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A Revolution in Personalized Medicine - from Concept to Reality

Abstract:

We are witnessing the translation of revolutionary medicine tools to the clinic at an unprecedented pace. Physicians and patients are eagerly adopting enabling technologies such as Genome Sequencing, Biomarkers and Non-Invasive Imaging on the diagnostics front, and Vaccines, Therapeutics and Stem Cells on the therapeutic front.

Today, a mere decade since the completion of the first human genome, patients' genomes are sequenced for under \$5000 and the information drives treatment decisions. Biomarkers and personalized medicine are being embraced by both pharma and the FDA, noted by the recent approval of Roche's vemurafenib for melanoma and Pfizer's crizotinib for lung cancer, and simultaneous approval of their companion diagnostic tests. The codevelopment of therapeutics and diagnostics led to cheaper faster development, allowing patients access to life-saving drugs in record time. Both drugs are small molecules, which historically have fared relatively poorly in terms of safety and efficacy; effectively targeting them using personalized diagnostics marks a renaissance for small molecule drugs.

For decades, the quest for cancer vaccines has been fraught with failure, yet within the past year, personalized vaccines for cancer have become both medically and logistically feasible. Another breakthrough that has high clinical potential, similar to vaccines, harnesses induced pluripotent stem cells (iPSCs) as a therapeutic. The clinical translation of these breakthroughs is being enabled by tools that span the in vitro-to-in vivo-to-human (IHH) continuum, and provide more information with less material, thereby solving two key constraints of translational medicine.

Perhaps the most meaningful impact of the medical revolution is the democratization of healthcare, illustrated by the precipitous (~100,000-fold) decline in DNA sequencing costs. Borrowing from industry's best practices, we are building the means to provide 21st century medicine, both preventative and therapeutic, in a sustainable and affordable manner.