CNR Rao Endowment Lecture

INDIAN INSTITUTE OF SCIENCE
BANGALORE

Microdroplet Chemistry : From Accelerating Reactions to Cancer Diagnostics

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About the Speaker : Richard N. Zare was born on November 19, 1939 in Cleveland, Ohio, and graduated from Harvard University with a B.A. degree in chemistry and physics in 1961 and a Ph.D. in chemical physics in 1964. He was Chair of the Chemistry Department, Stanford University, from 2005 to 2011. He is renowned for his research in the area of laser chemistry, resulting in a greater understanding of chemical reactions at the molecular level. By experimental and theoretical studies, he has made seminal contributions to our knowledge of molecular collision processes and contributed very significantly to solving a variety of problems in chemical analysis. He has received the National Medal of Science from President Reagan in 1983 and the Presidential Award for Science, Mathematics, and Engineering Mentoring from President Obama in 2012. He also received the Robert A. Welch Award in Chemistry in 1999, the Wolf Prize in Chemistry in 2005, the ACS Priestley Medal in 2010, and the King Faisal International Prize in Science in 2011. Some of his outside activities include being Chair, Board of Directors, Annual Reviews, Inc., Chair, Committee on Science, Engineering, Medicine, and Public Policy of the three academies, and member, Board of Directors, Camille and Henry Dreyfus Foundation. He is an honorary fellow of the Indian Academy of Sciences.

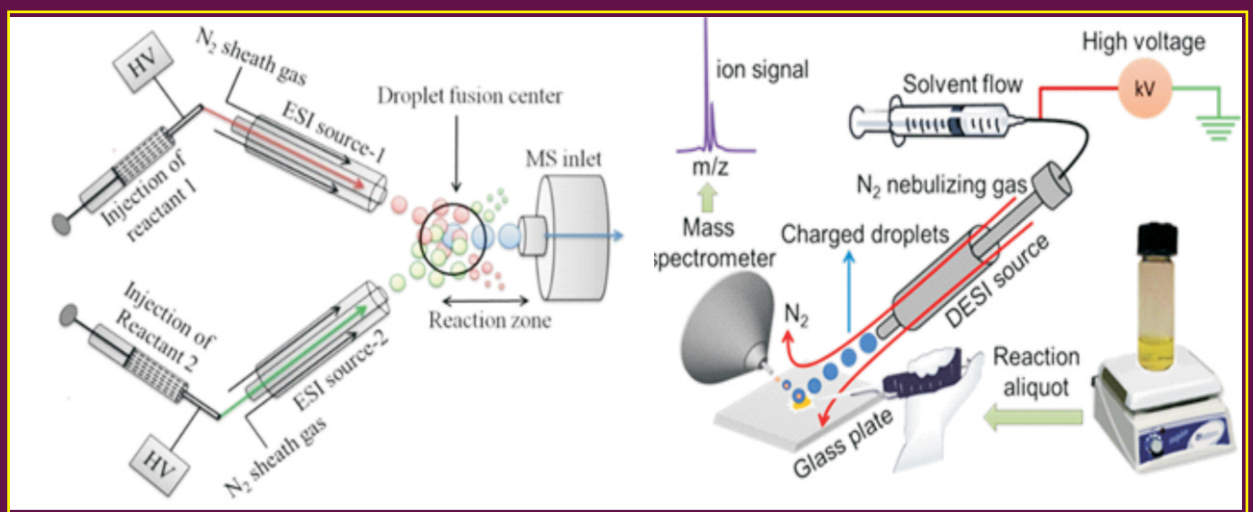

Figure 1. Two experimental setups used to investigate the chemistry occurring in microdroplets.

Abstract of the talk : My research group has been studying chemical reactions in microdroplets and comparing the findings with the behavior of the same reaction in bulk solution. Our detection method has primarily been high-resolution mass spectrometry. Two different experimental setups are employed, one involving fusing together two streams of microdroplets(shown in Fig. I, the panel on the left), the other simply involving desorption electrospray ionization (shown in Fig, 1, the panel on the right): One significant advantage of investigating reactions in microdroplets is that this technique allows us to detect and identify fleeting intermediates in complex reactions. Another special feature of microdroplet chemistry is that the rates of some reactions can be accelerated by a factor of 1000 or more! An example is the reduction of ascorbic acid by dichlorophenylindophenol. Some speculations will be presented to account for this marked rate enhancement.

We have also been using microdroplets as an analytic tool to distinguish between normal and cancerous tissue to aid surgical removal. A stream of droplets bombards the tissue sample and the splash of tinier microdroplets enters the inlet of a mass spectrometer for chemical analysis. The tissue is mounted on an XY-translation stage allowing us to make a chemical map of hundreds of lipids and small metabolites with a resolution of approximately 200 x 200 microns (pixel size). Using sophisticated statistical methods, we are able to predict with high accuracy which picture elements of the tissue need to be removed by surgery.

Wednesday, 8th February 2017 | 4:00 p.m. | Faculty Hall, IISc

Director, IISc, will preside

Tea: 5-00 p.m.

All are Welcome