

Historical aspects of meetings, publication series, and digital resources dedicated to echinoderms

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Abstract

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Half a century after the first scientific meeting dedicated to marine spiny-skinned animals (Deuterostomia: Echinodermata) was held in Washington, DC, we take this opportunity to provide information on a number of historical aspects related to the echinoderm scientific community. Apart from shedding light on the historical origins of modern echinoderm conferences, the present contribution presents photographs taken during the first meeting of echinoderm researchers in 1963 as well as during the first installments of the *International Echinoderm Conference* and the *European Conference on Echinoderms*. Furthermore, we provide background information on publication series dedicated solely to the Echinodermata as well as descriptions of selected digital resources that focus on echinoderms. Finally, we present a number of echinoderm conference logos and flyers in addition to selected information about specific echinoderm meetings.

Introduction

The present article is the third in a series of publications aimed at furthering an understanding of various historical aspects of the echinoderm scientific community. In a first contribution, a concise summary of worldwide echinoderm meetings and associated publications was given (Ziegler and Kroh 2012). The second contribution introduced an online database containing metadata derived from numerous articles and abstracts published in echinoderm conference proceedings since 1963 (Kroh et al. 2013). In order to complement the data provided in these two preceding articles on the history of the echinoderm research community, we here present i) information about the historical origins of echinoderm meetings, ii) photographs taken during the first official echinoderm meeting as well as photographs taken during the inaugural sessions of the *International Echinoderm Conference* (IEC)

and the *European Conference on Echinoderms* (ECE), iii) background information on a number of publication series and digital resources dedicated to echinoderms, and, finally, iv) conference logos and flyers from past echinoderm meetings as well as information on additional echinoderm gatherings. As it is “appropriate that the students in a field be aware of their history” (Lawrence 1998), the present article provides, fifty years after the first-ever echinoderm meeting was held 1963 in Washington, DC, further historical data on meetings and publications that focus on marine spiny-skinned animals.

The historical origins of modern echinoderm meetings

Although our previously published compendium of national, regional, and international echinoderm meetings

might provide the impression that echinoderm scientists started to meet as late as the second half of the 20th century, researchers with a focus on the Echinodermata have convened long before.

The first official echinoderm meeting, the *Symposium on Physiology of Echinodermata* held 1963 in Washington, DC was in fact part of the 16th *International Congress of Zoology (ICZ)*. Since the first ICZ, held 1889 in Paris, zoologists from around the world had come together on a regular basis, interrupted only by the two World Wars. However, it was at the conference held in 1963 that multiple parallel symposia were introduced in order to accommodate the ever-growing number of attendees (Romer 1963). The 16th ICZ boasted over 2,500 participants that presented 510 papers and attended 36 sessions as well as 29 special symposia. Although the considerable size of this congress reflected the expansion of zoological sciences during the 20th century, it also exposed the growing disunity of organismic and experimental biology (Johnson 2009). The fragmentation of zoology into different, highly specialized disciplines soon led to a marked decrease in the importance of the ICZ as the representative gathering for zoologists, which in response led to an increase in more focused zoological meetings. The notable increase in national, regional, and international echinoderm conference series from the early 1970s on must be seen in this historical context.

Nonetheless, echinoderm researchers have certainly met and spoken to each other during the fifteen ICZs held prior to the congress in Washington, DC. The programs, participant lists, and selected articles from all these meetings have been published in the form of conference proceedings volumes, and it will be of interest to explore which echinoderm researchers actually came together during these events. The 7th ICZ, held 1907 in Boston, may serve as a good starting point for future historical research, for it was no less a figure than Alexander E. Agassiz who acted as president during the conference (Anonymous 1912).

With the inception of specialized echinoderm conferences from the early 1970s onwards came a transition from meetings intended primarily for established researchers to events that provided a welcoming environment for all academic degrees as well as the occasional echinoderm amateur. Photographs taken during the first echinoderm meeting in 1963 (Fig. 1), group photographs taken during the first gatherings of the IEC in 1972 (Fig. 2) and the ECE in 1979 (Fig. 3), as well as photographs taken during a poster session at the first ECE (Fig. 4) provide an impression of the general atmosphere during these events. This series of photographs also documents that echinoderm science had started to become less and less dominated by male scientists from the 1970s onwards.

Echinoderm publication series

In contrast to several other major invertebrate phyla (e.g. Crustacea, Mollusca), the Echinodermata are not repre-

sented by a journal dedicated solely to their study. Nonetheless, over the years a set of formal and informal publications exclusively aimed at echinoderms has enriched the scientific landscape. These publications include such well-known volumes as *Echinoderms* (Nichols 1962, 1969), *Echinoderm Nutrition* (Jangoux and Lawrence 1982), or *Edible Sea Urchins* (Lawrence 2001, 2006, 2013). However, these books constitute single publication events rather than a continuous series in the form of a journal. Still, there are a few examples for journal-style publication series dedicated exclusively to echinoderms, and in the following we list the most prominent examples in chronological order.

The Echinoderm Newsletter (1968 - today)

Encouraged by the many positive replies to a questionnaire sent out to echinoderm specialists around the world in 1967, Maureen E. Downey and David L. Pawson launched *The Echinoderm Newsletter* in November 1968. The intention of this periodical was to provide an informal means of communication between echinoderm researchers and, in particular, to foster collaboration and minimize duplication of research efforts. With its content arranged around a number of sections such as “Addresses”, “Current Research”, “Job Offers”, “Meetings”, “Mysteries”, “Publications”, or “Requests”, *The Echinoderm Newsletter* relied on active participation and feedback from members within the research community. In fact, the creation of this periodical - in conjunction with the inception of the IEC a few years later - did help considerably to build the present sense of community among echinoderm scientists. The formal publisher of *The Echinoderm Newsletter* was the Department of Invertebrate Zoology of the National Museum of Natural History (NMNH) in Washington, DC. The editors from issue 1 (1968) to issue 11 (1980) were Maureen Downey and Dave Pawson. Having been administered by John M. Lawrence from issue 12 (1982) to issue 18 (1993), responsibility for the periodical eventually returned to the staff at the NMNH. Cynthia G. Ahearn was then in charge of providing the echinoderm community with the latest news from issue 19 (1994) to issue 26 (2001).

