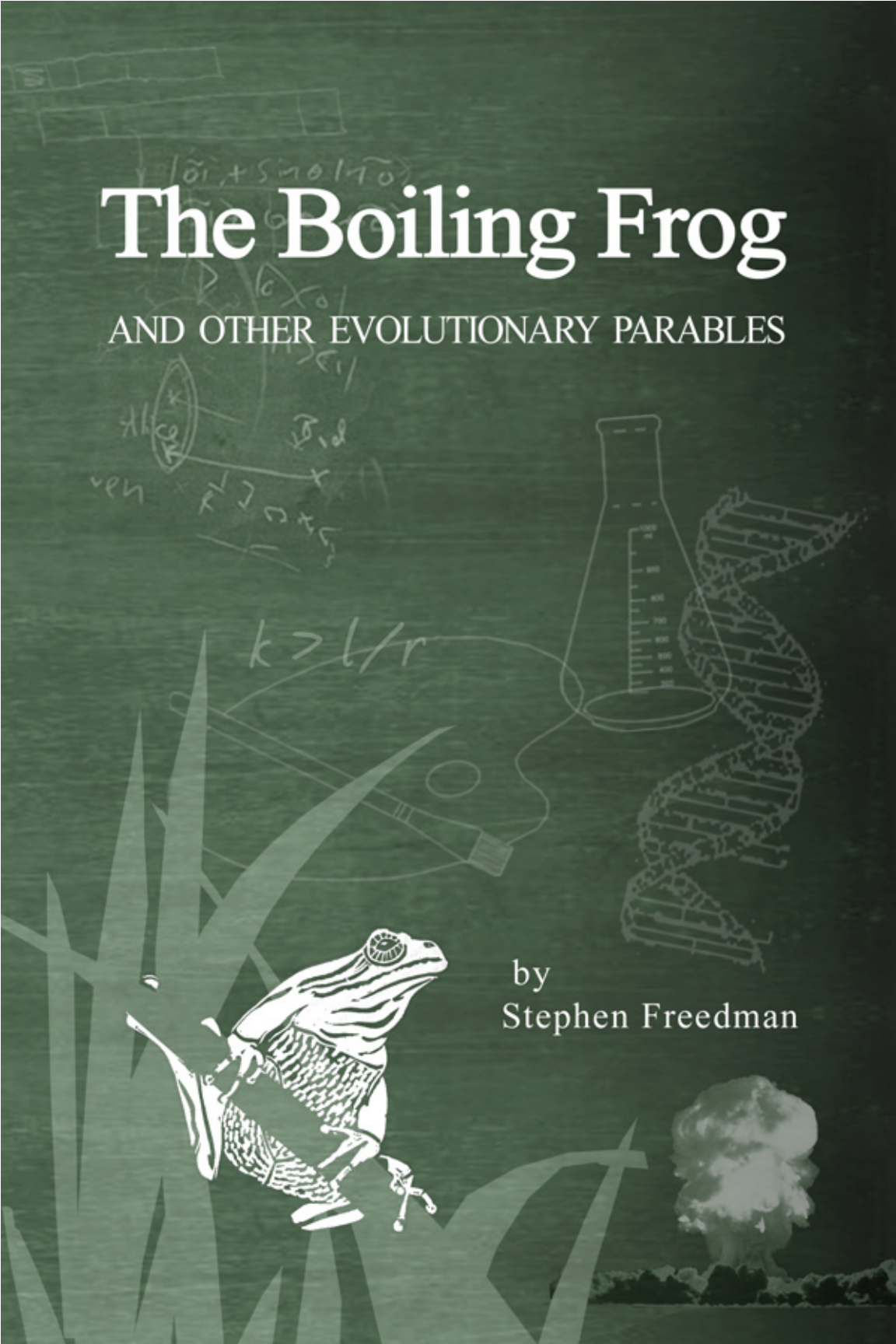
The Boiling Frog

AND OTHER EVOLUTIONARY PARABLES



by
Stephen Freedman

There is grandeur in this view of life, with its several powers, having originally appeared by some wholly unknown process; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being evolved.

Charles Darwin

Preface:

Thousands of years of myth and magic collide with a hundred and fifty years of Darwinism. As children we bandied about complex concepts of morality and religion while the implications of evolution remained cloistered in the vaulted minds of balding polysyllabic scientists.

But within these paradigms can be found models of ourselves; clear pools for reflection of our position in time, the world, and our own minds; models for understanding our past, present, and future—how we came to be, who we are, and what we might yet become.

Observations and concepts compiled over the millennia of human observation form the basis of these parables. With perspectives and paradigms borrowed and stolen from human biology, genetics, comparative anatomy, and embryology, I hope to conjure images as palpable as the ghosts and angels of myth, yet as natural as the world we see, touch and feel around us.

For my father, Leonard Freedman
and my daughter, Bella Freedman.

The Boiling Frog

There they sat sipping drinks, poised between eras, Mouse and Frog, representatives of their respective phyla, experiencing an epiphany, a moment beyond moments when all things are revealed.

Mouse stretched back in the hot tub. "Yes, I'm afraid it's the way of the dinosaur for your kind," he quipped, groping for the temperature control. The water was becoming tepid for the warm-blooded mammal, so while Frog considered his comment, Mouse cranked the temperature up another ten degrees and settled himself, comforting his Piña Colada.

As the temperature rose, Frog's eyelids drooped and his great head nodded precariously toward the bubbling water. But the notion that a primitive limbic system in some way placed his species in line for extinction couldn't go unchallenged.

"We amphibians share a common ancestor with both the dinosaur and you mammals," he rejoined. "To suggest identical sequelae to our thoroughly divergent evolutionary paths would be more than presumptuous, it would be in poor taste! Frankly I find the idea rather 'cold-blooded'," he mused, chuckling at his own pun.

