Biopsy and personalized medicine

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Personalized medicine relies upon accurate biopsy. The Perspectives article by David C. Whitcomb (What is personalized medicine and what should it replace? *Nat. Rev. Gastroenterol. Hepatol.* **9**, 418–424 [2012]),¹ mentions cancer, but we wanted to highlight an important area of personalized medicine that is relevant to hepatic and gastrointestinal malignancies. Personalized drugs found their origins in gastrointestinal malignancies with imatinib for gastrointestinal stromal tumours. The role of biopsy might expand beyond diagnosis to facilitate more accurate characterization of which targeted therapies will be effective. In the past 5 years, the emergence of fusion-guided biopsy technologies (Figure 1) has enabled multimodality biopsy, or referencing of the tissue to any image (CT, MRI or PET) in a prospective and accurate way.^{2,3} This ability might facilitate personalized characterization of tumour fingerprints during targeted drug selection or validation, whose success might depend on the presence or absence of specific biomarkers, receptors, mutations or ligands within the tumour. The ability to guide a biopsy needle with metabolic guidance from data from a 3D PET scan or from MRI-based vascular density or diffusion maps might have implications for drug sensitivities, metabolomics, prognosis or validation of intended drug effects.^{4–6} Sequential biopsy (before and after drug administration) has also had a role in drug discovery and validation^{7,8} and could have an enhanced role in the further personalization of gastrointestinal and hepatic cancers. Furthermore, the correlation of imaging features with specific genetic markers is in its infancy, and promises to enhance the importance of biopsy in the personalization of medicine, and highlight the role of imaging as a surrogate biomarker for tissue biology.⁹

Figure 1 | Fusion-guided biopsy for accurate image-to-tissue correlation. **a–d** | PET with CT and ultrasound-guided biopsy can be used to characterize a specific portion of a heterogeneous tumour. Real-time feedback from the fusion of modalities enables the display of a virtual biopsy needle (pale blue line) in relation to the CT and PET scan defined target (blue dots). Tissue sampling is from exactly where the PET scan has the most activity (red circle), which could prove to be a useful tool for tumour characterization during drug discovery and development of personalized medicine. Permission obtained from Elsevier Ltd © Wood, B. J. et al. *J. Vasc. Interv. Radiol.* **8** (8 Suppl.), S257–S263 (2010).

As the function of biopsy continues to expand beyond diagnosis to facilitate improved accuracy of prognosis, metabolomics and tumour susceptibility to drugs, and to facilitate drug discovery for personalized medicine, fusion-guided biopsy using multiple imaging modalities of improved accuracy could prove critical to medical oncologists as they seek to unearth biology from imaging.

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Competing interests

B. J. Wood declares an association with the following company: Philips Healthcare. See the article online for full details of the relationship. H. Amalou declares no competing interests.

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