



Conference Report

Molecular pathways to therapeutics: Paradigms and challenges in oncology meeting report: Carcinogenesis 2015

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Abstract

The search for the most effective therapy with minimum side effects has always been the goal of oncologists and efforts to develop such therapies through understanding disease mechanisms has been the focus of many basic scientists in cancer research, leading to a common interest of convergence. The 5th International Conference organized by the Carcinogenesis Foundation, USA and Advanced Centre for Treatment, Research and Education in Cancer (ACTREC), Tata Memorial Centre, India, was held between February 11th and 13th 2015, at ACTREC. During these proceedings, the scientific community engaged in oncology research discussed novel ideas emerging from the laboratory and their translation into improved clinical outcomes. However, the lack of major success in the genesis of novel cancer therapeutics that is safe and provides long-term relief to patients is a challenge that needs to be overcome. The focus of this meeting was to highlight these challenges and to encourage collaborations between scientists and clinicians and clearly a message through exemplary scientific contribution was conveyed to all the dedicated scientists and clinician that even if two decades of tireless work on a single idea does not generate a reliable and safe therapy, the combat to rein cancer must not cease. In this report we have communicated some of the outstanding work done in the areas of cancer therapeutics, biomarkers and prevention and described the salient observations associated with cancer stem cells in disease progression and some of the pathways implicated in tumor progression.

Keywords: Carcinogenesis, conference report, cancer therapeutics

INTRODUCTION

The conference began with a customary inauguration and a welcome address by Dr. SV Chiplunkar, Director, Advanced Centre for Treatment, Research and Education in Cancer (ACTREC) and Conference Chairperson, to all

the delegates many of whom had braved rough weather to be present and participate in this international meeting. The director conveyed gratitude and thanked the Carcinogenesis Foundation USA and Dr. Gopala Kovvali for selecting ACTREC as the host Institute for the Fifth International Conference of the Foundation. It was indicated that the venue was perfect and suited the mandate, which is to develop a unique model and carve a niche in translational research with contribution from available expertise in both basic and clinical science from the institute.

Dr. Gopala Kovvali, Conference Chairperson and Editor-in-chief, Journal of Carcinogenesis addressed the delegates to welcome them to exciting and interesting

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sessions on translational research which could directly have an impact on the treatment of cancer. An insight was given of how such research was initiated with studies done on the shift in the pattern of cancer, of migrating populations from underdeveloped countries to the Western World and life-style differences. He went on to add that this conference would be a reflection that basic science is going through a transition with a necessary component of an application to effectuate clinical research.

Dr. Sorab Dalal, PI, ACTREC and Organizing Secretary of the conference, delivered the vote of thanks to acknowledge all the members, staff and students involved in planning and organizing the conference. Gratitude was expressed toward the Carcinogenesis Foundation USA; Director, Tata Memorial Centre; Director ACTREC and Dr. Gopala Kovvali for selecting ACTREC as the venue and the opportunity availed by the host institute in conducting the conference.

The Scientific Program was thoughtfully planned to include areas of cancer research with a translational component. On each day the plenary session kick started the scientific deliberations and enthused active participation from the delegates and audience.

CANCER THERAPEUTICS

There were some very interesting talks in the session on Cancer Therapeutics, which began with the plenary lecture, “promises and challenges of RNAi therapeutics” by Dr. Anil Sood, MD Anderson Cancer Center, Houston, USA. The talk encompassed the RNAi approaches for therapeutics with the example of using it for treatment of ovarian cancer which is one of the most aggressive cancers known where no improvement in cure rates has been observed despite many decades of research. Even with The Cancer Genome Atlas (TCGA) sequence data available, there is a need to rapidly functionalize the genomic findings which will be quite a challenge and could be overcome with the RNAi technology. He stated that the lack of a solved structure for multiple proteins and the fact that tyrosine kinases have functions that are independent of the catalytic domain, which are often revealed under disease conditions suggests that many of these important protein targets are not “druggable.” Therefore, a better therapeutic approach was to inhibit the expression of these proteins using RNAi. Another benefit of using siRNA versus miRNA lies in the size of the oligonucleotide that has to be introduced into cells with miRNA's being much larger than siRNAs. MiRNA technology is ineffective in cancers such as ovarian and lung cancer as these cells contain low levels of Drosha and Dicer. The requirement of carriers for the successful

