J Biotechnol Biomater 2012, 2:6
http://dx.doi.org/10.4172/2155-952X.S1.020

OMICS Group Conferences
Accelerating Scientific Discovery

3rd World Congress on
Biotechnology

September 13-15, 2012 Hyderabad International Convention Centre, Hyderabad, India

New defence mechanism against viruses and cancer

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Introduction: Many drugs and therapies have been developed for treating viral infections, HIV/AIDS, cancer but with little success or adverse and toxic effects on the organisms. Scientists have found a mechanism which might help us fight with these, dreadful disease.

Interluekin 33: IL-33 is a cytokine belonging to the IL-1 superfamily. IL-33 induces helper T cells, mast cells, eosinophils and basophils to produce type 2 cytokines. This cytokine was previously named NF-HEV 'nuclear factor (NF) in high endothelial venules' (HEVs) since it was originally identified in these specialized cells. IL-33 mediates its biological effects by interacting with the receptors ST2 (aka IL1RL1) and IL-1 Receptor Accessory Protein (IL1RAP), activating intracellular molecules in the NF-κB and MAP kinase signaling pathways that drive production of type 2 cytokines (e.g. IL-5 and IL-13) from polarized Th2 cells. The induction of type 2 cytokines by IL-33 in vivo is believed to induce the severe pathological changes observed in mucosal organs following administration of IL-33.

Experiment: Scientist have exploited the mechanism of vaccination and found that when a foreign or viral particle enters our body which are regarded as PAMP's, these cells alert the dendritic cells and there by alert T-cells but the new mechanism found, relates the activity of dendritic cells with the injured cells which give out alarmins(factor) responsible for stimulating T-cells i.e., Interluekin 33(IL-33).It forms scaffold for T-cells and improves their activity and thus T-cells destroy the foreign or cancerous cells. It was found when a mouse was knocked out of the gene responsible for IL33 it could not sustain the viral attacks Conversely, IL-33 could be used to artificially increase the T killer cell army, which was generated in response to vaccination.

Result: The "foreign look" of viruses (PAMPs) activates the "dendritic cell" policemen to engage T killer cells. T killer cells, however, remain lousy fighters unless alerted by a cell death in their neighborhood. These new findings could provide a key to effective vaccination against infectious diseases and cancer.

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A dual purpose biological model for oxidation of sulphide waste and generation of electricity

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Two chamber microbial fuel cell has been studied since long time for waste water treatment. Among the different compound found in waste sulfide waste removal has gained significant importance as a consequence of its toxic effects and obnoxious properties. Conventional method of sulfide waste removal involves chemical oxidation of the sulfides to sulphates. Our present research is concerned with biooxidation of sulfide by Chromatium sp. using a mediatorless two chamber microbial fuel cell (MFC). The electrons released from sulphides during biooxidation will be captured and donated by the bacteria to the graphite electrode. The electrons flow to the cathode through an external circuit where potassium hexaferrocyanide acts as a catholyte. The balance of ions between the two chambers was maintained by a salt bridge. The proposed MFC model generated electricity with a highest power density of 0.0086mW/L of anode solution accompanied with 89% reduction of sulphide from the initial concentration. Thus this MFC model reduces sulfide level in the wastewater as well as provides a source of energy in the form of bioelectricity. SEM analysis was also done to detect presence of any biofilm formation. In this present mediatorless system, the transport of electrons was limited due to some medium components as could be demonstrated by cyclic voltammetry. Further study is being done on designing an appropriate medium and innoculum size to improve the power generation.

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