Mouse, however was unrelenting. "Actually, biological history points out that of the cold-blooded genera of 200 million years ago, fully 99% have left no surviving descendent. Your inability to adapt to a changing climate will lead inevitably to extinction!"

But Frog pulled himself easily from the steamy water and, adding ice to his bourbon, commented blithely: "What of you mammals? Overpopulation, interpersonal violence, environmental vandalism! What price the ongoing survival of mammalkind?!"

...And now it was the cold-blooded Mouse who found himself in hot water.

The Green Beard Hypothesis

If you read books, watch television or go to movies, you know that every story has to have a hero. And maybe you've noticed how many of those heroes die young. As you furtively dabbed the tears from the corners of your eyes, perhaps you've wondered:

If an attribute such as heroism, by definition puts heroes at risk of losing more than they gain, then why would such a characteristic be carried down in the population?

Shouldn't heroic genes be buried with heroes? Shouldn't heroes die out, burned at stakes or crucified on crosses, leaving us mercenary types to carry on the species, bequeathing our selfish genes on down through the generations?

Science can be so cold-blooded when it comes to the sublime. But wait! Actually, an evolutionary rationale for the survival of heroic genes has been described mathematically in this way:

The ratio of benefit for the recipient of a heroic act, to the cost for the hero, must be greater than the reciprocal of the coefficient of relationship.

i.e. $k>l/r$, where k = ratio of benefit to cost, and r = coefficient of relationship.

(The coefficient of relationship is the probability that two persons have in common a gene that came from the same ancestor.)

What does this mean?

If I share 50% of my genes with my son, 25% with my niece, and 12.5% of my genes with my first cousin, and I lose my life in an act of heroism, I would have to save e.g. at least one son and one niece or nephew plus two first cousins to preserve 100% of my genes in the population.

A shabby bit of rhetoric? Wait. It gets worse.

Imagine that I had a green beard and my wife, enamored with that attribute, married me for that green beard (and those were inheritable attributes). Then our children may be endowed with genes for green beards, but also with genes for a preference for men with green beards.

How does this help our hero?

If three of my children (each containing 50% of my genes) are caught in a fire and I can save one child at the loss of my own life, then half of my genes would be carried on into the propagation market. If I saved two, then of course double that percent survive; but if I can save three, even at the loss of my own life, then 150% of my genes would be carried on, with a commensurate potential for reproduction—the ultimate imperative for a gene.

And should my wife have selected me for that altruistic characteristic then our children might have *two* inheritable characteristics: one for heroism and the other for preference of heroism, my wife's attribute.

Quite a profit!

My children then might tend to be heroic and also might tend to be attracted to heroism as a characteristic in a mate.

But "Aha!" you say. "What if, on the other hand, your wife was attracted to ruthless selfishness and you were an extremely ruthless and selfish (non-heroic) individual? Your children would then be predisposed to ruthless self interest and have a tendency to be attracted to that characteristic; it would all balance out!"

Not so! Without the gene for heroism—when that fire starts, there's no way that I'll jump in after the kids: The result, a conflagration of genetic selfishness.

So nature demands our concern for each other, rewarding altruism geometrically for mothers and sons, nieces and nephews, all the way down through 52nd cousins. Down the slide of diminishing relationship goes diminishing concern and altruism.

But the blood of green-bearded heroes flows in all of us.

The Immortal Cell

Budding: What an appealing notion! We think of Life and Death as intimately tied together – guardians of two doors to the same room – but just a minute. Imagine this:

You are the first single-celled organism on the planet. All the information of life on Earth is contained within that tiny blob of DNA which constitutes your nucleus, complete information about life in its germinal form. Mitosis—the splitting of that DNA into two nearly identical halves—constitutes the entirety of your sex life. At first this may seem unfulfilling but consider the advantages.

You've just had your first single-celled child. Who is the mother and who the baby?

There is no parent cell and there is no progeny. We now have two single-celled organisms. You are at least one of them. And so far you're not aging badly either; there's no retirement village in your immediate future.

Generations pass and you reproduce geometrically. There are 256 of you by now with still no hint of an older or younger cell. Barring natural disaster, most of you is/are still alive.

Now pass a few million years: you're swimming through the waves off the California coast. Given a worst case scenario of attrition due to predators, accidental deaths, and even natural disasters, there is/are very likely still billions of you hanging ten off Malibu.

You are potentially immortal!

So where did things go wrong? What was the reward so tantalizing for which nature sacrificed our immortality?

Its origins lie in those nearly identical halves into which our original cell split through mitosis. Accidental variations in the duplication and division processes (mutations) precipitated the gradual evolution of distinct and varied life forms based on that original, potentially immortal cell.

Over time a new mode for reproduction developed—the big mistake: We traded mitosis for meiosis.

That might not seem so bad at the moment but here's the down side: While sexual reproduction (meiosis) allows for the joining of two sex cells, each containing approximately half of the genetic information of the parent, facilitating rapid variations between individuals, it also allows death to enter the equation. Not accidental death, nor death by natural disaster, but death through old age!

Vessel disposal.

Now there is a certain sort of immortality even in sexual reproduction, as generation upon generation recombines aspects of genetic heritage to create diversity and specialization. But somehow, the immortality of all the information contained in a sperm or egg seems less meaningful (and less emotionally appealing) than the bodily deathlessness of our acellular ancestors. Viewing the necessary death of the parent organism—ourselves—as the dropping of some vestigial tail, somehow stretches the aesthetic limits of the reasonable.

So a chicken becomes nothing more than an egg's way of having more eggs. Why did this happen? Why did nature open this hole through which we must be flushed from life?

Death for sex: Was it worth it?