delivery of siRNA is crucial as naked molecules injected in the blood will be degraded by the endogenous enzymes, and hence the use of viral vectors or nanoparticles preferred. Some of the initial studies done in identifying efficacious delivery agents for siRNA were performed by Sood and his group, and a nanoliposomal delivery platform dioleoyl phosphatidylcholine (DOPC) (multistage vector composed of mesoporous silicon particles [stage 1 microparticles, S1MP] loaded with neutral nanoliposomes [DOPC]) developed by Sood *et al.* has been widely used to target candidate genes like EphA2, Kras, in many different tumor models and is poised to enter clinical trial. An interesting point highlighted during the talk was on the preclinical studies done in animal models and it was emphasized that two animal models and both sexes should be included in these studies as very often the efficacy is not the same in males versus females, and the therapeutic strategy often does not go beyond a phase one trial. Limitations like the stability of the siRNA molecule in blood and use of modifications like the MePS2 on the siRNA were discussed to enable improved efficacy. Targeting miRNA Networks was discussed and targeting the microenvironment with chitosan nanoparticles to deliver miR200. The key message here was that RNAi offers many opportunities and targeting the key miRNA molecules could bring about a robust reduction in tumours.

Following the talk there were several interesting questions, some of which were on multiple targets, the off-target effects of silencing and toxicity and effects on the host immune factors.

Dr. Vikram Mathews from CMC, Vellore, India, presented findings on the drug combination of Arsenic trioxide and Bortezomib in the treatment of acute promyelocytic leukemia (APL). The treatment protocol for the chimeric onco-protein PML-RARA traditionally has been the use of all-trans retinoic acid in combination with other chemotherapeutic drugs but the major disadvantage of its use in India has been its high cost and unaffordability and also the presentation is usually as an advanced disease and a younger age group when compared to the Western Countries. Studies done with a single agent arsenic trioxide in treatment of APL were initiated with a small subset of patients to establish safety and efficacy and subsequently in a study with a larger sample size a long-term follow-up proved it to be a well-tolerated with sustainable response. The findings also showed that even though Arsenic Trioxide resistance is a rare phenomenon there were a subset of patients who were not cured and termed as the high-risk group and these had a mutation in the B2 domain of PML in the PML-RARA fusion gene. The mode of action of Arsenic trioxide is to mediate the degradation of the fusion gene product through

the proteasome complex. In this talk the mechanism of action of bortezomib, a protease inhibitor in combination with Arsenic trioxide, which showed a synergistic effect in the degradation of PML-RARA was discussed and shown to be safe in patients in the high-risk group though the efficacy has to be determined, which is being done in a phase II trial. The synergistic effect of Arsenic trioxide with bortezomib is primarily through apoptosis triggered by increase in reactive oxygen species activity and up regulation of unfolded protein response pathway. A major question would be the justification of use of a protease inhibitor along with Arsenic trioxide but data generated with studies *in vitro* and *in vivo* indicated apoptosis and showed an up-regulation of the autophagy pathway to bring about the degradation of the fusion gene product.

