Children of the Genome

WHAT KNOWING WE EVOLVED CAN TELL US ABOUT OURSELVES

by Shaun Johnston

*author of "**Mind in Evolution** as Assessed Through Reviews of Major Texts"*

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To get by, we live in two worlds: a world bound by the laws of physics and—to manage being conscious and creative—traditional wisdom. These two worlds have quite different implications. To resolve these contradictions I apply the methods of the humanities—imagination and storytelling—to what we've learned about evolution and the genome.

I tackle these two questions:

- *Why do we experience ourselves as not being purely physical?*
- *What do our conscious experiences tell us about the rest of the universe?*

My answers amount to a new origin story: a new way of looking at the world and our place in it.

Shaun Johnston. "After studying biochemistry at University College London I pursued careers in writing and the arts. Since 2010 I've maintained the website evolutionforthehumanities.com, I recently published *Mind in Evolution as Assessed Through Reviews of Major Texts.*"

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Shaun Johnston

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87 N. Chestnut St, Apt 407,
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shaunj@evolvedself.com

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Introduction

Every once in a very long while, how we think goes through a revolution. Ancient paganism gave way to Christianity. Christianity gave way to modern science.

Modern science! That revolution happened 400 years ago! Aren't we due for another?

The premise of this book is, yes, we're due for another revolution in how we think, and here it is. Or, if you're not yet ready for a revolution, you might at least welcome another way of thinking to compare with how you think now. Don't we get better at something when we have more than one way of thinking about it?

After four centuries of science's success, why am I urging on a revolution? Because science's account of human nature is incomplete. True, it can describe in magnificent detail how our bodies work in terms of physics and chemistry. But the more magnificent the detail, the more precisely we can judge what it omits, that we want to understand.

I express that as two questions:

- Why do we experience ourselves as not being purely physical?
- What do our conscious experiences tell us about our place in the universe?

Prominent spokespersons for science (physicalists) deflect our attention away from these questions. There is nothing to explain, they tell us: despite our experiences we are purely physical, we're as determined by physical laws as everything else in the universe. Our experience that during consciousness we can be creative is just an illusion, with no reality outside our experience of it. Evolution seeming to be creative is also an illusion, its mechanism is purely physical.

Implied is, we have no option but to simply submit ourselves to the world's purely physical processes. Fatalism!

So we live in two worlds: a world bound by the laws of physics and—for how to manage being conscious and creative—traditional wisdom with quite different implications.

In this book I urge adoption of a new natural philosophy that can bring those two worlds together. We appear, within our experience, to be more than purely physical, and able to be consciously creative. I urge on a revolution in order to save those appearances.

What I've come up with is an account of everything, starting out with the universe itself, told in a new way. What we've learned from the modern physical sciences stays—physical matter and the deterministic laws of physics. But starting from there I go on to explain what the physical sciences can't—life, mind, creativity and consciousness.

What qualifies me to be your guide? I've had one professional career as a science and medical writer, another as a graphic designer. I've written two novels, a play, and created several videos. I've two patents to my name. I've published a survey of evolutionary theory as it applies to mind ("Mind in Evolution as Assessed Through Reviews of Major Texts," available at Amazon). I'm a creature of both worlds, the sciences and the humanities. I can think scientifically and creatively. That could be what you need to come up with a new origin story like this.

I keep things simple, though in case you want more detail I do every so often include a more technical note in a different typeface. For a quick summary visit "Take away," page 42.

Ready? Let's play the revolution game.

Chapter 1

Worlds out of one another

There's just one stuff in the universe. What happens is, over time, out of that original stuff emerge successive worlds, each with its own properties and processes. It's the same stuff, just coming with different properties and processes.

One is the quantum world. Stuff in the quantum world consists of particles and fields. They come with properties such as uncertainty, and processes such as quantum entanglement. All very mysterious and hard to comprehend.

Out of that in turn emerges the physical world. We're more familiar with that. Its stuff comes as chemical elements. Its properties include things like mass and electricity. Its processes, such as the pull of gravity and volcanoes erupting, happen deterministically. Whatever happens depends on what's happened before as determined by the laws of physics, so in a purely physical world there can't be any real novelty. We know all about this world from the scientific revolution starting four centuries ago.

Out of the physical world in turn emerges a world of life. How different is that from the physical world? You can get a sense of that by comparing the two planets, Mars and Earth. Mars is grimly brown, lifeless, unchanging over billions of years. Earth is a lively blue, because of its oceans, but also green. The green is a sign of change, of vitality, of life. It's life that makes the Earth so different from Mars.

All these worlds consist of the same basic stuff, so they can interact with one another. What happens in each world will happen in the others as well, but through different processes. Choose to raise your arm to demonstrate you have free will and in the physical world physical matter corresponding to your arm moves deterministically due to the laws of physics. This in turn

overwhelms uncertainty to cause change in the quantum world. It's all the same stuff, it just changes in properties and processes.

Next we'll look at the world of life, and the properties and processes special to that.

Chapter 2

The world of life

We already know what the stuff of the living world is like, it's mostly living creatures like us. So I'll just list properties and processes that set the world of life apart from the physical world.

Properties of life

Living stuff comes as whole persons.

In the physical world, as things grow they stay the same kind of stuff, they just gets bigger. For example a crystal grows simply by the addition of more of the same molecules. Its shape continues to reflect the shape of those molecules. It's organized by its molecules, from the bottom up. It has the same structure throughout, it's homogeneous.

Stuff in the living world is very different. First, it's organized differently at every scale. And it organizes itself from the top down, from the whole body level right down to the molecules at the bottom; what happens at the molecular level is driven by what the whole body is doing. For example, when we exercise we drive changes in muscles and bones right down to the molecular level.

Being organized like this from the top down means the living world comes as whole living creatures, collections of living tissues contained within some kind of outer skin.

Not only that, but each living whole is different from all the others, even among similar creatures of the same kind. What you learn about one you can't necessarily apply to another. So rather than thinking of living creatures as objects it's better to think of them as separate persons.

Living stuff comes as messages

Physical stuff can consist of many different chemical elements. Living stuff consists of just a few, mostly oxygen, hydrogen, carbon and nitrogen. What's more important to life than the kinds of atoms it's made of is that those atoms mostly come arranged as more complex molecules consisting of hundreds, thousands, even billions of atoms strung together. It's as if these molecules were written messages. And they are. Written into them are ways of satisfying a living creature's needs.

Living stuff brings change

Physical matter doesn't change much over time. Whatever happens to it is determined by the invariable laws of physics. But living stuff changes all the time, resulting in streams of novelties such as the world has never seen before. That's because life's processes aren't entirely deterministic, they allow for novelty (chapters 8, 9).

Processes of life

Growth and repair

A basic process of life is growth. It loves to grow. For example a human embryo, a single cell, can grow into an adult made up of trillions of cells, of hundreds of different types, all organized into different kinds of tissues.

