Charles M. Lieber to receive 2016 Von Hippel Award for research on nanoscale wires

The 2016 Von Hippel Award, the Materials Research Society's (MRS) highest honor, will be presented to Charles M. Lieber, Department of Chemistry and Chemical Biology, Harvard University. Lieber is being recognized "for pioneering contributions to nanoscience, defining the foundations of rational synthesis of nanoscale wires, characterization of their fundamental physical properties, and the development of applications of these materials in chemistry, biology, and medicine." Lieber will present his award talk at the 2016 MRS Fall Meeting in Boston on Wednesday, November 30, at 6:30 pm, in the Grand Ballroom of the Sheraton Boston Hotel.

For more than two decades, Lieber's research on nanoscale wires (nanowires) has revolutionized nanoscience and nanotechnology by defining new paradigms for the rational growth, fundamental properties, and original applications of a broad range of functional nanowires and heterostructures. Lieber has made seminal contributions to the designed growth of nanowires in which composition, size, structure, and morphology can be controlled.

Lieber demonstrated that carbon nanotubes (CNTs) could be used as templates for the synthesis of a broad range of transition-metal and main group carbide nanowires (NWs), which provide access to nanoscale metallic, superconducting, and semiconducting materials. He made a second breakthrough with the synthesis of freestanding (molecule-like), single-crystal semiconductor NWs.

Subsequently, Lieber has driven this field with the rational syntheses of a large number of Group III–V and II–VI binary and ternary NWs, the growth of NWs with controllable doping, which has been central to developments demonstrating nanoscale devices, and the synthesis of molecular-scale NWs. He also pioneered the related heterojunction concept of radial core–shell NW structures, pushing this idea to the limit of single-crystalline multiple-quantum-well structures. Most recently, Lieber has discovered a previously unreported crystal-growth phenomenon unique to one-dimensional substrates termed Plateau-Rayleigh crystal growth, which allows for simultaneous modulation of axial and radial growth to yield three-dimensional materials with complex, tunable morphologies.

Lieber has also made pioneering contributions to characterizing the physical properties of these materials. He developed new applications of scanning probe microscopies to define the electrical and mechanical properties of individual CNTs and NWs, for example, showing how lateral force microscopy could be used to measure the elastic modulus and strength of individual NWs and CNTs. In addition, Lieber led early scanning tunneling microscopy efforts demonstrating that CNTs could exhibit fundamentally metallic or semiconducting electronic properties depending only on subtle changes in diameter and helicity, and moreover, illuminated curvature- and symmetry-induced energy gaps in "metallic" CNTs.

Lieber reported a conceptual and experimental approach to integrate electronics in a minimally/noninvasive manner in three dimensions within the brain using macroporous mesh nanoelectronic circuits. Lieber has recently shown that this new form of electronics can be injected by syringe, like any other biological reagent or therapeutic, to precisely target and position nanodevices in the brain, and has demonstrated that this ultra-flexible mesh electronic circuit does not elicit an immune reaction and integrates with neuronal circuitry in a manner that is similar to the tissue itself. While still at an early stage, his approach could transform fundamental studies of long-term brain activity mapping and modulation, as well as applications of electronics for treating neurological and neurodegenerative disease.

His current work focuses on the chemistry and physics of nanoscale materials, rational synthesis of new nanoscale materials and nanostructured solids, development of methodologies for hierarchical assembly of nanoscale materials into complex and functional systems, and investigation of fundamental electronic, optical, and optoelectronic properties of nanoscale materials. Lieber co-founded Nanosys, Inc., which focuses on broad commercialization of nanowire technology, and Vista Therapeutics, which focuses on commercialization of nanowire nanoelectronic biosensors.

His research has led to more than 375 articles and 80 issued or pending patents. He has been recognized by honors, including election to the National Academy of Inventors, the Willard Gibbs Medal, the Wolf Prize in Chemistry, the ACS Inorganic Nanoscience Award, the NIH Pioneer Award, the ACS Award in the Chemistry of Materials, the World Technology Award in Materials, and election to the National Academy of Sciences and the American Academy of Arts & Sciences.

Named after Arthur von Hippel (1898–2003), the Von Hippel Award includes a $10,000 cash prize, honorary lifetime membership in MRS, and a trophy. The award recognizes the qualities most prized by materials scientists and engineers—brilliance and originality of intellect, combined with a vision that transcends the boundaries of conventional disciplines, as exemplified by the life of Arthur von Hippel (www.mrs.org/vonhippel).

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