

# Our (Chemical) World, Our Juniata: “The World of Things That Change”<sup>1</sup>

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Since I’ve been given the opportunity to talk to all of you on the first day of classes, on your first official day going about the business of being Juniata students, I thought I’d begin by sharing a story with you from my own very first day on Juniata’s campus back in November 2013, when I was interviewing for my job. That interview day, I met many people; most of them I have come to know quite well in the years since. In one meeting, I was asked a question that caught me off guard. Sitting across the desk from another faculty member near the end of a meeting, I asked if he had any last questions for me. He thought for a minute; then he furrowed his brow and asked perplexedly, “Why are you a chemist?” It was a question that surprised me—one that showed me that Juniata was a place that would encourage me to think, often and hard, about who I am and who I have the capacity to become. I hope Juniata will ask the same of each one of you. So my question for each of you today is this: Who will you become while you are here?

To help you begin to think about that question, I want to share with you my answer to the question I was asked about why I am a chemist, but, before I answer this question, I’d like to tell you a story.

It is a story in translation, written by a twentieth century Italian chemist and writer named Primo Levi. Primo Levi was raised an Italian Jew in Fascist Italy and survived eleven months of imprisonment in the Auschwitz concentration camp in 1944 and 1945. Returning to a career as a chemist after the end of World War II, he also took up his pen to become a renowned writer, publishing memoirs, a novel, poetry, and essays that reflected especially on his internment and questioned the humanity and inhumanity that he had witnessed during his wartime experiences.

The story I will share with you is from his autobiography, entitled *The Periodic Table*, in which he explores his identity in relation to the elements that comprise our material world. This story is undoubtedly told from a chemistry perspective, but it is not only a story about chemistry. Rather, it is a much larger story of which we are all part. The story starts and ends with a single carbon atom:

[This carbon atom] lies for hundreds of millions of years, bound to three atoms of oxygen and one of calcium, in the form of limestone . . . The limestone rock ledge of which the

atom forms a part lies on the surface. It lies within reach of a man and his pickax [in the year 1840]—a blow of the pickax detached it and sent it on its way to the lime kiln, plunging it into the world of things that change.<sup>2</sup>

Each time I read this story, the line “plunging it into the world of things that change” catches my attention. Change feels scary to many people, but change is the essence of chemistry. On the molecular level, we are all changing all of the time. Countless chemical reactions are occurring in this very room; they allow us all to breathe, allow you to fidget in your chairs, allow me to speak. “The world of things that change” is the reality of the world in which we all spend each day of our lives.

Let’s return to the story. Because there is much to imagine in this story and much to distract you where you are, before we keep going, I invite you, if you wish, to close your eyes and picture the journey that this little carbon atom is about to embark on.

[The carbon atom, still part of limestone, now in a kiln] was roasted until it separated from the calcium . . . Still firmly clinging to two of its three former oxygen companions, [together forming a molecule of carbon dioxide, this carbon atom] issued from the chimney and took the path of the air.

[The story of this carbon atom], which once was immobile, now turned tumultuous. It was caught by the wind, flung down on the earth, lifted ten kilometers high. It was breathed in by a falcon, descending into its precipitous lungs, but did not penetrate its rich blood and was expelled. It dissolved three times in the water of the sea, once in the water of a cascading torrent, and again was expelled. It traveled with the wind for eight years: now high, now low, on the sea and among the clouds, over forests, deserts, and limitless expanses of ice; then it stumbled into capture and the organic adventure.<sup>3</sup>

The author goes on to tell about this same carbon atom as it takes part in photosynthesis, as it becomes part of a cedar tree, as it is consumed by an insect, as it undergoes decay. On and on its adventure goes. The story then continues:

[This carbon atom] is again among us, in a glass of milk. It is inserted in a very complex, long chain, yet such that almost all of its links are acceptable to the human body. It is swallowed; and . . . the chain is meticulously broken apart and the fragments, one by one, are accepted or rejected. One, the one that concerns us, crosses the intestinal threshold and enters the bloodstream: it migrates, knocks at the door of a nerve cell, enters, and supplants [another carbon atom] which was part of it. This cell belongs to a brain, and it is my brain, the brain of the *me* who is writing; and the cell in question, and within it the atom in question, is in charge of my writing . . . It is that which at this instant, issuing out of a labyrinthine tangle of yeses and nos, makes my hand run along a certain path on the paper, . . . guides this hand of mine to impress on the paper this dot, here, this one.<sup>4</sup>

At this point in the story, we have seen this single carbon atom make a tremendous journey. There are a great many carbon atoms in the world—many, many, trillion trillions of them—and all of them are in the process of their own tremendous journeys.