Talks in this session were directed toward identifying therapeutic targets and anti-cancer drugs. Dr. Gennaro De. Libero, SigN, A-STAR, Singapore and Department of Biomedicine, University of Basel, Switzerland presented a talk entitled, “a novel self-lipid antigen targets human T cells against CD1c⁺ Leukemia’s.” This was quite detailed and began with a description and definition of CD1 antigen presenting molecules and the cell types (dendritic cells, tissue macrophages) that express and present them to T cells. Descriptions of CD1a sulfatide structure and the antigen binding pockets of CD1 molecules, description of the immunogenic lipids and one of the important question of the existence of a tumor associated lipid antigen was raised. Data were presented showing investigations carried out on different cell lines with most acute myeloid leukemia cell lines expressing CD1c, identification of the stimulatory self-lipids was done by high-performance liquid chromatography and LC-MS-NMR. Subsequently synthetic methyl-lysophosphatidic acid (m-LPA) analogs were prepared and a dose-dependent response was recorded *in vitro*. These findings were verified in an *in-vivo* model using nonobese diabetic/severe combined immunodeficiency mice injected with human cells (MOLT-4). A reduction of the tumor cells was observed when the mice were treated with m-LPA specific cells. This showed that m-LPA specific T cells limit the growth of primary leukemia. The conclusions drawn were that m-LPA are a novel leukemia associated lipid antigen and that m-LPA specific T cells kill leukemic cells *in vitro* and *in vivo*. Dr. Gopal C. Kundu, NCCS, Pune, India convincingly demonstrated that osteopontin (OPN) which is a pro-inflammatory and chemokine like protein could be an appropriate therapeutic target as it influences all the hallmarks of cancer. The group has reported in breast cancer, that OPN is a crucial determinant of tumor progression. Furthermore, hypoxia induces OPN expression and OPN dependent hypoxia-inducible factor 1 α (HIF-1 α) expression, which

in turn leads to the expression of VEGF and angiogenesis. The expression profile of OPN and HIF-1 α in human breast cancer subtypes showed that 75.5% of all primary tumors over-expressed OPN and 63% co-expressed HIF-1 α . The combined data presented indicated that OPN could be an appropriate therapeutic target for the control and treatment of cancer.

PATHWAYS TO TUMOUR PROGRESSION

The session started with the talk, “epigenome deregulation in cancer” by Dr. Zdenko Herceg, IARC Lyon, France. The complexity of cancer always sparks a debate about its etiology and the role of genes and epigenetic events as causative factors are implicated. The epigenetic changes introduced by the environment could be controlled to bring about prevention. The emphasis was that even though there are driver genes in the cancer genome, it harbors small number of driver events and it is the deregulation of epigenetic modifiers that promote gene alterations and should be remembered while designing therapy and prevention. Aberrant DNA methylation of junk DNA and technologies for epigenetic profiling of cancer, DNA methylome changes associated with tumor grade and risk factors in hepatocellular carcinoma (HCC), epigenetic patterns in surrogate tissues as predictors of cancer were also discussed. The conclusions drawn were that the Epigenome is altered in cancer and that epigenetic changes read as fingerprints of cancer.

Dr. Susanta Roychoudhury, IICB, Kolkata, India, presented data on the gain of function mutant p53 protein in conferring chemo-resistance. To understand how this protein actually drives the process of mutagenesis, a strategy was used that sensitizes the mutant p53 tumor to chemotherapeutic drugs. Chromatin immunoprecipitation (ChIP) followed by deep sequencing (ChIP-seq) is an important technique of studying the behavior of transcription factors in a genome-wide scale. Mutant p53 ChIP-seq, Untreated, and 5-FU treated was carried out. With bio-informatics analysis and data mining from NCI-60 cell line dataset, an identification of 44 hub genes was made, and the expression pattern of these was compared in the SW480 and MIAPaCa₂ cell lines. It was demonstrated that mutant p53 upregulates Ephrin-B2 expression in the chemoresistant cancer cells upon addition of chemotherapeutic agents. Also, perturbation of Ephrin-B2 restores chemosensitivity that is Ephrin-B2 silencing sensitizes mutant p53 tumors to 5-FU *in-vitro*. This study identifies Ephrin-B2 as a potential target to overcome chemotherapeutic resistance.

