Suspended in a gelatin infused with growth factors, small clusters of cells extracted from a cancer-stricken pancreas divide and grow, extending upward and outward. Slowly, shapes take form—spheres whose outer surface is composed of a single layer of cells, each filled with a slurry of all the protein building blocks and nutrients necessary for growth. All cancer research relies on a steady supply of cells—both normal and cancerous. By comparing normal cells to cancer cells, scientists can identify the changes that lead to disease—information useful in developing effective therapies. In many cancer types, researchers obtain cells during surgery or autopsy. But since 85 percent of pancreatic cancer patients are ineligible for surgery at the time of diagnosis, there are few opportunities to obtain tissue to study in the lab. When researchers do get their hands on pancreatic cancer cells, growing them in plastic Petri dishes and testing potential drugs against them has provided flashes of hope, but the results have ultimately disappointed. “We’re very good at killing those cells in culture dishes, but once we try to kill those same cells in the patients, we find that their tumors are much more complicated,” says Danielle Engle, a postdoctoral researcher in Tuveson’s lab.

Pancreatic tumors are comparatively complex. Only 10 percent is composed of cancer cells; the rest is a combination of fibroblasts (cells that give structure to tissue), blood vessels, and immune cells. This mix forms a “stromal shell” that can be hard for drugs to penetrate. Looking to test therapies on a more representative model of pancreatic tumors, including the confounding stromal shell, Tuveson turned to organoids.

In his former position at Cambridge University in the UK, Tuveson struck up a friendship with Dutch researcher Hans Clevers, who developed a general technique for creating organoids. “I take care of patients with pancreatic cancer,” explains Tuveson, “and I was just sick and tired of watching everything going so slowly towards helping individual patients.” He collaborated with Clevers to perfect a method of fabricating organoids from pancreatic cells.

Creating enough organoids to test a variety of drugs for an individual patient takes about two weeks. Tuveson and his team obtain cell samples from patients—either during surgery or a needle biopsy. Then they cultivate the cells into dozens of the spherical 3D tumor facsimiles. Once developed, the organoids are transferred into the pancreas of several mice and allowed to form tumors, providing the team with a chance to simultaneously test different therapies. They probe the organoids to identify molecular pathways contributing to their growth and try to target those pathways with various drugs to see if survival rates improve.

In addition to deriving personalized therapies for patients, organoids can be used to identify biomarkers—molecular signatures of disease that can aid diagnosis. “Before, when you grew these cells in a dish, you could only grow fully cancerous cells,” says Engle. But with organoids, each stage of the cancer can be grown. Studying differences across organoids from many patients could help identify reliable biomarkers. “This would give us a way of finding pancreatic cancer early enough that more patients would be eligible for surgery,” says Engle.

Because patients live on average only 6 months past their diagnosis, pancreatic cancer has been viewed as an incredibly fast-moving disease. However, two recent studies suggest that the progression from the cancer’s initiating events to an overt malignancy can take more than 10 years. After that, spread throughout the body can take another 5–7 years. “That means we have at least a decade to find these tumors before they spread,” says Lindsey Baker, a postdoc who has worked closely with Tuveson, Engle and others to make organoids a tool that might help change the prognosis for pancreatic cancer patients.

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