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Bioimprint Replication For Cancer Research Investigations and Its Analysis Using Artificial Neural Network

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***Abstract*— In this paper, we have described about the obtaining of high resolution image of abnormal cells and the analysing it through artificial neural network (ANN). High resolution images can be obtained through imprinting method. High resolution imaging techniques like AFM, SEM and TEM can be used. These cell replicas contain features related to the cancer which can be used to train the neural network. Further it can be used for autonomous classification of cancerous and non-cancerous cells.**

***Keywords*— Imprint, Cancer, Feature and Neural Network, NIL.**

I. Introduction

In this article, we have proposed about the classification of cancer cell replicas using ANN. This proposed method provides precise and accurate results due to high resolution images.

Cell is the building blocks of life. Analysis of cell plays the major role in the cancer research. There various techniques and methods for the same. Analysis of abnormality at the cell level can facilitate the better analysis, treatment and cure.

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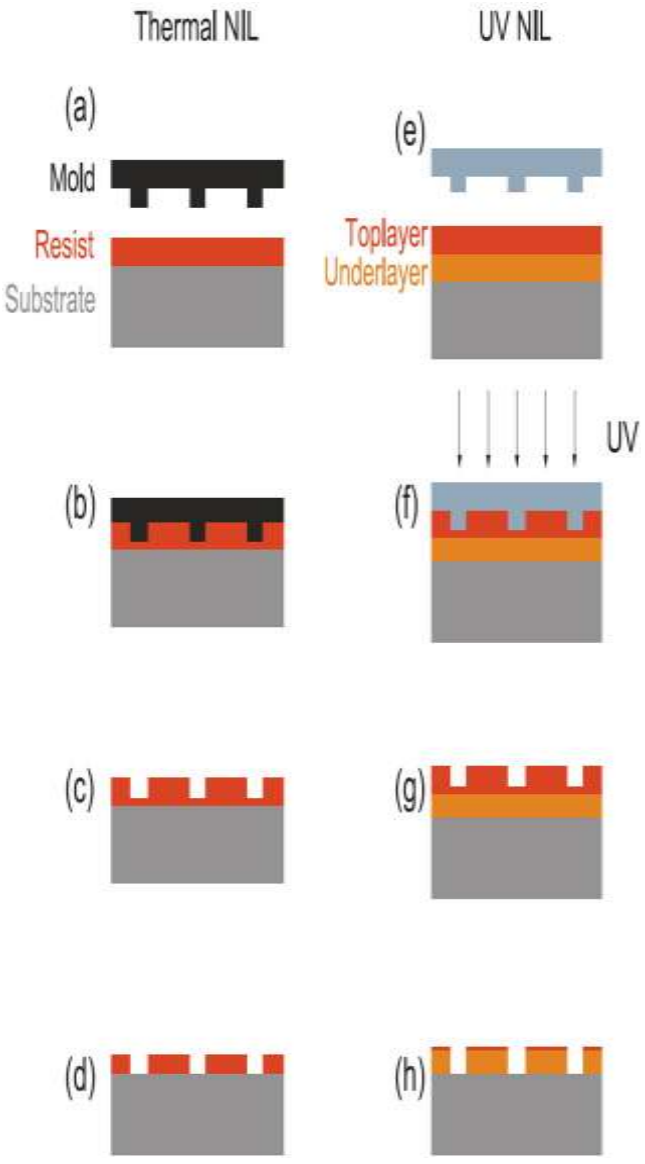

Fig 1: Imprinting Process [5]

Conventional method uses optical method to view the cancer cells which is very difficult and hard to view the high resolution images. From which extraction of subtle features is

very difficult as images are not so in depth and high resolution. Process like fixation, embedding, sectioning and staining is also carried out for cell analysis. These methods are tedious and time consuming. This process also adds noise to the morphology, due to involvement of several series of process.

Imprinting is the process in which patterns are formed by mechanical deformation of imprint resist (polymer) which is then cured by heat or UV light during the imprinting. In T-NIL (Thermal Nano Imprint Lithography) process, a thin layer of imprint resist is spin-coated onto the substrate. Then the mold with patterns is made into contact with the substrate and they are pressed together under certain pressure. When heated up above the glass transition temperature of the polymer, the feature pattern on the mold is pressed into the melt polymer film. After being cooled down, the mold is separated from the substrate and the pattern resist is left on the substrate.

