

THE ITALIAN SPONGIOLOGISTS: A HISTORICAL OVERVIEW

ELDA GAINO, MAURIZIO PANSINI, ROBERTO PRONZATO

former professors at the University of Genoa

Correspondence: elda.gaino@gmail.com, pansini@gmail.com, roberto.pronzato@libero.it

ABSTRACT

The Italian school of spongiologists appeared later than similar schools in other countries. Nevertheless, Italian sponge scientists spread out from Genoa, the school's original setting, to various universities, research centers, laboratories, schools and natural parks. Michele Sarà and Gustavo Pulitzer-Finali founded the school in the second half of the 20th century. Now in its fourth generation, the school pursues interests that range from basic fields, such as taxonomy, morphology, electron microscopy, ecology, evolution, phylogeny, cell biology, microbiology, symbiosis and molecular biology, to paleontology. At the same time, its applied research also concerns sponge farming (mariculture), bioprospecting, conservation, sustainable aquaculture, and so on.

Key-Words: Biology, Italy, paleontology, research, Sponges.

FROM THE PRE-LINNEAN PERIOD TO THE END OF THE 18TH CENTURY

The precursor of scientific natural observations on sponges was almost certainly Aristotle, whose detailed morphological and ecological descriptions in “On the parts of animals” and “The history of animals” (350 BC) include notes on the few sponge species then known.

Sponges were part of the culture of the ancient Romans and were widely used. Each Roman legionary was equipped with one for personal hygiene. Matrons soaked sponges in milk and honey and used them as pacifiers for their children. Moreover, it was with a sponge that a Roman centurion attempted to quench the thirst of the dying Christ.

The *Spongia somnifera/soporifera* was a medieval milestone in the history of general anaesthesia. Indeed, in the Middle Ages, the “soporific sponge” was used by the Italian surgeons Nicholas of Salerno (end of the 12th century), Theodoric of Lucca (1205-1298) and Arnold of Villanova (Arnaldus Villanovanus) (c. 1238-1310) to anaesthetise their patients. The “soporific sponge” was created by boiling a sponge in a mixture of opium, hemlock and the juice of mandrake, ivy and unripe mulberry, and was positioned over the nostrils of the patient. The anaesthetic effect of this cocktail was usually interrupted by applying a sponge soaked in vinegar to wake the patient after the operation. Of the pre-Linnean Italian naturalists who studied sponges (no more than 10: Vosmaer, 1928), the most important was Ulisse Aldrovandi from Bologna. In his “*De Reliquis Animalibus exanguibus*” (1606) he described and illustrated some varieties of “*Tethya*” (Figure 1), though some figures apparently matched the morphotraits of *Chondrosia reniformis* and *Suberites domuncula* (Vol IV, pp: 584, 585). His notes also mentioned the use of some species in cooking and in medicine.

In the “Systema Naturae” (1735-1770), Linnaeus introduced the fundamental binomial nomenclature and the hierarchy of taxa, though only in the 10th edition did he describe a few “Spongia” species. The only species still preserved in the Linnaean herbarium in London is *Spongilla lacustris*, which was brought to light by Manconi & Pronzato (2000, Figure 2) during the first meeting of the working group “Systema Porifera” in 1994.

