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The smallest sprout shows there is really no death;
And if ever there was, it led forward life, and does not wait at the end to arrest it,
And ceas'd the moment life appear'd.
—Walt Whitman

The notion of regeneration can be considered in many ways. Here are three, starting with the fact that if you were a planarian flatworm, you could be cut into 16 pieces and, in a few days, there would be 16 of you. You'd grow 15 new heads along with all of your other important parts, and you'd be just fine. Every one of you, that is.

These fascinating animals caught the attention of Alejandro Sánchez Alvarado early in his career. No other researcher was paying attention to planaria when Dr. Alvarado decided to build a lab around them in 1995. First, he spent a year reading about thousands of species he might use for a career-building model. He decided on the freshwater planarian *Schmidtea mediterranea*, which is endowed with abundant pluripotent stem cells of a certain stripe that allow it to rebuild itself as needed.

Of course, you and I are not planaria, but there's a little flatworm in all of us. Human bodies churn out billions of new cells daily to keep things ticking, notably the skin and liver.

Dr. Alvarado visited Pittsburgh to give the Mellon Lecture at our annual Science Festival this fall. His lab at the Stowers Institute has developed molecular tools allowing him to uncover hundreds of genes related to regeneration and its intertwined mechanisms. Among other discoveries, he found a key molecular switch for regeneration that is not turned on in humans. Perhaps to the good, since evolution would likely not allow there to be 16 humans with identical affective and cognitive brains!

I keep thinking about Dr. Alvarado's talk, because it was brilliant, and because this is a time when resiliency and regeneration are needed more broadly.

In this regard, I was struck by a recent talk by Zanny Minton Beddoes, the editor in chief of the *Economist*. She speaks of the five shocks our society is now experiencing: the digital shock (artificial intelligence/big data); the economic shock (e.g., the manufacturing shift to high technology); the geopolitical shock (China's global ascendancy); the demographic shock (massive immigration waves); and climate. All five shocks are interdependent: We're undergoing a technological revolution that's creating a profound and widening skill and income inequality with great economic consequences. These consequences include demographic jolts as waves of migrants seek refuge from poverty and danger; in response, populism and nationalism are rising suddenly and globally. China seems poised to outpace the world. And our climate may well be out of control. As our climate system puts on epic and devastating spectacles, we can expect more shifts and shocks.

These can be frightening times, and it's easy to feel paralyzed. Yet, as Pittsburghers in particular have shown again and again, we have the ability to breathe new life into our world. After all, we got through the Industrial Revolution, which shocked our manufacturing and economic bases, led to massive but welcome immigration and global ascendancy, and turned the streetlights on in our smoky city at noon! This is our regenerative story. We reinvent ourselves and discover our own pluripotency.

Now for my own pluripotency, this little essay's third regeneration. Soon I will move to a new career as my decanal successor arrives: morphing into a physician-scientist intrigued with the challenges of research on the brain, applying what I know about cellular DNA damage and repair to neurons and glia, and hopefully keeping my own head—not 16!



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