treatise on invertebrates. Apart from all the books that she wrote, she also had 135 scientific papers to her credit. Almost all of these were on invertebrates. She was also editor of *Systematic Zoology* from 1959 to 1963.

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Honours and Awards

In 1960 she was awarded the Linnean Medal (different from the Linnean Gold Medal, which has been awarded only thrice in the



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history of the Linnean Society) by the Linnean Society of London. The medal was made of pure gold until 1976 and later made of alloy metal. She received it at the hands of C. F. A. Pantin, a great zoologist himself. Another singular achievement was becoming a member of the National Academy of Sciences. She was the first woman zoologist to be elected to this position. There is a photo of a dignified Libbie Hyman in a wheelchair being awarded the Gold Medal of the American Museum of Natural History (AMNH) for distinguished achievement in science on 09 April 1969, on the occasion of its centennial celebration. She was also the first woman to be part of the American Society of Zoologists Governing body—elected as Vice President in 1953. Despite all these achievements, she never got a tenured position as Professor. Was it because she was Jewish and also a woman? We do not know.

Dr C. M. Child

Her guide and mentor was Dr Child. He was nearly 19 years senior to her. He respected her ability to work independently and, unlike most other men at that time (and today!), was not chauvinistic. When he considered her work important, he published papers with her and never attempted to take credit from her. Hyman, on the other hand, was equally deferential towards him, unfailingly acknowledging him as his mentor and valuing his guidance. One can safely say that theirs was a fine model for a student–guide relationship; as mentor, he would have been extremely pleased that his ward achieved more fame than he did!

Some Nuggets

Libbie Hyman had an easy, lucid style of writing. But she never had the habit of keeping her correspondence. She exchanged many letters with Martin Burkenroad, a crustacean biologist, on academic matters and mentored him as well. Frederick Schramm, a carcinologist, compiled their correspondence, giving personal insight to Libbie Hyman; hence, the article ‘A correspondence



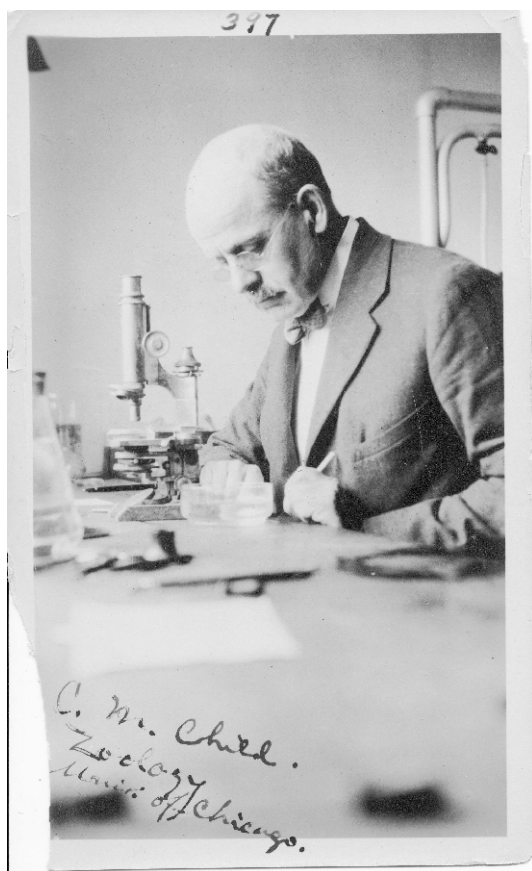


Figure 5. Charles Manning Child. (*History of the Marine Biological Laboratory*, <http://hpsrepository.asu.edu/handle/10776/3233>; undated.)

between Martin Burkenroad and Libbie Hyman' is worth its weight in gold.

Regarding Mr G. K. Noble, who gave Hyman the space to work at the Museum, she didn't seem to like him very much. She wrote, "It is unpleasant to be in a laboratory where you are constantly urged to grind out research as if it were a pound of coffee and to publish large quantities of print. He's got infected with ambition." Consider this in the context of today's attitude to research, with pressure to churn out research publications even if they are of poor quality. Indeed this is a pressure that has largely come from the US that we in India are copying.