Yet it's all under tight control: while we're still supported in the womb like a fish in water, muscles attach themselves to bones just where they'll be needed to exert just the right leverage so when we leave the womb they'll hold us up against gravity and help us walk and run.

We also come able to repair ourselves if something goes wrong. Often that's different from how it grew in the first place. For example, when fish lose the lens of an eye the replacement lens may grow out of a different tissue from the tissue it grew from originally, involving a different set of instructions.

We each come richly equipped to change, with massive resources for growth and repair built into us.

Needs + solutions = provisions

Any challenge a living creature faces poses a need. Special to the living world is, needs induce satisfactions. The need of bees for food for their young induced the satisfaction of that need by them being able to make honey.

You could say creatures' needs getting satisfied is the essence of life's stuff. Where the physical world consists of matter responding to forces, you could say the world of life consists of living creatures getting equipped to satisfy their needs.

What makes that happen? For that we need concepts we haven't got to yet. Mind, for example—yet another world. We'll get to that.

Evolution

Something else distinctive about the living world is, over time living creatures come as various kinds, each kind first appearing when and where the kind most like it already lives. Different kinds of living creatures seem to emerge from one another, to evolve out of one another.

Evolution, that's our origin story. We are one of the things it made. How it made us will tell us a lot about ourselves. That's what the next chapter is about.

CHAPTER 3.

Evolution

How life began

To get some idea of how the living world emerges from the physical world I'm going to run the process of evolution backwards. I'm going to run it back from us to a creature perhaps half as "evolved" as we are, perhaps halfway back to life's emergence.

Hydra is a simple creature about an eighth of an inch long that lives in pond water. It's a simple tube closed at one end with an opening at the other (its mouth) surrounded by tentacles. Scattered over its body is a network of nerve cells. With the help of these nerve cells the hydra can contract and extend its body and its tentacles to feed and to move, even in such complex ways as by somersaulting its body.

To us, how a hydra feeds and moves looks purposive, as if it wants to survive as we do. Yet it evolved way before we did. As satisfactions of its needs for food and movement it has that simple network of nerves. Satisfactions of its needs got written into the very stuff it's made of.

To visualize life emerging from matter, just imagine evolution running back down from the hydra to creatures consisting of a single cell, and from there down to where life first succeeded in getting its needs written into matter.

> Tech note: Imagine, on the early Earth, a pond in shadow but lit with a vertical shaft of sunlight. The sun's energy is dispersed into the surrounding coolness by convection currents in the water, that at the pond edge cool, sink and are eventually drawn back to the shaft of light.
>
> That shaft of energy will drive any process capable of dispersing it. Take for example, adenosine tri-phosphate,

> ATP, that in our bodies acts to transfer energy around the cell from where it's produced to where it's needed. Or how ammonia transfers energy in refrigerators, absorbing heat as it turns from liquid to gas, giving heat off as it turns back from gas to a liquid. Such a chemical could take over the dispersing of the sun's energy in our pond.
>
> Then suppose there's another chemical that can act as a catalyst to speed up the process. It might be made even more efficient by the two chemicals being sequestered inside a lipid film, and other processes that make these capsules divide and regrow. The shaft of sunlight will have written into matter a better satisfaction for its "need" to be dispersed.
>
> This could mark the first step in life's evolution.

Life progressing

Now let's plot the path of evolution from the hydra in the other direction, going forwards in time.

Living creatures' most pressing needs are for stuff to feed on and to grow. Evolution's very creative, there's no end to its ingenuity in coming up with ways to satisfy those needs. Along the hydra's tentacles, for example, there's another kind of cell that the hydra can use to stun its prey. It comes with a small hair trigger. When prey touches one of those triggers a tiny harpoon shoots out injecting poison into the prey. Another example, this time a plant: the Venus flytrap comes equipped with muscles in its leaves and trigger hairs so when insects set off those triggers the leaf closes around them and slowly digests them. That's two more examples of satisfactions for creatures' needs getting created and built into them. More complex living creatures like us come packed with clever provisions like that.

I left evolution to last among life's properties and processes, but perhaps I should have put it first. How different the worlds of life and matter are is mainly due to evolution, and whatever it is that drives it.

CHAPTER 4

The Genome

In the nucleus of every cell in our bodies there's a long molecule or set of molecules made up of smaller molecules, joined together end to end, of a type referred to as DNA or RNA. The order those small molecules come in acts like writing. That writing spells out almost all the provisions needed for making a creature grow and maintaining it alive. All those provisions come written along that long molecule or set of molecules. That's the creature's genome.

Genomes may come locked away in the nuclei of cells, but they act like independent living creatures. As cells divide their genomes divide too, one copy finding its way into each new cell. Each creature gets its genome from its parents, so genomes pass down through the generations. Since life began four billion years ago genomes have never stopped spreading, from living cell to living cell and from each generation to the next.

You'd think for something to be copied all the time it would have to be simple. Yet genomes are by far the most complex molecules we know about, much more complex than any molecule in our brains. Our genome consists of three billion of those smaller molecules, that act like letters of an alphabet. Translate that into a necklace, strung eight beads to an inch, one bead for each of those three billion letters, and that necklace, three billion beads long, would stretch from New York to Tokyo. 6000 miles. We've nothing to compare that to, to tell us what it could be capable of.

It's a vast amount of information, corresponding to a huge satisfaction of needs. Writing for 20,000 proteins takes up less than a fiftieth of our genome. And all of it must be necessary;

any we didn't need we'd have lost as happens to free-living creatures when they become parasites: their genomes lose the code for free-living those creatures no longer need.

What is all that information needed for? Almost everything. Take how fur lies on the head of a cat. Cats need unobstructed vision both into the distance to hunt and close up to eat their prey. To ensure that their vision is unobstructed, hairs around their eyes are short and lie flat against the skin, all pointing away from each eye like petals of a flower. Hairs thin out in front of their ears, are absent inside the ear, are short and lie flat on the back. Hairs are absent on the cat's nose, and they're short around the mouth, except for a few long whiskers. So the cat genome codes precisely for all the hairs covering the cat's face: the length, lie, density, and stiffness of every one.

Now bear in mind that this precision and complexity of form applies to everything about the cat's body—its eyes, its sense of smell and taste, its heart, lungs, kidneys, liver, digestive enzymes, claw production, muscle attachments to bones and so on. That could be more information than you'd need to send a rocket to Mars, yet it's all there, written in the cat's genome.

It's genomes that carry scripts for elaborate devices such as the hydra's stinging cells and the insect-trapping leaves of the plant I described above. In our genomes come written the complex instructions needed for constructing ingenious devices like our ears and eyes.