Dr. Ellora Sen, NBRC, Manesar, India the last speaker in this session conveyed the possibility of developing new

therapeutic modalities based on one of the major hallmarks of cancer, deregulation of cellular energetics. Malignant tissue is a highly proliferative tissue and prefers the anaerobic pathway basically due to reduced oxygen levels. The work described was on two glioblastoma cell lines A172 and U87MG treated with interferon gamma (IFN- γ). A series of experiments led to the observation that retinoic acid-inducible gene 1 (RIG-1) localizes to the mitochondria on the treatment of IFN- γ and peroxisome proliferator-activated receptor- γ is a co-activator. Prolonged IFN- γ treatment induces sphere formation, G9a (histone methyltransferase) and SP1 (transcription factor) negatively regulate the expression of RIG-1 which appears to be a master regulator. Hence, the targeting of such aberrant pathways/circuitries could lead to the development of novel therapeutic modalities.

ORAL PRESENTATIONS BY STUDENTS

There were twelve presentations on diverse topics in cancer research with a country-wide representation of students. Most of the talks saw active participation from the audience and the four students adjudged best were Sembulingam Tamilzhalagam, MKU, Madurai; Monica Pandey ICGEB, New Delhi; Priya R. Prabhu, RCGB, Trivandrum and Crismita D'mello, ACTREC, Navi Mumbai.

POSTER SESSION

Posters were displayed from the first to the last day of the meeting and enabled excellent interaction for the young researchers with experts in the field. This platform evokes honest opinions on the work presented which allows the researcher to assess critically and sometimes generates leads for future prospects. As always, there is an impetus to excel in terms of clarity and presentation of the research work, which is in the form of "awards." The achievers were, Jagriti Choudhury, Tezpur University, Tezpur; Sagar Chhabria, Mithibai College, Mumbai; Saikat Bhattacharya, ACTREC, Navi Mumbai; Sajad Bhat, ACTREC, Navi Mumbai; Shafqat Ali Khan, ACTREC, Navi Mumbai; Rahul Sarate, ACTREC, Navi Mumbai.

CANCER BIOMARKERS

This session began with the plenary lecture, "immunotoxin therapy for cancer" by Dr. Raffit Hassan, NCI, USA. Immunotoxins were described as a novel class of antibody-conjugated therapeutics which possess an antibody-based targeting domain fused to a bacterial toxin payload for cell killing. The mode of action is unique as it kills cells by inhibiting protein synthesis, and affects both dividing and non-dividing cells. This was a very inspiring

talk, as the difficulties encountered were not a deterrent and led to the development of immunotoxins, which were taken forward to clinical trials. Dr. Hassan described lucidly about the development of the anti-mesothelin immunotoxin, SS1P. The identification of mesothelin for the use of developing an immunotoxin were initiated with early studies which identified the expression of this protein in lung adenocarcinomas and the observation that anti-mesothelin monoclonal antibody localizes to mesothelin expressing tumors in mice. A very thought provoking statement was that, "it took two decades to arrive at a therapy against mesothelin even after showing that anti-mesothelin localized to mesothelin expressing tumors." This talk generated a lot of questions from the audience and led to discussions on mesothelin vaccine, nanoparticle delivery of immunotoxin, the importance of T cells for the antibody response, modification/mutation of the B and T cell epitopes, monitoring the cytokine levels after immunotoxin therapy.

