Targeting cancer and careers: Precision Medicine

The migration away from “one-size-fits-all” medicine, particularly in the areas of cancer detection and treatment, holds great promise for patients and the field of precision medicine. Demand and jobs are increasing for researchers, clinicians, and professionals who are at home collecting, analyzing, and using more and newer forms of data. By Ellen R. Delisio

In the field of oncology, innovations continue to grow rapidly in precision, or targeted medicine, as clinicians seek to find better treatments for specific kinds of cancer, rather than take a blanket approach via the traditional trifecta of radiation, chemotherapy, and surgery. To do so, they must test patients, note mutations, and identify biomarkers to determine what treatments could work best with the fewest side effects.

Scientific breakthroughs, in these areas and more, have led to greater understanding of genes and their functions and have created new opportunities for precision medicine—and for those with technical, research, and clinical skills eager to work in this ever-expanding field. Special consideration will be given to those job applicants who can perform big data analysis and multidisciplinary research. However, new jobs will also emerge in previously unseen areas, such as business, translational medicine, and genetic counseling.

“The theory of precision medicine is exciting and clear—deliver the right medicine, at the right time, to the right patient. But, in practice, it can be quite challenging—identifying how to develop a medicine with the right biomarker is actually really tough,” says Thomas Hudson, vice president, oncology discovery at AbbVie, a biopharmaceutical company with a major interest in cancer research, headquartered in Lake Bluff, Illinois. “It will take the collective efforts of multiple stakeholders coming together.”

Government projects lend a hand

New and powerful tools have aided the precision medicine movement. The Human Genome Project, the first complete mapping of human genes, published its preliminary results in 2001. The project’s numerous benefits include knowing the location of the approximately 20,500 genes identified in the body and gaining a clearer understanding of how genes are organized and operate.

“The Genome Project has significantly improved our ability to learn how tumor cells work at the molecular level—the more we learn their inner workings, the better we’re able to develop effective therapies,” says Andrea Califano, chair of the Columbia University Department of Systems Biology, director of the JP Sulzberger Columbia Genome Center, and associate director for Bioinformatics of the Herbert Irving Comprehensive Cancer Center, in New York City. “Right now, we... cont.>
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know that using drugs targeting specific molecular dependencies of the cancer cell leads to significant increase in response. We expect that the future of medicine is going to be even more predictive, rather than being based on trial and error.”

The next big game-changer was the Precision Medicine Initiative, launched by President Obama in 2015, with USD 215 million in the 2016 federal budget. The allocation included USD 70 million for the National Cancer Institute (NCI) at the U.S. National Institutes of Health (NIH) in Bethesda, Maryland, to accelerate programs to single-out genomic drivers of cancer and to use that knowledge to create more effective treatments. Also part of the package was USD 130 million for NIH to collect the health profiles of 1 million Americans and establish a database that can be shared and used for research.

Called All of Us, the database project aims to gather information from as many different segments of the population as possible, says Kelly Gebo, M.D., M.P.H., chief medical and scientific officer of the All of Us Research Program. “We know different people respond to different types of medicines,” says Gebo. “We’re trying to do research on a diverse group of people that traditionally have not been included in biomedical research.”

While researchers often look at factors such as gender, All of Us is recording other information including age, income, and education. “We want to try to look at [these other] differences in populations and how they affect clinical outcomes in the field,” Gebo says.

Since the program launched on May 6, 2018, 150,000 volunteers have registered, 90,000 of whom have supplied data about their health and family history. The goal is to have people stay with the program for several years, updating their health information. NIH has gone to great lengths to ensure participants’ privacy and intends to create a data platform that can be used by all scientists, as well as other companies and individuals.

“This is going to be a tremendous data resource that allows us to look at information we never could before,” continues Gebo. “I look forward to researchers getting their hands dirty as they look into the data.”

Companies get into the act

One of the fastest-growing precision medicine approaches, thanks to the availability of more genetic information, is the development of cancer drugs that target specific types of cancer and are effective in individuals with a particular genetic makeup or biomarker.

“How do we understand the genetic architecture of each cancer. Sometimes it is better to know the genetic basis of cancer rather than its location. Drugs are being developed based on cancer’s genetic vulnerability rather than [on] tissue of origin,” says Chris Boshoff, chief development officer at Pfizer Oncology in New York City, citing as an example the fact that lung cancer has at least 10 different subtypes. Currently, Pfizer has 14 cancer drugs approved, and out of those, seven are based on precision medicine and target a specific subtype of lung cancer, he says.

Some companies are even more specialized, such as Loxo Oncology in Stamford, Connecticut, (recently acquired by Eli Lilly), which focuses on treatments for cancers caused by a single DNA abnormality. A single drug could have a dramatic effect on that type of cancer.

“I’m excited about the work—you take a biopsy of a tumor and use next-generation sequencing to identify alterations in the DNA or RNA that indicate why it became cancer in the first place and help you identify vulnerabilities against which we can use drugs,” says Loxo’s CEO Josh Bilenker.