Brains

One particular device, key to the evolution of creatures like us, is the brain. Creatures like the hydra and jellyfish have needs you can satisfy with a simple network of nerves. More complicated creatures like sea slugs come with networks of nerves looking more like subway maps that provide dedicated routes for signals to travel directly to where they were needed. In more evolved creatures, nerves congregate, first as in insects into "ganglions"—knots of nerves where signals can be more efficiently sorted—then, as in mollusks, into brains. The octopus has a brain

in each leg as well as one in its head. Finally come creatures like us with backbones and a single brain in a head that feeds signals down a spinal cord able to carry out even more elaborate behaviors.

What drives evolution

Genomes are special in carrying written along them all the scripts needed to grow and maintain a living creature. They've been around without a break since life first began. As living creatures became more complicated, involving more script, the genomes carrying those scripts grew longer.

So, not much question, living creatures evolving is going to have a lot to do with genomes.

CHAPTER 5

The genome thinks

How can the various parts of a body know where they belong? They do seem to. Take a hydra, for example. Mash it into a clump of separate cells and in a few days those cells will have reorganized themselves back into the hydra's original form, resuming its usual behavior. Each cell will have migrated back through physical space to where it belongs!

In effect, it's as if each cell has a mind, able to read the other cells' minds, together forming a single group mind that "knows" the creature's original form and where each cell belongs in it.

Here's another example. Cut a planaria worm in half and each half will figure out what's missing and grow it back, precisely, including new eyes and brains, in the right position in physical space. It's as if the worm can tell what's missing and figure out what's needed to replace it. Some creatures can replace almost any part of their body they lose, even parts of their brains.

So each cell in a creature's body seems to "know" what kind of creature it's a part of. But if so, what part of each cell is doing this "knowing"? What else could that be but the genome? It's the only structure in a cell complex enough to "know" something. But this makes sense. Genomes "knowing" what kind of creatures they're part of could account for how embryos—single cells—"know" how to grow in space and time into an entire adult.

How far apart can genomes be and still communicate with one another? If they communicate with one another to manage the growth of entire creatures, such as a whale, then they must be able to communicate over the adult whale's length of 100 feet.

That's a lot of "knowing." Does that much "knowing" amount to a mind?

What would it mean for genomes to have a mind? I think it would mean that a genome can think.

Could molecules like genomes think? What we know about ourselves says, yes, they could. You may object that a genome is just a molecule and molecules can't think. But our brains consist of only molecules yet we can think. And the genome is a far more complicated molecule than any in our brains. Also, it's been evolving for billions of years, who can set any limit to what that's made it capable of? So, yes, there's reason enough to conclude genomes could have minds, they could think.

If genomes can read each other's minds over distances of up to 100 feet, why not from one creature to another? This could account for how insects such as bees and ants show intelligence when gathered in a colony that they show little sign of as individuals. And we see creatures of entirely different kinds happily communicating. Bees and aphids work together as farmers and their livestock, algae and fungi cohabitate amicably as lichens.

So we see networks of genomes' minds appear to stretch among cells, throughout individual living creatures, to colonies, to species, even to creatures of entirely different kinds. How far might this network extend? Maybe to a network of intelligence covering the entire living world. Each node in the network would correspond to a distinct mind managing the life served by that node and directing its evolution.

I'm not the first to come up with such a suggestion. The ancient Roman Stoics believed in just such an intelligence. They believed it was such an intelligence that maintained creativity and order throughout the entire natural world. What made humans special, they said, was this august intelligence embedding in each of us a small portion of its majestic wisdom. They referred to this wisdom embedded in us as the Microcosm, to the mighty intelligence in nature as the Macrocosm. Microcosm and Macrocosm, they said, each reflected the other. What you wanted to find out about either of them you could learn by studying the other.

And this makes sense. Before genomes could devise and embed minds in us, wouldn't they have to have evolved minds themselves? To come up with minds to give us they'd probably draw on what they already knew about their own. Borrowing from the Stoics, we can expect to find genomes' minds similar to ours.

Looking at evolution this way tells us it's not primarily about living creatures, it's about genomes. To really understand evolution we need to figure out how genomes evolved.

At first, genomes evolved extremely slowly. For a billion years living creatures were tiny and simple. It took another billion years for a second kind of living creature to emerge from the first, also tiny and relatively simple. A further billion or so years after that, one of one kind got itself lodged inside one of the others, resulting in a much more complicated cell with its genome confined within a nucleus. Those genomes developed complicated sex properties that provided evolution with separate channels within which to innovate. That's the kind of cell that multicellular creatures are made of.

What took so long? It took that long, over three billion years, for genomes to evolve a mind. But once they did they made up for lost time with a remarkable burst of creativity. In just twenty million years they came up with almost all the kinds of complicated creatures we know about today. Then within each kind they set about creating a huge variety of even more complex creatures. Among them, very recently, came human beings. We have by far the biggest brains of creatures our size, and hands, vocal apparatus enabling us to speak, and a wonderful palette of thoughts and feelings.

> Since we come with feelings, does that mean that genomes do too? We know we get at least some of our thoughts, feelings and behaviors from our genome—in each of us at puberty emerge the feelings and urges readying us for sex. We don't have to be taught that, those feelings and urges develop in us naturally, as a

complex and coordinated program of feelings and behaviors.

I don't see how logically we can deny feelings like those to genomes themselves. For us to have those feelings there must be corresponding code written along our genome. If the genome can embed those mental abilities in us, I don't see how it could without possessing similar abilities itself.

CHAPTER 6

How evolution works

Nowadays, biologists trace how living creatures evolved by studying their genomes. It's by what's written along those genomes that they tell species apart. They refer to stretches of writing along a genome as genes. When one species evolves into another they say that's essentially due to changes in their genes.

So to drive evolution, genomes must be able to make changes to the genes they carry code for, the very same molecules they consist of!

Even if genomes come with minds, how could those minds make changes to the molecules those genomes consist of? I suggest, the same way we do. To commit something to memory our minds make changes in our brains, something purely physical. Later, we can draw on those purely physical brain cells to bring that information back to mind. Minds and brains are free to interact. Remember, they're the same stuff, just with different properties and processes.

So what I'm supposing is, all a genome has to do to evolve the living creature it codes for is just to think about it—bring code from the genes of that creature to mind, have new thoughts about it, those new thoughts registering back as changes to those genes, to the genome itself. Merely by thinking about it, a genome can evolve one kind of creature into another.

Hey presto! A new theory of evolution. Genomes can simply think new species into existence.

And a new answer to the question that so puzzled Darwin: what is a species? Our answer: a species is a thought in the mind of a genome.

Wait a moment! By supposing a genome can think into existence new kinds of living creatures, am I invoking the

supernatural? I know, that's how making this connection between mind and matter can seem at first, when applied to the genome. But remember it's something that, as we register our thoughts in purely-physical brain tissue and later bring them back to mind, we're doing all the time. In us, mind and matter can interact freely. So why not in the genome?