In the pioneering pre-digital times, *The Echinoderm Newsletter* was in fact photocopied and then mailed to up to seven hundred subscribers worldwide - at no cost to the reader. Using a state-of-the-art Gestetner mimeograph machine, Maureen Downey, Cindy Ahearn, and Dave Pawson produced up to 56,000 paper sheets per issue, that they laid out in 80 stacks of 700 pages each before manually assembling every single newsletter. Luckily for the editorial team, the NMNH eventually offered to accept *The Echinoderm Newsletter* as an official publication (ISSN 0735-7494), meaning that duplication and collation of each issue would be carried out by the U. S. Government Printing Office. Until issue 22 (1997), *The Echinoderm Newsletter* was available only in printed form, while for issues 23 (1998) and 26 (2001), a digi-

tal version was published in parallel to the print version. Budget cuts at the NMNH eventually led to the omission of hard copies and so, with issue 26, *The Echinoderm Newsletter* became *The Virtual Echinoderm Newsletter*, designed by Susan Hottenrott, but still edited by Cindy Ahearn. In 2004, the responsibility for this now entire-

ly electronical periodical was transferred to the Swedish Museum of Natural History in Stockholm, where it was recreated in reduced form and again named *The Echinoderm Newsletter* (<http://www.nrm.se/echinoderm>).

Of particular interest from a historical perspective are those sections of *The Echinoderm Newsletter* entitled



Figure 1. Impressions from two social gatherings organized during the first official echinoderm meeting, the *Symposium on Physiology of Echinodermata*, held 1963 in Washington, DC as part of the 16th *International Congress of Zoology*. (A) John B. Loefer, Richard A. Boolootian, John M. Anderson, Allahverdi A.-H. Farmanfarmaian. (B) Dennis J. Crisp, W. Randolph Taylor. (C) George P. Wells, Friedrich Krüger. (D) Hans O. Brattström, Wolfgang Wieser, Williamina A. M. Courtney, C. Ladd Prosser, unidentified person. (E) Jeremy D. Woodley, Lary V. Davis, Thomas S. Hopkins, John S. Pearse. (F) John M. Anderson, Aage M. Christensen. Images courtesy Mark Boolootian and Richard A. Boolootian.

“How I Began to Study Echinoderms...”, “Theses & Dissertations”, and “Obituaries”, as they provide a valuable source of information for future historical research on individual echinoderm scientists. We have digitized all back issues of *The Echinoderm Newsletter* and the resulting files have been made accessible through the recently created database *The Echinoderm Files* (<http://tinyurl.com/p2f9d9j>).

Echinoderm Studies (1983–2001)

In parallel to the numerous echinoderm symposium or conference proceedings that have appeared since the mid-1960s - starting with Boolootian (1965) - a short series of echinoderm-related publications entitled *Echinoderm Studies* was issued between 1983 and 2001 (Jangoux and Lawrence 1983, 1987, 1989, 1993, 1996, 2001). The name of the series was inspired by the title of a doctoral thesis published at Uppsala Universitet in the mid-1920s (Gislén 1924). The guiding principle of *Echinoderm Studies* was to cover all aspects of echinoderm research from molecular biology to ecology, paleontology, physiology, and taxonomy. The main goal of the book series (ISSN 0168-6100) was to provide biologists from different backgrounds with a rapid access to the field of echinoderm research and to give direction for future studies in echinoderm science.

The idea for *Echinoderm Studies* emerged between Michel Jangoux and John M. Lawrence at the end of the 1970s and they took the opportunity of the 4th IEC held 1981 in Tampa, Florida to invite the authors of the plenary papers to present their respective field of research in the form of a broad review article. The first issue received critical acclaim (Nichols 1983, Birkeland 1984), as did many of the following volumes (Tyler 1988, Mladenov 1991, Ellers 1997). However, the initial contract that had been signed for six volumes was not renewed by the publisher as a consequence of the purchase of this company by another publishing house, which unfortunately did not judge the series as profitable. For copyright reasons, the content of all six issues of *Echinoderm Studies* is currently only available in printed form through libraries.

SPC Beche-de-mer Information Bulletin (1990 - today)

The *SPC Beche-de-mer Information Bulletin* (BDM) is the only echinoderm-related publication ever issued in true journal format right from its inception (ISSN 1025-4943). As the name suggests, the BDM revolves around sea cucumber fisheries, although its content has expanded considerably over the years. It now includes original research papers and review articles, correspondences, abstracts from publications and conference papers, bibliographies, address lists, spawning observations, market news, information on upcoming meetings and workshops, as well as general data on sea cucumber resource management. The first issue of the BDM was published

in January 1990. Since then, the Secretariat of the Pacific Community (SPC, formerly known as the South Pacific Commission) has published 33 issues of the BDM, all of which are available for download at no charge (<http://tinyurl.com/pr9uzpm>).

The BDM does not constitute a peer-reviewed publication (Conand 2008), as all contributions are sent to the managing editor, who then decides, with the help of specialized colleagues, whether the article is fit for publication. Until issue 27 (2008), Chantal Conand acted as the managing editor, before co-editing issue 28 (2008) together with Igor Eeckhaut, who became the managing editor of the BDM from that issue onwards. Technical and editorial aspects of the BDM have been arranged by SPC staff, in particular by Jean-Paul Gaudechoux for the first issues and Aymeric Desurmont since 1996.

The BDM is a bilingual publication: the original texts are submitted and published in English, but a full French translation of each issue, called *La bêche-de-mer bulletin d'information*, is provided by the SPC in addition to the English version (<http://tinyurl.com/ncg76j9>). In some years, the BDM has been published twice annually (i.e., 1990, 1999, 2001, 2002, and 2004–2008), but budget cuts for translation services at SPC have led to a reduction to one issue per year from 2009 onwards. In addition, the supply with printed copies had to be suspended from issue 24 (2006) on due to environmental reasons and further budget cuts at SPC. However, the total page numbers of BDM issues have steadily increased over time, from 14 pages in issue 1 (1990) to 76 pages in issue 32 (2012). Numerous articles published in the BDM over the last 20 years have been cited in high-ranking research papers, further illustrating the importance of the work presented in the *SPC Beche-de-mer Information Bulletin*.

Perspective

We would like to point out that the notable absence of a central publishing organ for the echinoderm community entails that important biographical data on individual echinoderm researchers (e.g., obituaries) have to be published elsewhere, often leading to difficulties in locating this information. It would therefore be important to discuss, in our eyes, how and where such data could be published in the future to ensure an improved accessibility.

