EDITORIAL

DOI: http://dx.doi.org/10.29387/ms.2014.2.1.75-76

Sharing my fifteen years experience in the research field of Atomic Force Microscopy (AFM)

Guha T

Correspondence to:

tapanguha@googlemail.com

Dr. Tapan Guha, Professor in Physiology, College of Dental Sciences and Hospital
Rau, Indore, M.P.

Editors for this Article:

Dr. A.K. Pradhan, MBBS, MD. Professor, KIMS, Amalapuram, Editor-In-Chief, Medical Science.

Cite this article:

Guha T. Sharing my fifteen years experiences in the research field of Atomic Force Microscopy (AFM). Medical Science. 2014, 2(1): 75-76.

Information about the article

Received: Jan. 25, 2014
Revised: Feb 19, 2014
Accepted: March 17, 2014
Published online: March 30, 2014

Atomic Force Microscope (AFM) was developed by Binnig and his coworkers in the year 1986. He was awarded Nobel Prize in physics for this work in 1986 in sharing with Rohrer and Ruska.

Rationale to develop AFM:

Scanning Tunneling Microscope (STM), the precursor to AFM is efficient in imaging electrically conducting specimen at atomic resolution. The impetus for development of AFM came to Binnig's mind because of relatively poor efficiency of STM to image electrically non-conducting biological samples. He wondered why the surfaces be always imaged with a current but not with a force. He thought if small forces of interactions between a probe tip atoms and specimen surface atoms could be detected and amplified then imaging of biological specimen would be possible at a very high resolution.

AFM working Principle:

AFM is a Scanning Probe Microscopy (SPM) by which imaging is realized by interaction of a probe with sample surface without any beam (light, electron) and lens system. The probe is attached to a soft and sensitive cantilever and either specimen is scanned by probe or specimen scans itself under a stationary probe. Probe's spring constant must be small and the deflection must be measurable along with high resonance frequency.

The most commonly associated force with AFM is called Vander Waals force. Three modes of working are contact mode, non contact mode and tapping mode. In contact zone, the probe tip attached with cantilever is held less than a few A˚ from the sample surface and the inter-atomic force between the atoms of probe tip and sample surface is repulsive. In non-contact zone, the probe tip is held at a distance of 100s of A˚ from the sample surface and the inter-atomic force here is long range Vander Waals interaction and is attractive in nature.

AFM is also called Scanning Force Microscope because the force of interaction between probe tip atoms and surface

ISSN 2321-5291
Medical Science 2014;2(1): 75-76
Atomic Force Microscopy

atoms is amplified to generate a signal voltage which modulates video monitors' spot intensity to form an image on the screen. Modulation of spot intensity on the video monitor during line scan is continuous and synchronous with line scan by probe of the sample surface (or sample surface under the tip). The image is formed line by line and the image frame is constructed by integrating the line images forming the raster

Our Achievements

- Comparative surface architecture study of different seeds like moong dal
- Elucidation of cyto-architecture of red blood cells from an evolutionary perspective in fish, amphibians, reptiles, birds and mammals and their comparative study
- Determination of surface structure of sickle cells and comparison of its nanostructures with that of normal RBC
- Study of effect of various drugs like sildenafil citrate, hydroxy urea, potassium thiocyanate on normal human RBC surface in perspective of their entry in circulation and varied half lives after consumption.
- Study of effect of similar drugs on sickle cells in view of their anti- sickling property to lessen the problems associated due to rigid sickled shape
- We observed and reported for the first time that sildenafil citrate (viagra) was hemolytic at high dose but prescribed dose was safe in vivo
- Hydroxyurea had no hemolytic properties and it attenuated viagra induced hemolysis
- KSCN has desickling effects confirmed by AFM

Authors' information

Dr. Tapan Guha, M.Sc, PhD
Professor in Physiology, College of Dental Sciences and Hospital, Rau, Indore, M.P. Editorial Board Member Medical Science.