How genomes satisfy creatures' needs

Among life's processes I included creatures' needs being paired with corresponding solutions. Bees' need for food for their young was satisfied by them being able to produce honey. Another example: vertebrates emerging onto land from the sea needed amplification apparatus in their ears to help them hear better in air. The solution was for bones associated with the gills of fish to be shrunk and moved up into the head and into precise position in their ears. Both these innovations came about, I'm saying, by genomes thinking them up.

What's involved in genomes being able to create innovations like this? First they have to be able to read their creatures' minds—well, they would wouldn't they, since they made those minds. Being able to read their creatures' minds makes genomes aware of those creatures' needs. They then come up with solutions that they can think into their creatures as changed or new genes. That accounts for why genomes have grown to be so long over the course of evolution, as they wrote into themselves code for an unending flow of ingenious solutions to creatures' needs.

We now know of two sets of causes for things happening in our universe. There's physics. And there's mind. Recall my comparison of the Earth and Mars, how different the evolution of living creatures has made the Earth. I'm proposing that difference is because of minds, ours and the genomes'.

Intermission

Am I serious? Genomes can think!

Well, what makes a living creature, a mammal like you, able to think? Isn't that rather odd, when you reflect on it? Aren't you made of the same basic stuff as everything else? What makes you able to think? What's your answer?

What I'm proposing in this book is what I call an "as if" theory. How the world appears, including how you and I experience ourselves, is "as if" my theory is true. That's like Richard Dawkins talking about "The Selfish Gene," he didn't mean genes really are selfish, he meant that the way evolution works is "as if" genes are selfish. I'm saying something similar, except where he says genes are selfish I'm saying genomes can think. The way the world looks to me it's "as if" genomes have minds and can think new species into existence—and embed minds into us.

Why do I care? I want a world-view that's consistent, that can account for both how the outside world looks and how it feels inside, to think and be conscious. Then, what's the problem? It's the concepts available to us coming clumped together in theories that don't do a good enough job. What I'm trying to do is to pull those concepts apart and reconnect them in a way that can account better for all of what I experience.

Is my theory unscientific? True, we haven't yet made all the scientific discoveries needed to confirm it. But it's rational enough. It's as rational as the alternatives (see my "Mind in Evolution as Assessed Through Reviews of Major Texts").

So, am I serious? I can testify, my theory works for me. It's given me a greater appreciation of the world around me, and a sounder sense of my place in it. For me, in a world dominated by technology, that's felt like progress.

CHAPTER 7

Thinking and consciousness

We've two ways of thinking

We come with satisfactions for many of our needs already transcribed out of our genomes into our brains. There they can work automatically, without us having to be aware of them. For example, they can manage our breathing and our hearts beating. We can even drive an automobile automatically while thinking about something else.

Let's refer to this kind of thinking as "autonomic." It's sometimes called the quick way. That's one way we can think.

But we humans are unique in having a second way we can think. And it involves consciousness.

I arrived at this conclusion by borrowing concepts from the Stoics. For me, their Macrocosm corresponds to the intelligence and creativity of the genome mind, their Microcosm corresponds to the intelligence and creativity the genome mind embedded in each one of us. And just as their Macrocosm and Microcosm reflected each other, so will genome and human minds. That means we can learn more about ourselves by studying the genome mind, more about the genome mind by looking into our own.

Let's give that a try. Genomes make species evolve by thinking about them. So, for the genome, thinking goes along with something evolving. Can we apply that to ourselves? Could thinking in us involve something evolving? How about thoughts? Could some of our thinking consist of thoughts evolving as they do in genome's minds, one thought evolving into another, that thought evolving into another, and so on? Thinking like that, being driven by something evolving, could be very different from autonomic thinking.

What could make it so different? Because genomes thinking this way is what makes them hugely creative. Did they pass some of that creativity on to us? Can we recognize some of that creativity in how we think?

I think so. Sometimes we do feel creative, as if we can create genuine novelties. And it's true, just look at the new kinds of bridges engineers keep dreaming up, kinds that are entirely new. So yes, we can think creatively, as genomes do. It's how we built culture and created civilization.

How can we tell when we're thinking this way? By what we experience. As I can testify from my own experience and what I gather from reports by others, it's when we're being creative that we experience consciousness. Thinking creatively comes associated, somehow, with consciousness.

Here's something else I experience as I engage in creative thinking; a relaxing of physical determinism. I seem to gain some control over physical matter. For example I can look wherever I choose. As I do, my physical body registers what I choose to look at, and brings it into focus. What's happening is, muscles attached around the lenses in my eyes are stretching and relaxing in response to my conscious decisions. This is just one example of how while thinking consciously we exert control over physical matter, in this case those muscles in my eye, and the shape of the lens itself.

Can we now carry these insights back over to the genome? In us, thinking associated with something evolving induces consciousness. If what's true of us is also true of the genome, genomes too will experience consciousness as they think. That, I'm going to suppose, is why it took so long for genomes to create creatures with minds. The global networked genome mind had to evolve not just to think, but to become conscious. Only then could it create, in a mere 20 million years, so many kinds of multi-celled living creatures, and then figure out how to equip those creatures with minds of their own. And finally to embed in us minds capable, like its own, of creativity and consciousness.

Consciousness and creativity stand revealed as the primary powers of evolution.

Needs can be satisfied in the physical world; a river can smooth out its flow by scouring out a wider river bed for itself. And needs of living creatures can similarly induce solutions that way; by taking the same route repeatedly they can beat a path. But only when genomes became conscious, with the creativity that accompanied it, could they proactively sense creatures' needs and satisfy them on a huge scale, creating the magnificent creatures we know today.

CHAPTER 8

The world of mind

Once minds evolved, physical changes could happen in two different ways. One is physical: physical processes acting on physical objects. The other is mental: evolutionary processes in mind generate new thoughts. These thoughts then drive changes in the physical world.

But how? How can thoughts, that are part of mind, drive change in what's physical, like our minds telling our bodies what to do?

They can do it because each mind, like a snail, carries an entire universe with it, like a shell.

Physical things don't need to be told how to change. They change because of physical processes outside them that exist everywhere in the universe. But for a mind to be equipped to change it has to come with its own "universe," its own account of the world around it and its own set of evolutionary processes that specify how it can change. That's what I mean by its "shell." It's through this shell that a mind interacts with the physical universe around it.

Take an insect, for example. Almost all the information it needs comes in its genome. Moths and butterflies pass through several very different stages, from an egg through a series of caterpillar "instars" to a pupa to an adult. At each stage its genome provides it with the appropriate world view and lifestyle, along with the appropriate senses and impulses; some kind of brain registers the creature's needs and equips its body to satisfy them. That's an illustration of minds coming with their own universes or shells of meaning.

