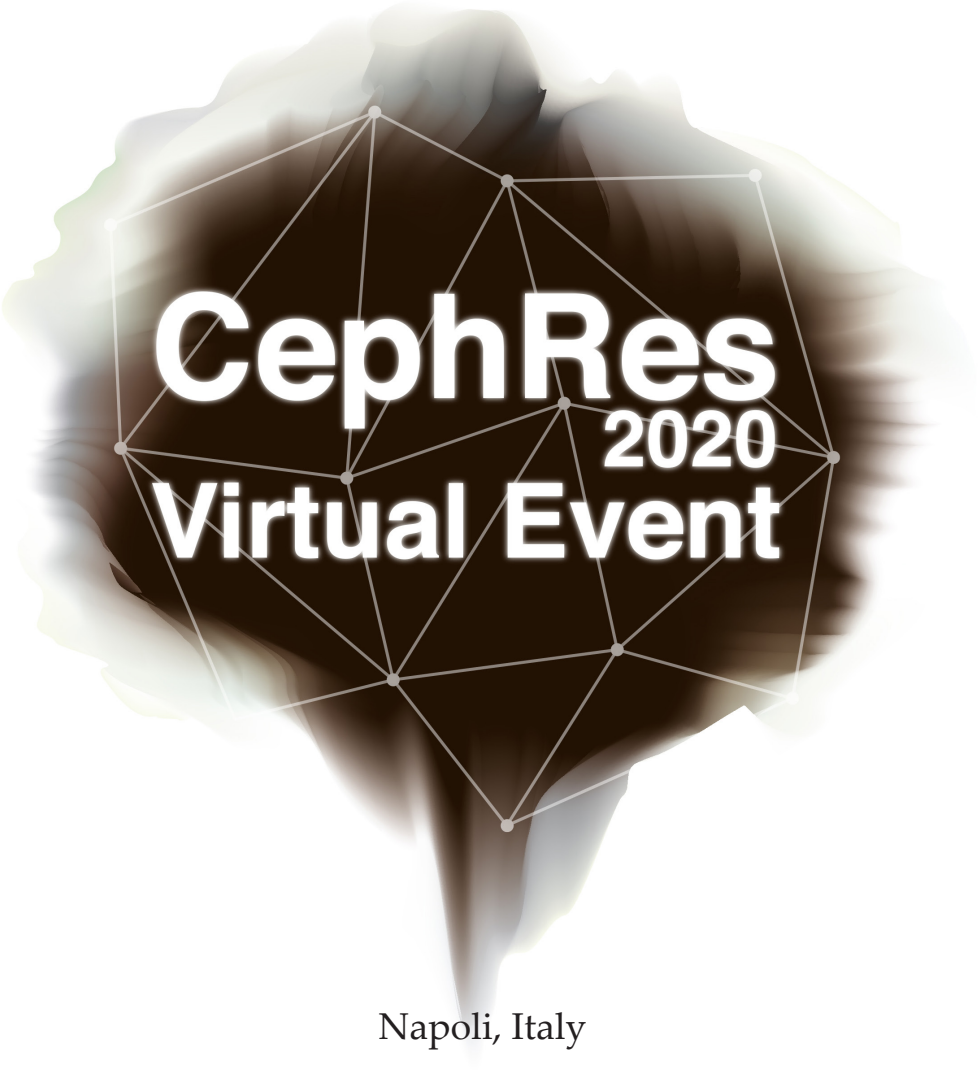
Biology and Life History of Cephalopods

an interim meeting of the international cephalopod community



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Ceph Gastrophysics

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In contrast to many places in the world, e.g., South East Asia and Southern Europe, there are regions such as the Nordic countries where there is no tradition for using cephalopods as food, although there is an abundance in the waters and, e.g., squid is only brought in by the fishermen as a bycatch. In order to promote a cephalopod cuisine in Northern Europe we have initiated a research programme to develop a cephalopod cuisine, combining the science of gastrophysics with gastronomy, culinary innovation, and design. Our main focus has been exploring flavour (umami) and texture of Loligo forbesii, attempting to use most parts of the organism. We have also performed consumer testing.

Along the way we pay attention to the special role cephalopods may play in sustainable, flexitarian eating behaviour and for promoting a green transition, engage in a new research programme relating humane slaughtering methods to cephalopod eating quality, as well as reaching out to children and young people on our communication platform Taste for Life.

References of interest

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2. Cephalopod gastronomy-a promise for the future (O. G. Mouritsen and K. Styrbæk). Front. Comm. 3:38 (2020).
3. Umami potential of Nordic squid (Loligo forbesii) (C. V. Schmidt, M. M. Poojary, O. G. Mouritsen, and K. Olsen) Int. J. Gastronomy. Food Sci. submitted (2020).
4. A role for macroalgae and cephalopods in sustainable eating (O. G. Mouritsen and C. V. Schmidt) Front. Psychol. 11:1402 (2020).
5. Mouritsen, O. G. & K. Styrbæk. Octopuses, Squid and Cuttlefish. Springer Nature, Zürich (2020).

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From giant brains with tiny neurons to tiny brains with giant neurons; the brains of Nudibranchs

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Unlike cephalopods, nudibranchs have brains composed of fewer than 10,000 neurons. Many of these neurons are individually identifiable and have large somata, allowing neural circuitry to be worked out with pairwise microelectrode recordings. Furthermore, homologous neurons can be recognized, allowing neural circuitry to be compared across species. My lab has studied the neural circuitry underlying swimming behavior in several nudibranch species and has found that these circuits can be quite small, consisting of as few as four neurons. The same neurons can play different roles across species. Moreover, homologous behaviors can be produced through different neural mechanisms, suggesting the behavior and neural mechanisms are independent levels of biological organization with their own evolutionary histories.

Recently, we have begun a connectomics analysis of the brain of the nudibranch, *Berghia stephanieae*. Initial results suggest that although the brain contains a small number of neurons, a much larger number of axons enter the brain from the periphery.

This raises the possibility that nudibranchs, like cephalopods, have "embodied intelligence", with peripheral processing playing a larger role than previously appreciated.

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Orchestration of motor and other behaviour by the two biogenic amines, tyramine and octopamine

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Tyramine and Octopamine are two biogenic amines which occur in all invertebrates.
These play an important role as neuromodulators and/or neurohormones for motor and other behaviour.

Most studies were carried out in insets and, therefore, this talk will mainly focus on functions in the insect nervous system but will also consider other invertebrates.

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