**Dictation:**

The operating system of life.

Every chicken was once an egg, every oak tree an ancon, every frog a tadpole. the patch of mold on that old piece of bread in the back of your fridge, not so long ago that was one solitary cell. Even you were once but a gleam in your parents’ eyes. All these organisms share the same basic goal, to perpetuate their own existence.

All lifeforms that we’ve discovered so far, stay alive by using basically the same rules, materials and machinery. Imaging a factory full of robots, these robots have two missions, One, keep the factory running, and two, when the time is right, set up an entirely new factory. To do those things they need assembly instructions, raw materials, plenty of energy, a few rules about when to work normally, when to work quickly or when to stop, and some exchange currencies, because even robot need to get paid.

Each factory has a high security office with blueprints for all the possible factory configurations and complete sets of instructions to make all the different types of robots a factory could ever need. Special robots photocopy these instructions and send them off to help make the building blocks of more robots. Their colleagues assemble those parts into still more robots which are transported them to the right location in the factory and given the tools they need to start working.

Every robot draws energy from the central power plant, a giant furnace that can burn regular fuel, but also scrap materials if not enough regular fuel is available. Certain zones in the factory have harsher working conditions so these areas are walled off. But robots inside can at least communicate with the rest of factory through specialized portals embedded directly into the walls.

And you probably figured out, what we are describing here is a cell. The high security office is the nucleus. It stores the blueprints and instructions as deoxyribonucleic acid or DNA. The photocopied instructions are RNA. The robots themselves are mostly proteins, build from amino acids. But they’ll often use special tools that are or are derived from vitamins and minerals. The walls between factory zones and around the factory itself are mostly made up of lipids, a.k.a. fats. In most organisms, the primary fuel source are sugars, but in a pinch, fats and proteins can be broken down and burned in the furnace as well. The portals are membrane proteins, which allow very specific materials and information to pass through the walls at the right times.

Many interactions between robot proteins require some kind of push, think robot minimum wage. A few small but crucial forms of money are transferred between proteins to provide this push. Electrons, protons, oxygen and phosphate groups are the main chemical currencies, and they’re kept in small molecular wallets or larger tote bags to keep them safe.

This is biochemistry. The study of how every part of the factory interacts to keep your life running smoothly in the face of extreme challenges. Maybe there’s too much fuel; your body will store excess as glycogen or fat. Maybe there’s not enough; your body will use up those energy reserves. Maybe a virus or bacteria tries to invade; your body will mobilize the immune system. Maybe you touched something hot or sharp, your nerves will let you know so you can stop. Maybe it’s time to create a new cell or a new person. Amazingly, oak trees, chickens, frogs, and, yes, even you, share so many of the same basic robot and factory designs that biochemists can learn a lot about all of them, all of same time.