To explore how our minds work let's examine our own conscious experiences.

First, what my conscious experiences tell me is, conscious mental processes aren't anything like physical processes.

> Conscious mental processes don't observe laws of conservation as physical laws do—one thought plus one thought will often equal several thoughts, or none.
>
> Conscious thoughts appear to grow out of one another more like evolving species than like strings of physical processes. We experience ideas connecting directly to one another without having to be translated into physical form. We experience ideas, not something physical, being the mind's raw materials.
>
> In a purely physically determined world, could you consider alternatives, like "whether" something will happen? I don't think so. A volcano can't wonder if it will erupt today or tomorrow, it just erupts when physics says it must. Our thoughts don't seem to be bound by the conceptual limits imposed by physical determinism on purely physical matter.

For an example of conscious experience let's take me coming up with a pun. People were talking about how birds they'd seen close up on the ground were covered in mites. Here are the steps I took to arrive at my pun:

> Mites—recognition of homonym "might."
>
> Association, literary, "How are the mighty fallen."
>
> Contrast with bird flight, "How are the mighty risen."
>
> From passive, have mites, to active "How the mighty rise."

It took me about a second and a half to compose the pun, by which time the conversation had moved on. Instead I turned to my wife and whispered my pun in her ear. She smiled.

Here's what this experience told me:

> The ideas involved connected directly to one another through mental processes such as association and contradiction, not through physical processes. Ideas seemed to be the raw materials making up these steps.
>
> The 400 milliseconds each step took was obviously long enough for one idea to connect to another in mind but surely not for strings of physical processes in nerve cells as we think of them

today to assemble in order and then trigger each other along neurons.

My wife got the pun in an instant by running the steps backwards in her mind. Purely physical processes typically aren't easily reversible.

After coming up with the pun I had the kind of thought you couldn't have in a purely physical world—I thought I'd refer to my pun to show mental processes were different from physical processes. That distinction, that there could be mental processes different from physical processes, I think couldn't arise in a deterministic purely physical world.

All this confirmed for me that there's a world of mind separate from the physical world. But can the two worlds, involving such different processes, interact? Yes, my experience tells me they can. In order to recall the steps in my pun so I could write about them here, I consciously rehearsed them a few times to impress them in memory in brain cells, something purely physical. To write about them here I was able to consciously access that memory in physical form and bring it back into consciousness.

Yes, the two worlds can interact.

CHAPTER 9

Changing our minds

This chapter is about how we can manage the vast amount of information a mind comes with. Most of it, what it takes to run a living body, digestion for example, we don't have to worry about. All we need to care about is what we can be conscious of, that we can consciously change.

What does that consist of? We humans didn't evolve already conscious, instead we evolved with the talents we'd need to make ourselves conscious, things like language and sciences and the arts. So our universe of evolutionary processes comes not only with the genome we're born with but also with the culture we absorb as we grow up, and then whatever we add to it personally.

Free will

If thinking takes place in a separate world of mind, does that mean it's free of determinism? In other words, do we have free will? Not of course complete freedom from physics, we can't fly just by waving our arms. But are we free, to any extent, to arrive at decisions within our minds and make physical things happen to carry them out?

I think you can figure this out for yourself. Think of something that could occur to you only if you weren't purely physical, and talk about it. See, you just did it. The thought was, suppose you weren't purely physical. If you made your brain put that possibility into spoken words, something physical, you showed your brain can access thoughts in a non-physical, mental, world.

Seems to me, we can assume we have free will until someone proves we can't, and physics hasn't managed to do that yet.

Volition

What difference does it make that we're conscious? When thinking autonomically, without consciousness, we can distinguish red and yellow from green, to know when to pick fruit that's ripe for example. But when we're thinking consciously we may grind rocks to give us red and yellow pigments, to paint a landscape involving sunset. Consciousness allows us to create in our mind's eye the picture before we paint it.

To help me think about all this I settled on the word "volition." I use this to include the jumble of words we use for conscious thinking, such as creativity, judgment and decision-making, being able to say "if" and "when," and having some degree of free will. We can consciously conceive of something novel and implement it in the physical world.

Fortunately, when we want to change our minds, all we need to care about is our "volition resource pool," everything that can contribute to our volition, to what inclines us choose to do or think something. It's everything that influences how our conscious mind works and what it feels like.

> In thinking like this, applying concepts from the humanities to the findings of science, I am following in Darwin's footsteps. To the science of his day he applied the thinking of Malthus, Auguste Comte, and his grandfather Erasmus. His theory celebrates particularly Comte's reductionism. Reductionism is not itself science, it is merely a recognition of the limits within which experimental science makes most sense. Working within these limits has made science alone too narrow a base on which to construct evolution-based origin stories. That may better involve combinations of the humanities and science. I wrote this book to show it is possible to rethink evolution along these lines, and to encourage others to try.

For a start in changing our minds, we could do some house cleaning.

Ideas we're better off without

I've already disposed of some ideas we're better off without:

- *We're entirely physically determined.*
- *Mind and matter can't interact.*

Once we drop Darwinism in favor of the intelligent genome, here are some other ideas we can dispose of:

- *Creatures evolve by adapting to the environment.*

Of course, any theory of evolution has to account for creatures being adapted to their environment. But is that enough? In an environment of rocks and pebbles, wouldn't that mean evolving to become more like rocks and pebbles? Instead living creatures evolved to become less and less like the physical environment, more like energy-distributors, entropy-generators. Us evolving merely to adapt to the environment sells us short, by a mile. We're much more wonderful than that; adapting to life on the African savannah didn't prepare us for driving at 70 miles per hour at night on country roads lit only by headlights.

- *Evolution is driven by creatures competing to survive.*

Obviously false. We are natural collaborators. Even wolf pack members collaborate in hunting and nurturing each other's cubs.

- *What evolves are weapons for in-group competition.*

Again, obviously false. What evolves are new ways of doing things that we invent and learn from each other.

And how about the other half of today's theory of evolution, genetic mutation? Once we drop that we can forget about:

- *Evolution requires random damage to our genome.*

Look, if I can contribute to the evolution of other species by donating money to a save-the-animals fund, I can certainly contribute to the evolution of my own species without having to have my genes damaged.

> How can such origin stories as Darwin's be judged? Perhaps by their implications. By that standard, Darwin's story has been a disaster, endorsing determinism and physicalism while diverting our attention away from

evolution's creative powers. Perhaps we should first arrive at the implications we want our theories to embody, based on the evidence of all appearances, then build our story around them. That's what I aimed to do.

An alternative theory of evolution, Lamarckism, involves the "inheritance of acquired characteristics." "Acquired characteristics"—new ways of doing things—that prove successful are copied and spread until they become inherited ("The Baldwin Effect"). But where do those new behaviors and habits come from? Obviously, from some source of creative thinking due to something like the intelligent genome. Rocks and pebbles won't think up new ways of doing things.

