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You wake up, tumble out of polyester sheets in bed, shampoo your hair in the shower and brush your teeth with toothpaste. You grab some yogurt and juice out of the fridge for breakfast, hop in the car pumped with gasoline and equipped with a catalytic converter, and pull up at school or work, beginning a day of typing away at your laptop.

We often use each of these products every day without a second thought. However, each of these technologies which we mostly take for granted and have been unknowingly integrated into every facet of our day to day lives, have been developed thanks to the field of chemical engineering. Chemical engineering is a branch of engineering at the intersection of pure sciences such as physics and math, while leveraging the principles of chemistry to improve, develop, and produce new forms of energy and materials. With applications ranging from the nanoscale to industrial power and processing plants, chemical engineering is a broad field encompassing multiple sub branches including nanomaterials science, nuclear engineering, materials science, and biological engineering.

First coined by British chemist George E. Davis (considered the father of modern chemical engineering) in 1839 in describing the production of sulfuric acid, by the late 19th century chemical engineering developed into a full-fledged field integral to the robust British and American chemical factories of the Industrial Revolution era. The onset of World War II triggered an explosion of chemical engineering developments, from invention of synthetic rubber for tires and equipment, adhesives and plating on aircraft and naval ships, to development of the atom bomb which ultimately ended the war. Post-war advances continued to reshape modern life. The establishment of the petrochemical industry and rapidly burgeoning automobile industry expanded access to affordable cars and transport to the general population. Development of synthetic polymers like nylon paved the way for the “age of plastic”, a cheap and durable material utilized everywhere from packaging to utensils to insulation. Discovery of antibiotics like penicillin and insulin synthesis transformed the pharmaceutical industry - sparking a profound increase in human lifespan and eliminating deadly septic infections and high child mortality which were once commonplace for the majority of human history. Rooted in military origins but now impacting every facet of modern life, chemical engineering plays equally a crucial role in developing current military technologies - from explosive, propellant, chemical weaponry, jet and vessel fuel, and anticorrosive coating developments, chemical engineering provides critical materials for Naval and Marine Corps operations.

With such a broad scope and impact of chemical engineering, what could a chemical engineer’s career and research look like? Dr. Richard Ordonez is a nanomaterials scientist who works on optical technologies, microelectronics and chemical sensors for Department of Navy applications. Discovering materials science through a Naval Research Enterprise Internship where he conducted advanced research on incorporating graphene into integrated circuitry, he transitioned into a position at a naval research facility as a nanomaterials researcher focusing on novel nanotechnologies such as enhanced space and underwater communications. Although Dr Ordonez has successfully advanced the field of nanotechnology through years of meticulous research, some of his experiences show that even accidental, seemingly discoveries can be intriguing and impactful. As a grad student sick with gastritis

and while drinking honey tea, after failed experiments to design potentially biodegradable transistors using water and sugar structures instead of toxic and costly heavy metals, he offhandedly decided to use honey as its gate dielectric material and created a functioning transistor, ultimately getting his research published in the prestigious nature journal. His work on creating a graphene and honey transistor demonstrates that unintended discovery, and often nature-inspired design in the most unlikely places can spark pivotal innovations in one's career.

Imagine instead of an emission-producing gasoline car, driving a one-charge, hundred mile battery electric or hydrogen-fuel cell vehicle to work. Imagine a world without billions of animals bred and slaughtered, thousands of acres of rainforest razed, tons of greenhouse gases released, replaced by clean and in vitro, or cell based meat, to feed a growing world without killing a single animal. These are only a few paradigm-shifting applications of a chemical, and soon to be biological, engineering future. Although innovations and products which have the potential to reshape our daily lives are already being rapidly developed - necessity is the mother of invention. The most looming, urgently worsening, and globally impactful issue facing the world is inarguably climate change. The agriculture-booming nitrogen fertilizers, petroleum-based plastics, and massive chemical production plants which chemical engineering helped build have now bred a global crisis. By 2040, chemical engineering can reverse the consequences of its innovations and spark another societal transformation from thermolytic batteries to decarbonize and improve our energy grid to nanomaterial-driven sensing technologies in the Navy. By pushing the boundaries of chemical engineering and other fields, we can engineer a more sustainable society, military, and future.