Prof. Stephen Y. Chou's Biography

Stephen Y. Chou (Ph.D., MIT, 1986) is the Joseph C. Elgin Professor at Princeton University. He is also the founder and founding chairman of the board of three startup companies: Nanonex Corp., NanoOpto Corp., and Essenlix Corp., and is a co-founder of BioNano Genomics Inc. He is a member of the US National Academy of Engineering (2007), a Fellow of the US National Academy of Inventors (2013), a recipient of the IEEE Cledo Brunetti Award (2004), the IEEE Nanotechnology Pioneer Award (2014), and the Nanoimprint Pioneer Award (2015); a Packard Fellow (1990), and a Fellow of the IEEE (2000), the American Vacuum Society (AVS) (2010), the Optical Society of America (OSA, now Optica) (2011), and the International Society for Nanomanufacturing (ISNM) (2010), among other awards and honors.

Chou's pioneering research has spanned several fields, including nanofabrication, a broad spectrum of nanodevices (electrical, optical, magnetic, and biological) and their applications, bioengineering, and medical diagnostics. His groundbreaking inventions and pioneering works have created multiple new research fields, launched new industries, been broadly used in numerous disciplines and industrial sectors, and generated multiple multi-billion-dollar businesses, having transformed both academia and industry.

Chou's best-known inventions and pioneering works include:

(1) Nanoimprint: A paradigm shift in nanopatterning methods that has revolutionized nanotechnology research and nanomanufacturing across various disciplines. Chou is recognized as 'the father of the field of nanoimprint.' He invented and demonstrated nanoimprint technology and envisioned its future in 1995, founded the first nanoimprint equipment company in 1997, and was a leading and pivotal force behind dispelling early skepticism about nanoimprint. He has convinced the community of nanoimprint's potential, through his extensive developments and demonstrations of nanoimprint's capabilities, including various even smaller feature sizes, different nanoimprint methods, and the first nanoimprint fabrication of nanoscale transistors, optical, magnetic, and biological devices. Moreover, since the inception of nanoimprint and for the past three decades, Chou has been a prominent leader, inventor, developer, and driver in developing various nanoimprint technologies and their applications in a broad of fields.

Today, nanoimprint has been widely used in academia and industries across multiple fields, including optics and photonics (e.g., virtual reality, imagers, lenses), biotechnology (e.g. gene sequencing, and other sensing) and medicine (e.g. diagnostics and treatments), semiconductor ICs, optical communication, smartphones, displays, light-emitting diodes, solar cells, batteries, pharmaceutics, security features (such as banknotes and identifications), and data storage, among many others, generating multi-billions of dollars annually.

(2) Ultimate-scaling and new architectures of nano-transistors, particularly the device architecture and the first experimental demonstration of the room-temperature crystal-Si single-electron transistor (~10 nm diameter wire-channel and 7 nm square floating gate) – representing the ultimate scaling limit of MOSFET (1996), and the wrap-around gate Si nanowire-MOSFET (termed "gate-all-around" or "GAA" today) and its parallel arrays (termed "nanoribbon transistor" today) that have necessary critical small

channel width and thickness for short channel operation (1997). Today (2023) the GAA and nanoribbon transistor architectures begin to replace previous architecture for 3 nm node CMOS integrated circuits and beyond.

(3) Pioneering development of various new SOEs and systems (e.g. control VCSEL polarization and laser clock) since 1994, when the SOE field had only a handful of researchers and seemed to have little future due to the lack of viable fabrication technologies.

(4) Pioneered the use of nanoimprint to fabricate electrical, optical, magnetic, and biological nanodevices, which has transformed the research, manufacturing, and commercialization of these devices. Chou was not only the first to fabricate devices using nanoimprint in each of these fields but has also continuously advanced nanoimprint applications in these areas. As examples, nanoimprint has revolutionized the SOE field, including VR goggles, new imagers, and cameras.

(5) An ultra-sensitive nanoplasmonic bio-chemical sensor, termed “disc-coupled dots-on-pillar antenna array” (D2PA): Offering up to 1,000,000 times signal enhancement and digital assay. And

(6) iMOST™ (Instant Mobile Self-Test) for digital health: A groundbreaking new diagnostic test platform that provides instant, laboratory-accurate results (even in imperfect conditions) at the point of care, at home, and elsewhere, operable by anyone, anytime, with an easy-to-use, low-cost, and portable design. iMOST was invented by Chou, drawing on his vision and nearly four decades of multidisciplinary research. iMOST's unique functions are implemented through the integration of intelligent nanostructures with machine learning, computer vision, biochemistry, and diagnostics.

Chou’s other inventions and pioneering works include various quantum transistors; single-domain patterned magnetic media (quantized disk) — a new paradigm in magnetic data storage; new nanophotonics (e.g., subwavelength optical elements, photodetectors, ultra-sensitive Raman and fluorescence sensors, nanoplasmonic LEDs and solar cells, and nanostructures for light extraction and trapping); nanochannel single DNA molecule analyzers; and a broad array of new nanopatterning techniques, including lithographically induced self-assembly (LISA), self-perfection by liquefaction (SPEL), and laser-assisted direct imprint (LADI).

Chou, a serial entrepreneur, has transformed some of his inventions, research breakthroughs, and visions for the future into new industries and significant commercial products. He has achieved this by founding, building, and leading three startup companies -- Nanonex Corp. (1997), NanoOpto Corp. (2000), and Essenlix Corp. (2013) -- and co-founding another, BioNano Genomics Inc. (BGI) (2003) (NASDAQ: BNGO)). Nanonex was the first company to commercialize nanoimprint technology. NanoOpto was one of the first companies to design and manufacture subwavelength optical elements (SOEs), also termed 'meta optics,' and was the first company to manufacture them using nanoimprint. Essenlix was the first company to commercialize Chou’s iMOST platform. BGI was the first company to commercialize nanochannels for stretching and mapping long strands of nucleic acids, such as DNA and RNA (a technology jointly developed with Prof. Robert Austin at Princeton University).

Chou has authored over 700 refereed journal/conference papers (H-index = 97, ~44,000 citations) and delivered over 200 plenary/invited talks. Additionally, he is the primary inventor and author of over 400 patents/applications in various fields, more than half have been granted. According to Google Patents, Chou’s technologies have been referenced in over 35,000 patents/applications worldwide.

Chou has served over 130 times as Conference Chair, Co-chair, Program Chair, Steering/Advisory Committee member, Program Committee member, and Session Chair; including the Conference Chair of the prestigious EIPBN conference in nanofabrication and the Founding Chair of the International Conference of Nanoimprint and Nanoprint Technology (NNT).