So let's fold Lamarckism into the conscious genome theory. Then that becomes our primary alternative to today's "modern synthesis" of Darwin's natural selection and genetic mutation.

Having cleaned house, let's look for some new ideas.

CHAPTER 10

Become 3% more conscious

Supposedly, it's a sign of intelligence if you recognize what you see in a mirror as a reflection of yourself. In my mid teens I went one step further. Seeing myself in a mirror I said to myself, "That's me over there. I'm conscious of myself." Then I thought, can I use this to make myself more conscious? "I'm conscious of being conscious," I said, then "I'm conscious of being conscious of being conscious," then, "I'm conscious of being conscious of being conscious of being conscious," and I waited to see if uttering that rigmarole had made any difference. But I didn't look, or feel, any different. I resolved to look for other ways to make myself more conscious.

Can this book's new way of thinking help us do that?

Origin of consciousness

From what little I know about paleontology, I've concluded our species wasn't conscious at first, 200,000 years ago. Instead, we evolved with only the means of making ourselves conscious, over time. First came language, maybe gradually over the past 100,000 years. From Julian Jaynes' "Origin of Consciousness in the Breakdown of the Bicameral Mind" I've concluded we began the process of becoming conscious only with the appearance of major civilizations, about 5000 years ago. Consciousness like ours arose only when the invention of alphabetic writing allowed us to record our thoughts, for others to read back later as if we spoke them, about 3000 years ago.

That would be around 100 generations ago, 1% of today's consciousness being forged, on average, per generation, or 3% per 90-year lifetime. Can we continue that pace, increasing the reach of consciousness from when we were born by 3%?

Let's see what's involved. I'm going to talk of, first, meanings, then tools.

Meanings

We come into the world already equipped to find meaning in it. For example, we're born with several dozen cells in our brains that label things around us with directions and distances of them from us, and several dozen cells that analyze faces and help us recognize each other. We're born with capabilities for memory, sensation, prediction, decision-making, doubt. We come into the world with a whole lot of equipment helping us think.

Consciously drawing on this machinery we can then—by association and contradiction, by reason and logic, by finding answers for questions, by linking causes to their effects—come up with new meanings. Here's an example: "Mother" and "Father" may be among the first meanings we form. From them we can construct "Motherland" and Fatherland," the former the country where our mothers nurtured us, the latter the territory our fathers call on us to defend. Generally we augment meanings like those through education and cultural creativity. As long as we live our stock of meanings continues to grow.

Tools

By tools I mean major mental innovations like metaphors, writing, memorization techniques, mathematics, logic, the scientific method, taxonomy.

Where do such tools come from? Some come from advances in technology, such as the internet, artificial intelligence and virtual reality. Some arise through ways we play, as Steven Johnson points out in "Wonderland: How Play Made the Modern World."

My favorite source of new tools is revolutions in "natural philosophy," in how we think the world is put together. Hey, isn't that what I say I've come up with, what I've been talking about in this book? What tools might that inspire us to create?

In previous chapters I drew on wisdom of the Ancient Stoics, on their intuition of a mind responsible for all the creativity and

order in nature, and of that mind embedding some of its wisdom in us. Perhaps by contributing our discovery of the genome and evolution to their tradition of wisdom we can continue it into the future, discovering in our turn new tools for thinking and becoming more conscious.

Where might we begin? We usually think of evolution as being about where we came from. But genomes may have evolved through a much more fundamental "natural" process. From the living creatures they create being so wonderful we can appreciate how powerful that process must be. How powerful must the mental tools of genomes be, generated by that process! Can we tap into those tools?

Suppose we regard genomes as parts of the living world, as persons. Suppose we study living creatures for the ingenuity in their genomes implied by how they evolved, what you might call entire engines of evolution. By incorporating these mental engines into our own minds we might succeed in passing on to future generations some of the genomes' awesome mental powers.

By starting now we might play some part in those future generations becoming children of the genome.

STORY

Children of the genome

What will children of the genome be like? How will they develop their powers? We don't have to wait to see, I can just imagine it by coming up with a story.

Here it is.

I flag down a passing time machine promising "Evolution Revolution Tours." It glides to a halt, the doors open, we step inside. "Jane at your service," says a cheerful young woman at the controls.

OK, I say, let's be on our way.

Jane's hands flutter over the controls. There's a brief shudder. "That was it," she says, "the revolution, we're on the other side." She turns to face us. "Now, what would you like to know?

"Where are we going?" I ask.

"We're going to touch down three times," she says, "to see how differently the revolution made people think about what it meant they evolved."

"How does time travel work?" I ask.

"The same way history does" she says. "It gets its power from new ideas. To get us to our first landfall we'll be traversing four ideas laid end to end."

Once you're under way, time travel is pretty boring. There's nothing to look at. "Tell me about these ideas," I say. She picks them off on her fingers.

"Idea Number One: Reality includes non-physical processes

"Conscious experiences don't have weight or location. You can't sort them and put them in boxes. They aren't physical. But we all have them. So here's something that's part of our

everyday reality, that's non-physical. Let's check—if you experience conscious experiences as part of everyday reality, raise your hand."

I raise my hand.

"You raised your hand, so you're revolution-ready. What made you raise your hand was something only your consciousness could know—that you experience having conscious experiences. What's revolutionary is realizing that conscious experiences—thinking or feeling or experiencing something—while they're not physical, can make something physical happen, like make you raise your hand. Brains that are physical and consciousnesses that are non-physical can tell each other what to do. They can work together.

"So Idea Number One is: Physical processes in brains can interact with non-physical processes in consciousness. We need that idea to connect us to Idea Number Two.

"Idea Number Two: Non-physical processes can be accessed through mind

"Those non-physical processes of consciousness, let's call where they operate, 'mind.' But instead of thinking of it as a place, think of it more as a banking system where, instead of an account giving you access to money, it gives you access to non-physical processes like those in consciousness.

"How do you set up an account in this 'mind'? You don't. Your brain does it for you. The way we evolved, the human brain can plug in and set up an account for you, automatically. Then you're conscious. It's as easy as that. You didn't ask to become conscious, it just happened, right?

"Idea Number Two is: By setting up accounts in mind that provide access to non-physical processes, brains can establish conscious selves. We need that idea to engage with Idea Number Three.

"Idea Number Three: The genome is a brain

"The genome is a genetic blueprint. It's all the specifications for a living creature. In us it's written as a few dozen molecules, called chromosomes, that we've a copy of in the nucleus of every cell in our bodies. But, rather than thinking of the genome as molecules, think of it instead as 'one long string of genetic code' that carries a lot of information.

