Science to Watch in 2018: From Immunotherapy to Gene Therapy, Big Data to New Tech

Fred Hutch experts lend their predictions for the coming year's advances

January 12, 2018 By Rachel Tompa

2017 was a banner year for cancer and other medical research in the U.S. Two different types of engineered cell therapies were approved to treat cancer. The first gene editing experiment in a human body was performed. And initiatives kicked off to help scientists share and harness massive amounts of data to accelerate discovery.

As 2018 kicks off, we asked experts at Fred Hutchinson Cancer Research Center what advances to watch for in the coming year.

The scientists aren't psychic, they warned us. But they've got their ears to the ground in their respective fields and can see trends on the horizon.

Cancer immunotherapy, precision oncology and gene therapies will continue to see rapid advances on the clinical and research fronts, driven by leaps in new technology and big data.

Other topics we'll be keeping tabs on? The rising costs of health care in the face of health insurance fluctuations, promising infectious disease research, and new ways to maintain a healthy lifestyle and lower cancer risk.

Momentum in cancer immunotherapy continues

CAR T-cell therapy was arguably 2017's hottest news in the cancer research field, both the Food and Drug Administration approval of the first two commercial T-cell therapies for two specific types of blood cancers and the publication of studies showing the success of other, experimental T cell therapies in other blood cancers.

Don't expect that momentum to slow down any time soon, said Fred Hutch immunotherapy researcher Phil Greenberg, MD.

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“2018 should be a watershed year for therapy of cancer with engineered T cells,” Greenberg said. “The breadth of malignancies that can be targeted with T cells will increase, and the use of existing and developing technologies to enhance the activity of these T cells will make this therapy increasingly useful and effective.”

Fred Hutch T-cell therapy researchers traditionally have focused on blood cancers, although they also recently launched a trial that includes patients with lung cancer and triple-negative breast cancer and another trial for patients with melanoma. In 2018, Hutch researchers will broaden their efforts to include many more solid tumors and more blood cancer types, including ovarian, lung, head and neck, and gastric cancers, and multiple myeloma.

Other forms of immunotherapy are also gaining steam. 2017 brought the first hints that personalized cancer vaccines — tailor-made to individuals’ own tumors — could work to combat cancer. “2018 may be the year where [personalized cancer vaccines] start finding their place in immunotherapy,” Greenberg said.

Immunotherapy researcher Mac Cheever, MD, who directs the Fred Hutch-headquartered and National Cancer Institute-funded Cancer Immunotherapy Trials Network, agreed that 2018 will see more effective immunotherapy regimens, primarily checkpoint inhibitors in combination with other agents. Checkpoint inhibitors act by releasing the brakes that tumor cells put on the immune system.

Five years ago, researchers predicted that immunotherapies would be the backbone of 60 percent of cancer therapy in the next decade, Cheever said.

“In 2018, the 2013 prediction will come true in five years rather than in 10,” he said.

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Fred Hutch prostate cancer researcher Pete Nelson, MD, pointed to another 2017 watershed moment: The approval of the checkpoint inhibitor pembrolizumab to treat any tumor that bears a certain genetic alteration. That was the first approval of a drug for patients based on genomics rather than in which organ the tumor began, a convergence of immunotherapy and precision oncology advances.

“I think there will be more drugs approved, hopefully in the next year if not the year after, that will link a genomic feature to a drug,” Nelson said.

New technology will drive advances

As the demand for immunotherapy research, especially clinical trials, increases, the equipment needs to match that demand, said Andrew Berger. He directs the Hutch’s flow cytometry facility, which houses shared equipment used to sort cells into very specific groups — a core necessity for immunotherapy studies.

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A few years ago, Berger and his colleagues started talking with Sony Biotechnology to create a new type of cell sorter tailored for the type of cell sorting required in immunotherapy clinical trials. The first unit ever made was recently installed at the Hutch — and it’s going to dramatically expand the facility’s capacity for producing specific populations of immune cells, Berger said.

“We’re going to be able to scale these projects and do more of them,” he said. “With our old system, we could at best [sort cells from] one or two [patients] a week. With the Sony, it could be possible to do more than one a day.”

New technologies will act as an accelerant not just for immunotherapy but across the research spectrum.

“Basic biomedical science in 2018 will be even more technology-driven than it was in 2017,” said director of the Hutch’s Basic Sciences Division Jonathan Cooper, PhD.

That means an even larger role for those who manage the Hutch’s shared scientific resources like Berger and Julio Vazquez, PhD, director of the Hutch’s scientific imaging facility. Vazquez described new microscope systems that allow researchers to watch cells in real time at incredible levels of detail — like immune cells attacking and killing tumors or cells migrating during development.

Genetic sequencing technologies continue to improve as their costs go down, allowing researchers to capture larger data sets. Fred Hutch evolutionary biologist Trevor Bedford, PhD, pointed to the power of these technologies to help teams like his learn more about human immunity, including better understanding how our bodies respond to HIV and other diseases, which could vastly improve vaccine development.

In many cases, the new technologies also mean tidal waves of data.

Big data will continue to shift how science is done

“We’ll be swamped in data,” said Cooper. “The breakthroughs will come from those able to see new types of patterns that require new concepts to explain.”

Fred Hutch epidemiologist Polly Newcomb, MD, MPH, says she sees her entire field changing course, thanks to new abilities to mine and analyze large amounts of patients’ medical information (with their consent, of course). Previously, epidemiologists had to proactively and painstakingly collect data and samples, she said.

