Animal Weapons: The Evolution of Battle

by Douglas J Emlen with illustrations by David J Tuss

reviewed by Rafe Sagarin

Douglas J Emlen’s Animal Weapons is a hard-hitting campaign—a bit of a Blitzkrieg through major themes in evolutionary escalation, peppered with dazzling examples from across the spectrum of animals and their adaptations, from the horns of dung beetles to the guns of battleships. Although the major lessons of offensive and defensive weaponry, escalation, and sexual selection will be quite familiar to any biologist or biology teacher, Emlen is so intimately immersed in those subjects and such a good communicator that he easily weaves them into some clever new syntheses and clear comparative frameworks.

Emlen convincingly shows that there is essentially no difference between the weapons of humans and those of all other species. All of the chapters are infused with examples from the animal world and the world of human technology, and a final section focuses on these parallels in the specific cases of human fortresses (of the land, sea, and air varieties) and weapons of mass destruction. Throughout, he shows that if certain conditions apply—if there are scarce and defensible resources and the opportunity for head-to-head combat—there will be escalation toward bigger and more dangerous weaponry. This parallelism holds up even though much of human weaponry evolves through conscious design and by sharing information laterally rather than through the natural process of descent with modification. Although he doesn’t dwell on it extensively, it is rather remarkable that discoveries of modern biology—particularly the more recent understandings of lateral gene transfer in bacteria, viral evolution, and epigenetics—bring the world of biological evolution even closer to the world of human systems evolution.

I can’t go further without mentioning the illustrations by David J Tuss. They are dazzling, emotive, and highly informative. Especially when composed around intra- and inter-specific comparisons, they become far more than eye candy: they are real tools to aid Emlen’s various syntheses. An especially great example is a comparative study of the common curling-up defensive postures of species as far afield in time, space, and phylogeny as trilobites, pill bugs, cuckoo bees, armadillos, and pangolins. Another comparative illustration, of same-age male elk and beetles with wildly different horn sizes, hammers home Emlen’s point that there are many ways to go about using (or not using) weaponry that your species and sex might be predisposed to produce.

The overwhelming recurring theme of Animal Weapons is the multidirectional nature of evolution. Almost every example that Emlen discusses—horns on beetles, armor on knights, antlers on deer—gets bigger, smaller, bigger again, and/or altogether forgotten, depending on where and when you start to look. Weapons get larger and more ominous until they become too costly, or the environment changes, or some disruptive agent turns
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their previous splendor into folly. I was astounded to learn that, among fifty of the dung beetle species of which Emlen is so fond, horns had developed fifteen different times and disappeared nine different times.

Emlen subtly reinforces the theme of evolution’s multidirectionality by often starting from the opposite direction of where we’d expect. Indeed, the whole book starts not with a discussion of overt offensive weaponry, as its title might suggest, but of camouflage and armor. Later, a section on sexual selection starts with the more unusual case of jacana birds, in which it is the females that grow weapons, fight for coveted territories, and take mates serially. These counterintuitive approaches are useful in Emlen’s exposition because they underline just how far the spectrum of weapons reaches and shifts depending on environmental conditions and a multitude of other factors.

This multidirectionality of course translates to the world of human weaponry. Emlen relies on what must be a great fondness for naval history and associated scholarship to show that several times in history—with oared galleys in the ancient Mediterranean, galleons in sixteenth-century Europe, and dreadnought battleships in the modern day—ships got huger and more imposing, until huge and imposing no longer could win the game. The unwieldiness of oversized rowed vessels, the creation of rifled and exploding shells that could shred the thickest wooden hulls, and the arrival of submarines, respectively, led to the demise of the giants of these eras.

Although Emlen doesn’t go there, we can easily see these undulations in our most modern weaponry—the mobile phones so ubiquitous in industrial society, which have morphed from huge and conspicuous contraptions to micro-sized fold-up devices and back to slab-sized behemoths, all indicate the owner’s ability to amass enough resources to acquire the most advanced technology in any given environment. On a more serious note, shifts in mobile technology were bitterly tracked in recent wars in Iraq and Afghanistan, where coalition forces spent millions in projects to jam cell phone signals that were used to set off improvised explosive devices (IEDs), only to find that when jamming was used, insurgents would revert to using wired pressure-plate mines.

A shortcoming of Animal Weapons is that there is very little treatment of asymmetric conflict. This gap arises naturally as a function of Emlen’s tight focus on arms races, which are dependent on several kinds of symmetry between opponents (Sagarin 2012). Indeed, he argues that one major prerequisite for directional escalation is the opportunity for one-on-one duels, or “fair fights.” But as we know from a daily read of the newspaper, there hardly ever are any fair fights in modern geopolitics. The United States is vastly more resourced and invested in weaponry than any other, and those that would oppose it must rely on a wide variety of both technologies and behaviors to injure it. Emlen very briefly mentions asymmetry in the context of “cheaters” who sneak around the weaponry of their better endowed competitors, but I don’t think that cheating fully encompasses the range of behaviors assumed by today’s “rogue” nations and terror organizations. My colleague Dominic Johnson, for example, has shown how the outcomes of asymmetric conflict in Iraq fit very closely with straightforward predictions of natural selection theory (Johnson 2009).

Emlen suggests that asymmetrically weaker sides cannot cause the destruction that matched escalation can create, using the massive escalation of cold war nuclear weapons to empha-
size the point. In fact, nuclear weapons are in some ways more scary today because the relative stability of “mutually assured destruction” has been erased in a world that leading international relations scholars increasingly refer to as “adrift” (Crocker and others 2015). Geopolitics, like animal weaponry and evolution itself, swings wildly between periods of relative stasis and periods of rapid change, and unfortunately we find ourselves in a highly unstable point in history.

The book is driven by, and indeed thrives upon, Emlen’s self-proclaimed obsession with weaponry, but this leaves it with a second, though somewhat esoteric, blemish. Throughout, Emlen seems biased toward the relative importance of technology—the weaponry of escalation—over tactics—the behavior of escalation. This allows him to dismiss, for example, the skills and innovations of fighter pilots in driving the evolution of military aircraft, using the recent rise of unmanned drones to make his point. But it is a fallacy of evolutionary analysis to assume that an endpoint tells us everything about the path that got us there, and there are multiple cases in military history where tactics drove changes in technology, such as the tactical theories of air-to-air combat and subsequent weapons developments engendered by the fighter pilot John Boyd (Hammonds 2002). Indeed, there are cases in animal evolution where behavior seems to lead the development of weapons, cases where weapons seem to lead, and cases where technology and tactics seem to be inseparable components of a complex suite of adaptations (West-Eberhard 2003).

An intriguing question for science teachers raised by books like this is whether there is some value added by a book that injects the theory of evolution into a topic—weaponry and warfare—of great interest to conservative readers. Can it be the “spoonful of sugar” that helps the medicine of evolutionary theory go down? Having worked across this nexus over the last ten years, I cannot be sure that such synthetic treatments can inoculate a population generally, but I do know through one-on-one conversations and small classes that the basic utility of appreciating evolutionary theory can be effectively conveyed through these kinds of mash-ups. In that regard, this very readable and at times thrilling account of weaponry’s wild ride through evolutionary history will be most welcome to science teachers and science aficionados looking to share what Darwin called the “grandeur” of “this view of life” beyond the usual suspects.

**References**


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