Digital echinoderm resources

In addition to their century-old presence in the print media, echinoderms have since the early 1990s increasingly been featured in the digital domain. More than 20 years later, there are today dozens or probably even hundreds of institutional and private websites that provide echinoderm-related information. Because it would be beyond the scope of this article to list them all, we here present a chronological

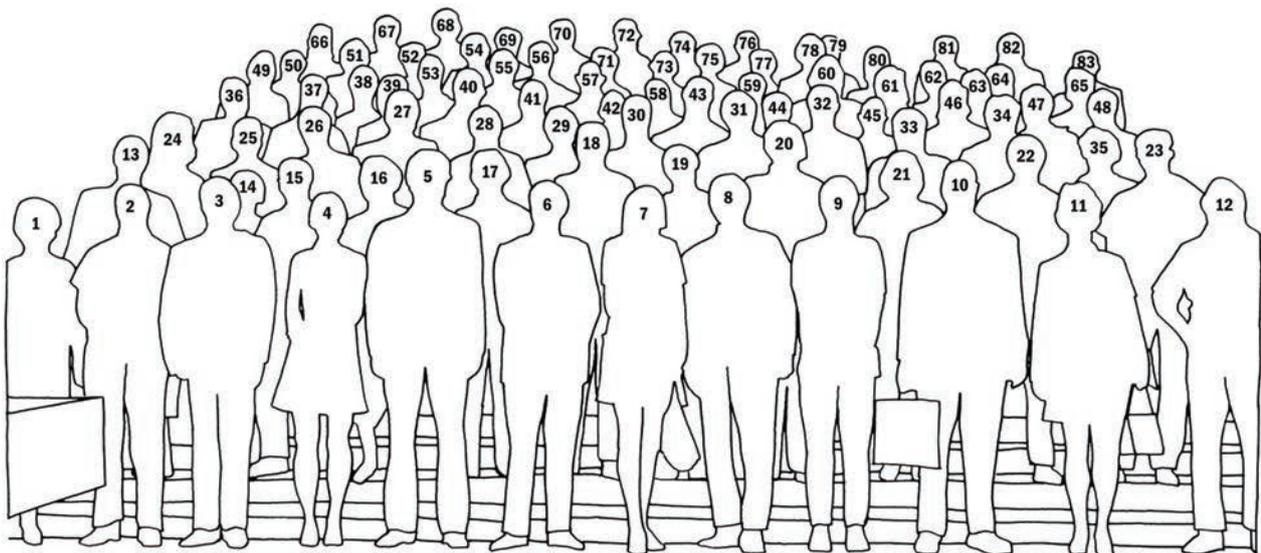


Figure 2. Group photo of the participants of the 1st *International Echinoderm Conference*, held 1972 in Washington, DC. 1 Lucienne Fenaux, 2 Harrell L. Strimple, 3 Thomas A. Ebert, 4 Jacqueline E. Moss, 5 Fu-Shiang Chia, 6 Alfred B. Chaet, 7 Sylvia Broderick, 8 Allahverdi A.-H. Farmanfarmaian, 9 Stanley E. Blake, 10 Michael H. Salazar, 11 Judith Eastwood, 12 Thomas F. Phelan, 13 Albert Breimer, 14 Christina Strimple, 15 John C. Ferguson, 16 Jennifer Nielsen, 17 Charles W. Walker, 18 Porter M. Kier, 19 Richard H. Chesher, 20 William C. Austin, 21 Bertha M. Cutress, 22 Charles Major, 23 Christopher R. C. Paul, 24 Ilana Ferber, 25 David L. Meyer, 26 Donald B. Macurda Jr., 27 Dennis W. Burdick, 28 Gerald J. Bakus, 29 Robert S. Carney, 30 F. Julian Fell, 31 Donald Broom, 32 Robert L. Singletary, 33 A. John Jordan, 34 Lawrence W. Coady, 35 Ailsa M. Clark, 36 Andrew C. Campbell, 37 John M. Lawrence, 38 Jeremy D. Woodley, 39 David G. Atwood, 40 Lowell P. Thomas, 41 John H. Dearborn, 42 Michael A. Kyte, 43 David L. Pawson, 44 Irving Gray, 45 Alan S. Horowitz, 46 David N. Emerson, 47 George D. Sevastopulo, 48 Richard L. Turner, 49 James Sutton, 50 James C. Brower, 51 Frank J. S. Maturo, 52 Edward P. F. Rose, 53 David Nichols, 54 Douglas H. Fenner, 55 W. Ross Ellington, 56 Donald P. Kelso, 57 James Sprinkle, 58 N. Gary Lane, 59 Michael LaBarbera, 60 John P. Eylers, 61 D. Keith Serafy, 62 Elizabeth M. Sides, 63 Dana Scott, 64 Maria Elena Caso, 65 Frank Jeal, 66 Jerald A. Halpern, 67 J. Wyatt Durham, 68 John M. Warn, 69 Dennis R. Kolata, 70 Ronald L. Parsley, 71 Richard U. Gooding, 72 Bruce M. Bell, 73 Gordon Hendler, 74 John S. Pearse, 75 Richard R. Strathmann, 76 Thomas S. Hopkins, 77 Stephen E. Stancyk, 78 John Caldwell, 79 Unidentified person, 80 Frederick H. C. Hotchkiss, 81 Aage M. Christensen, 82 Juan C. Castilla, 83 Fred C. Ziesenhenn. Image courtesy John M. Lawrence.

list of selected digital resources, some of which have already been discontinued. Most of these echinoderm websites - as well as multiple others - have also been featured in the section “Echinoderm Links” of the more recent issues of *The Echinoderm Newsletter*.

Starnet Echinoderm Newsletter (1992–1997)

One of the first, if not *the* first, digital echinoderm projects was the *Starnet Echinoderm Newsletter*, launched in 1992. This resource was created and edited by Winston A. Hide, who at that time was working for Dave Pawson as a postdoctoral student. The *Starnet Echinoderm Newsletter* was originally a stand-alone website, but later came to complement *The Echinoderm Newsletter* (see above). The aim of this electronic resource was to provide the worldwide echinoderm community with instantaneous and up-to-date information about meetings, book reviews, addresses of echinoderm scientists, and even recipes, as well as with a forum for current research. Apart from the main website, the project also included an electronic newsletter sent out to all subscribers via Email. The *Starnet Echinoderm Newsletter* went offline in 1997.

