Podcast Name: *ACM ByteCast*
Episode: H.-S. Philip Wong - Episode 39

Welcome to the *ACM ByteCast* podcast, a series from the Association for Computing Machinery! The podcast features conversations with researchers, practitioners, and innovators at the intersection of computing research and practice about their experiences, lessons learned, and visions for the future of computing. In this episode, host Bruke Kifle interviews guest Dr. H.-S. Philip Wong. Dr. Wong is a renowned Professor of Electrical Engineering at Stanford University and Chief Scientist of the Taiwan Semiconductor Manufacturing Company, also known as TSMC. Prior to Stanford, he was with IBM research for 16 years. From 2018-2020, he serves as Vice President of Corporate Research at TSMC. He is a Fellow of the IEEE and has received numerous awards for his research contributions to solid devices and technology.

To begin, Dr. Wong shares some of the key experiences throughout his journey which have led him to the field of computing. His entrance to the field was fueled by his interest in science and physics during undergraduate. Wanting to make something of use, he steered towards electrical engineering. Listen as he touches on the challenges of scaling down technologies as we so heavily rely on nanotechnology. These technologies which operate on quantum mechanics are utilized daily by nearly everyone in cell phones and computers.

Next, Dr. Wong highlights what he believes will be the next technological breakthrough for industry. He believes that the path we have been down in recent years will soon be coming to an end and a brand-new space is opening up. This is great news for those who are just joining the industry as there will be so much room for innovation. Emerging technologies like AI depend solely on continuous technological advancement. Similarly, Dr. Wong excitedly shares the potential that innovators currently have in finding inspiration from biological systems in their work with technology. The way we understand the human brain can help us to design better computing systems. Also, the way in which we fabricate electronic systems and understand how to communicate will help our understanding of biology. Many of Dr. Wong's colleagues are currently working on bioelectronic systems like a human brain interface.

Non-volatile memory is an important topic of research for Dr. Wong. This simply means stored information which doesn't disappear. While some devices can store information for just a few seconds, others can store it for over 10 years. Modern cell phones, for example, have hundreds of gigabytes of non-volatile memory. Going forward, researchers are working to determine how this memory can be placed right next to the computing chip. They are building 3-d chips, rather than 2-d, with multiple layers of computing and memory devices on top of each other.

In addition to serving as Faculty Director for Stanford's NanoFab Lab and SystemX Alliance, he also serves as Chief Scientist at TMSC. He enjoys engineering for its exploration of practical applications of technology. The insights into understanding what is really going on in the market is a huge benefit to the research of universities and professors across the board. On the other hand, he enjoys his work in academia as it is a place where you can explore hard things quickly

and at a low cost. It is also filled with people who have no experience and thus are able to do some really interesting things.

Before wrapping up, Dr. Wong offers his best advice for aspiring engineers, scientists, and innovators who want to make an impact in the world. Technical expertise, a sense of curiosity, and an aptitude for questioning the status quo is a necessary condition. With this, you should be sure in your understanding of the way things are traditionally done and how something new might compare. In closing, he looks ahead to the most exciting research opportunities of the future. Finally, he expands on some of the ethical and environmental implications of some of the biggest emerging trends.

Key Takeaways:
0:29 - Introducing today's guest Dr. Philip Wong.
2:22 - What led Dr. Wong to computing?
5:30 - Key challenges of scaling down technologies.
10:30 - Looking towards the next technological breakthrough.
17:20 - Drawing inspiration from biological systems.
23:20 - What drives this direction of research?
25:00 - Developments in non-volatile memory.
30:10 - Dr. Wong's role as Faculty Director.
34:35 - Comparing the fields of engineering and academia.
39:15 - Addressing the challenges brought about by the pandemic.
43:35 - Advice to young aspiring engineers, scientists, and innovators.
47:00 - Looking ahead to the most exciting research opportunities of the future.
55:36 - The ethical implications of some of the biggest emerging technologies.

Links
Learn more about Dr. Philip Wong.
Learn more about Bruke Kifle.
Learn more about the ACM ByteCast podcast at https://learning.acm.org/bytecast

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Dr. Philip Wong, Stanford University, electronics, technology, engineering, electrical engineering, devices, memory technology, device fabrication, academic, researchers, computing, computers, innovators, academia, nanotechnology, computer chips, physics, Moore's law, innovation, neuroscience, Non-volatile memory, impact, societal problems, technical expertise, AI, ChatGPT