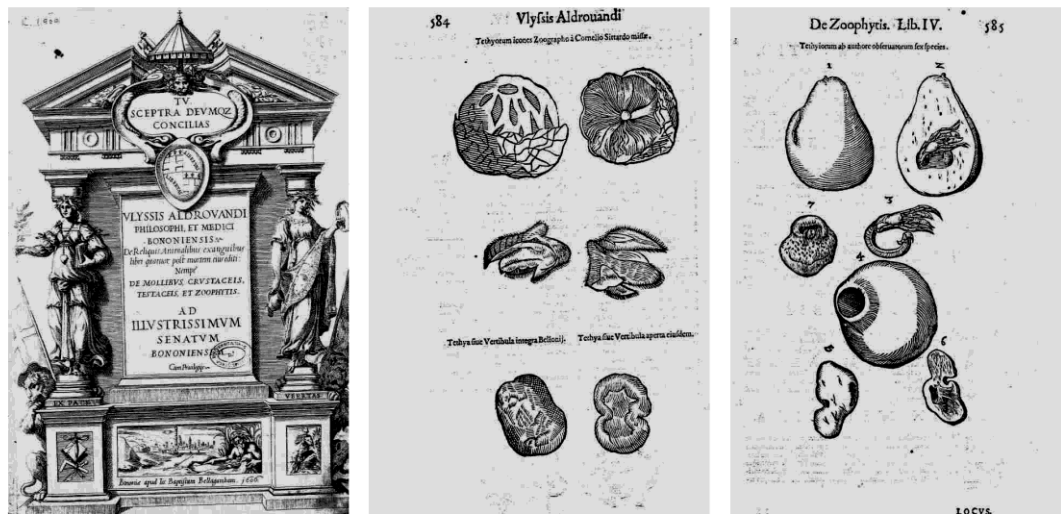


Figure 1. Ulisse Aldrovandi was one of the most important pre-Linnaean naturalists in Italy. In the fourth volume of his work “De Reliquis Animalibus exanguibus” (1606) he also described some species of sponges.

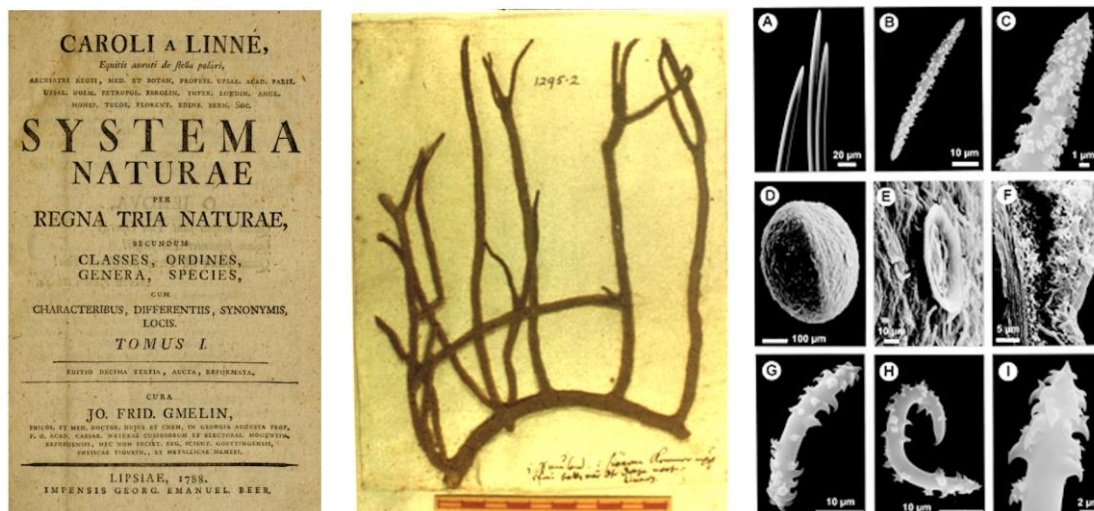


Figure 2. Linnaeus (1735-1770) described some sponge species in the first volume of the “Systema Naturae”. Only one of these is still preserved in the “Linnaean Herbarium” at the Linnaean Society in London. This was studied and re-described by Manconi & Pronzato (2000) as *Spongilla lacustris* (Linnaeus, 1759), a typical specimen of freshwater sponge species.

In the second (post-Linnaean) half of the 18th century, few Italian scientists (less than 20: Vosmaer, 1928) worked on sponges. Lazzaro Spallanzani observed the dynamic flow of water through their bodies, thinking that they were vegetables (Pighini, 1928). Vitaliano Donati (1750) described and illustrated some sponges (Alcionii and Tetic) from the Adriatic (Figure 3), while Giuseppe Olivi (1792) investigated various species of *Spongia* from the Venice lagoon, and provided some valuable illustrations (Figure 4).

In Southern Italy, the Neapolitan marine biologist Filippo Cavolini (1785) was a pioneer/precursor of sponge farming in shallow waters (Figure 5).

THE 19TH CENTURY AND THE FIRST HALF OF THE 20TH CENTURY

In the 19th century, too, very few papers (about 30: Vosmaer, 1928) on sponges were published by Italian authors.