The Tree of Life Web Project (1996 - today)

Since its official release in 1996, the digital resource *The Tree of Life Web Project* (ToL) aims to provide information about the current knowledge of the evolutionary tree of life (<http://tinyurl.com/wz8l>). The contents of ToL are created by a multi-national team of more than five hundred biologists, each of them an expert for a particular group of organisms. The main goal is to document all significant clades and to provide basic information about the diversity and phylogeny of life on Earth. The individual web pages of ToL are arranged according to branching patterns between taxa and permit browsing the hierarchy of life as well as the characteristics of individual groups (Maddison et al. 2007). ToL covers extant and fossil taxa, providing images of characteristic morphology, images of key taxa, bibliographical lists, web links, vernacular names, as well as evidence for morphological and molecular characters.

The prototype of ToL was developed in 1994. Back then, the database underlying ToL was created using the software Mac-Clade and its NEXUS file format. However, in 2004, this program was replaced by TreeGrow, a cross-platform system which would allow all taxonomic experts to edit their web pages directly, thereby resulting in a more dynamic web environment. Despite similar names and foci, ToL is not directly associated with the National Science Foundation’s *Assembling the Tree of Life* (AToL) initiative. Therefore, in order to avoid confusion, ToL’s initial name, *The Tree of Life*, was changed to its current name, *The Tree of Life Web Project*.

Echinoderms are represented in ToL by a number of individual web pages. The first of these to go online was the website on Crinoidea, created in 1998 by William I. Ausich and Charles G. Messing (<http://tolweb.org/Crinoidea>). A

year later, the main page on the Echinodermata, compiled by Gregory A. Wray, was launched (<http://tinyurl.com/q9mka8t>). In 2000, this web page was followed by pages on holothurians (<http://tinyurl.com/p3xs4p7>) written by Alexander M. Kerr. Asteroidea, compiled by Emily Knott, were the next clade of extant echinoderms to follow, going online in 2004 (<http://tinyurl.com/pms4wol>). The last echinoderm-related website in ToL to be published was the page on the fossil clade Somasteroidea, online since 2005 and written by Alexander E. Primus (<http://tolweb.org/Somasteroidea/24272>).

Although there has not been any major activity over the past several years, the echinoderm section of ToL will expand in the coming years (Greg Wray, pers. comm.). This development will primarily be fueled by the National Science Foundation’s new AToL project, the *Echinoderm Tree of Life* (EToL).

Sea Urchin Embryology (1998 - today)

Likely the first truly interactive website on echinoderms was *Sea Urchin Embryology* (<http://tinyurl.com/noss-wz3>), which went online in 1998. The aim of this electronic publication was to provide high school teachers with a digital resource on sea urchin fertilization and deuterostome development that could be constantly updated by the editors. The website offers advanced high school level laboratory activities with materials to support school lessons. *Sea Urchin Embryology* was inspired by animations of cell development that Chris Patton had created for Daniel Mazia at Stanford University in the mid-1990s. Funded by the National Science Foundation, a team surrounding David Epel, Pamela Miller, and Chris Patton created a first version of the website with 150 pages in 1997, but *Sea Urchin Embryology* was later expanded to well over 300 pages. The site was programmed using Hypertext Markup Language (HTML) and was complemented with animated Graphics Interchange Format (GIF) files, Joint Photographic Experts Group (JPEG) files, and further types of digital data. *Sea Urchin Embryology* received numerous awards, among them the “Bridge Steller Site” award by The Bridge and the “Webivore Featured Site” award by Webivore, Inc. Although the website is still maintained by Chris Patton, new information has not been added for some time. Since 2005, *Sea Urchin Embryology* has been complemented by a further digital resource, the *Virtual Urchin* website (see below).

The Echinoid Directory (1999 - today)

In 1999, another electronic echinoderm project went online, *The Echinoid Directory* (<http://tinyurl.com/p3bkosd>). This website was created by Andrew B. Smith and is aimed at replacing the pages on sea urchins found in *The Treatise on Invertebrate Paleontology* (Moore 1966). In order to complement the data contained within this printed volume, Andrew Smith made use of the advantages of a web-based