There were three more talks in this session, Dr. Chitra Sarkar, AIIMS, New Delhi, India spoke on, "biomarkers in gliomas: Current concepts." A pathologist's view point was portrayed as to the necessity of biomarkers for accurate diagnosis and further treatment and management of the disease. The drawbacks of histological grading were presented and the emergence of molecular biomarkers as diagnostic, prognostic predictors was discussed. Dr. Harsha Gowda Institute of Bioinformatics, Bangalore, India spoke on "quantitative phosphoproteomics to identify aberrantly activated pathways in cancer." Some of the work presented was on SILAC based quantitative proteomics to identify aberrantly activated tyrosine kinase signaling pathway in pancreatic cancer; Molecular signatures of carcinogen exposure and a comprehensive proteomics screening to establish a draft map of the human proteome. Dr. Neelam Shirsat, ACTREC, Navi Mumbai, India presented data on the differential microRNA expression in molecular subgroups of medulloblastomas. Data obtained from her lab as well as other labs classify medulloblastomas into four molecular subgroups; WNT, SHH, Group 3 and Group 4. The characteristics of these groups are distinct to the age-related incidence, prognosis and survival rates. Pertaining to these molecular subtypes the miRNA profiling using TaqMan low density array further helped in risk stratification. In India, there is a large WNT group representation and this group overexpresses a number of miRNAs. MiR224 is one of them, and its expression has been shown to be important in sensitizing glioblastoma cells to radiation therapy. Thus it could be one of the reasons for the greater survival rates observed in the WNT subgroup.

PATHWAYS TO TUMOUR PROGRESSION-2

Dr. Manoj Mahimkar, ACTREC, Navi Mumbai, India spoke on, “understanding the molecular genetics of oral cancers: Role of genetic alterations in disease progression and prognosis,” have identified the KRT76 gene alteration as early event in the development of oral cancers. Dr. Paul Brandt Rauf, University of Illinois, Chicago, USA presented, Perspectives on occupational Carcinogenesis and the cancer inducing properties of asbestos an environmental and occupational carcinogen. The biomarker analysis and the predictive value of biomarkers for cancer in Asbestos workers were discussed. Dr. Lijun Sun, Harvard Medical School, Boston, USA talk entitled, “targeting stathmin: Discovery of the next generation broad – spectrum anticancer drugs,” was a very lucid presentation about the road map from research to the launch of a new anti-cancer drug. The causes of the high attrition rates of drugs and the key to successful clinical translation, a novel modulator of stathmin (CD-1026) and a screen for anti-metastatic drugs, which were anti-parasitic were discussed. Question from the audience, as to why the success rates of most drugs were as low as 10% brought a response that drug discovery in an academic environment should be increased so that robust data can be generated and can be validated.

STEM CELLS AND CANCER

This session began with the presentation entitled, “unraveling the intercellular signaling networks that lead to tumor stroma formation” by Dr. Colin Jamora, Institute for Stem Cell and Regenerative Medicine, Bangalore, India. The contribution of the tumor microenvironment to disease progression is difficult to study as it is a complex entity comprising of cancer-associated fibroblasts (CAF), immune cells, blood vessels and extracellular matrix (ECM) proteins. The significant role of CAF has been recognized but not completely understood in the process of invasion leading to metastasis. This problem was addressed using a mouse model engineered to overexpress the transcription factor snail in epidermal keratinocytes, which expressed characteristics of squamous cell carcinoma and also led to crosstalk with the underlying dermal fibroblasts. A snail is a transcription factor known to induce EMT. However, in this model found that mindin is a chemoattractant of fibroblasts and mediates the initiation of cutaneous inflammation and the development of tumor stroma.

Dr. Dean G. Tang, MD Anderson Cancer Center, Smithville, TX, USA gave a talk entitled, “prostate cancer stem cells: Molecular regulation and clinical relevance.” The gist of the talk was that Cancer stem cells are quiescent and resistant

