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Personalized cancer medicine – A strategy to counteract an increasing cancer challenge

The problem of cancer is increasing annually and will only escalate further in the future, mainly due to the aging population. The number of new cancer cases diagnosed will increase by approximately 60% during the next 20 years and cancer mortality by a similar percentage, unless we can improve cure rates. The number of patients living for 5 or more years with a cancer diagnosis is increasing even more, a challenge for the health care systems all over the world (International Agency for Research on Cancer). Clearly, present preventive, clinical and research strategies have not been sufficient to meet these challenges.

At the same time, in recent years there have been enormous advancements in basic research, leading to insights into cancer biology that offer new possibilities for improving prevention, early detection and therapeutics. For several reasons (organization, funding, education, etc.) translation of new information from basic research discoveries into clinical testing of new treatments is too time consuming, as is the movement from clinical research into evidence based cancer medicine for adoption by health care systems. The cancer research continuum is not optimally integrated for efficient translation and the necessary translational cancer research infrastructures are often not in place. Further, the expanding information obtained from cancer biology research demonstrates the complexity and heterogeneity of the many diseases called cancer, with increasing recognition of many tumor sub-types that have different biological characteristics and responses to therapies. The increasing complexity is also evident in the number of competencies needed to deliver high quality care. These include diagnostic disciplines like pathology/cytology, laboratory medicine and imaging, as well as therapeutic specialties including surgery, radiation therapy, medical oncology, psychosocial oncology, rehabilitation, and palliative oncology. This complexity has a huge impact on the organization and design of clinical cancer research and patient care.

To effectively address the increasing challenges cancer medicine must be more predictive and personalized, with effective preventive and early detection programs as well as

treatments that significantly increase survival and cure rates. This issue of *Molecular Oncology* aims at discussing important research areas that represent many of the different aspects of the cancer research continuum needed for development of personalized cancer medicine. These range from cancer biology and clinical investigation to comparative effectiveness research to evaluate outcomes and economic consequences of implementation of personalized cancer medicine. Cancer biology is fundamental for identification of new druggable targets for therapy. Predictive cancer medicine needs the relevant biomarkers for identification of who should be treated and which treatment is optimal regarding both antitumor effects and side-effects, acute and long-term as well. Due to the complexity of the signaling pathways and cross-talk between them, multiple targets will be necessary for effective therapy. Therefore systems biology approaches must be introduced into clinical cancer research. Development of clinical trials driven by molecular pathways also requires new approaches to the design of clinical trials. Important decisions on what and how to treat will be based on histology, molecular pathology and imaging, disciplines which will in future be even more integrated with clinical care. Pharmacogenomics will be an increasingly important tool for prediction of probable efficacy as well as acute and long-term side-effects.

The overwhelming treatment problem is linked to metastatic disease, and therefore medical oncology focusing on biomarker-based targeting of drugs, hormonal treatment and immunotherapy is presented. Biomarker research will also contribute to optimized loco-regional treatment with surgery and radiation therapy. Another area that must be explored clinically in the future is the impact of the host tissue environment on the growth of metastases. A personalized medicine approach to cancer care will be an important strategy to reduce cost and increase value, and expanded infrastructures for outcomes and health economics research are mandatory. Avoiding treatment of patients who are likely to be non-responders to therapy will have an impact not only on the cost of care, but on the quality of life for patients.

When considering the whole cancer research continuum it is obvious that translation requires better integration between different disciplines and new forms of collaborations. An example of a comprehensive cancer center that has organized its research programs to approach personalized cancer medicine is presented, as a paradigm which is relevant to most research-oriented clinical cancer centers. It is also evident that new forms of collaboration between academic and community centers is mandatory to reach the critical mass of selected patients for effective targeted clinical research. The initiative to publish this issue came from the EurocanPlatform consortium linking 28 European cancer research centers and organizations with the aim to develop personalized cancer medicine. The Worldwide Innovative Networking consortium (WIN) is exploring biomarkers and targeted therapies in trials with diverse populations worldwide.

Due to the complexity of the field, it has not been possible to cover all areas of importance for development of personalized cancer medicine in this issue. We hope, however, that the

areas highlighted will stimulate more effective and rapid translation of cancer research into personalized cancer medicine.

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1574-7891/\$ – see front matter

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European Biochemical Societies.

doi:[10.1016/j.molonc.2012.03.002](https://doi.org/10.1016/j.molonc.2012.03.002)

Available online 13 March 2012