The most important authors were Bertolini, Delle Chiaie and Nardo, who was the first Italian to describe a new species of sponge still valid: *Aplysina aerophoba* (Nardo, 1833). More than a century would pass before Italian scientists again described new species of sponges systematically (1951). The first was Sarà, followed by Pulitzer-Finali and, subsequently, all their successors. In this long gap there were very few exceptions (e.g. Buccich, 1886).

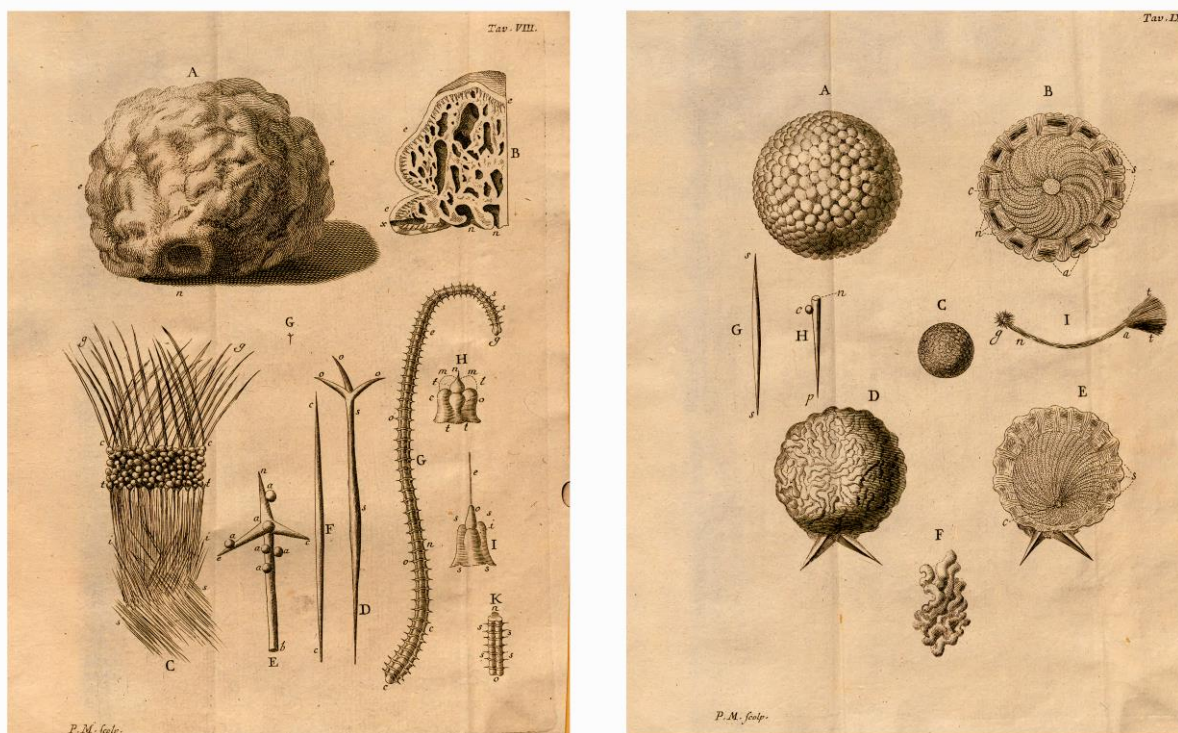


Figure 3. Images of “Alcionii” and “Tetic” from the plates that accompany the essay “*Della storia naturale marina dell’Adriatico*” printed by Donati & Sesler in 1750.

