INTRODUCTION

MADE, NOT BORN

WHO FIRST IMAGINED the concepts of robots, automata, human enhancements, and Artificial Intelligence? Historians tend to trace the idea of the automaton back to the medieval craftsmen who developed self-moving machines. But if we cast our nets back even further, more than two thousand years ago in fact, we will find a remarkable set of ideas and imaginings that arose in mythology, stories that envisioned ways of imitating, augmenting, and surpassing natural life by means of what might be termed *biotechne*, "life through craft." In other words, we can discover the earliest inklings of what we now call biotechnology.

Long before the clockwork contraptions of the Middle Ages and the automata of early modern Europe, and even centuries before technological innovations of the Hellenistic period made sophisticated self-moving devices feasible, *ideas* about making artificial life—and qualms about replicating nature—were explored in Greek myths. Beings that were "made, not born" appeared in tales about Jason and the Argonauts, the bronze robot Talos, the techno-witch Medea, the genius craftsman Daedalus, the fire-bringer Prometheus, and Pandora, the evil fembot created by Hephaestus, the god of invention. The myths represent the earliest expressions of the timeless impulse to create artificial life. These ancient "science fictions" show how the power of imagination allowed people, from the time of Homer to Aristotle's day, to ponder how replicas of nature might be crafted. Ideas about creating artificial life were thinkable long before technology made such enterprises possible. The myths reinforce the notion that imagination is the spirit that unites myth and science. Notably, many of the automata and mechanical devices actually designed and fabricated in Greco-Roman antiquity recapitulate myths by illustrating and/or alluding to gods and heroes.

Historians of science commonly believe that ancient myths about artificial life only describe inert matter brought alive by a god's command or magician's spell. Such tales certainly exist in many cultures' mythologies. Famous examples include Adam and Eve in the Old Testament and Pygmalion's statue of Galatea in classical Greek myth. But many of the self-moving devices and automata described in the mythical traditions of Greece and Rome—and in comparable lore of ancient India and China—differ in significant ways from things animated by magic or divine fiat. These special artificial beings were thought of as manufactured products of technology, designed and constructed from scratch using the same materials and methods that human artisans used to make tools, artworks, buildings, and statues. To be sure, the robots, replicants, and self-propelled objects described in myth are wondrous—marvelous beyond anything fashioned on earth by ordinary mortals—befitting the sublime abilities of gods and legendary inventors like Daedalus. One might consider the myths about artificial life as cultural dreams, ancient thought experiments, "what-if" scenarios set in an alternate world of possibilities, an imaginary space where technology was advanced to prodigious degrees.

The common denominator of mythic automata that took the forms of animals or androids like Talos and Pandora is that they were "made, not born." In antiquity, the great heroes, monsters, and even the immortal Olympian gods of myth were the opposite: they were all, like ordinary mortals, "born, not made." This distinction was a key concept in early Christian dogma too, with orthodox creeds affirming that Jesus was "begotten, not made." The theme arises in modern science fiction as well, as in the 2017 film *Blade Runner 2049*, whose plot turns on whether certain characters are replicants, facsimiles of real humans, or biologically conceived and born humans. Since archaic times, the difference between biological birth and manufactured origin marks the border between human and nonhuman, natural and unnatural. Indeed, in the stories of artificial life gathered here, the descriptive category *made, not born* is a crucial distinction. It separates automata described as fabricated with tools from lifeless objects that were simply enlivened by command or magic.

Two gods—the divine smith Hephaestus and the Titan Prometheus—and a pair of earthbound innovators—Medea and Daedalus—were involved in Greek, Etruscan, and Roman tales of artificial life. These four

figures possess superhuman ingenuity, extraordinary creativity, technical virtuosity, and superb artistic skills. The techniques, arts, crafts, methods, and tools they employ parallel those known in real life, but the mythic inventors achieve spectacular results that exaggerate and surpass the abilities and technologies available to mere mortals in the quotidian world.

With a few exceptions, in the myths as they have survived from antiquity, the inner workings and power sources of automata are not described but left to our imagination. In effect, this nontransparency renders the divinely crafted contrivances analogous to what we call "black box" technology, machines whose interior workings are mysterious. Arthur C. Clarke's famous dictum comes to mind: the more advanced the technology, the more it seems like magic. Ironically, in modern technoculture, most people are at a loss to explain how the appliances of their daily life, from smartphones and laptops to automobiles, actually work, not to mention nuclear submarines or rockets. We know these are manufactured artifacts, designed by ingenious inventors and assembled in factories, but they might as well be magic. It is often remarked that human intelligence itself is a kind of black box. And we are now entering a new level of pervasive black box technology: machine learning soon will allow Artificial Intelligence entities to amass, select, and interpret massive sets of data to make decisions and act on their own, with no human oversight or understanding of the processes. Not only will the users of AI be in the dark, but even the makers will be ignorant of the secret workings of their own creations. In a way, we will come full circle to the earliest myths about awesome, inscrutable artificial life and *biotechne*.

