H. Möhwald

The author presented on this page has recently published his ***25th article*** *since 2000 in Angewandte Chemie:* "Pure Protein Microspheres by Calcium Carbonate Templating": D. V. Volodkin, R. von Klitzing, H. Möhwald, *Angew. Chem.* **2010**, *122*, 9444–9447; *Angew. Chem. Int. Ed.* **2010**, *49*, 9258–9261.

Helmuth Möhwald

Date of birth:	January 19, 1946
Position:	Professor of Physical Chemistry, Director of the Department of Interfaces, Max Planck Institute of Colloids and Interfaces, Potsdam (Germany)
E-mail:	moehwald@mpikg.mpg.de
Homepage:	http://www.mpikg.mpg.de/aktuelles/nachrichten/index.html
Education:	1971 Diploma in Physics, University of Göttingen (Germany) 1974 PhD in Physics with Albert Weller and Erich Sackmann at the Max Planck Institute for Biophysical Chemistry, Göttingen 1974–1975 Postdoctoral position with Dietrich Haarer, IBM San José (USA) 1978 Habilitation in Physics, University of Ulm (Germany)
Awards:	**1979** Gustav Hertz Prize of the German Physical Society; **1998** Raphael-Eduard-Liesegang Award of the German Colloid Society; **2000** Chaire de Paris; **2004** Corresponding Member of the Austrian Academy of Sciences; **2007** Gay-Lussac-Humboldt Award, French Ministry of Science and Technology; **2007** Overbeek Gold Medal of the European Colloid and Interface Society; **2008** Honorary Doctorate of the University of Montpellier (France); **2009** Wolfgang Ostwald Prize of the German Colloid Society
Current research interests:	Molecular interfaces, fluid interfaces, organized films, biomembranes, nanoparticles, micro- and nanocapsules; X-ray, neutron scattering, optical microscopy and spectroscopy, FTIR-, Raman spectroscopy; understanding interactions at the molecular and supramolecular level; macromolecular conformations and dynamics at interfaces; sensitized remote release through external fields; controlled release coatings; ultrasonic surface treatment
Hobbies:	Playing soccer, walking, hiking, swimming, politics (passively)

My favorite subject at school was … mathematics.

The biggest problem that scientists face is … to realize that the purpose of science is to predominantly serve people, not the other way around.

The biggest challenge facing scientists is … to be aware of the world around us, although being dedicated to your work.

The greatest scientific advance in the next decade will be … to understand the structure and dynamics of water and to provide sufficient clean water.

My greatest achievement has been … the advancement of many successful academic careers.

The three qualities that make a good scientist are … passion for work, persistence, and openness.

My science "heroes" are … Erich Sackmann and Harden M. McConnel, because they managed to establish successful schools between chemistry, physics, and biology long before interdisciplinarity became fashionable.

My first experiment was … writing a FORTRAN program for a computer, which then broke down for two days.

The most exciting thing about my research is … that I managed to combine physics, chemistry, and biosciences and managed to succeed with "cheap" experiments.

My biggest motivation is … to discuss and collaborate with young people.

In my spare time I … enjoy outdoor activities.

The secret of being a successful scientist is … to be open to new ideas and to be able to listen and to discuss.

The part of my job which I enjoy the most is … to devise experiments and systems that experts believe to be impossible.

My favorite book is … "Mit Träumen beginnt die Realität" ("Reality begins with dreams", Daniel Goeudevert).

The biggest problem that chemists face is … to worry about molecular details of a reaction and at the same time keeping the "big picture" of the work in view.

How is chemistry research different now than it was at the beginning of your career?

I did not study chemistry, and from the practical courses I only concluded that a chemist's life is hard and boring. Later I got acquainted with chemists that knew the details of atomic and molecular interactions but could use them in an imaginative way to create systems and functions that have been most successful and that have dominated large areas of the chemical sciences. Owing to this research, chemistry has developed into a discipline that is fundamental to many areas of the now fashionable fields of materials and biosciences. The curricula have taken this into account but with the continuing specialization early in the career there is now the danger that basic knowledge and skills get lost.