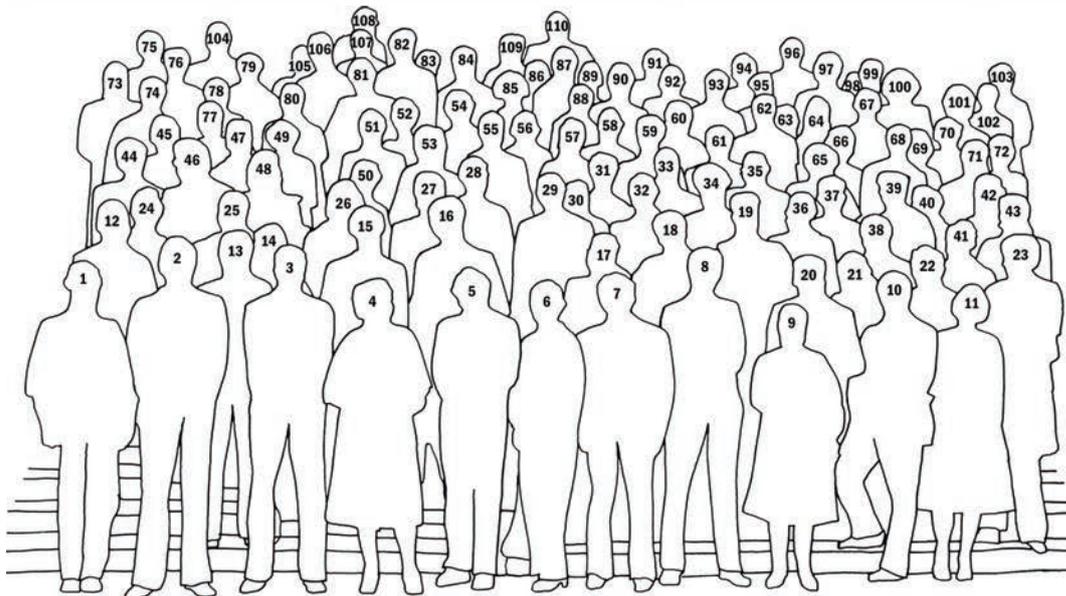


Figure 3. Group photo of the participants of the 1st European Conference on Echinoderms, held 1979 in Brussels. 1 Chantal De Ridder, 2 Michel Jangoux, 3 Claude Massin, 4 Anneliese Strenger, 5 Charles W. Walker, 6 Mrs. Hulbert, 7 Alan W. Hulbert, 8 David Nichols, 9 Mrs. Vasserot, 10 Robert F. O'Brien, 11 Anke Burkhardt, 12 Helge Hilgers, 13 Alfred Goldschmid, 14 Mrs. Goldschmid, 15 Richard M. Pagett, 16 Alan M. Raymond, 17 Raimundo Pidal, 18 Jean Le Menn, 19 Michel Huet, 20 Jean-Michel Vasserot, 21 Maria de Natividade Albuquerque, 22 Konrad Märkel, 23 Sebastian Bachmann, 24 Heinz Splechtna, 25 F. Jensenius Madsen, 26 Mrs. Guille, 27 Alain Guille, 28 Hubert Caspers, 29 Henri Termier, 30 Genevieve Termier, 31 Mrs. Roman, 32 Jean Roman, 33 Edwin Van Impe, 34 Jean-Guy Ferrand, 35 Robert Delavault, 36 Mrs. Huet, 37 Yulin Liao, 38 Jovanka Mitrović, 39 Norman Millott, 40 Mrs. Millott, 41 Ricard Martínez, 42 John E. Binyon, 43 Edward P. F. Rose, 44 Duncan Heddle, 45 Michel Philippe, 46 Jean-Pierre Féral, 47 Daniel Fournier, 48 Solveig Sjøgren, 49 Monique Guillou, 50 Ms. Bacallado-Aranega, 51 Jacques Guillou, 52 Mrs. David, 53 Juan Jose Bacallado-Aranega, 54 Bruno David, 55 Celso Rodriguez Babio, 56 Mrs. Monteiro Marques, 57 Myriam Sibuet, 58 Enrico Tortonese, 59 Michel Roux, 60 Peter A. Voogt, 61 Gustave Cherbonnier, 62 Reimund Haude, 63 Mrs. Paterson, 64 Mrs. Durkin, 65 Ailsa M. Clark, 66 Radu Sukarno, 67 Michael K. Durkin, 68 Richard P. S. Jefferies, 69 Lesley I. Messer, 70 Ester Ryberg, 71 David G. Stephenson, 72 Edith Bricourt, 73 Guy Coppois, 74 Michel Demargne, 75 Christopher R. C. Paul, 76 Erhard Höbaus, 77 Pierre Magniez, 78 Alain Bidar, 79 Geoffrey Q. Case, 80 Lydie Dupont, 81 M. De Waal, 82 Wolfram P. Tertschnig, 83 Unidentified person, 84 Gerardo Gustato, 85 Aagje J. Van der Plas, 86 Anna Villari, 87 Derek E. G. Briggs, 88 Vasco M. A. Monteiro Marques, 89 Megumi F. Strathmann, 90 Rob C. H. M. Oudejans, 91 Peter M. Jost, 92 Unidentified person, 93 Gordon L. J. Paterson, 94 Paula F. Dehn, 95 Hussein Kamel Badawi, 96 Roland H. Emson, 97 Paul A. Tyler, 98 Grace S. Y. Lim, 99 John M. Lawrence, 100 Andrew B. Smith, 101 Ilana Ferber, 102 Haruo Kanatani, 103 Desmond B. Johnson, 104 Iain C. Wilkie, 105 Jaume Gallemí Paulet, 106 Kurt Traer, 107 Bent Hansen, 108 Jan J. S. Broertjes, 109 Richard R. Strathmann, 110 Tine Valentinčič.

approach, in particular the possibility to continuously update and improve the content of the website and to upload an unlimited number of images. The currently more than 2,500 pages of *The Echinoid Directory* are arranged taxonomically, covering both extinct and extant taxa. Dichotomous keys permit sea urchin identification to genus level, while additional sections illustrate various aspects of echinoid biology and systematics. The initial design was carried out by Andrew Smith, while the technical development was accomplished by the information technology department at the Natural History Museum in London. The website has been generated using various Hypertext Transfer Protocol (HTTP) and JavaScript software. *The Echinoid Directory* was edited by Andrew Smith from 1999 to 2011, but he and Andreas Kroh are sharing the editorship since 2011. From 2006 on, the project has been opened to registered contributors, who can add or modify existing pages. An example is provided by the addition of interactive three-dimensional Portable Document Format (PDF) models of several sea urchin species that are available for download and online inspection (<http://tinyurl.com/p2ndfom>). *The Echinoid Directory* was elected “Best Palaeo Website” by The Palaeontological Association, received the “GSIS Outstanding Website” award by the Geoscience Information Society, and is indexed in the ISI Web of Knowledge Current Web Contents. The Natural History Museum is committed to maintaining the website for the coming years.

The Echinoderm-L (2000 - today)

In 2000, *The Echinoderm-L* project (<http://tinyurl.com/pjjenvp>) was introduced to the echinoderm community. This digital resource (the letter “L” stands for the software LISTSERV) was created by Sabine Stöhr following discussions during the 10th IEC held 2000 in Dunedin, New Zealand. Similar to part of the now inactive *Starnet Echinoderm Newsletter* (see above), *The Echinoderm-L* is an electronic mailing list intended to facilitate direct communication and discussion between echinoderm scientists. Like with other electronic mailing lists, each participant can send an Email to the editor, who will then send it on to all registered users. The mail server was configured by Cary Karp at the Swedish Museum of Natural History in Stockholm. The LISTSERV software was used from 2000 to 2010, while the software Mailman was employed from 2011 to 2012. However, since 2012, *The Echinoderm-L* is run using the Google Groups software. Sabine Stöhr plans to keep the mailing list active for the coming years.

Virtual Urchin (2005 - today)

The *Virtual Urchin* website (<http://tinyurl.com/ydyaxrt>), funded by the National Science Foundation, was launched in 2005. It was created by a team surrounding Jason Hodin, Pamela Miller, and David Epel at Stanford University. The aim of *Virtual Urchin* is to augment the materials already available at the *Sea Urchin Embryo-*

logy website (see above), which is primarily intended for high school teachers. In contrast, for *Virtual Urchin* students are the target users, and the intention is to provide them with a “real research lab” experience, albeit online. The website was built using HTML and Cascading Style Sheets (CSS) using multiple Flash animations. The content is arranged around a number of virtual tutorials that provide information about sea urchin fertilization and development as well as sea urchin anatomy and ecology. The website developers are currently planning to expand their concept to sea urchin larvae, but are also open to echinoderm biologists that seek to design high-quality outreach activities based on their research (Jason Hodin, pers. comm.).

