>> Sally: Happy Birthday Dude.

>> Dude: Geez Sally.

I can't believe you remembered!

Can I open this now?

>> Sally: Of course, I hope you like it.

>> Dude: Sounds like it has parts!

>> Sally: I know how much you like to build things.

>> Dude: I think I know what it is.

Will I have to keep this here in the lab?

>> Sally: Only if you want to.

>> Dude: Awesome.

It's an electronics building kit.

>> Sally: It has all the parts to build a bug that scoots around on the floor.

The box says the red laser eyes will flash when it hears a voice.

Dude, do you like it?

>> Dude: I do...I guess...but...well I thought this might be the parts to build something real.

You know, something living...like a real bug with red eyes and legs that move.

>> Sally: You thought the box had parts for genetic programming?

>> Dude: Yeah...that's what I really want to try.

If I do OK snapping these wires and lights together, can I get a genetics kit next?

>> Sally: I would love to give you that!

But there is no snap-together version.

Here let me show you the closest thing.

You know that all living things are programmed by their DNA, their genomes.

And that DNA is made of four kinds of nucleotides, G,A,T,C.

But even when we know the order of every nucleotide in the master program, we still don't completely understand how the program works.

So it's not easy to snap together a new genetic program that works predictably.

To really program with DNA we'll need our own programming language, one that allows us to create our own grammar and vocabulary.

We can call the words parts where each part describes some biological function.

Here's a functional sequence I happen to know.

>> Dude: Is that a real sequence?

>> Sally: What do you mean real?

It's really nucleotides.

>> Dude: I mean does it do anything?

Is it really a part?

>> Sally: It is.

This one is a promoter, a piece of DNA where the RNA polymerase from the bacteriophage T7 can bind.

>> Dude: But how did you know that?

How am I supposed to know that?

>> Sally: Dude, that's the point!

>> Dude: What?

That you know more than me?!

>> Sally: No.

Look. The point is that we can describe the function of a sequence and catalog it so you don't have to memorize sequences.

No one does.

Here, let's draw a black box around the sequence itself and call it a promoter part.

>> Dude: Here, let me try?

>> Sally: Dude!

>> Dude: No Sally, really.

Parts are only cool if they can be snapped together.

Even this electronics kit makes it easy to hook the wires up to the battery and the LED.

The instruction book gives me rules for putting the parts together so I don't short circuit or fry the thing.

Don't be mad but I really don't see how biological parts will help me write a new genetic program if there isn't an easy way to put them together so they'll work.

>> Sally: I'm not mad.

These are two really important ideas, and you're exactly right.

No one knows the all rules for reliably assembling genetic programs but there are some ideas about how to put the parts together.

Want to look?

>> Dude: Sure.

>> Sally: Well the parts will need to be standardized in some way so they can snap together.

Let's look at BioBricks for one example.