Has your approach to chemistry research changed since the start of your career?

Initially I considered chemistry as a means to obtain a molecule, like an engineer who constructs an apparatus. Later I realized that synthesis can be original and that one can draw original ideas from discussions with synthetic chemists. Concerning the field of physical chemistry I realize that the focus on spectroscopy as a fundamental discipline has changed toward spectroscopy as a tool to conclude on the interactions and the environment of a molecule. I personally experienced this in my diploma thesis when I used liquid crystals to orient molecules to study their spectroscopic properties, but more important results were obtained by using spectroscopy to study interactions with the matrix.

Has your approach to publishing your results changed since the start of your career?

When starting my career I did not care about the impact factor or the reputation of a journal; I selected the journal according to suitability of the readership. Later the reputation of the journal became important as well as the spreading of publications into different disciplines. Impact factors became relevant only in the last 10 years but not directly for me, because my career was established. They were, however, introduced by co-workers whose career depends on the impact factors. I personally dislike publishing in newspaper-type journals and consequently had my name removed from the list of referees for these journals. A serious issue to me is the prescreening, since it is typically done by nonexperienced scientists and has a strong influence on careers.

What do you think the future holds for your field of research?

Concerning my own field, colloid and interfacial science, I am very optimistic. It is at the crossing between the macro- und the nanoworld, combines many disciplines, and attracts many bright young people. It is also close to applications, which is a virtue and a danger. I expect its future perspectives to result from the tendency and challenge to construct functional systems with increasing complexity and from the need to control nonequilibrium processes.

Have you changed the main focus of your research throughout your career and if so why?

I have changed the main focus of my research several times. Starting with optical spectroscopy of organic molecules and complexes in liquid crystals, I moved to investigating energy and charge transport in organic charge-transfer crystals. Then I suspended my academic career to spend 3 $^1/_2$ years in industry, supervising projects in interface technology that span from space craft design to medical technology. Back in academia I studied membrane biophysics and as model membranes we focused on amphiphile monolayers. The last 25 years I expanded this topic towards physical chemistry of interfaces, ultrathin films, and capsules.

What has been your biggest influence/motivation?

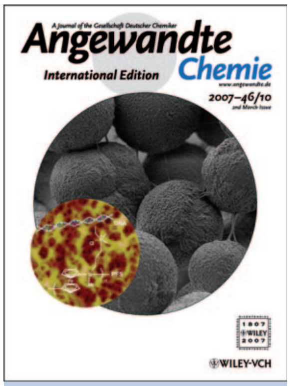
I have always enjoyed to combine simple principles of different disciplines and by this combination to gain a new quality in research. Applications have always been a strong motivation but never the topic of research. On the contrary, I have often transferred projects and funding to start-ups or to collaborating institutes with an applied mission. Still, I do not consider a specific scientific result as most important output but many well-trained and skilled scientists.

What advice would you give to up-and-coming scientists?

It is most important for a young scientist to find a supervisor that gives him/her the impression that he/she enjoys their research. Once you have matured, the main issue is to find highly motivated co-workers in order to develop attractive topics but also to develop team spirit. To achieve this goal, one has to be confident and give co-workers the confidence that they can use their freedom most constructively. Above all, they should question any statement by experienced experts.

What is the secret to publishing so many high-quality papers?

If one manages to assemble motivated co-workers it is not difficult to achieve outstanding results, and these results are the basis for high-quality papers. Their publication is a matter of filtering and arranging results, which should be feasible for most experienced scientists. Hence I cannot claim that there are secrets to publishing excellent papers; maybe sometimes one needs luck and intuition, which is difficult to acquire by training.



The work of H. Möhwald has been featured on the inside cover of Angewandte Chemie: "Layer-by-Layer Constructed Macroporous Architectures": Y. Ma, W.-F. Dong, M. A. Hempenius, H. Möhwald, G. J. Vancso, *Angew. Chem.* **2007**, *119*, 1732–1735; *Angew. Chem. Int. Ed.* **2007**, *46*, 1702–1705.

