Cover illustration
Fluorescence-mediated tomography image showing angiogenesis (red) and protease activity (dark pink) in lung cancer. (Courtesy of R. Weissleder)

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MOLECULAR CANCER DIAGNOSTICS

A myriad of differences in the biological make-up of cancers compared with their healthy-tissue counterparts have been catalogued. Large-scale analyses have detailed the heterogeneity of these changes at the genetic and epigenetic levels, as well as in gene-expression profiles and signal-transduction networks in a wide range of cancers. This knowledge has led to the discovery and regulatory approval of drugs that target cancer-specific pathways.

Even as the first genetic alterations in human cancers were unravelled, scientists proposed that differences between individuals and between the various types of cancer might necessitate personalized therapies. But the drug-discovery process has proven difficult, and the rate of the approval of targeted cancer therapies remains woefully low. A key challenge and priority in cancer research is therefore to identify molecular biomarkers that could be used to improve early diagnosis, as well as to guide prognosis and the design and monitoring of new therapeutic avenues.

This Insight highlights key approaches for the discovery and validation of such biomarkers (or diagnostics) at the level of DNA, RNA and proteins. It also looks at how non-invasive imaging technologies and serum biomarkers can be used to monitor early responses to treatment and guide the therapeutic course.

Translating these advances into personalized cancer care will entail challenges far beyond the scientific discovery and validation strategies. We hope that the articles in this Insight not only bring together key aspects of the translational research into cancer biomarkers but also draw attention to associated issues such as trial design, tissue collection and regulatory requirements.

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Barbara Marte, Alex Eccleston, Deepa Nath, Senior Editors

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