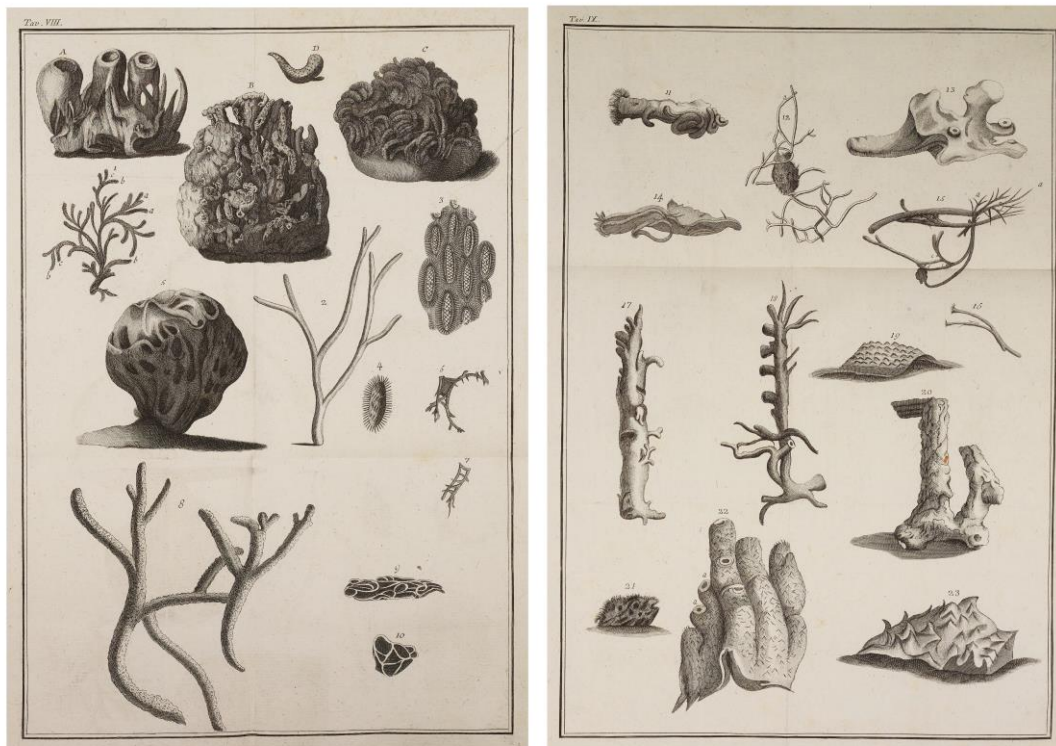


Figure 4. The two original plates on sponges, showing the different species and varieties that the abbot Olivi reported in his work “*Zoologia adriatica: ossia catalogo ragionato degli animali del Golfo e delle Lagune di Venezia; preceduto da una dissertazione sulla storia fisica e naturale del Golfo; e accompagnato da memorie, ed osservazioni di fisica storia naturale ed economia*”, published in 1792.

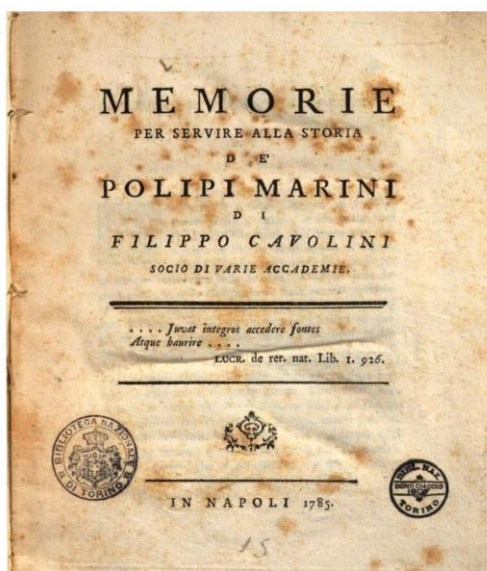


Figure 5. The Neapolitan Filippo Cavolini, a pioneer of marine biology towards the end of the 18th century, farmed sponges experimentally by using “necklaces” of the earthenware pots normally used to catch octopuses.

Balsamo-Crivelli (1864), Paglia (1881), Pavesi (1881) and Garbini (1894) recorded only a few freshwater sponges from northern Italy; these are common and widespread species. Paolo Celesia (1893) published a note on the symbiosis between *Suberites domuncula* and hermit crabs (Figure 6): a mutual relationship known for over two centuries (Aldovrandi, 1606). The first Italian marine biology manual (Issel, 1918) mentions only four species of sponges: two in the abyssal environment (glass sponges - ch. 7), one on coralligenous bottoms (*Axinella* sp. - ch. 12) and one in *Posidonia* meadows (*Suberites* sp. - ch. 15).

In the first half of the 20th century, the *Bollettino di Pesca, Piscicoltura e Idrobiologia* (AA.VV., 1926-1938) published annual reports on Mediterranean sponge fishery, and Sella (1912), Chiavara (1920), Maldura (1931) and Bini (1933) provided more detailed treatments and illustrations of this subject (Figure 7).

