

EPILOGUE

The sanction of experienced fact as a face of truth is a profound subject, and the mainspring which has moved our civilization since the Renaissance.

—JACOB BRONOWSKI

I began this book with another quote from Jacob Bronowski:

Dream or nightmare, we have to live our experience as it is, and we have to live it awake. We live in a world which is penetrated through and through by science and which is both whole and real. We cannot turn it into a game simply by taking sides.

As I have also argued, one person's dream is another person's nightmare. A universe without purpose or guidance may seem, for some, to make life itself meaningless. For others, including me, such a universe is invigorating. It makes the fact of our existence even more amazing, and it motivates us to draw meaning from our own actions and to make the most of our brief existence in the sun, simply because we are here, blessed with consciousness and with the opportunity to do so. Bronowski's point, however, is that it doesn't really matter either way, and what we would like for the universe is irrelevant. Whatever happened, happened, and it happened on a cosmic scale. And whatever is about to happen on that scale will happen independent of our likes and dislikes. We cannot affect the former, and we are unlikely to affect the latter.

What we can do, however, is try to understand the circumstances of our existence. I have described in this book one of the most remarkable journeys of exploration humanity has ever taken in its evolutionary history. It is an epic quest to explore and understand the cosmos on scales that simply were unknown a century ago. The journey has pushed the limits of the human spirit, combining the willingness to follow evidence wherever it might lead with the courage to devote a lifetime to exploring the unknown with the full knowledge that the effort might go nowhere, and finally requiring a mixture of creativity and persistence to address the often tedious tasks of sorting through endless equations or endless experimental challenges.

I have always been attracted to the myth of Sisyphus and have likened the scientific effort at times to his eternal task of pushing a boulder up a mountain, only to have it fall back each time before he reaches the top. As Camus imagined, Sisyphus was smiling, and so should we. Our journey, whatever the outcome, provides its own reward.

The phenomenal progress we have made in the past century has brought us to the cusp, as scientists, of operationally addressing the deepest questions that have existed since we humans took our first tentative steps to understand who we are and where we came from.

As I have described here, in the process the very meaning of these questions has evolved along with our understanding of the universe. “Why is there something rather than nothing?” must be understood in the context of a cosmos where the meaning of these words is not what it once was, and the very distinction between something and nothing has begun to disappear, where transitions between the two in different contexts are not only common, but required.

As such, the question itself has been sidelined as we strive in our quest for knowledge. Instead, we are driven to understand the processes that govern nature in a way that allows us to make predictions and, whenever possible, to affect our own future. In so doing, we have discovered that we live in a universe in which empty space—what formerly could have passed for nothing—has a new dynamic that dominates the current evolution of the

cosmos. We have discovered that all signs suggest a universe that could and plausibly did arise from a deeper nothing—involving the absence of space itself—and which may one day return to nothing via processes that may not only be comprehensible but also processes that do not require any external control or direction. In this sense, science, as physicist Steven Weinberg has emphasized, does not make it impossible to believe in God, but rather makes it possible to not believe in God. Without science, everything is a miracle. With science, there remains the possibility that nothing is. Religious belief in this case becomes less and less necessary, and also less and less relevant.

The choice to turn to the notion of divine creation falls to each of us, of course, and I don't expect the ongoing debate to die down anytime soon. But as I have stressed, I believe that if we are to be intellectually honest, we must make an informed choice, informed by fact, not by revelation.

That has been the purpose of this book, to provide an informed picture of the universe as we understand it and to describe the theoretical speculations that currently are driving physics forward as we scientists attempt to separate the wheat from the chaff in our observations and theories.

I have made clear my own predilection: the case that *our* universe arose from nothing seems by far the most compelling intellectual alternative to me at the present time. You will draw your own conclusion.

I want to end my discussion by returning to a question that I personally find even more intellectually fascinating than the question of something from nothing. It is the question Einstein asked about whether God had any choice in the creation of the universe. This question provides the basic motivation for almost all research into the fundamental structure of matter, space, and time—the research that has occupied me for much of my professional life.

I used to think there was a stark choice in the answer to this question, but in the process of writing this book, my views have altered. Clearly, if there is a single theory involving a unique set of laws that describes and, indeed, prescribes how our universe came into being and the rules that have governed its evolution

ever since—the goal of physics since Newton or Galileo—then the answer would appear to be, “No, things had to be the way they were, and are.”

But if our universe is not unique, and it is a part of a vast and possibly infinite multiverse of universes, would the answer to Einstein’s question be a resounding “Yes, there is a host of choices for existence”?

I am not so sure. It could be that there is an infinite set of different combinations of laws and varieties of particles and substances and forces and even distinct universes that may arise in such a multiverse. It may be that only a certain very restricted combination, one that results in the universe of the type in which we live or one very much like it, can support the evolution of beings who can ask such a question. Then the answer to Einstein will still remain negative. A God or a Nature that could encompass a multiverse would be as constrained in the creation of a universe in which Einstein could ask the question as either would be if there is only one choice of a consistent physical reality.

I find oddly satisfying the possibility that, in either scenario, even a seemingly omnipotent God would have no freedom in the creation of our universe. No doubt because it further suggests that God is unnecessary—or at best redundant.