netic test, we're going to have to better understand the meaning of probability." That points to the department's pedagogical mission: educating graduate students (who will become research scientists) and medical students in order to ensure that they know how to use the computational tools in increasingly wide use.

Grappling with Genomic Data

This new approach is consistent with trends in medical education generally. "It's now accepted that in medical school you're only going to learn a tiny fraction of what you need to actually provide expert care for patients," Kohane points out—even in a narrow subdiscipline. Genomics, he adds, has compounded the problem by several orders of magnitude: "There's no way anyone, no matter how manic, is going to know what a million different [gene] variants mean for an individual." Doctors therefore need a computational "decision support infrastructure" that *interprets* a patient's medical history, family history, and genomic background to show what the risks are, as well as the preferred therapies.

Bringing individualized genomic information into the clinic will "accelerate the realization that we need just-in-time decision support," Kohane continues. But "process automation"—such as digitizing medical records to streamline hospital operations and doctors' offices—is nowhere near that capability, so tackling that problem is on the new department's agenda, too.

Such a system might do what Google has done for maps: layer atop a location's geographical coordinates all kinds of other useful information, such as current weather or crowd-sourced data on good places to walk or dine. Imagine if environmental exposures, genetic makeup, lifestyle habits, diet, and epigenetic information (about which genes are actually turned on or off) were "mapped" onto patient records. "Stacking that all together," he says, will provide "a better understanding of the patient as a whole" in order to predict, for example, if someone is at risk for diabetes.

New Models of Diagnosis and Care

Two years ago, Kohane and colleagues demonstrated the power of integrating genetic data into diagnoses in a contest, the Clarity Challenge (see www.irdirc.org/?p=2892). Thirty teams of doctors around the world were given the histories

HARVARD PORTRAIT

Jelani Nelson

Jelani Nelson lights up when he talks about algorithms. The soft-spoken assistant professor of computer science is a rising star in a field made vital as data proliferate exponentially faster than the growth of computational power or storage. Algorithms, well-defined procedures for carrying out computational tasks, speed the way to answers. Nelson has a knack for speed: online, where he is known as "minilek"—a handle chosen in youth when he was growing up on St. Thomas, and derived from the name of an early ruler of Ethiopia, whence his mother hails—he has won with equal ease coding competitions and typing contests (topping out above 200 words per minute). Though he is a theorist now, solving real problems quickly "cements the concepts in your mind," he says. Borne of that conviction, every homework assignment in his undergraduate course Computer Science 124, "Data Structures and Algorithms," includes an algorithmic programming problem. His own student years were spent practically next door, at MIT, where he majored in mathematics and computer science, and remained to earn a Ph.D. in the latter field. He came to Harvard in 2013 after postdoctoral research at Berkeley and Princeton's Institute for Advanced Study. Nelson's specialty is "sketching," an approach to dealing with problems in which there are "too many data in the input." He figures out how to create compressed, often exponentially smaller, versions of datasets that nevertheless retain useful, accurate information. His proofs defining the limits of such approaches have illuminated fundamental questions, some of them unanswered for decades. Though he is humble and quiet, his colleagues are less reserved: they call him "simply brilliant." ~JONATHAN SHAW

Photograph by Jim Harrison