Clearly, Italian naturalists displayed very little interest in the study of Porifera until the 1950s. Elsewhere in the world, however, studies flourished, making the entire period of the 19th and 20th centuries one of the most prolific for sponge sciences, particularly taxonomy. Indeed, the United Kingdom, France, Germany, Austria and the United States saw authors such as Pallas, Grant, Lamarck, Topsent, Schmidt, Arndt, Bowerbank, Dendy, Hentschel, Hyatt, Burton, Haeckel, Lendenfeld and others.

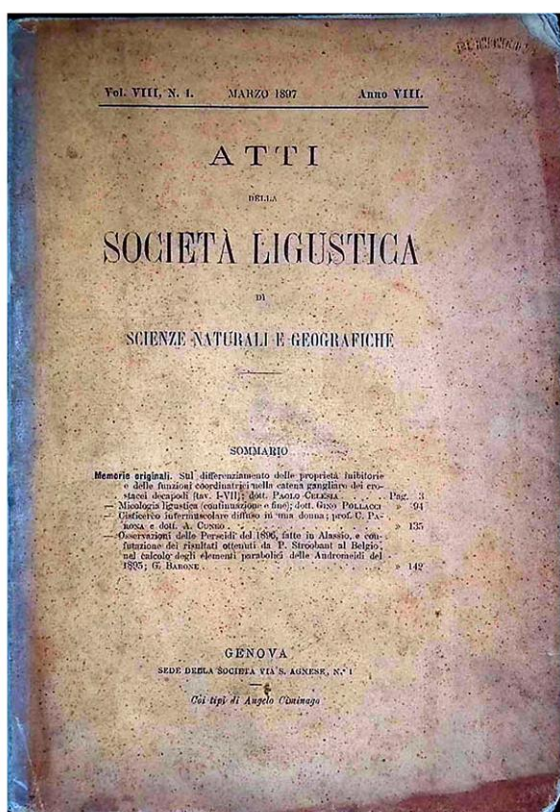


Figure 6. Paolo Celesia (in 1893) published a note on the symbiosis between the sponge *Suberites domuncula* and hermit crabs, accompanied by fine illustrations. In the entire 18th century, only a few other papers on sponges were published by Italian authors.



Figure 7. In the first half of the 20th century, several Italian scientists, e.g. Sella (1912), Chiavara (1920) Maldura (1931) and Bini (1933) studied sponge fisheries in the colonial territories of the Italian Kingdom.

THE FOUNDERS: SARÀ AND PULITZER-FINALI

Michele Sarà (Figure 8) was born in Naples on April 27, 1926. An attentive and promising student, he maintained his studies partly by doing small “part-time” jobs until he graduated brilliantly with honors in 1947. His scientific training began at the “Anthon Dohrn” Zoological Station in Naples. Subsequently, he moved to Roscoff, where he learned the rudiments of the study of Porifera from Odette Tuzet.

Sarà’s first scientific studies on sponges were conducted in Naples, at the Zoological Station and the Zoological Institute of the University; in some areas of research, he cooperated with Lucia Siribelli. Sarà started his academic career at the University of Bari at the beginning of the 1950s and involved Lidia Scalera-Liaci, Margherita Sciscioli and Nicola Melone in sponge studies; he subsequently moved to Genoa University in 1969.

About 10 species of sponges have been dedicated to Sarà by authors working in the most diverse and distant geographical locations, from *Spiroxina sarai* (Melone, 1965) to *Microxina sarai* (Calcinai & Pansini, 2000).

Not only was Sarà a scientist with a lucid mind, he was also a man of a thousand interests, which ranged far beyond his profession. Indeed, he was also a painter with a particular skill in watercolor, exhibiting his works in Italy and abroad, and published three collections of poems.

Gustavo Pulitzer-Finali (Figure 8) was born in Trieste on 4 October 1915. After graduating in Economics and Commerce, he devoted himself to marine biology from an early age, specializing in the systematics and ecology of sponges. During his many trips to London and Paris, he acquired an impressive naturalistic bibliographic collection, which he continued to build up for over 40 years.

He also organized numerous scientific expeditions in the Mediterranean, the Caribbean and the Indian Ocean to collect invertebrate specimens (especially of Porifera). Most of these

important collections are now cataloged and conserved at the “Giacomo Doria” Civic Museum of Natural History in Genoa.

