

THE SCIENCE OF BETTER MEDICINES



The Harvard Program in Therapeutic Science (HiTS) is building partnerships and developing new ideas and technologies to advance drug discovery and precision medicine.

Improving the treatment of life-threatening diseases, such as cancer and diabetes, requires the discovery and development of new therapies. The road that these therapies must travel is long: it starts with basic science and ends with testing in human patients. Costs are high because the process is unpredictable. Moreover, even if a therapy is successful, not all patients will benefit and some will suffer unintended harm. Research in HiTS focuses on solving these challenges by treating the development and use of therapies as a systems problem – a network of interconnected activities that must each be measured and understood to optimize the output.

HiTS students, fellows and faculty apply interdisciplinary approaches that combine laboratory-based experiments, computer science and molecular medicine to:

- Advance precision medicine in cancer and other diseases by studying the beneficial and adverse effects of new and existing drugs in individual patients.
- Develop and test improved approaches for evaluating drugs in clinical trials to increase the chance that new therapies can be found for complex and incurable diseases such as Alzheimer's disease.
- Create new technologies for predicting and alleviating adverse drug effects and for understanding how drugs work together.
- Provide a rich training ground in therapeutic science for the next generation of scientists and physicians.

Using a Systems Approach to Advance Precision Medicine

Precision medicine at HiTS focuses on improving the accuracy and usability of information needed by chemists to synthesize new drugs and by physicians to select which drugs to prescribe to specific patients. HiTS places a strong emphasis on artificial intelligence, deep learning and mathematics to analyze data from genomics, proteomics and imaging studies, and to better understand the complexity of human disease.

- **Measure it and model it:** HiTS applies a quantitative measure-model approach in which experimental and clinical data are linked together and understood using computer models. We measure the genetic and physiological changes that turn a healthy cell into a diseased cell and ways in which drugs reverse these changes.
- **Mapping the diversity of human disease:** We aim to create a “Google Maps” of cellular biochemistry and plot the traffic accidents and road closures caused by disease. In a sense, therapies overcome or bypass such roadblocks without causing new problems. Fundamental advances in experimental and computational biology are needed to create and use maps of human biology and disease.
- **Data sharing and integration:** Innovation in biomedicine is increasingly dependent on an open innovation model in which data from new laboratory experiments are integrated with publically available big data. HiTS is at the forefront of technologies for sharing complex data with the scientific community and for using artificial intelligence approaches to mine such data.

Scientists, engineers and physicians from multiple universities and research hospitals in the Boston-area find a common home in HiTS and the Harvard Medical School, where they collaborate with biotech, pharmaceutical and device companies to tackle the most important and difficult challenges in drug development.

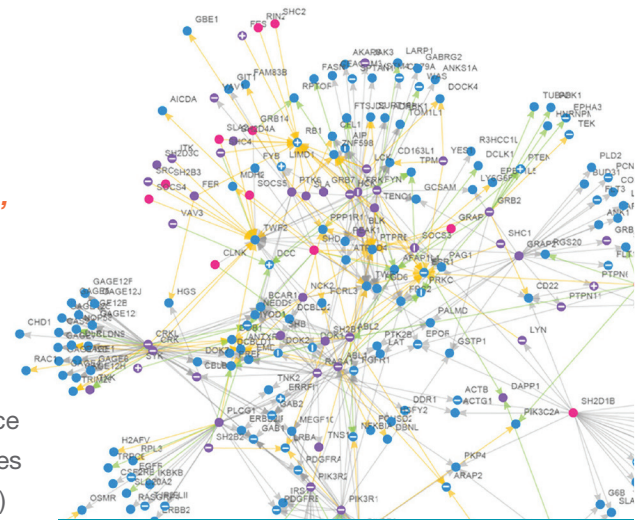
Building a Community to Innovate in Regulatory Science

The promise of cutting-edge medicines such as cell-based therapies and cell-device combinations can only be realized if methods for testing and evaluating such therapies are developed. HiTS works with industry and regulatory agencies (such as the FDA) to fundamentally improve the ways in which drug safety and efficacy are measured in pre-clinical and clinical studies, and to reduce the prevalence of inconclusive or unsuccessful clinical trials.

By understanding the origins of variability in drug response and developing better means for predicting the success and failure of new medicines, therapeutic science will accelerate innovation and save money. This will help to make new therapies available at a cost society can afford.

Training Pioneers in Therapeutic Science

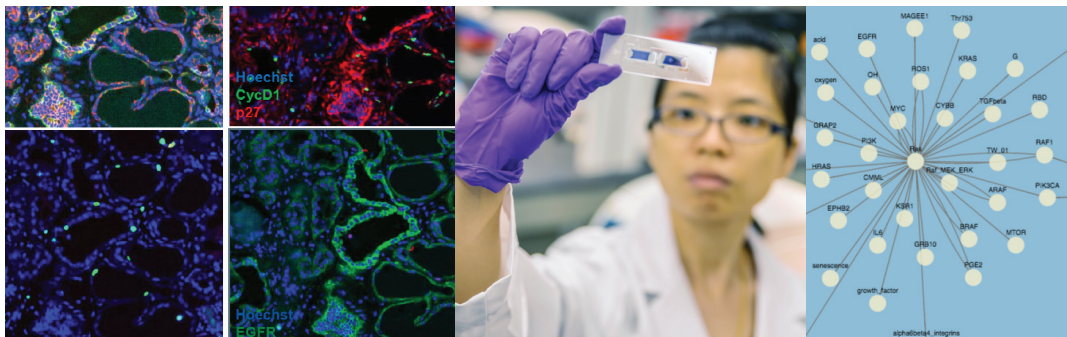
HiTS Training Programs for PhD students and postdoctoral fellows offer rigorous, multidisciplinary training in the laboratory and computational science skills needed to understand drug mechanism of action, develop novel therapeutic concepts, improve clinical trials, understand the reasons for therapeutic failure, and apply new methods to personalized patient care. Training for PhD students includes an intensive, hands-on internship in industry, the clinic or a regulatory agency, and training for postdoctoral fellows focuses on complex interdisciplinary research problems aimed at enabling innovation in academic and entrepreneurial careers. Internships and visiting scientist positions are also available for individuals at other career stages.



Become a Champion

We invite industry and clinical partners and philanthropists to learn more about the Harvard Program in Therapeutic Science and join us in the search for better the medicines.

To learn how you can help, please contact us at hits@harvard.edu and contact Rohan Barrett, HMS Director of Development, at rohan_barrett@hms.harvard.edu



Leadership:

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HiTS

Harvard Program in Therapeutic Science

A Harvard University program based at Harvard Medical School



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