In the same story, the author writes:

I could recount an endless number of stories about carbon atoms that become colors or perfumes in flowers; of others which, from tiny algae to small crustaceans to fish, gradually return as carbon dioxide to the waters of the sea, in a perpetual, frightening round-dance of life and death . . . ; of others which instead attain a decorous semi-eternity in the yellowed pages of some archival document, or the canvas of a famous painter; or those to which fell the privilege of forming part of a grain of pollen and left their fossil imprint in the rocks for our curiosity; of others still that . . . participated in the subtle process of division, duplication, and fusion from which each of us is born.<sup>5</sup>

That is a beautiful story, I think. To me, this story shows that this progression of matter, this nature of change, this chemistry, connects all of us; in it, we all find commonality. And just as much, this story demonstrates the complexity of the chemical world and the vast numbers of atoms and molecules that comprise it. This diversity of the natural world around us mirrors the diversity that we each bring to our human experience.

So why am I a chemist?

Studying chemistry, in learning all I can about the nature of the atomic and molecular world and the ways that interactions on this scale affect our experience in the macroscopic world, has provided me with a perspective of matter. More importantly, studying chemistry has also shown me that so much in life is a matter of perspective. Because the atoms and molecules that make up our world are on a scale too tiny to directly observe, the experiments I perform can only be understood by pausing to question my vantage point and biases. To make sense of the chemical world requires that I ask and answer questions through varied experimental lenses. By measuring a sample's interaction with light, I learn a bit. By placing it in a magnetic field, I learn more. By bombarding it with a beam of electrons, I learn more still, always with the goal that my conclusions are not clouded by a limited perspective.

What's more, this act of studying chemistry that has taught me to pause to evaluate carefully what I learn in the laboratory has also challenged me to understand that the human experience, the ways in which my own experiences are similar to and different from the people around me, is likewise a matter of perspective. Just as the atoms and molecules I study are invisible to direct observation, so, too, are human intentions. Just as biased experimental design can lead to false interpretations in the laboratory, the biases I hold about the people around me can draw me to incorrect conclusions. Studying chemistry has challenged me to consider the ways in which I understand the people who surround me and to continue to move and grow to gain a better view. Studying chemistry has changed me for the better.

This brings me to the question I wish to pose to each of you: Who will you become while you are here? The excitement I find in the study of chemistry is mirrored in the experiences that faculty and students all over campus find as they explore a great breadth of academic questions. Whether you choose to study art or politics, history or computer science, geology or psychology, or perhaps an exciting mixture of disciplines, you will uncover new ways to think about the world. If you let it, the course of

study you will engage in while you are here, however you choose to craft it, will be a complex lens of discovery that will allow you to uncover characteristics of the world that are currently hidden from view. Your time at Juniata is an opportunity for academic exploration. So explore! Explore new things, new fields, new interests. And trust that this Juniata community will support you as you do. Your task over these next few years is to discover your intellectual passions earnestly, creatively, and reflectively. If you do, you will take away a great deal when you leave this place; you will leave changed.

And just as this place, if you let it, will change you, you will also leave having changed this place. All of us in this room—students, faculty, staff, and administrators—are valuable members of this Juniata community. As time goes on, we each will leave our mark on Juniata. No matter where we have come from and where we will go next, each of us has a part to play in sustaining Juniata as it grows and changes to face the future. It is up to each of us to support one another in that common goal.

I'd like to end with a word of optimism that I hope we will all embrace. As we each go about our business this academic year and in the next few years to come, I hope that the opportunities we encounter will inspire us to become greater versions of ourselves. I hope we will ask with open mindedness how we can best contribute to Juniata, which, like the people who comprise it, must adapt as time marches on. I also hope we will face the changes we encounter with optimism and courage. I think if we do, Juniata, our Juniata, this place we are all a part of, will be the better for it.

Welcome to Juniata, Class of 2023. Your potential is enormous. I can't wait to see what you will make of your time here.

## NOTES

1. Primo Levi, *The Periodic Table*, trans. Raymond Rosenthal (New York: Schocken Books, 1984), p. 229. Excerpts from PERIODIC TABLE by Primo Levi, translated by Raymond Rosenthal, translation copyright © 1984 by Penguin Random House LLC. Used by permission of Schocken Books, an imprint of the Knopf Doubleday Publishing Group, a division of Penguin Random House LLC. All rights reserved.
2. Ibid., pp. 228-229.
3. Ibid.
4. Ibid., pp. 235-236.
5. Ibid.