with better chances of success is a common strategy. But Stassun says that sometimes the best option is just to push through. "The single most important thing you can do is pull the bedcovers back and walk out the door," he says. He uses ShareLaTeX, a shared online text-editing application, as a quick way to check for stalled project manuscripts. Stuck trainees should find one thing that they can write down, he says — maybe it's one paragraph describing an experimental set-up or one paragraph of the introduction explaining a piece of background research.

Some senior scientists like to remind more-junior researchers that everyone gets mired at some point — it's how they handle it that determines their success. When third-year PhD candidate Alice Bachmann, a member of Straube's lab, got stuck for nearly 18 months on how best to prove that she had depleted a protein from her rat cells, she recalled the mantra of a friend: "If Plan A is not working, there are 26 letters in the alphabet." Plan D ended up working, after she repeated it many times. Astrophysicist Rodolfo Montez Jr, a support scientist for the Chandra mission at the Smithsonian Astrophysical Observatory in Cambridge, Massachusetts, notes that he spends most of his research time running up against 'bugs' when computing an equation for an astronomical observation. "Solving the bug is now what your job is. It's not a nuisance, it's part of the path, and it's cool," he says.

That psychology of 'flipping' failure on its head is a recurring theme among lab leaders: embrace the failures, embrace the spinning wheels, embrace the bad weather at the field station. These things force researchers to get more creative and to approach problems in fresh ways. That, the leaders add, is when true discovery often happens.

"Don't wait till they get stuck! The time to intervene is way before someone is despondent."

Ultimately, the research enterprise works best when energy and enthusiasm remain high, even in the face of rejection, failure and defeat. "Keeping morale up in the lab is one of the most important aspects of trying to succeed," says Vogelstein, whose group has identified more than a dozen major cancer genes, including the most common culprits in colon cancer.

"Succeeding in science is difficult," he says. "We are always competing: for publications, for grants, for experiments. We are fighting battles all the time. The best thing to hear in the lab are the words, 'It worked!'. You might think after 35 years it gets old, but it doesn't." ■

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TURNING POINT
Nanotech bridge

Hossam Haick, a nanotechnology researcher at the Technion-Israel Institute of Technology in Haifa, has developed devices to detect cancer using exhaled breath rather than through biopsies. But, he explains, life in Israel can be difficult for Arab scientists. He is therefore trying to use his science to bridge cultural boundaries.

ITZHAR VARDI

How many Arab professors are at the Technion?
Out of 600 faculty members, there are 9 Arab professors. The Arab community in Israel is 20% of the population, but in academia, it is roughly 1%. There is a pervasive belief in Israel that the Arab community is not educated. I try to dispel that notion.

How did you get the idea to use breath to diagnose disease?
I read a lot of the history. From the ancient Greeks 2,400 years ago to Alexander Graham Bell in the early 1900s, there were long-standing hypotheses of the smell of chronic disease in breath. I also heard hypotheses that dogs could smell cancer. I decided to see if I could prove scientifically whether there is something about exhaled breath that can reveal signs of disease.

At what stage is the research?
We have shown that exhaled breath contains unique fingerprints of specific diseases. We have lab results, as well as animal experiments. We have run clinical studies with 5,000 patients across 19 departments and 9 institutions, where we collected breath with a small device called NaNose, which is able to detect more than 1,000 different compounds in the breath from all of these people. We started with lung cancer, and have extended studies to gastric, colorectal and breast cancers, as well as to degenerative disease such as Parkinson's, Alzheimer's and multiple sclerosis. In the case of lung cancer, we are able to discriminate between benign and malignant tumours with 88% accuracy. By using breath to discriminate between benign and malignant tumours, we could save people from having to undergo unnecessary biopsies and surgeries.

Will this be in use soon?
We have built technology in a portable device that can detect disease in an easy and inexpensive way — only a few thousand dollars. Three companies have obtained the licence from Technion.

How else are you building on this technology?
We are also working on Sniffphone. The idea is to bring breath analysers into smartphones. If a risk is found, the smartphone could send the results to a physician.

How do you try to improve relations between Arabs and Jews in Israel?
In a research institute, you are judged on excellence and achievements. That's not the reality outside an academic institute, however. And in the Arab sector, there is a belief that whatever you do, you will not excel in Israel, unfortunately. As scientists, our role in the community is not only to produce papers. We have to disseminate the results and provide a message for the community. I volunteer to go to many community schools, both Jewish and Arab, to talk about science. These efforts consume a lot of my personal time. Every year, I give 200 lectures in schools. This is huge, considering I lead three research consortia. But it's important.

How else do you pursue outreach?
A professor at the Technion had the idea that we should disseminate the fundamental principles behind nanotechnology and nanosensor research. We decided to present the course in a digital way, to talk to people beyond the boundaries of Israel. I said I would only do it if courses were offered in English and Hebrew, as well as in Arabic, so as not to discriminate. We have many people from Arab countries that have taken the course. One of the nicest data points is that 900 of those people who took my course were from Iran, which has huge political sensitivities with Israel. My students come from 127 countries worldwide, an indication that education, science and technology can serve for peace. ■

INTERVIEW BY VIRGINIA GEWIN

This interview has been edited for length and clarity.