In the 1950s, he settled in Portofino, where he collaborated with Luigi Ferraro and Egidio Cressi to create prototypes of experimental underwater equipment. For over 20 years he was a frequent visitor to the submerged cliffs of the Portofino Promontory, the benthic fauna of which was meticulously documented by his pioneering activity as an underwater photographer.

He was the classic gentleman naturalist. Thanks to his prestigious family lineage, he could afford to devote his time totally to his passion for the sea.

He described several species of Porifera that were new to science, and several colleagues dedicated to him the new species that they had discovered.

The volume reporting the proceedings of the “Sixth International Sponge Conference” (Rapallo, 2002) was dedicated to Michele Sarà and Gustavo Pulitzer-Finali while they were still alive. In the autumn of 2006, in just over a month, the Italian school of Porifera biology lost both its founders. In 2011, the book on Porifera (vol. 46 of the series “Fauna d’Italia”) was dedicated, *post mortem*, to these two mentors of the Italian Sponge Sciences.



Figure 8. The first international appearance of the just-founded Italian Spongiology School was in 1969 at the first Sponge Conference in London: Michele Sarà (right) and Gustavo Pulitzer Finali (left).

THE FIRST FOLLOWERS

When Michele Sarà moved from Bari to Genoa in 1969, Maurizio Pansini and Roberto Pronzato became the first Genoese undergraduates to study with the new professor. Together with Elda Gaino, in 1971 they were also the first members of a group of marine zoologists who are now scattered throughout Italy. This triad of Sarà’s “first followers” was soon joined by Daniela

Pessani, Andrea Balduzzi, Nando Boero and Riccardo Cattaneo; though specialized in different marine taxa, they collaborated in marine benthic synecological studies. Subsequently, in the 1980s, the second generation of spongiologists appeared: Renata Manconi, Giorgio Bavestrello, Bruno Burlando and Giuseppe Corriero; these were followed in the 1990s by Barbara Calcinai and Carlo Cerrano. Subsequently, various members of the Genoese group migrated to several Italian universities, giving rise to the present generation. Made up of numerous graduates, doctors and PhD students, this generation has had the good fortune to benefit from over 50 years of experience accumulated in the laboratory and in the field.

ANCONA, BARI, PERUGIA, SASSARI: THE 1990S

In the 1990s, Renata Manconi, Giuseppe Corriero, Elda Gaino and Giorgio Bavestrello “migrated” to other Italian universities: Renata Manconi to Sassari, Giuseppe Corriero to Bari, Elda Gaino to Perugia and Giorgio Bavestrello to Ancona. In their new positions, they all founded branches of the Genoese school of sponge sciences; while each branch had its own specialist area, all maintained solid interconnections with their Genoese roots.

The first to leave Genoa was Renata Manconi. A native of Sardinia, she graduated at Sassari University, before training in marine biology at the Zoological Station in Naples. She subsequently moved to Genoa University, where she took her PhD in Marine Science/Animal Biology. In 1990, she took up a tenured position at Sassari University, specializing in sponge farming, taxonomy, the ecology of “horny sponges” and the systematics/ phylogeny/evolution of freshwater sponges. In this last field, she is considered a world authority. Her pupils are Tiziana Cubeddu, Fabio Ledda, Nisit Ruengsawang, Annalisa Serusi, Barbara Cadeddu and Andrea Padiglia, all of whom are the authors of various publications on Porifera in international journals.

The second member of this quartet to leave Genoa was Giuseppe Corriero, in 1993; a native of Sicily, he had moved to Genoa University after graduating, in order to cultivate his passion for marine biology. After obtaining his doctorate in Marine Sciences, he moved to Bari University, where he was welcomed by Lidia Liaci, a former student of Michele Sarà. The research activities of the Bari school increased with the arrival of Carlotta Nonnis-Marzano, Maria Mercurio and Caterina Longo.

Elda Gaino moved to the University of Perugia in 1994, after several years of research on sponges and insects at Genoa University. Specialized in cell biology and a pioneer of electron microscopy (SEM and TEM), she had a remarkably successful academic career, reaching the position of vice-rector. With Manuela Rebori, she studied *Ephydatia fluviatilis* from Lake Trasimeno and Lake Piediluco, in central Italy.

