Y. Xia

The author presented on this page has published more than ***25 articles*** *since 2000 in Angewandte Chemie, most recently:*
"Mixing an Aqueous Suspension of Pd or Au Nanocrystals with a Less Polar Solvent Can Cause Changes to Size, Morphology, or Both": B. Lim, T. Yu, J. Park, Y. Zheng, Y. Xia, *Angew. Chem.* **2011**, *123*, 6176–6179; *Angew. Chem. Int. Ed.* **2011**, *50*, 6068–6071.

Younan Xia

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Position: James M. McKelvey Professor for Advanced Materials, Department of Biomedical Engineering, Washington University, St. Louis (USA)

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Education: 1982–1987 BS in Chemical Physics, University of Science and Technology of China, Hefei (P. R. China)
1987–1991 Graduate student, Fujian Institute of Research on the Structure of Matter, Chinese Academy of Sciences, Fuzhou (P. R. China)
1991–1993 MS in Inorganic Chemistry with Prof. Alan G. MacDiarmid, University of Pennsylvania, Philadelphia (USA)
1993–1996 PhD in Physical Chemistry with Prof. George M. Whitesides, Harvard University, Cambridge (USA)
1996–1997 Postdoctoral fellow with Profs. George M. Whitesides and Mara Prentiss, Harvard University, Cambridge

Awards: **1997** New Faculty Award of the Camille and Henry Dreyfus Foundation; **1999** Victor K. LaMer Award of the American Chemical Society; **1999** Faculty Early Career Development Award of the National Science Foundation; **2000** Research Fellow, Alfred P. Sloan Foundation; **2000** Fellow in Science and Engineering of the David and Lucile Packard Foundation; **2002** Camille Dreyfus Teacher Scholar of the Camille and Henry Dreyfus Foundation; **2005** Leo Hendrik Baekeland Award of the American Chemical Society; **2006** Director's Pioneer Award of the National Institutes of Health; **2009** Fellow of the Materials Research Society; **2009** Top Ten Chemists in the World (Times Higher Education)

Current research interests: My research interests include nanocrystal synthesis, nanomedicine, biomaterials, tissue engineering, self-assembly, photonic crystals, colloidal science, surface modification, catalysis, fuel cell technology, and electrospinning. In the past, my research has been conducted in a way that started with the development of new nanomaterials and then sought their applications in biomedical research and other fields. In the future, I wish to conduct my research by starting from learning about the biological systems and then use the knowledge to design and engineer nanomaterials for various applications.

Hobbies: Reading, hiking, and playing table tennis

When I was eighteen I wanted to be … a mechanical engineer.

The biggest challenge facing scientists is … nonlinearity.

I am waiting for the day when someone will discover … a hybrid of a plant and an animal that can create its own energy by photosynthesis and move around.

Young people should study chemistry because … it is the foundation for studying other subjects in science, engineering, and medicine.

Looking back over my career, I … would like to say "thanks" to those who have said "no" to me from time to time.

My science "heroes" are … Boltzmann, Einstein, Bohr, Ostwald, and Pauling.

The most significant historic event of the past 100 years was … the invention of the internet.

My favorite quote is … "To study without thinking is futile, to think without studying is dangerous" by Confucius.

I admire … alchemists for their courage and endless effort to try new things without knowing much about them.

My favorite way to spend a holiday is … cleaning my desk.

If I had one year of paid leave I would … like to spend some time in an immunology lab.

My favorite molecule is … fullerene or buckyball.

The most important thing I learned from my students is … to approach the same experiment from different angles.

My motto is … "gold will always shine, no matter where it is placed".

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

Not at all! I was fortunate to spend four years with Prof. George Whitesides at Harvard University, where I learned the most important lesson about doing research and publishing papers. The first thing I was told by him upon joining his group was: "interesting and unpublished" is equivalent to "nonexistent". The next thing I received was a handout about how to write a paper efficiently from scratch in the Whitesides group (see *Adv. Mater.* **2004**, *16*, 1375–1377). I followed the instructions while I was in his group and I was able to produce roughly 15 first-author papers in four years. When I started my own independent career, I also asked the members of my group to follow the same approach and that tradition has never changed.

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

My research centers on the development of chemistry, physics, materials science, and technological applications related to nanocrystals—a novel class of materials whose building blocks have at least one dimension in the range of 1–100 nm. On the fundamental side, there is still a lot that needs to be learned about their synthesis, in particular, the evolution from atomic species to nuclei and then seeds. On the practical side, we still need to demonstrate some killer applications that have a profound impact on society one way or the other; for example, a better way for diagnosing and/or treating a disease, a cleaner and more sustainable source of energy, or a greener route to a product.

