

An Interview with Professor George Whitesides

By Mindy Levine

Introduction

“I want to show you something,” Professor George Whitesides said as I sat down in his office. He took out a starfish-shaped object made of soft, flexible polymeric materials, and demonstrated how the arms of the “starfish” moved when air was injected via syringe. “This is the future of chemistry,” he said. “We are giving people a starting point to think about soft robotics.”

Professor George Whitesides, the Woodford L. and Ann A. Flowers University Professor of Chemistry at Harvard University, has spent a career providing “starting points” for people to think about a variety of chemically-related endeavors.

Professor Whitesides elaborated on providing “starting points” for other chemists. “There are two schools of thought,” said Professor Whitesides. “One says you make big changes when you invent new tools, and one says that you make big changes when you use the tools. We are the tool makers.”

Research in the Whitesides Group

The research in the Whitesides group has covered a wide range of topics throughout Professor Whitesides’ career. “When we first started, we did real scholarship,” said Professor Whitesides, investigating topics such as C-H activation and detailed reaction mechanisms.

Over the years, Professor Whitesides has investigated diverse topics such as electrets, soft-lithography, the origin of life, self-assembled monolayers, soft robotics, and microfluidics. “We try to go from program to program. Once something is established, other people can use it,” Professor Whitesides said.

Dr. Michael Filosa, Senior Manager of Science and Technology at ZINK Imaging, recalled the diversity of topics that were covered in a course he took with Professor Whitesides at MIT. “It was probably one of the most eye-opening courses I ever took,” said Dr. Filosa. “He talked about things like organometallics, enzyme immobilization, and remote functionalization of hydrocarbons – things that ended up being linchpins of many people’s careers over the next 30 years.”

Selecting Research Topics

Professor Whitesides explained his strategy for choosing research topics, and provided advice for newer chemists on how to select appropriate topics. “The problems that run the world are our problems,” said Professor Whitesides, meaning that some of the most significant problems that face humanity can and should be addressed by chemists. For

example, meeting the growing energy needs of industrialized societies in an environmentally responsible manner is something that chemists can help solve.

Chemists may also have a responsibility to the public, in part because chemists' salaries are largely paid from taxpayer funds. "Keep in mind that someone is not buying a package of cigarettes in order to pay your salary," Professor Whitesides said. "What bearing does this have on the sort of research that you do?"

As a result, Professor Whitesides advocates choosing research questions with this fact in mind: chemists have both the ability and responsibility to address significant issues. Unfortunately, he pointed out, the current peer review system may discourage this sort of ambitious thinking.

"We need the peer review system, because anything else is worse," said Professor Whitesides. "However, I would prefer a world where assistant professors do something that other people have not done," as opposed to a system where assistant professors try to do something that has already been done, but do it better.

As an example of a chemist with broad ambition, Professor Whitesides recalled that when Professor K. Barry Sharpless came to MIT, he presented a long list of reactions that he wanted to investigate. "You looked at the list and thought, 'It can't possibly go anywhere,'" Professor Whitesides said. "But good things are bound to happen."

Structure of the Whitesides Group

The Whitesides group is comprised of 8 graduate students and more than 30 post-doctoral fellows and visiting scholars. Professor Whitesides manages the research of the group members primarily via the writing of successive paper drafts. "As soon as we are confident there will be a paper, we start writing," said Professor Whitesides.

Over the course of several paper drafts, all of Professor Whitesides' research questions are fully explored and answered. "I want to know how this works, and what the science is. I also want to know why we are doing it," Professor Whitesides said. "I ask every question I can possibly ask until I am satisfied with the answer."

This research management strategy successfully promotes linear and organized thinking. "George runs his group like a corporate entity, in terms of document flow and accountability," said Dr. Dana Gordon, a former post-doc in the Whitesides group, and current Deputy Chair of the Intellectual Property Group at Foley Hoag, LLP "He was very good at making clear what you needed to do."

Entrepreneurship

Professor Whitesides, who described himself as a "serial entrepreneur," is chairing a new ACS task force, charged by ACS President Dr. Joseph Francisco with investigating the

future of chemical entrepreneurship and the potential role for ACS in facilitating such entrepreneurship.

As someone who has been involved in starting 12 companies during his career, Professor Whitesides explained some of the difficulties involved. "There is not a good culture in chemistry for small companies," said Professor Whitesides, mostly because "not a lot of people do it."

For chemists who are interested in entrepreneurship, Professor Whitesides advised serving as an "apprentice" to a current CEO. "Take advantage of their expensive mistakes, so that you don't make the same mistakes yourself," Professor Whitesides said. "There will be plenty of new mistakes for you to make."

Conclusion

"What will you work on?" Professor Whitesides asked me, when I mentioned that I would soon be starting a faculty position. "Why should I care?"

If one works on an important problem, Professor Whitesides explained, people will care about the research regardless of whether it is ultimately successful. Conversely, research on a non-important problem will not garner much interest even if it is successful.

"The future of chemistry is you and your generation," Professor Whitesides concluded. "Work on something important."