Giorgio Bavestrello moved to Ancona University (Politecnico delle Marche) in 1998, followed by his pupil Barbara Calcinai PhD in 2001. They continued to collaborate with Carlo Cerrano PhD, who had acquired a permanent position at Genoa University in 2001; he later moved to Ancona, in 2011, at the same time as Bavestrello returned to Genoa. In Ancona, the group of marine biologists has expanded: Cristina di Camillo; Martina Coppari; Camilla Roveta and Torquato Pulido Mantas.

Maurizio Pansini and Roberto Pronzato continued their teaching and scientific activities in Genoa until they retired, leaving the responsibility of continuing to Giorgio Bavestrello, Marco Bertolino, Gabriele Costa and their students.

By the end of the 20th century, the number of Italian spongiologists had increased to around 30, working at five Italian universities in various parts of the country. In less than half a century, the Italian school of “Spongiology” had reached its point of maximum expansion since its foundation at the beginning of the 1950s.

THE NEW MILLENNIUM AND THE SCIENTIFIC HERITAGE TO DATE

In 2000, a milestone in sponge taxonomy was reached with the publication of the volume “*Systema Porifera*”, edited by Rob van Soest and John Hooper. This was the result of seven years of painstaking work by an international committee, which also involved Michele Sarà (chapter on Tethyidae) and Renata Manconi & Roberto Pronzato (chapter on Spongillina) (Figure 9). This publication still constitutes a key reference for those scientists who deal with Porifera taxonomy/systematics.

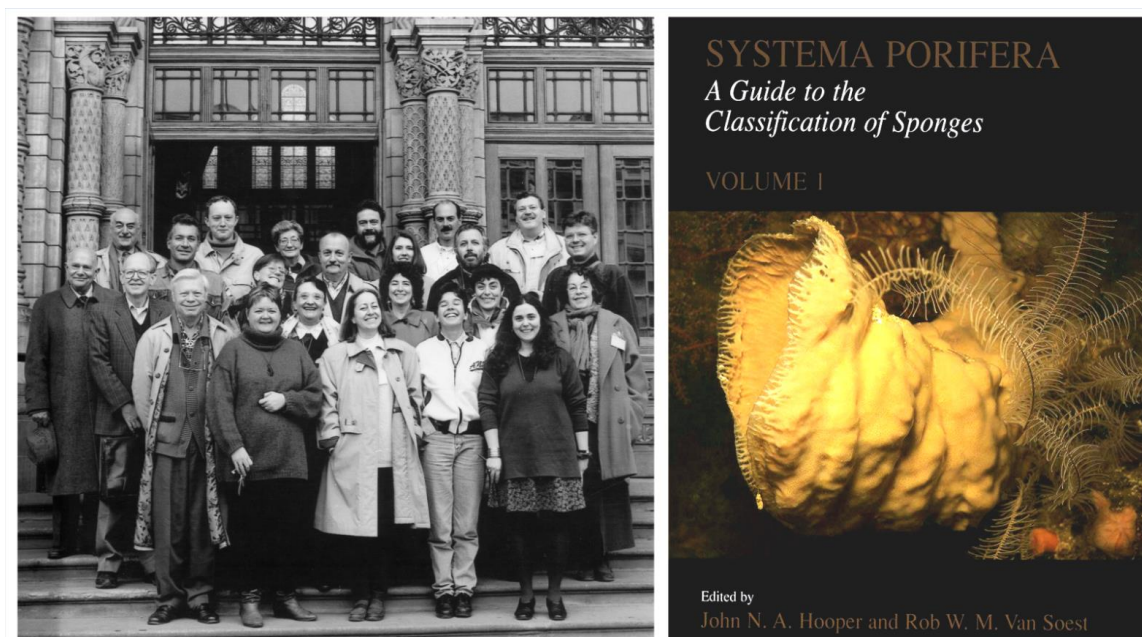


Figure 9. The characterizing event of sponge research at the beginning of the third millennium was the publication of the fundamental book on systematics/taxonomics “*Systema Porifera*” (2002). The first meeting of the international authors involved in this challenge had taken place eight years earlier (1994) in London at the British Museum of Natural History. Among the authors: Michele Sarà, Renata Manconi and Roberto Pronzato.