The Echinoblog (2008 - today)

In order to engage the public in echinoderm science, Christopher L. Mah started his web log (or blog), *The Echinoblog* (<http://echinoblog.blogspot.com/>), in 2008. Since then, he has added more than 400 entries to his website, which contains numerous exquisite images and many lines of informative text. The aim of this digital project is to raise the public’s awareness about echinoderms and other marine invertebrates. Chris Mah has designed and developed *The Echinoblog* using the Google Blogger software and is currently the acting producer of the website. The content of his blog is primarily a digest of echinoderm research and a presentation of facts about echinoderms which are poorly understood by the public (e.g., the fact that sand dollars are sea urchins). But the website also includes images of other eye-catching invertebrates, including polychaetes, amphipods, or ctenophores. *The Echinoblog* is accompanied by a Twitter feed (<https://twitter.com/echinoblog>), also produced by Chris Mah. This complementary resource constitutes an almost instantaneous way of communicating scientific facts and findings to a wider audience.

The World Register of Marine Species (2008 - today)

The *World Register of Marine Species* (WoRMS) is a large database project aimed at providing an authoritative and comprehensive list of names of extant and extinct marine organisms. The main website (<http://www.marinespecies.org>) was launched in 2008, building on previously available data from the European Register of Marine Species as well as the infrastructure of the Aphia platform of the Vlaams Instituut voor de Zee (VLIZ). The species lists contained in WoRMS are supplemented by additional information on marine organisms, including, but not limited to, species distribution, nomenclatural status, ecological traits, vernacular names, and images. The database is hosted by VLIZ and is curated by more than two hundred taxonomic experts. Some taxa and/or regional lists are covered particularly extensively and are therefore represented by individual websites. Three of these thematic databases are focused on echinoderms:

The World Ophiuroidea Database (<http://tinyurl.com/q9elnbk>), created in 2007 by Sabine Stöhr and Timothy O'Hara; *The World Asteroidea Database* (<http://tinyurl.com/o6dz4qy>), launched in 2009 by Chris Mah; and *The World Echinoidea Database* (<http://tinyurl.com/pcohn6h>), published in 2010 by Andreas Kroh and Richard J. Mooi. Similar projects for holothuroids and crinoids are currently in preparation.

The Echinoderm Files (2013 - today)

The latest addition to the digital world of echinoderms is the website *The Echinoderm Files* (<http://tinyurl.com/nrrrkme>). This website, which went online in 2013, provides bibliographical information and metadata on 2,450 articles and abstracts published in the proceedings of IEC and ECE meetings (Kroh et al. 2013). In addition to these



Figure 4. Impressions from a poster session organized during the 1st *European Conference on Echinoderms*, held 1979 in Brussels. (A) Jan J. S. Broertjes, Haruo Kanatani, Peter A. Voogt. (B) Guy Coppois, Chantal De Ridder, Edith Bricourt, Lucie Jangoux, Robert Fenaux, Lucienne Fenaux. (C) Mrs. Monteiro Marques, Vasco M. A. Monteiro Marques, Gustave Cherbonnier, Lucie Jangoux, Solveig Sjögren. (D) Alfred Goldschmid (background), Tim Bowmer, Claude Massin, Jean-Pierre Féral, John Costelloe, Brendan O'Connor. (E) Richard M. Pagett, Iain C. Wilkie, Alan M. Raymond, Roland H. Emson. (F) Raimundo Pidal, Ricard Martínez, Enrico Tortonese, F. Jensenius Madsen, Bent Hansen.

two major echinoderm conference series, publications related to a number of independent echinoderm symposia have been included as well. By making the bibliographical data of these proceedings volumes available in the form of a searchable database, *The Echinoderm Files* aims at facilitating an easier access to the information contained within these often hard-to-locate volumes. In addition, the website supplements the information on echinoderm meetings and symposia compiled in Ziegler and Kroh (2012). The website itself has been programmed using the software Exhibit 3.0, which allows online searching and browsing of the database. Furthermore, the raw data contained within the database can be downloaded in different file formats for convenient data export. *The Echinoderm*

Files has been integrated into the project landscape of *The World Register of Marine Species* (see above).

Perspective

For well over 20 years now, the Internet has been successfully used to document the diversity of echinoderms and to present scientific and popular facts about this group of marine invertebrates to a wider audience. Although websites do not constitute formal publications in the classical sense, their contribution to echinoderm science should not be underestimated. In particular so, because websites facilitate rapid access to pieces of information that previously were hard or even impossible to locate.