An example of her insight into human psychology is when she berated Martin Burkenroad, "One of the rules of human conduct is

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– Libbie Hyman

that if you wish people to acknowledge your superiority, you have to treat them as equals.” And more relevant to all of us Indians in these illiberal times is this gem—“The business of a scientist is to find out the truth thoroughly and conscientiously and not to go about insulting anybody who happens to disagree with ...”

Regarding the emphasis on doctorate degrees, she wrote to Martin, “The decision to take a PhD (providing you stick to it) is a sound move on your part. Because of the artificial value that has been placed on collegiate degrees it is very difficult to get any advanced position in academic circles without a PhD degree.”

he felt, and rightly so that students must learn to sketch what they saw.

There was a fair amount of correspondence between the Chicago University Press and Hyman, which has now come into the public domain. She was not interested in writing the next edition of *Comparative Vertebrate Anatomy*. She was at her acerbic best when replying to persistent publishers. Apart from this, various other matters come to light in this correspondence. An interesting one is her opinion regarding giving ready-made diagrams of dissections to students. She felt, and rightly so that students must learn to sketch what they saw. “This matter (including diagrammatic illustrations in the lab instructions) comes up perennially. There are always popping up well-intentioned teachers who want to do the students’ work for them. Thirty years ago, at the University of Chicago, we tried out the method of handing out drawings of the dissections to the students but soon abandoned it as pedagogically bad. The poor students would not work for themselves, and the good ones were confused by the fact that their dissections did not fit too well the diagrammatic drawings...Hence I am unalterably opposed to the inclusion of such drawings in the book. Of course, the students would love to have such drawings as those made by the Hildebrands; they would love still more to have a complete set of drawings of all the dissections. **This would be in line with the policy of our educational system handing out everything to the students (emphasis mine).** The results of this system are all too evident in our public life. This country is woefully lacking in leadership; our citizenry knows nothing of history or economics, cannot speak or write good English, and is want-



ing in responsibility and initiative.” Much of this is true for our country as well.

The above is from Hyman’s correspondence with Chicago University Press in connection with the publication of *Comparative Vertebrate Anatomy*.

Judith Winston, a taxonomist, considered herself Libbie Hyman’s intellectual daughter; she, along with others, wrote an excellent memoir in *American Novitates* (AMNH, 1999). In a letter to Robert Ogren, who contributed to the *Novitates*, she (Hyman) wrote, “A taxonomist cannot operate on a local basis. One must have knowledge of world literature”. Touché!

Box 1. Axial Gradient Theory

Charles Manning Child put forth a new theory based on ‘patterns’. He observed gradients of metabolic and other functions among both radially and bilaterally symmetrical organisms. Among the Hydras, he observed along with Hyman that there is a basipetal gradient of susceptibility to dyes, toxins, etc. Basipetal means from apical end to base and also from the tip of the tentacle to its base. In other words, the apical (or oral) end dominates the rest of the body. This primary gradient is proportional to metabolic functions; it may be modified by functional activities such as digestion or budding.

Among bilaterally symmetrical organisms, Child proposed the idea of anteroposterior (AP) dominance. His research on regeneration in several invertebrates showed that the regenerative process begins at the head and works back along the AP axis towards the posterior end. Hyman showed that this is also a physiological gradient along which metabolic processes such as feeding, response to toxins, etc., occur with the greatest activity toward the head. In a sense, the gradient has a quantitative basis. Recent studies indicate that some signalling pathways have been detected to help us understand this better. Some organisms—Annelids, Arthropods and Vertebrates have two axes. Among them, growth originates from the posterior segment. This is also called the secondary gradient. Thus there is a double gradient. Much of this was based on Hyman’s modifications, and additions of detail based on her research were clearly important in refining Child’s theory. These gradients, according to her, are causal factors of morphological and, indeed, teratological development.

