

Atomic force microscope

[Engineering](#)



Article Review The article by Anshu Bagga, Mathur, Geoge, Monty Reichert, and Tuskey deals with the study of force transmission in endothelial cells using the Atomic Force and the Total Internal Reflection Fluorescence microscopy. The objective of the article was to examine the transmission of force from the cell membrane of the apical cell to the cell membrane of the basal cell. In the second article, the authors Mike, Harton and Guillaume, are more concern with analyzing the atomic force microscope in ascertaining magnitude and the nature of strains upon which cells often respond. The third article was authored by Kenneth A, and the article aims at ascertaining the role of the Subcellular Stress-Shear distribution in the Endothelial Cell mechanotransduction. This paper summarizes, and reviews the three articles with a focus on how the authors were successful in achieving what was intended. In the first article, by Anshu Bagga, Mathur, Geoge, Monty Reichert, and Tuskey, experimental design and the quantitative method techniques were employed in conducting research. They made use of quantitative method in justifying their findings. In trying to establish how force transmission in endothelial cells is achieved, for instance, the authors utilized the Atomic Force and the Total Internal Reflection Fluorescence microscopy. The authors did this by mounting a bioscope AFM on an inverted microscope. Then they contacted an experiment for Variable-angle TIRFM. This was meant to help calibrate the coupling angle using the depth of penetration of the evanescent wave. They collected the set of force curves on the whole cell surface to help them in measuring the cellular mechanical properties. Using the linear regression fit for the force indentation curves, they were able to find the elastic modulus for the nuclear, cell body that was in proximity to the nucleus, and for the cell body that was near the edge.

They investigated the stress transmission by imaging the basal surface response to the localized force application on the apical surface. From this experiment, they were able to conclude that the position of the focal contacts changed, alongside its area whenever a force of magnitude 0.3-0.5 nN was applied. They also found that the focal contact area also changed with the same magnitude. When they removed the force from the nucleus, they found that the focal contact area significantly increased. The focal coverage area did not significantly change before and after applying the force over the edge. In conclusion, the authors were able to meet their research objective, which was meant to ascertain the transfer of localized stress from apical to the basal surface, thereby leading to rearrangement of contacts along the basal surface. However, just like in any other experiment, the authors of this article had a ray of problems. For example, it was challenging for them to calculate the exact modulus because of faultiness of the Hertz model. More disturbing to the authors was the experiment for ascertaining the change in the contact area and relaxation of the focal contact within the first five minutes because of viscous relaxation of the cell, which they feel might have altered the results of the experiment. Since they were dealing directly with the skeleton, it was expected that they show how the cytoskeleton directly contributes to the force transmission.

Unfortunately, this was not the case. There are outstanding shortcomings of this research article as far as the validity of its data is concerned. In any standard research it is expected that Claims about Results, as well as Implications are supported by Data (Njihia 23). In this article, this is not the case. When the researcher failed in finding the correct value of modulus, which is an important factor as far as the research is concerned. He gets

wrong results, which do not amount to concluding that the materials were elastic to justify his modulus values. He is only keen at using other research literatures to support his assertion making the whole process of research invalid. Additionally, the researcher does not experimentally justify the direct link between the cytoskeleton and the force of transmission instead they concentrate in using other experiments in justifying the link. This implies that as so far as the data presented is concerned, there is no link between the force of transition and the cytoskeleton. Then why do the research in an area that in the first place does not exist? It is also ideal for the researchers' to clearly explain the terms used. For this, the researchers did not do. The article by Mike, Harton and Guillaume, concerns analyzing the atomic force microscope in ascertaining magnitude and the nature of strains upon which cells often respond. Like the first group of authors, the authors of this article, also employed experimental design and the quantitative method techniques in the analysis of their research. They made use of a confocal microscope in analyzing of the cellular responses. From this experiment, the authors concluded that; in a cell, there exist two different response pathways. First, it is the consequent that comes upon contact, which is depended on activating stretch-activated ion channels, and secondly, the respond pathway that follows stress relaxation, which requires an intact microtubular cytoskeleton. The authors, in this experiment, found that it is possible to modulate the cellular responses by selectively disrupting the components of the cytoskeleton that are often thought to cause mechanical stimuli transduction. They also found out that F-actin cytoskeleton is never a requirement in so far as a response to the mechanical strain is concerned, but important to the mechanical response are the vimentin networks and the

<https://assignbuster.com/atomic-force-microscope/>

microtubular. In this study, they were able to note that treatments that cause reduction in the tension of the membrane selectively caused a reduction. The third article is by Kenneth A. B, titled The Role of the Subcellular Stress-Shear Distribution in the Endothelial Cell Mechanotransduction. In this article, the author notes that the blood endothelium vessels presents have a wavy surface that is felt by the flowing blood. The sub cellular spread of stress shear depends on the orientation and the shape of the cells together with their spatial arrangement on the monolayer. The author decided to carry out this study because he felt by studying the stress distribution at a scale and the morphological responses that modify this distribution; he could get an insight on the physical mechanisms over which the cell senses the fluid mechanical environment around it. This morphological response of the endothelial cells to flow was among the very first direct demonstrations that endothelial cells are able to respond to mechanical excitation as stated by the author. The author talks of the endothelial cells capacity to discriminate between subtle changes in variations in the loading conditions with the differences in spatial and the temporal gradients of shear stress. This has only been mentioned by the author he should have explained in detail this phenomenon. The author identified several research problems in this article. For instance, the time-average shear stress alone does not explain the pathological characteristics of endothelial cells when exposed to a complex flow rhythm occurring in atherogenic site. Fortunately, atomic force microscope (AFM) paved the way first time concise measurement of the endothelial surface height with high a spatial resolution. Just like the first group of authors, the author of this article, employed the experimental design and the quantitative method in <https://assignbuster.com/atomic-force-microscope/>

his research. For instance, he used the microscopic scale of the atomic force microscope and the 3D surface topography in finding the association between shear stress and endothelial cell monolayer. The results did show significant variations of shear stress in the individual cell of the monolayer. In conclusion, the author observes that the microscale dispersion of shear stress is vital for endothelial cells response to flow. In considering the role of this effect, endothelial cell dysfunction in atherogenesis, it is also important to remember that the subcellular variations magnitude is proportional to macroscopic shear stress. Work cited. Njihia, Isaac. Characteristics of a High Quality Manuscript. 2004. Retrieved on 14th July 2012 from <http://www.soma.com>