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Impact of deploying a genetic approach to stem cells opens-up new facets in the “blank slates” of our body

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Since the dawn of the Post-Genomic era (25 years back), applying a genetic approach to solving various intricate problems/issues in research has taken-off even more swiftly than ever before. Spatio-temporal cues defined for certain critical components in a particular developmental pathway (involved in causing/progression of certain disease) provide a firm basis for detecting the order, hierarchy and “switching-off or on” of genes that regulate it. The various time-points, at which genes are switched on/off, clearly determines the fate of what a cell does in terms of being functional or non-functional, due to disruption of that specific pathway. Recent research-work in this area provides strong evidence, toward identifying such components (associated with Wnt-signaling involved in Colorectal Cancer-CRC disease). These crucial elements indeed determined the genetic transformation of a “blank slate” (“cells of origin” and/or putative “cancer stem cells”) or “primitive-state” epithelial cells to an intermediate adenoma/polyp (*dysplastic*), and later to a proliferative (*hyperplastic*) or cancerous (*neoplastic*) state. The idea is to re-iterate the power of genetics, in solving and filling the missing links of any developmental pathway involved in progression of a disease (in this case, CRC). A critical temporal requirement of certain molecules [*Caesin*-Kinase I (CKI) and Human-Discs large (*hDlg*)] was finally established and these proteins were identified as “early” and “late” acting molecules respectively, in a very crucial developmental event, that basically transforms “polyps” to full-fledged “carcinomas” (epithelial cancers) in COLORECTAL tumors. The detection of these genetic and developmental parameters, served as a focal-point and a prominent diagnostic feature, for detection of effects, i.e., Gain/ loss of other components involved during progression of CRC disease. Coincidentally, the chromosomes on which these genes reside have been found to be dense and rich in SNPs (hot-spots), the details of which were published in a separate report (Patidar & Bhojwani, 2013). This work harnessed the potential of Genetics, Developmental Biology and Bio-Informatics tools to solve a long-standing puzzle in pin-pointing some genetic factors that were critically involved in the progression of CRC disease. The report has created enough impact, in terms of authentically suggesting,

that it is only when we deploy a combinatorial approach towards certain complicated biological problems, can we successfully unveil the underlying mechanisms in greater details. However, it is now conceived that, at the heart of every tumor lies a rare sub-population of cells (Cancer Stem Cells-CSCs), which give rise to most of the Cancers and are now the targets of investigation. Since no definitive markers or efficient labeling tools are available, this population of cells still remains elusive in both cancer and stem cell biology. Therefore, it would be critical to understand molecular differences between stem cells and cancer cells, which might be helpful in providing novel insights into the mechanism of tumorigenesis as well as potential therapeutic targets, in foreseeable future. We have come a long way in the stem cell advances over time. Very recent breakthroughs include: (a) The tuning and genetic re-programming of stem cells (iPS cells) by a handful of genetic factors. The transformation of cancerous cells to normal cells by reversing the genetic changes involved and also restricting the awry cancerous cells by using microRNAs (<http://yournewswire.com/breakthrough-scientists-find-way-to-change-cancer-cells-into-healthy-cells/>).

Speaker Biography

Jyoti Bhojwani is currently a Faculty of Genetics/Bioinformatics/ Principal Investigator of the MTech Research Programs (Bioinformatics) at University of Indore, India. She obtained her BSc (Bachelor's degree) in Biological Sciences/Chemistry/Physics, MSc (Master's degree) in Life-Sciences, and Doctoral degree (Ph.D.) at School of Life-Sciences, University Of Indore. She pursued her post-doctoral ventures at Max-Planck Institute for Biophysical Chemistry (FRG), University Of California-Irvine and University of Pittsburgh (USA). Currently, her projects mainly focus on translational-research and extrapolation of basic developmental mechanisms from model-systems like fruit fly (*Drosophila*) to human. Apart from this, her thrust areas of research interest include; Cancer Biology, Stem-Cell Biology and Homeotic-Gene Regulation. She is keen on studying in details the genetic factors, which presumably aid in understanding of mechanism by which “cancer stem cells” function in transforming a tissue from normal to cancerous states. Her research has a motive to further facilitate the perception of stem cell potential/mechanistic in areas of Regenerative Medicine, Translational Research and Anti-cancer therapy. Being involved in Clinical informatics, her students are also training a Cancer model and a Stem cell model, deploying Systems Biology approach and other Gene Networking Bioinformatics tools. This novel area of research will hopefully lead to further understanding the tipping of balance from a stem cell/normal cell to a transformed cancer cell. Owing to her immense interest in science journalism and writing potential, she is now on the editorial board of several International Journals. Her Specialties Include: Research/Teaching/Mentoring/ Science-Journalism.

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