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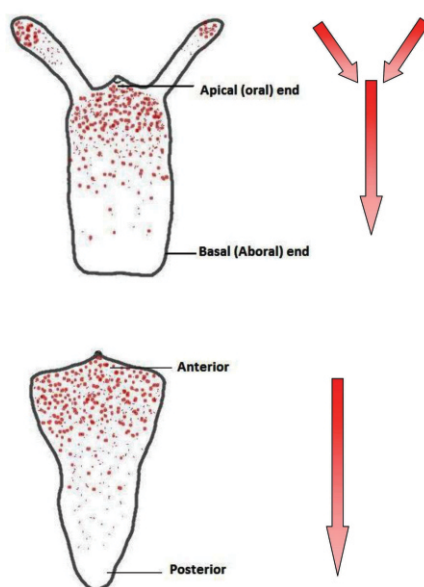
Box 1. Contd.

Fig. 6 Axial Gradients in Hydra and Planaria

The axial gradient theory was criticised and somehow lost favour and hardly finds a mention in most books of developmental biology, which is unfortunate. Jenner hopes that Hyman's work and contributions to developmental biology will be seen afresh and be given proper credit.

Acknowledgement

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Suggested Reading

- [1] L H Hyman and G E Hutchinson, Libbie Henrietta Hyman, December 6, 1888–August 3, 1969, *Biographical Memoirs*, National Academy of Sciences, Vol.60, pp.103–114, 1991.



- [2] L Hyman, *A Laboratory Manual for Elementary Zoology*, University of Chicago Press, 1919.
- [3] L Hyman, *A Laboratory Manual for Comparative Vertebrate Anatomy*, University of Chicago Press, 1922.
- [4] H W Stunkard, Dr Libbie Henrietta Hyman, *Nature*, Vol.225, pp.393–394, 1970.
- [5] R A Jenner, Libbie Henrietta Hyman (1888–1969): From developmental mechanics to the evolution of animal body plans, *Journal of Experimental Zoology*, Vol.000, pp.413–423, 2004.
- [6] F R Schram, A correspondence between Martin Burkenroad and Libbie Hyman: Or, whatever did happen to Libbie Hyman's lingerie?, *Crustacean Issues*, Vol.8, pp.119–142, 1993.
- [7] J E Winston, Libbie Henrietta Hyman: Life and contributions, *American Museum Novitates*, Vol.3277, pp.1–66, 1999.
- [8] M H Wake, Libbie Henrietta Hyman and comparative Vertebrate anatomy, *American Museum Novitates*, Vol.3277, pp.33–39, 1999.
- [9] S. Tyler, Systematics of the flatworm—Libbie Hyman's influence on current views of the Platyhelminthes, *American Museum Novitates*, Vol.3277, pp.52–66, 1999.
- [10] R E Ogen, Contributions of Libbie Hyman to knowledge of land planarians: Relating personal experiences (Tricladida: Terricola), *American Museum Novitates*, Vol.3277, pp.39–47, 1999.
- [11] M P Morse, Libbie Henrietta Hyman: Her influence on teaching and research in invertebrate zoology, *American Museum Novitates*, Vol.3277, pp.48–52, 1999.
- [12] K Benson and E Quinn, The American Society of Zoologists, 1889–1989: A century of integrating the biological sciences, *Amer. Zool.*, Vol.30, pp.353–396, 1990.
- [13] C M Child and L Hyman, The axial gradients in Hydrozoa. I. Hydr, *Biol. Bull.*, Vol.36, pp.183–223, 1919.
- [14] E J W Barrington, *Invertebrate Structure and Function*, ELBS and Nelson, 1979.
- [15] L H Hyman, *The Invertebrates*, Vol.I, McGraw Hill, New York, 1940.
- [16] L H Hyman, *The Invertebrates*, Vol.II, McGraw Hill, New York, 1951.
- [17] L H Hyman, *The Invertebrates*, Vol.III, McGraw Hill, New York, 1951.
- [18] L H Hyman, *The Invertebrates*, Vol.IV, McGraw Hill, New York, 1955.
- [19] L H Hyman, *The Invertebrates*, Vol.V, McGraw Hill, New York, 1959.
- [20] L H Hyman, *The Invertebrates*, Vol.VI, McGraw Hill, New York, 1967.

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