Catherine J. Murphy

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Catherine Murphy is the Peter C. and Gretchen Miller Markunas Professor of Chemistry at the University of Illinois at Urbana-Champaign (UIUC). She earned two B.S. degrees from UIUC in 1986, one in chemistry and one in biochemistry, while conducting undergraduate research with T. B. Rauchfuss. She obtained her Ph.D. in 1990 at the University of Wisconsin, Madison, under the direction of A. B. Ellis. From 1990-1993 she was an NSF and then an NIH postdoctoral fellow in the laboratory of J. K. Barton at the California Institute of Technology. Professor Murphy started her independent career at the University of South Carolina's Department of Chemistry and Biochemistry in 1993, and rose through the ranks there, ultimately becoming the Guy F. Lipscomb Professor of Chemistry in 2002. In 2009 she returned to UIUC in her present position. Her research interests include the synthesis, surface chemistry, optical properties, biological applications and environmental implications of colloidal metal nanocrystals, especially gold. She is the winner of the 2011 Inorganic Nanoscience Award from the American Chemical Society's Division of Inorganic Chemistry, was named a 2011 Fellow of the American Chemical Society, a 2014 Fellow of the Royal Society of Chemistry, and a 2017 Fellow of the Materials Research Society. She won the Carol Tyler Award from the International Precious Metals Institute in 2013, and the Transformational Research and Excellence in Education (TREE) Award from the Research Corporation for Scientific Advancement in 2015. In 2015 she was elected to the U.S. National Academy of Sciences. In addition to her research, she is well-known to the chemistry community as the Deputy Editor of the *Journal of Physical Chemistry C* (2011-present) and as a co-author of the best-selling general chemistry textbook *Chemistry: the Central Science*, from the 10th to the current 14th editions.

Abstract: Growth, Form and Reactivity of Anisotropic Gold Nanostructures

It has been know for centuries that "finely-divided" metals do not look like bulk metals. Gold nanocrystals in colloidal suspension can appear red, green, blue, purple or brown depending on their shapes and state of aggregation. The visible colors of these metal nanocrystal suspensions are due to the coherent oscillation of conduction-band electrons upon resonant illumination with light, a phenomenon now termed "the plasmon." A seed-mediated growth approach to growing gold nanorods has been developed over the last two decades in our laboratory, leading to nanoscale control of crystal growth and therefore controllable plasmon bands throughout the visible and near-infrared portions of the electromagnetic spectrum. The seed-mediated growth method, performed in aqueous solution at room temperature, relies on the presence of various structure-directing agents to produce the nanorods in high yield. A recent factorial design-of-experiment approach has revealed molecular-level insights into the growth process. The interface of these colloidally stable nanocrystals with other solvents, polymers, biomolecules, and materials is an active area of research that spans the physics of metamaterials to photothermal destruction of pathogenic cells. Recent results from the laboratory along two lines of inquiry – performing spatially selective chemistry on colloidal nanoscale objects, and the effects these virus-size objects have on living cells – will be presented.