Finding felicitous and apt language to describe the range of automata and nonnatural beings designated in ancient mythology as *made, not born* is daunting. The magical and the mechanical often overlap in stories of artificial life that were expressed in mythic language. Even today, historians of science and technology acknowledge that *robot*, *automaton*, *cyborg*, *android*, and the like are slippery terms with no fixed definitions. I tend to use informal, conventional understandings for *android*, *robot*, *automaton*, *puppet*, *AI*, *machine*, *cyborg*, and so on, but for clarity, technical definitions are given in the text, the endnotes, and the glossary.

This book surveys the wide range of forms of artificial life in mythology, which includes tales of quests for longevity and immortality, superhuman

powers borrowed from gods and animals, as well as automata and lifelike replicants endowed with motion and mind. Although the focus is on the Mediterranean world, I have included some accounts from ancient India and China as well. Even though the examples of animated statues, self-moving objects, and simulacra of nature imagined in myths, legends, and other ancient accounts are not exactly machines, robots, or AI in the modern sense, I believe that the stories collected here are "good to think with," tracing the nascent concepts and imaginings about artificial life that preceded technological actualities.

It is important to avoid projecting modern notions of mechanics and technology onto antiquity, especially in view of the fragmentary nature of the ancient corpus about artificial life. This book is not intended to suggest direct lines of influence from myth or ancient history to modern technology, although resonances with modern science are noted. Here and there, I point out similar themes in modern mythologies of fiction, film, and popular culture, and I draw parallels to scientific history to help illuminate the natural knowledge and prescience embedded in mythic material. Along the way, the age-old stories, some very familiar and others long forgotten, raise questions of free will, slavery, the origins of evil, man's limits, and what it means to be human. As the evil robot Tik-Tok in John Sladek's 1983 science-fiction novel remarks, the very idea of an automaton leads one into "deep philosophical waters," posing questions of existence, thought, creativity, perception, and reality. In the rich trove of tales from the ancient mythic imagination, one can discern the earliest traces of the awareness that manipulating nature and replicating life might unleash a swarm of ethical and practical dilemmas, further explored in the epilogue.

So much of antiquity's literary and artistic treasure has been lost over the millennia, and much of what we have is incomplete and isolated from its original contexts. It is difficult to grasp just how much of ancient literature and art has vanished. The writings—poems, epics, treatises, histories, and other texts—that survive are but a tiny slice compared to the wealth that once existed. Thousands of artistic works have come down to us, but this is a small percentage of the millions that were created. Some art historians suggest that we have only about 1 percent of the Greek vase paintings ever made. And the modicum of literature and art that remains is often randomly preserved.

These cruel facts of loss and capricious preservation make what we do have that much more precious. They also determine one's approach and path of discovery and interpretation. In a study like this, we can analyze only what has managed to persist over millennia, as if we are following a bread-crumb trail in a deep, dark wood. And the birds have eaten most of the crumbs. Another analogy for what has perished and what survived derives from the nature of devastating wildfires cutting paths of destruction, driven by winds across a landscape of grass and trees. What remains after terrible fires is what foresters call a "mosaic effect": wide swaths of burned regions punctuated by patches of flowery meadows and copses of still-green trees. The random ravages of the millennia on Greek and Roman literature and art related to artificial life have left a patchwork dominated by blackened, empty spaces dotted here and there with vital passages and pictures from antiquity. Such a mosaic pattern necessitates a wandering path between evergreen oases, fortuitously preserved and elaborated over thousands of years. Following that path, we may to try to imagine the original cultural landscape. A similar approach, "mosaic theory," is also used by intelligence analysts to try to compose a big picture by amassing small bits of information. For this book I have gathered every text and scrap of ancient poetry, myth, history, art, and philosophy related to artificial life that I have been able to find—and enough compelling evidence emerges to suggest that people of antiquity were fascinated, even obsessed, with tales of artificially creating life and augmenting natural powers.

This is all by way of saying that readers should not expect to find a simple linear route in these chapters. Instead, like Theseus following a thread to navigate the Labyrinth designed by Daedalus—and like Daedalus's little ant making its way through a convoluted seashell to its reward of honey—we follow a meandering, backtracking, twisting thread of stories and images to try to understand how ancient cultures thought about artificial life. There is a narrative arc across the chapters, but the story lines are layered and braided, as we travel along what Artificial Intelligence futurist George Zarkadakis calls the "great river network of mythic narratives with all its tributaries, crisscrossing and circling back" to familiar characters and stories, and accumulating new insights as we go.

It may come as a relief to some, after wending our way through the vast memory palace of myth, that the final chapter turns to real, historical

chronology of inventors and technological innovations in classical antiquity. This historical chapter culminates in the proliferation of self-moving devices and automata in the Hellenistic era, centered in that ultimate space of imagination and invention, Alexandria, Egypt.

Together these stories, both mythical and real, reveal the surprisingly deep roots of the quest for life that is made, not born. Let us join that quest.