Mini-review

Precision medicine – Delivering the goods?

Dan Peer *

Laboratory of NanoMedicine, Department of Cell Research and Immunology, George S. Wise Faculty of Life Sciences, Israel
Department of Materials Sciences and Engineering, Faculty of Engineering, Israel
Center for Nanoscience and Nanotechnology, Tel Aviv University, Tel Aviv 69978, Israel

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A B S T R A C T

Personalized (or precision) medicine aims to individualize therapeutic interventions, based on OMICS data such as genomics, proteomics, metabolomics etc’, profiling together with histopathological insights to the type, stage, and the grade of the disease, as well as on the potential response of a particular patient to a particular treatment regimen. With next generation sequencing technologies, it is now possible to identify all germline variants of an individual in an affordable cost and thus paving the way for clinicians to provide healthcare from an individual perspective. In this special issue of Cancer Letters termed “Trends in Personalized Cancer Research” we bring together physicians and scientists summarizing the state-of-the-art in precision medicine from hematological malignancies and solid tumors with the current gold standard diagnostic and therapy to basic and translational research utilizing nanotechnology and RNA interference strategies for future personalized theranostics in oncology.

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Understanding the molecular pathways of the leading mutations that may result in transformation from a normal cell into cancerous cell and identification of tumor-specific biomarkers has been mostly contributed by large-scale ‘omics’ approaches, leading to the discovery and development of pathway-related targeted drugs and diagnostics. Several dozens of pathway-related targeted drugs are already approved for clinical use for breast cancer, some hematological malignancies, ovarian and colon cancers. These targeted drugs could generally be categorized into two groups: therapeutic monoclonal antibodies, which could target an overexpressed or specific receptors on tumor cells and subsequently mediate cytotoxicity via antibody dependent cell cytotoxicity (ADCC), complement dependent cytotoxicity (CDC) mechanisms or by carrying a toxic determinant (i.e. radioisotope, toxin). The second group is small molecules inhibitors, which specifically inhibit receptor signaling pathways or intracellular enzymatic activity and thus promoting apoptosis in the target tumor cells.

Large-scale gene, protein and metabolite measurements (via ‘omics’ technologies) have driven the resolution of biology to an extraordinary high definition, passing from reductionism to a system-oriented perspective. The rapid advancement of high-throughput technologies at the last decade such as Next Generation Sequencing (NGS) and mass spectrometry for precise proteomics analysis makes it possible to examine biological systems at different levels from whole genome or whole exome sequencing to whole metabolome and proteome with very high resolution and still at affordable costs. The ability to magnify a biological system at different ‘omics’ levels allows the medical community to stratify complex biological phenomena towards understanding of complex pathologies. Consequently, patients could be monitored regularly and personal profiles of multiple ‘omics’, such as the genome, the epigenome, the transcriptome, the proteome, and the metabolome, be collected and integrated to molecular signatures representing the patient’s physiological or pathological state at the specific moment when the sample is taken from the patient. These molecular signatures could enable physicians to individualize risk assessment, diagnosis, and treatment and improve disease management.

In this special issue of Cancer Letters we bring together comprehensive reviews from hemato-oncologists such as Personalized therapy in Chronic Lymphocytic Leukemia [1], Towards precision medicine in childhood leukemia [2], and the potential cure of chronic myeloid leukemia in the 3rd Millennium? [3] together with recent advances in personalized colorectal cancer research [4].

King et al. describes a patient-specific drug efficacy analysis on circulating tumor cells captured from peripheral blood [5] and Moghimi and coworkers suggest a novel strategy towards tumor-directed oligoclonal T cell therapy [6].

In addition, basic understanding at the chemokine receptors CXCR4 and CCR5 as potential targets for personalized treatment
in breast cancer [7] and a perspective essay by IP. Witz on the role
developed by the microenvironment in site specific metastasis shed
light on the importance of microenvironment and chemokines in
the metastasis process [8].
Canaani et al. provide new insights into the potential of long
noncoding human RNAs as new anticancer drug targets [9] and
Howard and coworkers [10] suggest to use such RNA molecules
as therapeutics in cancer treatment. Satchi-Fainaro and Decuzzi
and their respected groups describe novel approaches to theranostic
The group of Padler-Karavani is aiming at the Sweet side of
cancer [12] and a personalized view on cancer immunotherapy is
presented by the group of De Smedt [13]. Closing this special issue,
Rosenblum and Peer providing the vision for the future of personali-
zation of oncology using omics-based nanomedicine [14].
But one question remains open: will personalized cancer care
deliver the goods?
We will certainly learn more in the next five years.

Conflict of Interest

I declare financial interest in Quiet Therapeutics.

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