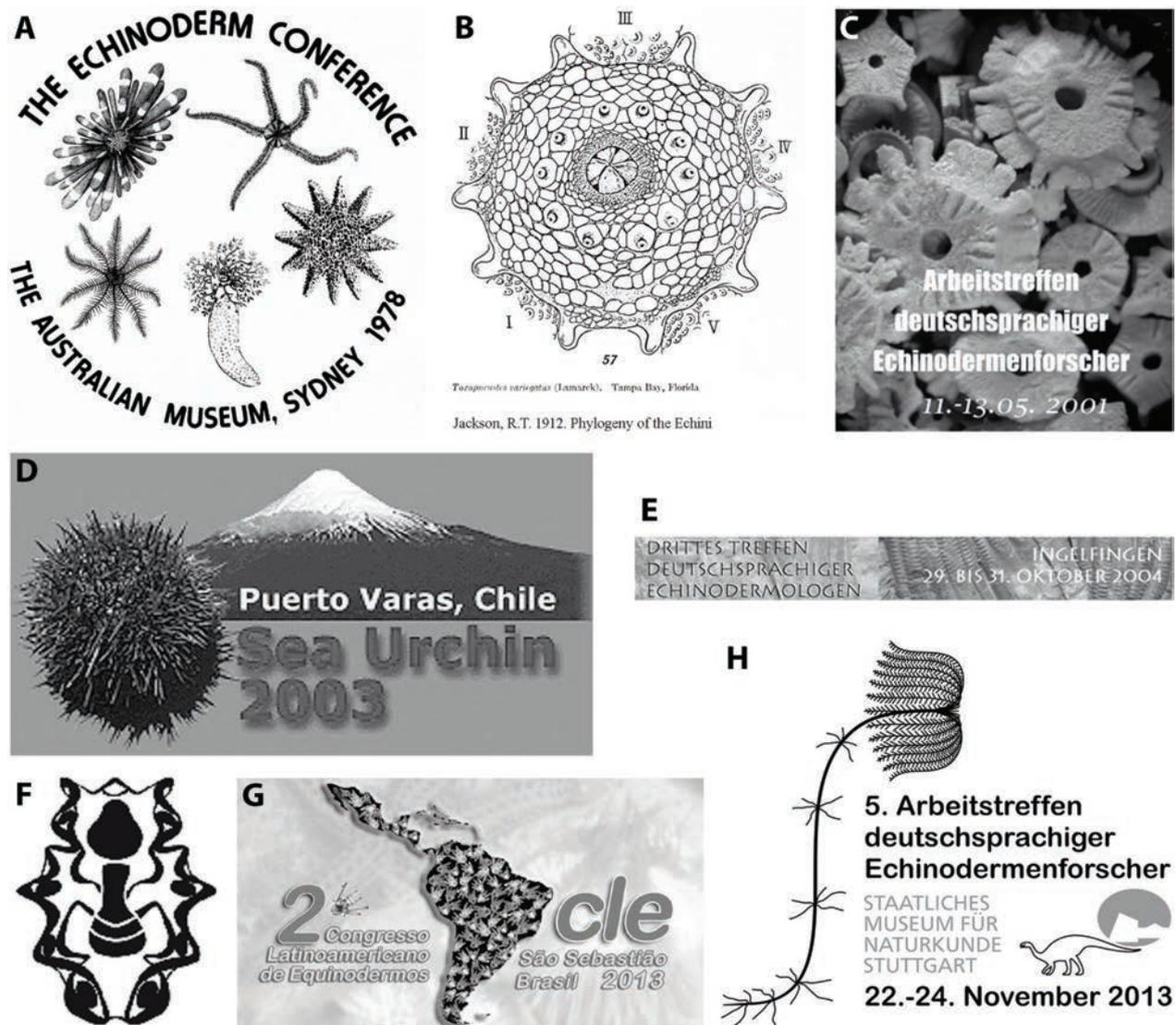


Figure 5. Conference logos from selected national, regional, and international echinoderm meetings held from 1978 to 2013. (A) 3rd International Echinoderm Conference, Sydney, Australia, 1978. (B) 5th Florida Echinoderm Festival, Tampa, Florida, USA, 1999. (C) 1. Arbeitstreffen deutschsprachiger Echinodermenforscher, Greifswald, Germany, 2001. (D) International Conference on Sea-Urchin Fisheries and Aquaculture, Puerto Varas, Chile, 2003. (E) 3. Arbeitstreffen deutschsprachiger Echinodermenforscher, Ingelfingen, Germany, 2004. (F) ACIAR-SPC Asia-Pacific Tropical Sea Cucumber Aquaculture Symposium, Nouméa, New Caledonia, 2011. (G) 2º Congresso Latinoamericano de Equinodermos, São Sebastião, Brazil, 2013. (H) 5. Arbeitstreffen deutschsprachiger Echinodermenforscher, Stuttgart, Germany, 2013.

Conference logos and flyers

In addition to the conference logos previously depicted in our first contribution on the history of echinoderm meetings (Ziegler and Kroh 2012), we are able to present further logos from national, regional, and international echinoderm conferences (Fig. 5).

We are particularly pleased to announce that the logo of the 3rd IEC (1978, Sydney, Australia), which was thought to have been lost, has been retrieved (Fig. 5A). This logo - and many others - can also be found online at *The Echinoderm Files* website (<http://tinyurl.com/o9fzoq8>). Furthermore, Figure 6 shows one of the echinoderm flyers traditionally handed out during the *Meeting of the Geological Society of America*. Such leaflets have been used to announce the informal gatherings of the *Friends of the Echinoderms*. Lane (1997) and Lawrence (1998) provide detailed background information about these events. Finally, the following echinoderm meeting unfortunately went unnoticed in our previous compilations:

Symposium on Biology and Ecology of the Crown-of-thorns starfish, *Acanthaster planci* (L.) (held as part of the Pacific Science Association Second Inter-Congress)

Agana, Guam, USA, 23–24 May 1973

Organized by Lucius G. Eldredge and the Pacific Science Association

Proceedings volume: *Biology and Ecology of the Crown-of-thorns starfish, *Acanthaster planci* (L.), Micronesica*, 9, 1–243, ISSN 0026-279X

Last but not least, we would like to correct a mistake made in our first article on the history of echinoderm meetings: the *Symposium on Echinoderm Development*, held as part of the *Winter Meeting of the American Society of Zoologists* took place in 1973 from December 27–28, instead of December 20–23.

Concluding remarks

Although the Echinodermata have been the focus of scientific study for well over 2,000 years, in particular the last 50 years have witnessed a significant increase in knowledge on all aspects of echinoderm biology. This welcome development must in part be attributed to the improved communication among echinoderm scientists due to meetings and the associated proceedings. Given the impressive tools for data dissemination and direct communication that are available to researchers nowadays, we estimate an even faster knowledge gain to occur in echinoderm science in the coming years.

Acknowledgements

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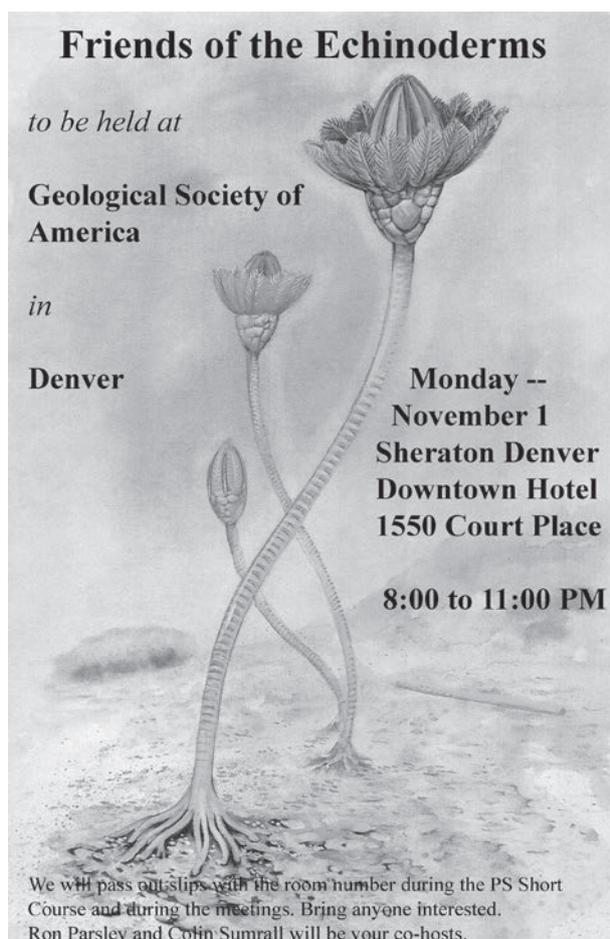