In UV-NIL (UV Nano Imprint Lithography), a UV-curable resist is applied to the substrate. After that mold and the substrate are pressed together. Then the resist is cured in UV light and becomes solid. After demolding, patterns are obtained in the polymer. The residual polymer is removed. Each method has its own merits and demerits. UV-NIL can be performed at room temperature and low pressure, hot embossing is low-cost. However, UV-NIL has established itself as a promising alternative to NIL in which imprint lithography is conducted at room temperature under low pressure conditions. In Fig. 1 T-NIL and U-NIL process is explained clearly. In this article we discuss how to image, diagnose and classification of the cancer more precisely. [1-7, 11-13]

II. Methodologies

This section deals with the proposed methodologies in detail. Initial step is the cell culture. Then it is followed by the bio-imprint replication method, by which the cell replica is obtained. Bioimprint replication method is clearly explained in the Fig.2.

In the process, biopolymer is applied over the cultured cells and then it is cured by UV radiation. Polymer is then removed and cleaned to obtain the cell replica. The obtained cell replica is imaged using high resolution imaging system like AFM,SEM or TEM.[1,6,7,9,10] Once high resolution images are obtained, it can be used for feature detection for cancer research investigations. By optimizing the process better images can be obtained. Morphologies features like shape, size, and pores can be used for detection. Once ANN [8] is trained for cancer feature detection based on the morphology feature, it can autonomously classify the images.

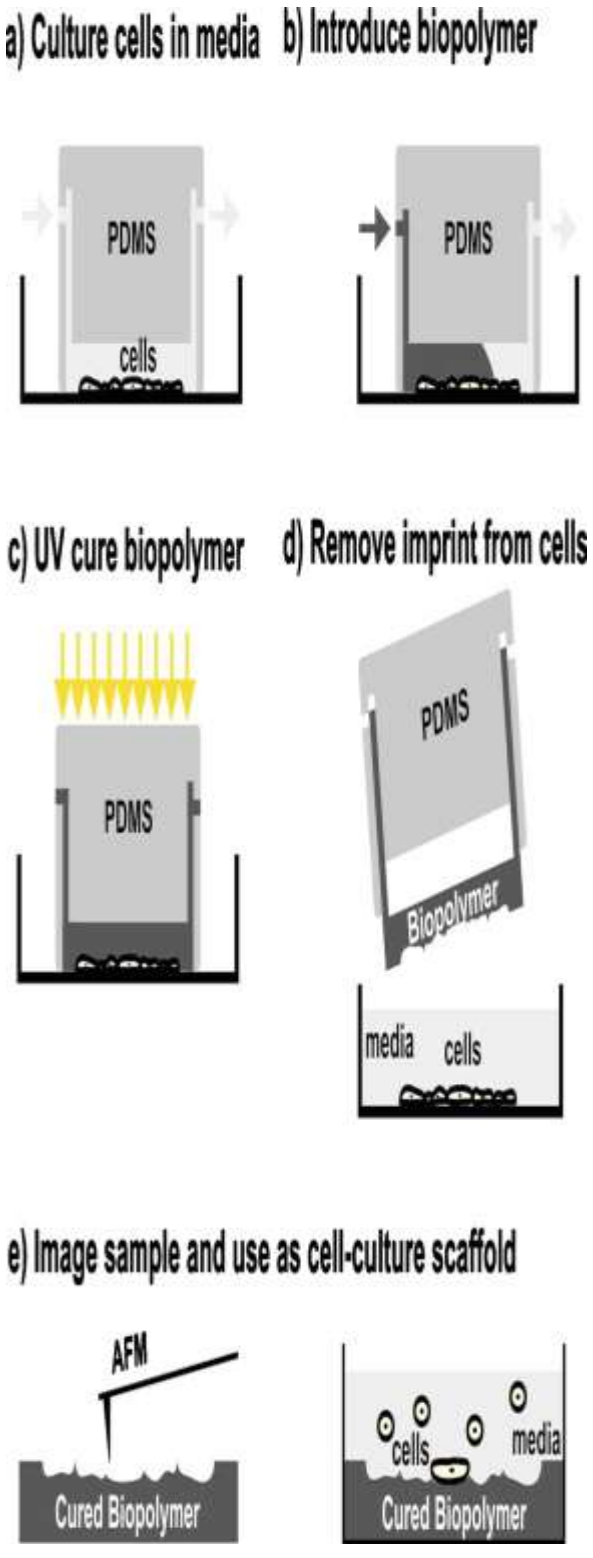

Fig 2: Bioimprint Process [1]

III. Results and Discussion

In Fig. 3. The AFM image of the cell replica is shown. In the image, the cell morphologies are clearly visible. Features based on morphologies for cancer can be detected and ANN can be trained for it. The concept behind this is to develop a ANN, which can be trained based on the cancer cell replica images. Once it is trained it can used to detect the features and classify it.

