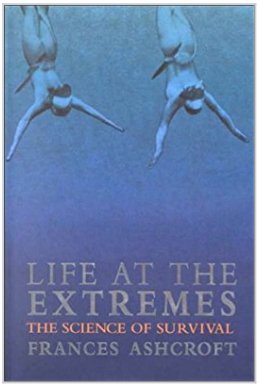

Life at the Extremes: The Science of Survival

By Frances Ashcroft

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The challenge of scaling the highest mountain, exploring the deepest ocean, crossing the hottest desert, or swimming in near-freezing water is irresistible to many people. *Life at the Extremes* is an engrossing exploration of what happens to our bodies in these seemingly uninhabitable environments. Frances Ashcroft weaves stories of extraordinary feats of endurance with historical material and the latest scientific findings as she investigates the limits of human survival and the remarkable adaptations that enable us to withstand extreme conditions.

What causes mountain sickness? How is it possible to reach the top of Everest without supplementary oxygen, when passengers in an airplane that depressurized at the same altitude would lose consciousness in seconds? Why do divers get the bends but sperm whales do not? How long you can survive immersion in freezing water? Why don't penguins get frostbite? Will men always be faster runners than women? How far into deep space can a body travel?

As she considers these questions, Ashcroft introduces a cast of extraordinary scientific personalities—inventors and explorers who have charted the limits of human survival. She describes many intriguing experiments and shows how scientific knowledge has enabled us to venture toward and beyond ever greater limits. *Life at the Extremes* also considers what happens when athletes push their bodies to the edge, and tells of the remarkable adaptations that enable some organisms to live in boiling water, in highly acidic lakes, or deep in the middle of rocks.

Anyone who flies in an airplane, sails the high seas, goes skiing or walking in the mountains, or simply weathers subzero winters or sweltering summers will be captivated by this book. Full of scientific information, beautifully written, and packed with many fascinating digressions, *Life at the Extremes* lures us to the very edge of human survival.

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Life at the Extremes: The Science of Survival By Frances Ashcroft Bibliography

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Editorial Review

Amazon.com Review
"It is an extraordinary coincidence," writes English physiologist Frances Ashcroft, "that the highest peak on Earth is also about the highest point at which humans can survive unaided." A coincidence, to be sure, and, like many other milestones of the limits of human endurance, one known to us through the joint efforts of scientists, mountain climbers, explorers, and athletes.

Ashcroft's book is a thoroughly engaging survey of those limits and their origins in the nature of things, of what happens to human beings in the most difficult environmental conditions. She writes, for instance, of why it is that astronauts have trouble standing after returning to Earth (because, in part, their leg muscles quickly atrophy outside of terrestrial gravity); of how the famed Japanese pearl divers condition themselves to attain such extraordinary underwater depths; of how and why the consumption of carbohydrates and caffeine can improve athletic performance; of why British children so easily suffer heat exhaustion on trips to such semitropical venues as, say, Disneyworld, whereas young Saudis can tolerate much higher temperatures (but would likely not thrive in an English winter).

Backed by extensive field research--the author has climbed Mount Kilimanjaro, sweated it out in Japanese hot tubs, and run after her share of buses--as well as by a wealth of laboratory studies, Ashcroft's book is of great appeal to anyone who wishes to test the world's limits--or their own. --*Gregory McNamee*

From Publishers Weekly
Ashcroft, a professor of physiology at Oxford, offers a fascinating compendium of facts about what it takes to endure intense heat and cold, the pressure of the deep sea, the lack of pressure and oxygen at high altitudes and the void of space, as well as what is necessary to perform such demanding sports as sprinting. She takes readers step by step through the intricacies of each. For example, in her chapter on mountain climbing, readers receive a brief history of "mountain sickness" and accounts of its effects; a tutorial on atmospheric pressure, how we become acclimated to the lack thereof and the dangers of airplane depressurization; there is also a sidebar on why birds can fly over Everest without suffering. Similarly, her chapter on deep-sea diving covers the perils of pressure, why people get the bends and whales don't, how Japanese fisherwomen can swim incredibly deep and how technology has helped us reach so far down. Her chapters on surviving heat and cold are particularly interesting, illustrating how the human body regulates its temperature and offering many accounts of why, for instance, people survived being lost in the desert and trapped in freezing water. Throughout, Ashcroft also explains how animals have adapted to horrific conditions far better than humans have, despite the efforts of foolhardy scientists to see how far their own bodies can be pushed. This is a worthwhile read both for those who participate in extreme sports and those who prefer to enjoy them from the comfort of an armchair. (Oct.)