to anticancer treatment. In prostate cancer, the cancer stem cells are not responsive to chemotherapy as well as hormonal therapy. Screening of miRNA libraries showed several microRNAs to be tumor suppressive. Systemic administration of some of these miRNAs inhibited tumor regeneration as well as metastasis and extended the lives of tumor bearing animals. One such example is of miR34a. Prostate cancer can be stratified into two types; prostate specific antigen (PSA) negative cells and PSA positive cells. The PSA + prostate cancer cells exhibit more limited serial tumor transplant ability. CD44 was shown to be a direct and functional target of miR34a. Ectopic expression of miR34a in CD44+ in PCa cells abolishes tumour regeneration. Dr. Annapoorni Rangarajan, IISc, Bangalore, India presented talk entitled, “targeting the anchorage – independent growth of cancer cells: Links with stemness.” Normal cells require attachment to a substratum for growth and proliferation and detachment leads to anoikis a term used for cell death due to separation from the substratum. Anoikis resistance is one of the hallmarks of cancer and facilitates the tumor cells to survive in circulation and lodge at distant sites to form metastases. The model used for studying anchorage-independent growth was the mammospheres, three dimensional spheroid bodies comprised of cells, which are anchorage-independent and enriched in stem/progenitor cells. Mammospheres have a high activity of AMPK (AMP-activated protein kinase). AMPK facilitates sphere formation by inhibiting apoptosis by phosphorylating PEA-15. Probably circulating tumor cells have a high activity of AMPK and targeting AMPK-PEA15 could be a strategy in controlling metastasis.

Short Talks

In this session there were three talks, Dr. Sambasivarao Damaraju, University of Alberta, Canada presented a talk entitled, “gene-environment lifestyle factors in breast cancer susceptibility: Machine learning tools to build predictive models”. The aim is to build predictive models for breast cancer risk for personalized screening. Dr. Alka Hande, DM Institute of Medical Sciences, Wardha, India spoke on, “the nature of tumor stroma-does pre-existing premalignancy alter it?” Immunohistochemical expression of myofibroblasts in oral submucous fibrosis (OSMF), OSMF with oral squamous cell carcinoma (OSCC) and OSCC patients was done. The conclusions were that OSMF is a high-risk precancerous condition with alterations in ECM. α -smooth muscle actin expression in OSMF was in 26%. OSCC associated with OSMF has a better outcome than OSCC alone. Dr. Sanjeev Waghmare ACTREC, Navi Mumbai, India gave a talk entitled, “secretory phospholipase A2/ enhancing factor in epidermal homeostasis and stem cell regulation.” The model used for this study is the transgenic mouse over-expressing enhancing factor sPLA2-IIA. The

phenotype of these mice is that they are hair-less. The role of enhancing factor in epidermal homeostasis and hair follicle stem cell regulation is being unraveled.

CANCER PREVENTION

The final day began with a very significant and important session and the plenary lecture was rendered by Dr. S. S. Shastri Tata Memorial Hospital, Mumbai, India. The title of his lecture was, “cervical cancer screening in India.” The talk covered the aspects and challenges encountered in conducting large screening studies in a country like India with diverse cultural and societal limitations. Presented data of the large screening study carried out using visual inspection with acetic acid (VIA). The advantage of this screening method were many; simple visual test, does not require a lab, results available immediately and does not require highly qualified personnel and paramedical workers can be trained. The design was based on the cluster randomized controlled study, and a large number of slum clusters were selected. The entire study took 16 years; accrual of women in the study was through the census list and the electoral list. Girls from the slum community were selected and trained for the execution of the screening program. The conclusions drawn from this study were, cervical cancer mortality reduced in the screened group as compared to the control group, 4 rounds of biennial VIA screening led to a 31% cervical cancer mortality reduction; there was no over diagnosis; can prevent 22,000 cervical cancer deaths in India. The talk included that these studies present 3 attractive options for cervical cancer screening; In situations where only a single round of screening is feasible, the best option would be human papillomavirus (HPV)-DNA testing; screen and treat; 4 rounds of biennial VIA screening by paramedical health workers. There were a multitude of questions after this lecture and to mention a few; were spouses screened, % of cervical cancer that is not HPV implicated; can p16 be used instead of HPV screening.

The other talks in this session were by Dr. Victoria Villaflor, University of Chicago, USA The talk covered clinical aspects and advances in the treatment of Head and Neck cancer, data from several trials for the treatment of head and neck cancer were discussed.