One new trend in precision medicine is noninvasive testing, according to a statement from Novartis. While cancer is traditionally diagnosed with solid tumor biopsies, some scientists are using blood tests known as liquid biopsies, followed by genomic analysis of fragments of tumor DNA found in the bloodstream. These DNA remnants reveal the kinds of mutations that may be driving a patient’s cancer and could provide clues about how to treat it. Novartis researchers have been developing liquid biopsy technologies for several years and are now working to make them a reality in clinical practice.

Novartis has also launched several targeted medications, such as Gleevec, which was the first in a new class of drugs for precision medicine known as tyrosine kinase inhibitors. Gleevec treats forms of leukemia—chronic myelogenous leukemia and acute lymphocytic leukemia—that were often deadly in the past, but are now treatable, chronic diseases.

Overcoming obstacles

Developing precision medicine treatments is not without challenges. These include the cost of testing and implementation, the fickle and resilient nature of cancer, and the volumes of data and regulations that researchers must deal with. Lack of uniformity in testing also hinders the field.

The complexity of drug discovery and development can also slow progress. Enter Harvard Business School’s Kraft Precision Medicine Accelerator, whose mission is to streamline processes so patients get treatments sooner. “We’re trying to apply business thinking to blockages in the system,” says Richard Hamermesh, faculty cochairman of the accelerator.

The initiative was funded by a USD 20 million endowment from Robert Kraft, owner of the New England Patriots. Kraft’s wife, Myra, died from ovarian cancer, and received targeted therapy late in her treatment, but her disease had progressed too far. “The experience made him realize there is a lot of friction in the system. If it could be eliminated, treatments could come to market faster,” says Hamermesh.

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Opportunities galore

As precision medicine grows and evolves, so will job opportunities, and not just for researchers and clinicians, although they will continue to make up the major share of the workforce.

“Career opportunities in precision medicine encompass a broad, multidisciplinary spectrum of capabilities, and also range from the discovery and preclinical [stages] to clinical development settings,” says Steffan N. Ho, vice president and head of translational oncology at Pfizer, adding that key job candidates will be individuals with expertise in cancer biology, immunology, bioinformatics, clinical laboratory science, and platform technologies supporting sample analysis and diagnostic test development.

At AbbVie, the number of people working in precision medicine in the oncology department grew from 30 to 60 in two years, says Hudson. “I see a lot of growth [for precision medicine] in pharmaceutical and diagnostic companies,” he says. “Companies will also need more specialized people who can analyze biomarkers and look at tissue samples.”

Data analysts will be some of the most sought-after personnel, professionals agree, since the volume of information coming from multiple sources will continue to grow.

“Big data needs clever, thoughtful analysis,” says Benedict C. S. Cross, head of functional genomic screening at Horizon Discovery, a translational genomics company based in Cambridge, England, which supplies pharmaceutical companies, researchers, and academia with cell lines that have been genetically modified to mimic diseases. “The more data you have, the greater the chance of better outcomes.” And the faster that data can be processed, the faster it can be translated into treatment options, he says.

Califano concurs. “There is going to be a tremendous requirement for analytical pipeline specialists—people who are able to perform sophisticated data analysis,” he says.

Wanted: Multitalented individuals

Precision medicine, and the life sciences in general, have become increasingly multidisciplinary and collaborative, explains Ho, and require professionals with multiple skill sets. “A degree of fluency in one or more fields outside an area of core expertise is needed in order to effectively communicate across disciplines,” he says.

Cross agrees. Bench scientists, computational scientists, geneticists, and other researchers will need to be able to synthesize many different types of information, he notes.

The wealth of existing data could also create the demand for more professionals to help patients process it, observes Califano. “I see a need for more genetic counselors,” he says. “When you get the whole genome, you see what else is there. If something is found by chance, should the patient be notified? It could be a fairly complicated process.”

Two new professional opportunities in precision medicine stem from the translational medicine and cellular and computational biology fields, says Klaus Hoeflich, vice president, biology, at Blueprint Medicines, with headquarters in Cambridge, Massachusetts and Zug, Switzerland. The company develops precision therapies that selectively target protein kinases, key signaling enzymes that are proven drivers of cancer progression.

Translational medicine in this arena involves applying advances in sequencing and biomarker assays to identify which patients are most likely to respond to treatment. “An emerging research area is to advance patient selection in immunology and immunotherapy to make it more like precision medicine,” Hoeflich says.

Cellular and computational biology will be called upon more and more to manage in-depth analysis of a broad range of data. “We are increasingly integrating additional molecular and genomic data, including from tumor and liquid biopsies, via machine learning and artificial intelligence, to reveal new insights,” says Hoeflich.

As entities form partnerships, explore licensing, and develop marketing and distribution plans for new products, opportunities will open up for business professionals, says Hamermesh, adding that the Harvard Business School’s Kraft Precision Medicine Accelerator was not started to create jobs.

And growth is continuing, asserts Califano. “We are in the infancy of precision medicine—we are setting the stage for what the future will be.”

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