In 2002, the Italian spongiology school successfully tackled the important challenge of organizing the Sixth Sponge Conference in Rapallo, which hosted almost 200 participants from all over the world. This onerous but prestigious commitment culminated, in 2004, in the publication of the volume entitled “*Sponge Sciences in the new Millennium*”, edited by Pansini, Pronzato, Bavestrello & Manconi (Figure 10). In 2011, all the members of the Italian Spongiology

School cooperated to compile the 26th volume of “Fauna d’Italia”, edited by Pansini, Manconi & Pronzato.

By then, the “Genoese school” had reached its maximum expansion (Figure 11) and had also established itself internationally. In the last 20 years, the members of the various research groups, now mature, have continued to carry out research with enthusiasm and competence, thereby making an important contribution to scientific progress. Moreover, their frequent collaboration with authors from all over the world has helped to foster international scientific cooperation.



Figure 10. The maturity of the Italian Spongiology School was manifested by the organization of the Sixth Sponge Conference (Rapallo, 2002), which hosted almost 200 participants. The conference book “Sponge Sciences in the new Millennium” was published in 2004.

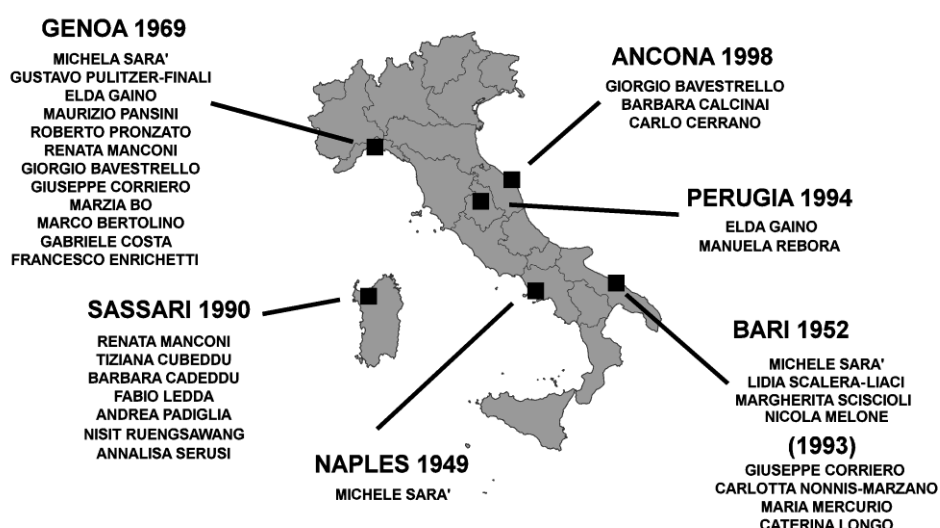


Figure 11. Our history began in Naples with Michele Sarà, in the second half of the 20th century. After a period of activity in Bari (1952), he moved to Genoa at the end of the 1960s, where he continued to collaborate with Gustavo Pulitzer-Finali (co-founder of the school). The first nucleus of disciples soon formed. The third generation of spongiologists emerged in the 1980s and then spread to various Italian universities throughout the country at the end of the century.

FINAL NOTES

As the authors of these short notes are now around 80 years of age, they may justifiably look back wistfully over the years that have passed too quickly. Our aim is not self-celebration, nor do we seek competition. However, we are proudly aware that we are a solid part of an international scientific community that moves in harmony to further the progress of all branches of sponge science. Indeed, taxonomy, morphology, electron microscopy, ecology, cell biology, microbiology, symbiosis, molecular biology and also paleontology are all subjects of our active research.

But now we must look forward. Good luck to the next generations of young sponge scientists. They will certainly be able to pick up our inheritance.

Let us conclude with a semi-serious nod to evolution. The Italian School of Spongiology is practically monophyletic, having been established by two contemporary co-founders, and found fertile ground in the lack of competition at the national level; in other words, it was able to occupy an empty ecological niche. Although the various members of the following generations developed their own specialist areas, they did not isolate themselves from the original stock. As often happens in growing populations, after many years of expansion, we have settled down, experiencing only minor fluctuations over the last two decades. Thus, the Italian school of spongiology reflects the laws of Nature: emergence, evolution and stabilization.

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