Dr. R Sankaranarayanan, IARC, Lyon, France spoke about, “can a single dose of HPV vaccination prevent cervical neoplasia.” A single dose would be better as there would be effective vaccination compliance, cost-effective for developing countries. Data of a randomized controlled trial of 2 versus 3 doses of HPV vaccination in India was presented. The trial had a sample size of 20,000 girls in the 10-18 years age group.

The vaccine was provided by Merck and the funding from Bill and Melinda Gates foundation. The number of girls who received only one dose was 4950 and two doses were given to 3452 girls. None of the girls received the third dose. The findings from this trial were that the titers from both the groups were similar and the avidity index ratio in the single dose was as good as three doses. The conclusions were that a single dose works better than 2 and 3 doses. After the talk there were several questions related to HPV infection and the manifestation of cervical cancer. One of the questions asked often is how many of the women testing positive for HPV actually gets the disease? Repeated and persistent infection is necessary for the infection to lead to disease and would also depend on the immune status of the women.

Dr. Prakash C. Gupta, Sekhsaria Institute for Public Health, Navi Mumbai, India, spoke on, “explosive rise of mouth cancer in India” and presented data which reflected the increase in number of reported cases of mouth cancer in different age groups over a period of 25 years.

Short talks

This was the last session for the day and began with a talk by Dr. Sanjay Gupta, ACTREC, Navi Mumbai, India on, “differential incorporation of histone H2A isoforms in chromatin and their potential implications in development and cancer.” He presented data on the differential expression of the two major H2A isoforms H2A.1 and H2A.2 both in HCC and liver development, their effects on nucleosomal dynamics and cellular proliferation. Dr. V. Poornima, Yerla Dental College, Navi Mumbai, India spoke on “the journey of plakias to carcinoma” Dr. Yogesh Dayma, MIT, USA spoke on “integrated genomic analysis of head and neck squamous cell carcinoma (HNSCC): Evaluation of HNSCC cancer cell lines as tumor models” the talk cautioned researchers on selecting model systems for studies in cancer, especially cell lines used to generate preclinical data as the cell lines very often do not represent the real tumor and could be one of the reasons for lowered efficacy observed subsequently. The selection of the cell line for preclinical studies required for therapeutics would be best done with the ranking score calculated using available data of cell lines and TCGA for the human tumor tissue. Dr. Praveen Kumar Shetty, SDM College of Medical Sciences, Dharwad, India, spoke on, “characterization of biomarker and therapeutic target for triple-negative breast cancer (TNBC).” Presented data on annexin A2 overexpression in TNBC and the possibility of using it as a drug target as these tumors are known to be chemoresistant and are difficult to treat.

At the end of the meeting was the panel discussion moderated by Dr. Nagraj Huilgol and Dr. Gopala Kovvali on Cancer Cure:

Hope or Hype. The panel members were Dr. Pankaj Chaturvedi, Dr. S. S. Shastri, and Dr. Paul Brandt-Rauf with an active audience. During the discussion a lot of questions were aimed at the audience. How many types of cancers are known? What can be done to avoid getting cancer? Discussion on whether the Indian diet is healthy was well accepted by majority and improvement of lifestyle should be implemented was agreed. How does one define hope? Moreover, what is hope? Several issues were debated, funding for cancer research, Food and Drug Administration approval of 21 anti-cancer drugs in the last year, the molecular diversity of the disease increasing its complexity and treatment failures. Hope given to patients is important but need not be false and should be based on the evidence of treatment for any particular cancer. There was also a comment that probably some cancers would be like chronic ailments and would be managed for the lifetime of the patient. The measures taken by the government (India) to curb tobacco-related cancer and the contribution of clinicians (Dr. Pankaj Chaturvedi) from Tata Memorial

Hospital toward implementation and execution of tobacco control were discussed.

The meeting concluded with the valedictory function conducted by the organizing secretary, Dr. Sorab Dalal and the Prize distribution to the students by the conference chairpersons, Dr. S V Chiplunkar and Dr. Gopala Kovvali.

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