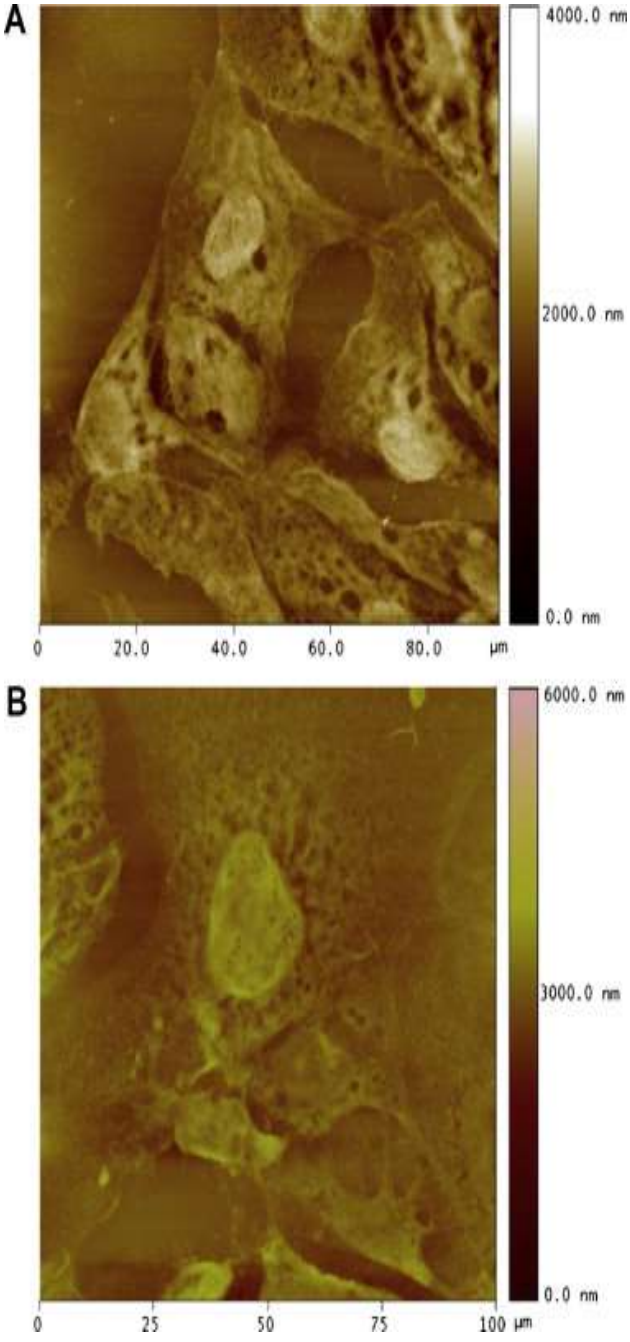

Fig. 3. AFM Image of Cell Replica [7].

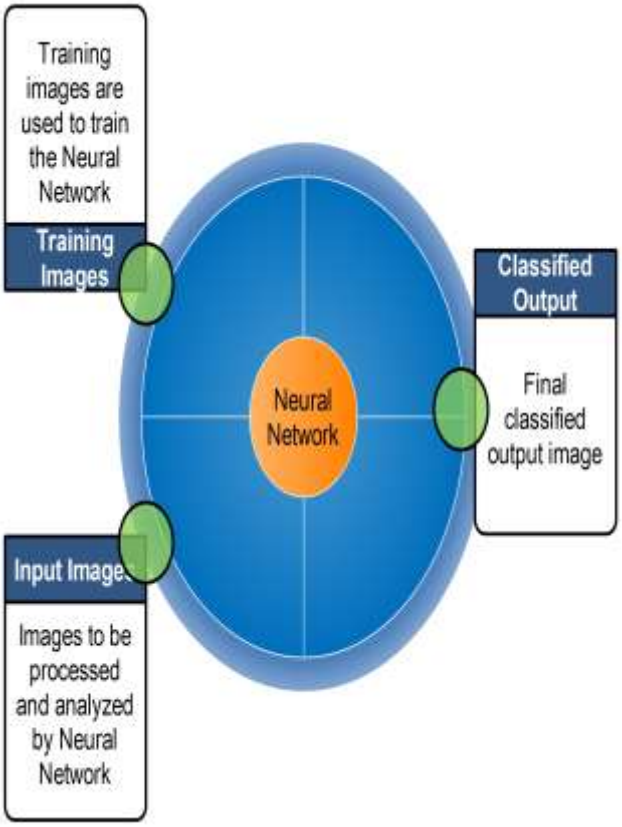

Fig 4: Classification using ANN

In Fig. 4., the classification of cell replica using ANN is shown. This proposed method provides precise and accurate investigations of cancer research based on morphologies of the cells. This facilitates the cancer research investigations.

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