My 5 top papers:

1. "Shape-Controlled Synthesis of Gold and Silver Nanoparticles": Y. Sun, Y. Xia, *Science* **2002**, *298*, 2176–2179.
   This paper provides an intellectual framework—including both rationale and methodology—for the synthesis of noble-metal nanocrystals with well-defined and controllable shapes (or facets on the surface). We reported two different new approaches to the shape-controlled synthesis of metal nanocrystals (with silver and gold as two examples): the use of a surface-capping agent to promote the formation of a specific set of facets and the use of a galvanic replacement reaction to transform the metals without changing the shape.
2. "Polyol Synthesis of Silver Nanoparticles: Use of Chloride and Oxygen to Promote the Formation of Single-Crystal, Truncated Cubes and Tetrahedrons": B. Wiley, T. Herricks, Y. Sun, Y. Xia, *Nano Lett.* **2004**, *4*, 1733–1739.
   This paper provides the first experimental evidence to support the involvement of "oxidative etching" in a synthesis of noble-metal nanocrystals. This work was an "accident" and "surprise" to us as the chloride ion—a major ingredient for oxidative etching—was actually an impurity in some batches of ethylene glycol used for polyol synthesis. It turned out to be that oxidative etching is a universal phenomenon that is always involved in chemical synthesis of noble-metal nanocrystals. Since the publication of this paper, we and other groups have observed oxidative etching in many other systems.
3. "Etching and Growth: An Intertwined Pathway to Silver Nanocrystals with Exotic Shapes": C. M. Cobley, M. Rycenga, F. Zhou, Z.-Y. Li, Y. Xia, *Angew. Chem.* **2009**, *121*, 4918–4921; *Angew. Chem. Int. Ed.* **2009**, *48*, 4824–4827.
   Again, this paper demonstrates the ubiquitous involvement of oxidative etching in chemical synthesis of noble-metal nanocrystals. The experiment was very simple: a second aliquot of silver nitrate was added to a batch of silver nanocubes (prepared using a polyol synthesis) in an attempt to obtain silver nanocubes with larger sizes. To our surprise, the silver nanocubes evolved into anisotropically truncated octahedra—an exotic shape that has never been reported before. Because these octahedra could take different orientations on a substrate, the sample appeared to be highly nonuniform under an electron microscope. In a sense, the sample could have been easily trashed if the student had not patiently resolved the detailed shape and structure.
4. "Controlling the Shapes of Silver Nanocrystals with Different Capping Agents": J. Zeng, Y. Zheng, M. Rycenga, J. Tao, Z.-Y. Li, Y. Zhu, Y. Xia, *J. Am. Chem. Soc.* **2010**, *132*, 8552–8553.
   The idea was so simple that I was surprised a similar experiment had not been reported in literature. It has been known for a while that different capping agents can selectively bind to a specific facet and thus induce the formation of nanocrystals with a specific shape. We designed a set of experiments based on single-crystal seeds to single out the role of the capping agent. The experiments were performed under identical conditions except for the use of different capping agents. We demonstrated that two distinct shapes, namely, nanoscale octahedra enclosed by {111} facets and nanocubes covered by {100} facets could be deterministically produced by adding citrate and PVP, respectively, to the reaction as the capping agent.
5. "The effect of sedimentation and diffusion on cellular uptake of gold nanoparticles": E. C. Cho, Q. Zhang, Y. Xia, *Nature Nanotech.* **2011**, *6*, 385–391.
   This paper describes a clever design of experiments to reveal the effect of sedimentation on cellular uptake of nanoparticles. Typically, the uptake of nanoparticles is measured by exposing cells at the bottom of a culture plate to a suspension of nanoparticles. However, since nanoparticles can sediment, the concentration of nanoparticles on the cell surface may be higher than the initial bulk concentration, leading to an increased uptake by cells. The exact concentration (dosage) of nanoparticles at the cell surface is very hard to measure in situ. We solved this problem by simply culturing cells with nanoparticles in the conventional upright and inverted (or upside-down) configurations and then comparing the disparity in cellular uptakes. Our results suggest that sedimentation needs to be taken into account when performing in vitro studies for large and/or heavy nanoparticles.

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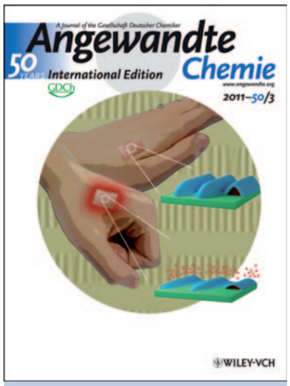

The work of Y. Xia has been featured on the inside cover of Angewandte Chemie: "Strain-Controlled Release of Molecules from Arrayed Microcapsules Supported on an Elastomer Substrate": D. C. Hyun, G. D. Moon, C. J. Park, B. S. Kim, Y. Xia, U. Jeong, *Angew. Chem.* **2011**, *123*, 750–753; *Angew. Chem. Int. Ed.* **2011**, *50*, 724–727.