"Here's something else about it that's extraordinary. It's alive—it's part of a living creature—but while individual living creatures die, the genome lives on, because it's copied from each generation to the next. It's the only part of living creatures that's existed ever since life first began. And here's something else about it that's amazing: As creatures evolved to become more complex the genome has grown longer, able to hold more information.

"So, does that qualify the genome to be a brain? It may not appear to be as complex as our brains but it's been evolving for 1000 times as long. And it holds a mind-boggling amount of information. There's nothing else on Earth remotely like it.

"So Idea Number Three is: For all intents and purposes the genome is a brain."

Jane turns back to the dashboard and fiddles with some controls. "To maintain our speed of travel," Jane says, "we have to join Ideas Two and Three. Like this:

"Idea Number Four: An entirely new mechanism of evolution

"Remember how I supposed brains, by opening accounts for us in mind, can make us conscious. If the genome is a brain and if it can open accounts for itself in consciousness too, who or what is it that becomes conscious?

"Whatever it is, could that be what drives evolution? I'll show you why it could.

"If the genome can become conscious then presumably it can think. What happens then? Well, what happens when we think? When we think we make changes to our brains. Take memory for example. To be sure of remembering something you can deliberately, consciously, think it to yourself several times over to

make sure it gets imprinted in your brain. What you're doing is consciously etching a physical change into cells in your brain. Later when you want to recall it you can recall that physical memory into consciousness again.

"Suppose something like that happens when the genome 'thinks.' Like us, it will make changes to its 'brain.' But its brain consists of chromosomes and the genes along those chromosomes. And genes are what define species of living creatures! So just by thinking, the genome can write changes into genes along the chromosomes it consist of, bringing new species into existence. On this side of the revolution, people think of species as 'really' ideas stored in memory. They're ideas the genome can recall, think changes to, and store back in memory as a new species.

"What I'm supposing for the genome isn't something unreal. It's nothing more than what we humans do when we think.

"Idea Number Four is: The genome is conscious and intelligent and creative—it can think new species into existence merely by bringing to mind the idea of an existing species and thinking changes back into its genes."

Jane turns to the controls. "The first landfall's coming up." She turns back to face us. "I'll give you a few pointers to help you feel at home.

"Even this early in the revolution, the world looks different. I'll help you see the world the way people here do. Wherever we look we're aware of not matter but life. In our homes everything we see is made of wood or leather and bone or fabrics made from plants. Outside we don't see mountains made of rock, we see forests. The ground isn't rocks and sand, we see the grass and weeds that cover it, we know the soil is rich in bacteria, insects, worms. It's teeming with life. Even the clouds we know to be mostly water vapor given up by plants, they are a sign of life too. And because we know it evolved, wherever there's life we see consciousness. Even this early in the revolution, physical matter has become remote. Our primary reality will be

consciousness, in ourselves and in the world of evolved creatures all around us.

"That's a big advance over your time. For you it was consciousness that seemed remote. The only example of it you knew about was locked away in each person's conscious experience. Your scientists could draw maps of what was going on in people's brains, but they couldn't study the experience of consciousness itself. To them, consciousness was more remote than the far side of the moon.

"But once you have two examples of something, as people do now, studying it becomes much easier. Once people realized the genome was conscious they could study consciousness not only in their own conscious experiences but also in the world around them in the form of living creatures.

"So what are those consciousnesses in nature like? Remember I said each genome opens up a consciousness in mind. Now, our consciousnesses can't communicate with one another directly, there seem to be barriers between them. But the consciousnesses set up by genomes can, they can communicate with one another in mind. The result is a genome consciousness at every level inside our bodies, from individual cells up through each organ and tissue to the individual itself. And beyond the individual there'll be a genome-consciousness for each species, each order, even each kingdom, all the way up to all of nature itself." Jane turns away to manage our landfall.

Landfall Number One: Revolution in Biology

We're coming in to make landfall at a future college campus. It's vast. What's that huge building there, right in the center? "That's the nature study complex," Jane says. So where are the physical science departments? "They're in those small buildings scattered around the edge of campus." So what are all those buildings grouped there, around the nature-study complex? "Those are departments for the humanities. When evolution involves consciousness you can study it much better through the methods of the humanities than through the methods of the physical

sciences. The study of evolution has gravitated back from the sciences to the humanities."

We come in for landfall right next to the nature study complex. Jane leads us inside to take a look.

Inside it's nothing but a maze of corridors, each one lined with small rooms along both sides.

What are people in these rooms doing? "They're compiling biographies, one for each node in each level of the genome-intelligences," Jane says. "Each genome-intelligence has its own personality and capabilities. Some drove the evolution of their species furiously for tens of millions of years then seemed to lose interest and let all their creatures go extinct, as happened to trilobites. Others fashioned creatures of an entirely new kind, like sharks, and then doggedly preserved them almost unchanged for hundreds of millions of years. The true story of evolution, it turns out, is better told in terms of the evolution of genomes, in mind, rather than of their creatures in the physical world."

First step in our trip—biology has been revolutionized.

Back in the time machine Jane gets us under way. "We're traveling on post-revolutionary ideas now," she says.

"Idea Number Five: Evolution is creative.

"Once people accepted the process of evolution was conscious, they accepted it also had free will, it could be creative," she says. "Non-living matter doesn't have free will—a volcano can't decide whether to erupt—and non-living matter can't be creative—snowflakes still come in the same hundred or so patterns they always have. Consciousness, free will and creativity, on the other hand, all involve non-physical processes special to mind.

"And if the process of evolution was conscious, creative, and had free will, that must be where we got our consciousness, creativity and free will from. Genomes evolved before we did!"

That's going to be the focus of our next landfall. "Idea Number Five: Evolution is the source of all creativity on Earth."

Landfall Number Two:
Revolutions in Philosophy and Physics

For our second landfall we glide silently through walls and corridors, ending up settling gently in what looks like a laboratory. It's filled with chairs and desks but all around us are posted graphs telling us that something like experimental science has reappeared.

Here's what Jane tells us: The new science is made possible by the invention of a new unit of measurement, the creatron. That's how much know-how an orb spider comes into the world with. It knows it can drop itself down on a line of silk but must climb back up to return—it knows about gravity. To lay out its web in a flat plane it has to pick its way through the world to the various anchor points; it has to know about space in three dimensions. To spin its web it must know about the production and deployment of five different kinds of silk.

With that unit established, you could measure the creativity of genomes throughout every level of nature—species, orders, entire kingdoms, even all of nature. At each higher level the creatron scores soared. The creativity of all of nature was so enormous you couldn't distinguish it from complete freedom from determinism by physics. The old philosophical debate about determinism versus free will was finally laid to rest. Evolved creatures, like us, sharing in all of nature's freedom from determinism, could be creative, we could have free will too. Unlike purely physical things we weren't entirely bound by the laws of physics, by prior chains of physical events. We could choose to go along with them or strike out on our own.