My 5 top papers:

1. "Field-Induced Charge-Carrier Trapping in the Photoconduction of a Quasi One-Dimensional System: Phenanthrene-Pyromellitic Acid Dianhydride": D. Haarer, H. Möhwald, *Phys Rev Lett.* **1975**, *34*, 1447–1450.
   This paper describes peculiarities of one-dimensional charge transport in organic crystals: carrier lifetime dependence on an external field, longer lifetime, and lower sensitivity with respect to defects compared to higher-dimensional systems. These observations are proven by "classical" time-of-flight measurements with crystals of sufficient purity. The paper is not well cited, because it was published long before the hype on organic electronics had started.
2. "A Fluorescence Microscopic Study Concerning the Phase Diagram of Phospholipids": M. Lösche, E. Sackmann, H. Möhwald, *Ber. Bunsengesellsch. Phys.-Chem.* **1983**, *87*, 848–852.
   This paper introduces a rather traditional method, fluorescence microscopy with suitable probes, to study amphiphile monolayers at the air/ water interface. By observing domains of coexisting phases, the method clarified questions as to the existence of first-order phase transitions that theoretically were denied for these two-dimensional systems. In addition, long-range electrostatic forces caused by the alignment of molecular dipoles could be shown by this method to cause regular arrays of domains of uniform size. The method also enabled analyses of crystal growth in two dimensions.
3. "Ordering in Lipid Monolayers Studied by Synchroton X-Ray Diffraction and Fluorescence Microscopy": K. Kjaer, J. Als-Nielsen, C.A. Helm, L.A. Laxhuber, H. Möhwald, *Phys. Rev. Lett.* **1987**, *58*, 2224–2227.
   This article introduces grazing incidence X-Ray diffraction as a method to study molecular arrangements at fluid interfaces. With this method it was shown that even monolayers of simple fatty acids exhibit a zoo of about ten crystalline, fluid, and mesophases. These phases are distinguished by positional and orientational order and tilt of the aliphatic tails. The method now is widely applied for the study of model processes at membrane surfaces like peptide and enzyme interactions and mineralization at phospholipid membranes.
4. "Novel Hollow Polymer Shells by Colloid-Templated Assembly of Polyelectrolytes": E. Donath, G. B. Sukhorukov, F. Caruso, S. A. Davis, H. Möhwald, *Angew. Chem.* **1998**, *110*, 2323–2327; *Angew. Chem. Int. Ed.* **1998**, *37*, 2201–2205.
   This paper, my first in *Angewandte Chemie*, introduces the formation of hollow capsules with defined wall thicknesses in the nanometer range. The article reports the method of alternating adsorption of oppositely charged polyelectrolytes (layer-by-layer adsorption), previously developed in my department in Mainz to coat sacrificial colloidal templates. Since the method is applicable to form shells with many different organic, inorganic, and biological molecules, these capsules can be made multifunctional and their mechanics and release can be controlled through environmental stimuli (pH value, salt, temperature, chemical, enzymatic reactions) as well as external fields (light, acoustic, magnetic). The simplicity of preparation and the large application potential has created a large world-wide research activity and has boosted many careers.
5. "Selective Ultrasonic Cavitation on Patterned Hydrophobic Surfaces": V. Belova, D. A. Gorin, D. G. Shchukin, H. Möhwald, *Angew. Chem.* **2010**, *122*, 7285–7289; *Angew. Chem. Int. Ed.* **2010**, *49*, 7129–7133.
   In this paper we create a laterally patterned surface by stamping of low-molecular-weight amphiphiles on an Al surface. We demonstrate that bubbles are created ultrasonically only on the hydrophobic surface areas and explain this result by a nucleation and growth model. Although I could not convince the reviewers of a European Research Council advanced grant application of this approach, I believe a new route to the understanding of sonochemistry at surfaces will be introduced. I hope the concept will be proven by future generations of young scientists.

Final remark: All above publications have in common that before starting the corresponding experiments, experts had claimed that the methods were not applicable to the problem in question, or the systems were not achievable. In the cases of (2) and (5) there was also heavy referee resistance against the conclusions. My own general conclusion: Don't believe the experts! Make your own mistakes!

DOI: 10.1002/anie.201007793