Figure 6. Flyer announcing an informal gathering of the *Friends of the Echinoderms* during the 2010 *Meeting of the Geological Society of America* in Denver, Colorado, USA. Image courtesy Ronald L. Parsley.

Michael F. Barker (Dunedin, New Zealand), Maria Byrne (Sydney, Australia), Chantal Conand (La Réunion, France), Bruno David (Dijon, France), Aymeric Desurmont (Nouméa, New Caledonia), Janina F. Dynowski (Stuttgart, Germany), Winston A. Hide (Cambridge, Massachusetts, USA), Jason Hodin (Pacific Grove, California, USA), Christopher L. Mah (Washington, DC, USA), Claus Nielsen (Copenhagen, Denmark), Ronald L. Parsley (New Orleans, Louisiana, USA), Jaume Gallemí Paulet (Barcelona, Spain), David L. Pawson (Washington, DC, USA), Doris J. Pawson (Washington, DC, USA), John S. Pearse (Santa Cruz, California, USA), Vicki B. Pearse (Santa Cruz, California, USA), Francis W. E. Rowe (Hoxne, UK), Andrew B. Smith (London, UK), Andrej N. Soloviev (Moscow, Russia), Sabine Stöhr (Stockholm, Sweden), Megumi F. Strathmann (Friday Harbor, Washington, USA), Richard R. Strathmann (Friday Harbor, Washington, USA), Richard L. Turner (Melbourne, Florida, USA), Paul A. Tyler (Southampton, UK), Iain C. Wilkie (Glasgow, UK), and Gregory A. Wray (Durham, North Carolina, USA). Richard A. Booloottian and his son Mark Booloottian (Santa Cruz, California, USA) kindly sent us images from the first echinoderm meeting held in 1963. We would like to thank John M. Lawrence (Tampa, Florida, USA) and Andreas Ziegler (Berlin, Germany) for their helpful comments on earlier versions of our manuscript.

References

- Anonymous (1912) Proceedings of the Seventh International Congress of Zoology. The University Press, Cambridge, 972 pp.
- Birkeland C (1984) Book review: Echinoderm Studies. Volume 1. The Quarterly Review of Biology 59: 342–343.
- Boooloatian RA (1965) Physiology of Echinodermata. Interscience, New York, 822 pp.
- Conand C (2008) Editorial. SPC Beche-de-mer Information Bulletin 28: 1.
- Ellers O (1997) Book review: Echinoderm Studies. Volume 5. The Quarterly Review of Biology 72: 340.
- Gislén T (1924) Echinoderm Studies. Zoologiska Bidrag från Uppsala 9: 1–316.
- Jangoux M, Lawrence JM (1982) Echinoderm Nutrition. Balkema, Rotterdam, 654 pp.
- Jangoux M, Lawrence JM (1983) Echinoderm Studies 1. Balkema, Rotterdam, 203 pp.
- Jangoux M, Lawrence JM (1987) Echinoderm Studies 2. Balkema, Rotterdam, 285 pp.
- Jangoux M, Lawrence JM (1989) Echinoderm Studies 3. Balkema, Rotterdam, 382 pp.
- Jangoux M, Lawrence JM (1993) Echinoderm Studies 4. Balkema, Rotterdam, 368 pp.
- Jangoux M, Lawrence JM (1996) Echinoderm Studies 5. Balkema, Rotterdam, 250 pp.
- Jangoux M, Lawrence JM (2001) Echinoderm Studies 6. Balkema, Rotterdam, 347 pp.
- Johnson K (2009) The return of the Phoenix: the 1963 International Congress of Zoology and American zoologists in the twentieth century. Journal of the History of Biology 42: 417–456.
- Kroh A, Jangoux M, Mirantsev GV, Ziegler A (2013) The Echinoderm Files: a database-facilitated access to a hidden treasure trove. Cahiers de Biologie Marine 54: 549–557.
- Lane NG (1997) Introduction to the Paleontological Society short course 'Geobiology of Echinoderms'. The Paleontological Society Papers 3: 1–2.
- Lawrence JM (1998) A history of meetings on Echinodermata in North America. Gulf of Mexico Science 16: 112–114.
- Lawrence JM (2001) Edible Sea Urchins: Biology and Ecology. First edition. Elsevier, Amsterdam, 419 pp.
- Lawrence JM (2006) Edible Sea Urchins: Biology and Ecology. Second edition. Elsevier, Amsterdam, 529 pp.
- Lawrence JM (2013) Sea Urchins: Biology and Ecology. Third edition. Academic Press, London, 600 pp.
- Maddison DR, Schulz KS, Maddison WP (2007) The Tree of Life Web Project. Zootaxa 1668: 19–40.
- Mladenov P (1991) Book review: Echinoderm Studies. Volume 3. The Quarterly Review of Biology 66: 89–90.
- Moore RC (1966) Treatise on Invertebrate Paleontology, Part U, Echinodermata 3. The University of Kansas Press, Lawrence, 366 pp.
- Nichols D (1962) Echinoderms. First edition. Hutchinson University Library, London, 200 pp.
- Nichols D (1969) Echinoderms. Second edition. Hutchinson University Library, London, 192 pp.
- Nichols D (1983) Talk of echinoderms at Tampa Bay. Nature 306: 296.
- Romer AS (1963) International Congress of Zoology, 20–27 August 1963. Science 140: 1113–1116.
- Tyler PA (1988) Book review: Echinoderm Studies. Volume 2. The Quarterly Review of Biology 63: 468–469.
- Ziegler A, Kroh A (2012) Echinoderm conferences and symposia: a concise history and bibliography. Zoosymposia 7: 1–24.