Prof. Dr. Nicole Dubilier's research has fueled a major change in our understanding of marine biodiversity by showing that symbiosis plays a critical, previously overlooked, role in contributing to the biological and functional diversity of ecosystems in both the deep sea at hydrothermal vents and cold seeps, as well as shallow water environments like seagrass meadows and coral reefs.

When Dubilier began working on symbioses between marine invertebrates and chemosynthetic bacteria in 1992, it was assumed that most invertebrates harbor one or at most two symbionts, and that only a few bacterial lineages were able to establish such symbioses in rare evolutionary events in a few animal groups. Her work has consistently revealed that the phylogenetic and functional diversity of chemosynthetic symbionts is much higher than previously recognized, with two protist and nine animal groups now known to live in symbiosis with over 15 lineages of bacteria. Her research has highlighted that the remarkable diversity of these symbioses has evolved independently numerous times in convergent evolution, not only in the deep sea but also in shallow-water coastal environments, habitats previously assumed to be driven only by photosynthesis. Thus, Dubilier's research has provided a critical contribution to our understanding of marine biodiversity by showing how wide-spread symbioses between marine invertebrates and bacteria are in terms of geography, animal and bacterial diversity, and habitats ranging from seagrass meadows and coral reefs to deep sea vents and seeps.

Through interdisciplinary and collaborative efforts using a wide range of methods that include high-resolution and correlative imaging analyses, metagenomics, metaproteomics, metabolomics, physiology, and deep-sea in situ analyses and experimentation, Dubilier has discovered novel symbionts and metabolic interactions in a wide range of marine invertebrates and environments. Highlights of her research include in chronological order:

1) The first discovery for a sulfate-reducing endosymbiont in a marine worm from Mediterranean seagrass beds, and evidence that this symbiont is engaged in syntrophic sulfur cycling with a co-occurring sulfur-oxidizing symbiont (Dubilier et al. Nature 2001).

2) The first metagenomic analysis of a complex symbiotic microbial consortium as well the first genomic analysis of a chemosynthetic symbiont (Woyke et al. Nature 2006).

3) Dubilier expanded our understanding of the energy sources that drive primary production in the teeming biological communities at hydrothermal vents by showing that hydrogen is used as an energy source by chemosynthetic symbionts (Petersen et al. Nature 2011, cover story).

4) In 2012, Dubilier described novel pathways for coping with energy and nutrient limitation in chemosynthetic symbioses from Mediterranean seagrass meadows (Kleiner et al. PNAS 2012).

5) In 2017, she discovered novel bacterial symbionts in deep-sea mussels from asphalt volcanoes in the Gulf of Mexico that use components of the oil and gas that are spewed from these tar seeps (Rubin et al. Nature Microbiology 2017). Furthermore, this study revealed that free-living oil-degrading bacteria from the Deepwater Horizon oil well blow-out use the same pathways as the mussel symbionts to degrade oil components.

6) In 2019, Dubilier was the first to show that high numbers of bacterial strains can coexist stably in an obligate, intracellular symbiosis (Ansorge et al. Nature Microbiology 2019), thereby challenging the paradigm that symbiont strain diversity destabilizes intimate mutualisms.

7) Dubilier showed in 2019 that even so-called simple animals at the base of the animal tree, called placozoans, live in highly specific and complex associations with symbiotic, intracellular bacteria (Gruber-Vodicka et al. Nature Microbiology 2019)

8) More recently, Dubilier discovered unexpectedly high amounts of sugar under seagrass meadows, at least 80 times higher than previously known from marine environments, and revealed the microbiological processes that allow labile carbon to accumulate to such high amounts (Sogin et al. Nature Ecology and Evolution 2022).

9) For over two centuries, scientific consensus has held that phytosterol synthesis is a metabolic capability exclusive to plants, with animals believed to be incapable of producing these sterols themselves. Dubilier and her team overturned this long-standing paradigm by demonstrating that animals can, in fact, synthesize phytosterols (Michellod et al. Science 2023)

Dubilier's outstanding achievements are further visible in her numerous invitations to give plenary and keynote lectures, and the prizes and recognitions she has received for her research. She was awarded Germany highest and most prestigious research prize, the Gottfried Wilhelm Leibniz Prize in 2014 (2.5 M€), was the first scientist from an institute outside of the USA to receive the Gordon and Betty Moore Marine Microbiology Investigator Award (2.0 M€ in 2013), and has received two awards for her research and mentoring from the American Society of Microbiology (2024 and 2025). Furthermore, she also received a highly competitive European Research Council Advanced Grant in 2014 (2.5 M€). She is an Elected Fellow of prestigious scientific societies such as the European Molecular Biological Organization, the German National Academy of Sciences (Leopoldina), the European Academy of Microbiology, the American Academy of Microbiology and the Academy of Sciences and Humanities in Hamburg.

Dubilier's service to the community is exemplary. She serves on numerous scientific advisory boards and councils including the Stazione Zoologica Anton Dohrn Napoli, the Singapore Centre for Environmental Life Sciences Engineering, the Mediterranean Institute for Advance Studies (IMEDEA), and the GEOMAR Helmholtz Centre of Ocean Research. She was the Chair of the largest microbiology meeting in the world, ASM Microbe, in 2016 and 2017, as well as two Gordon Research Conferences (Animal-Microbe Symbioses (which she initiated) and Applied and Environmental Microbiology), and was the President of the International Society for Microbial Ecology, the largest society in its field, from 2020-2022. She has served on numerous selection committees, including ERC Starting and Consolidator Grant panels, mentored over 50 graduate students that have gone on to build successful careers in academia, industry and government, regularly receives prizes for her teaching from students of the International Max Planck Research School for Marine Microbiology, and has been a strong contributor to community building through her service on editorial boards, as well as her engagement in advancing gender equity in science. Finally, she regularly engages in scientific outreach through TV and radio interviews, and talks for the general public.

Ten selected publications by Nicole Dubilier

(corresponding author in all paper listed, students and postdocs that contributed to papers while in the Dubilier lab are highlighted with an asterisk (*).

https://scholar.google.com/citations?user=vAXs9hwAAAAJ&hl=en&oi=ao

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