From The New England Journal of Medicine
Frances Ashcroft was "galvanized" to write this intriguing book when a friend suggested she submit an entry for the Wellcome Trust prize, awarded every two years to the British life scientist who writes the best book for nonscientists. Ashcroft, professor of physiology at Oxford and fellow of the Royal Society, has long believed that the general public is deeply interested in science if it is simply but accurately described, so she applied. She did not win the prize, but this fact should not detract from the appeal of her delightful book to scientists and the public alike.

Ashcroft describes how survival (primarily but not exclusively of humans) is possible in the most inhospitable environments on earth, and she speculates about survival in outer space. Each chapter is an account of survival in an extreme environment -- the low pressure of high altitudes, the high pressure in the ocean depths and deep in the earth, polar cold, desert heat, the vacuum of space -- and the limits of speed generated by human or animal muscles. Finally, there is a fascinating grab bag of descriptions of life in acid, salty, oxygen-free, and locked-in-stone conditions.

The richness and variety of Ashcroft's subjects are extraordinary. Here are only a few of the many remarkable tales in this book. Full-term babies are born with a layer of brown fat, which metabolizes rapidly to generate heat during the first few weeks of life. Caribou have fat in their feet that remains soft in subzero temperatures. Plant and animal life abounds 4.8 km (3 mi) down in the black depths of the ocean, right next to huge volcanic vents that spew superheated water and sulfurous fumes.

While holding his or her breath, a diver can descend 133 m (439 ft) in the ocean and remain underwater for six minutes, but elephant seals can swim 750 m (2475 ft) below the surface and stay there for two hours. Fully acclimatized humans can stand on the summit of Mount Everest for hours breathing only ambient air, but humans can live only a short time if they are taken directly from sea level to the summit. Without oxygen, the human brain will die within six minutes, but hibernating mammals and many cold-blooded animals survive for months or years with little or no oxygen, and many bacteria are killed by even a trace of it.

Half of our muscles are called slow-twitch, but endurance athletes can increase this proportion to 90 percent through training; all of us have tiny fast-twitch muscles that can close our eyelids instantly. A red fox can run 72 km (45 mi) per hour, whereas a champion sprinter can run 35 km (22 mi) per hour and a cheetah can reach a speed of 113 km (70 mi) per hour in three seconds from a standing start.

Ashcroft inserts lovely bits about ancient history and glimpses of contemporary primitive societies, and she pays tribute to recent scientists, such as the secretary of the Royal Society who emerged unhurt after 15 minutes in a room where the 105 degreesC temperature cooked an egg and overcooked a good steak.

Regrettably, most of her heroes and citations are British, and she overlooks many excellent contributions from other countries. The Korean War, for example, resulted in far more injuries from cold, and taught us more, than the battle for the Falklands. Bert, Haldane, and Barcroft were not the only ones to explore altitude illnesses; scores from other countries have contributed to a better understanding of hypoxia. A few pioneers, such as Scheele (who studied oxygen), Priestley (who identified photosynthesis), and Berti (who made discoveries that led to the invention of the barometer), have been omitted.

The book is a delicious meal, each chapter a tasty dish well suited to be sampled alone and all seasoned with wit and incredible anecdotes. Because there were too many references to be cited in a book for nontechnical readers, a comprehensive reference list for each chapter is available online from the publishers. There is a good index and a brief list of works for further reading.

We need more books like this to show us why even esoteric research can be important. Scientists with the curiosity that should be inherent in researchers and nonscientists alike will find new ideas and insights here. Every thoughtful reader will finish the book with greater awe and reverence for the complexity and beauty of the mystery we call life.

Charles S. Houston, M.D.

Users Review

From reader reviews:

Ricky Burnham:

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