Those laws of physics? The more creativity people found in nature the less they found to apply those laws to, until it didn't seem to matter whether those laws applied at all.

Now physics had been made over by the revolution in evolution.

Back into the time machine. "End of the line coming up," says Jane. "Eventually, worlds reached through time travel would become too strange for you to make any sense of. Our last

landfall will be just short of that point. Since your understanding will be as limited as that of a child there, we make landfall in a school classroom.

"Just bear this in mind—everything you've learned so far has melted down to become part of the mother tongue these people learn as infants. I have to introduce you to just one more idea before we land.

Idea Number Six: Thinking equals evolving

"The genome 'evolves' new kinds of creatures by thinking them into existence. So for the genome, evolving involves thinking. Could that be true for us, too? How about our thinking? Could thinking in us involve something evolving? Could thinking be our thoughts evolving, each one out of the one before, in mind? It could, if we want it to, we've no reason or logic for denying it. How simple that makes everything! Anything which isn't physical, is something evolving. No more mysteries. So idea Number Six is, thinking equals evolving, both take place through non-physical processes operating in mind."

We make landfall in a classroom.

Landfall Number Three: Revolution in Human Nature

"What makes us humans different from all other living creatures is how we think," our teacher is saying, "We think by creating thoughts and letting them evolve. What you need to learn now is the various ways living creatures evolve, so your thoughts can evolve like that, too."

Back in Landfall One, early in the revolution, we saw the genome intelligences being identified. In Landfall Two we saw them being assessed for their creative intelligence. Once they had had their creativity assessed, some stood out as exceptional. Surely, people thought, these genomes must have invented new "engines" to speed evolution up and make it more efficient. Patiently human engineers of the time teased apart the non-physical processes those engines consisted of, until out of those engines

they had created an entirely new set of mental tools that gave human thinking access to the creative power of evolution itself.

These are the tools children are being taught in class today. They are the final fruits, as far as we can follow them, of a revolution set in motion centuries ago, when we first asked ourselves what it meant we evolved.

We can understand nothing they are being told. We reboard our vehicle.

"No more, Jane? Can't you tell us a little more?"

"I can tell you in outline. In your day you'd already taken a big step; in just a century you'd already begun removing yourself from competition with other living species, doubling your life expectancy. Instead you'd begun putting your thoughts in your place, to evolve for you. Now, by adopting the genome's tools, humans are on track to elevate their own intelligence to genome-intelligence levels. Humans will then be able to direct their own evolution. Human nature will become both technology and the ultimate art.

"Already people like the teacher in that classroom look back to the evolution revolution in your time as the crucial hinge in history."

That's as far as Jane can take us. She scoots us back to our own time. Say goodbye to Jane. "Goodbye Jane."

CHAPTER 11

Take away

Now, my answers to the two questions I posed in the introduction:

- Why do we experience ourselves as not being purely physical?

My answer: on Mars, physical determinism reigns. The only exceptions our landers find there are other landers designed and sent there by us. On Earth, by contrast, human ingenuity running wild threatens to overwhelm the purely physical environment.

Our experience is, such creative determinism-defying ingenuity invariably originates in conscious experiences. This justifies us in regarding these experiences as not purely physical.

- What do our conscious experiences say about our place in the universe?

We are a part of the universe. If we can experience being conscious then we know that ours is the kind of universe that can accommodate conscious experiences. Unless we're going to claim human exceptionalism, that we are an exception to the rest of the universe, then we may expect to find conscious experiences elsewhere in it. An obvious place to look would be in whatever lead to our ability to become conscious. Where else would that be than the agent responsible for us having evolved? As the most likely agent I settled on the genome. And, sure enough, in the properties of evolved creatures I find evidence for evolution not being purely physical (chapter 5). Given evolution's creativity, I settle for assuming genomes are conscious as we are, only more so.

Then we are not alone in being conscious, we live in a world saturated with conscious intelligences, wherever there are genomes managing life.

Evolution as our origin story

That we evolved has become our shared origin story. But what it means has become a battleground dominated by extremists. The issue: appearances in us and the rest of nature of consciousness and creativity. At one extreme, rallying behind the banner of neo-Darwinism, physicalists demand we blind ourselves to those appearances and deny them. On the other extreme, creationists insist on the reality of those appearances and that we take them as proof for the existence of the Christian god.

For a lifetime, since the modern revival of Darwinism, the rest of us have lain low, waiting for the storm to blow over, wanting no part of either side. What we want is simply acknowledgement of those appearances, and a common-sense explanation of them we can live with, or even draw on to flourish.

That's what I set out to offer in this book. Failing to find in today's science the kind of concepts you'd need to assess the reality of those appearance, I've augmented what science can tell us with methods of the humanities, such as storytelling, to come up with such a common-sense explanation.

The promise

How can we benefit from such an explanation? Mainly, I suggest, by appreciating and celebrating how wonderful we are. We are at least as wonderful as other living creatures. In a garden recall each plant's lifecycle, from seed to stem and leaf, to flower, fertilization, and to seed again, and note how all those stages come defined in space and time along each plant's genome. Watch videos of moth or butterfly lifecycles, from egg to caterpillar to pupa to adult, all so fundamentally different, and reflect that all the behaviors you see, all apparent inborn familiarity with space and time, all intimations of instinct and intent, come written in linear order along the creatures' genomes. Though in

us the workings of that intelligence are less visible, concealed beneath our skin, we are at least as complex, as wonderful. Can we make our conscious experiences as wonderful?

In our search for meaning and satisfaction we might turn from the streams of merchandise and entertainment provided us by material technology to tap the rich "volition resource pool" (chapter 9) we come already equipped with.

Other works by Shaun Johnston:

Mind in Evolution as Assessed Through Reviews of Major Texts.
Think of your choice of evolutionary theory as like deciding which platform you want your computer to run on. Mac or Windows? Your choice affects the experience you'll have while using it. These reviews of major sources can help you choose. Appendix available separately. Both available at Amazon.

Are You Wonderful? Good Science Says Yes:
How to tell good science from bad.
An easy-read guide to finding meaning in life based on a theory of evolution able to account for mind. Available at Amazon.

Re-thinking What it Means We Evolved:
A new framework for universal moral values.
*"*Scientists are puzzled. Why, they wonder, won't the public embrace our scientific theory of evolution? Reading this book may tell them." A new account of evolution, a new natural philosophy, told through an engaging flow of articles and stories. Available at Amazon.

Evolvedself.com. A complete listing of all Shaun's media, all his books including two novels, a 90-minute play and videos, all concerning evolution as newly re-considered.

Evolution for the humanities (evolutionforthehumanities.com). A collection of resources intended to help those outside the science community get up to speed with issues involved in evolution in preparation for coming up with new theories. Most of the reviews included in this book first appeared there.

Youtube, channel "Evolved self," videos.