“In the coming years, I am confident that most health studies will leverage information that has been collected for clinical care,” Newcomb said. “There is so much we don’t know, but I am convinced the salient data is out there, we just need to figure out how to structure our observations.”

For biomedical research, ‘2018 will be the year of the commons.’

Researchers in many fields are coming up with new ways to store, share and find meaning in these reams and reams of data. Often, the amount of data generated from modern experiments is more than any single research center can handle, leading to unprecedented efforts to wrangle this information collaboratively and internationally in what are being called scientific data commons.

For biomedical research, “2018 will be the year of the commons,” said Matthew Trunnell, Fred Hutch’s chief information officer.

Trunnell presides over the rapidly growing Hutch Data Commonwealth, which will allow scientists to store and analyze their research data collaboratively using offsite, cloud-computing resources. These data commons are happening all around the U.S., spurred in part by new federal initiatives to pool data from projects funded by the National Institutes of Health.

However these initiatives evolve, sharing information will be key to realizing the promise of precision oncology, said Fred Hutch brain cancer researcher Eric Holland, MD, PhD.

“People have to start sharing the data in such a way that we can reference data sets to make better decisions,” he said. “That’s going to require sophisticated mechanisms of sharing and incentivized sharing of some sort.”

Gene editing and gene therapy

Like immunotherapy and precision oncology, the gene editing field will see a host of advances, our experts said.

“I would be on the lookout for reports of new and increasingly ambitious attempts to correct genetic disorders through gene editing and gene correction strategies,” said Fred Hutch protein engineering researcher Barry Stoddard, PhD. He referenced the example of the first in-human gene editing that happened in California late last year, which aimed to correct a gene that caused a rare metabolic disorder called Hunter syndrome.

I predict more attention on affordability of gene therapy treatments

Hutch clinical researcher Jennifer Adair, PhD, expects more investors will be interested in supporting gene therapy clinical trials, especially on the heels of the first FDA approval of a gene therapy to treat a rare form of inherited blindness.

And given that the newly approved therapy costs upwards of $1 million, Adair said, “I predict more attention on affordability of gene therapy treatments, which will push research in accessibility, portability and simplified delivery.” Adair is working on a portable “gene therapy in a box” that could lower the technique’s cost and make it more accessible in developing countries.

Health insurance policies in flux, drug prices on the rise

Speaking of health care costs, Fred Hutch health economist Gary Lyman, MD, MPH, co-director of the Hutchinson Institute for Cancer Outcomes Research, or HICOR, put his prediction bluntly: In 2018, “drug prices will continue to rise, limiting access and causing considerable hardship,” he said.

HICOR’s other co-director, Scott Ramsey, MD, MPH, also a health economist, is concerned about how changes in federal policy will affect insurance and health care costs for cancer patients.

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“Federal and state policies regarding health insurance are in flux,” he said. “While it is difficult to predict what will happen in 2018, it is clear that many changes — both those proposed and those being implemented by the Trump administration — will impact cancer patients.”

Improvements — and challenges — in combating infectious diseases

Steve Pergam, MD, MPH, a Fred Hutch infectious disease researcher and director of Infection Prevention at Seattle Cancer Care Alliance, is looking forward to advances in infection prevention for patients who receive blood stem cell transplants. In late 2017, the FDA approved the first new drug in decades for preventing deadly cytomegalovirus infections, one of the most common infectious complications after transplant. Researchers from top U.S. cancer centers, including Fred Hutch infectious disease researcher Michael Boeckh, MD, PhD, took part in the large clinical trial of that antiviral drug, letermovir.

”This agent will provide a new avenue to prevention,” Pergam said. “If we can prevent one of the main viral infections in bone marrow transplant patients, that would be a game changer for us.”

While a new drug for CMV is welcome news, infectious disease experts who look out for immune-compromised patients have other concerns. One is the growing threat of drug-resistant bacteria.

“All of us are scared about the spread of bacterial resistance around the world and the fact that we’re losing our antibiotic choices,” Pergam said. Cancer centers such as SCCA work to prevent resistance and preserve treatment options through careful antibiotic stewardship.

New strategies for lowering cancer risk

Fred Hutch cancer prevention researchers face another difficult challenge: Getting people to lower their risk of cancer by adopting healthier lifestyles. Their predictions for 2018? “New strategies to get people to make and sustain changes,” said Johanna Lampe, PhD, RD, associate director of the Fred Hutch Public Health Sciences Division. For example, rather than focusing on individual food components, she said, emphasis will shift toward understanding dietary patterns and the totality of diet to help people make healthy choices.

Fred Hutch epidemiologist Anne McTiernan, MD, PhD, studies the interplay between markers of cancer risk and diet and exercise. Again and again, she and her colleagues have seen that losing weight or maintaining a healthy weight lowers markers of risk of many types of cancer.

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individual’s health needs and challenges. Technology will be the way to get us there.

“In 2018, we’ll better understand how sustained weight loss can mitigate cancer risk factors driven by obesity,” McTiernan said.

For those looking for personalized help with their health — any aspect of it — more is on the way, said Fred Hutch smoking cessation researcher Jonathan Bricker, PhD. And once again, new tech will play a key role.

“2018 and the coming years will bring a more personalized approach that will adapt to each individual’s health needs and challenges,” he said. “Technology will be the way to get us there.”

Sabin Russell, Mary Engel and other Fred Hutch staff writers contributed to this story.

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