

► the peak of the cold war, 10 countries — including the United States, the Soviet Union, Britain and China — had built 65,000 nuclear warheads. But before the first bomb had been built, nuclear scientists had been lobbying politicians to change the mandate from building nuclear weapons to controlling them. The lobbying, partly through avenues such as the Pugwash Conferences on Science and World Affairs, was fairly successful: the number of nuclear weapons in those 10 countries has fallen to around 17,000.

But the fuel — fissionable plutonium or uranium enriched in a rare isotope of uranium — is still with us. Neither occurs naturally, so bomb-builders manufactured them. At the end of the Second World War, 100 kilograms of weapons-grade material had been made; now, it is 1,900 tonnes, enough for 100,000 bombs. As the authors show, material from dismantled bombs can be downblended to a less fissionable form and stored or used in power plants, but it cannot be destroyed, and it remains available for nuclear weapons or for low-tech radiological weapons. In 1945, only the United States could build a nuclear warhead; now, 35–40 countries can, and the margin of security is “too slim for comfort”, says a former director-general of the International Atomic Energy Agency.

Feiveson, Glaser, Mian and von Hippel convincingly argue that this problem demands a real and immediate solution. Along with the history of nuclear weapons, they cover attempts to control the weapons’ spread, including the 1970 Treaty on the Non-Proliferation of Nuclear Weapons; the physics and technology of producing, downblending and storing fuel; and the complexities of convincing nations to agree to be supervised and controlled by an international agency.

The authors’ suggested long-term policy is to reduce the amount of fissionable material in military and civilian stockpiles, and to regulate it “as if the world is preparing for complete nuclear disarmament”. Countries should stop hiding the sizes of their stockpiles, the authors write, and stop manufacturing weapons-grade uranium and plutonium; they should also downgrade or bury all fissionable material, even if they must give up nuclear energy. Finally, they should agree to international verification of declarations about weapons production — even if that means relying on nuclear scientists rather than politicians to tell the truth. ■

**Ann Finkbeiner** is a freelance science writer in Baltimore, Maryland, who often covers scientists advising governments. She blogs at *The Last Word on Nothing*, [www.lastwordonnothing.com](http://www.lastwordonnothing.com).



ORNITHOLOGY

## Fowl domination

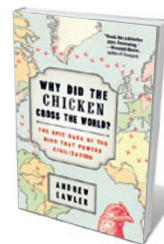
Ewen Callaway relishes a study tracing the chicken’s eventful march from Asian jungles to global ubiquity.

**T**he chicken is the Swiss army knife of livestock. Since its domestication in Southeast Asia as early as 18,000 years ago, the bird has been religious sacrifice, pet, research subject, fighting machine and, of course, dinner. The Victorians paid enormous sums for exotic breeds, and in the 1960s, NASA imagined the birds feeding Martian colonies. Around 20 billion are alive at any one time, bred to meet global demand. Science journalist Andrew Lawler explores the chicken’s multipronged place in human civilization in his rip-roaring, erudite *Why did the Chicken Cross the World?*

Genome data and resemblance have pinpointed the red jungle fowl *Gallus gallus* — a furtive bird that roams the subtropical forests of southern Asia — as the wild ancestor of *Gallus gallus domesticus*. The birds are considered one species, because unions between them still produce fertile offspring. A few thousand years of separation is an evolutionary blink of the eye, too brief to create reproductive barriers.

Scientific efforts to unpick the origins of the domestic chicken are muddled by the fact that few, if any, living red jungle fowl are free of the genetic vestiges of their ancestors’ romps with domestic chickens. The last purebred jungle fowl on Earth may reside, as Lawler shows, on a farm in the northeast of the US state of Georgia, rather than in a forest in Malaysia.

That is down to ornithologist Gardiner Bump. In the 1950s and 1960s, faced with a shortage of game birds in the US southeast, Bump set out to populate forests with imported wild red jungle fowl. He paid



**Why Did the Chicken Cross the World?: The Epic Saga of the Bird That Powers Civilization**

ANDREW LAWLER  
Atria: 2014.

trappers to collect eggs — the more remote the better, because he wanted purebred birds — and deliver them to US hatcheries. The birds never thrived, and the US government pulled the plug on the programme in 1970. Descendants of Bump’s birds survive in a handful of flocks. An evolutionary geneticist has sampled their blood, in the hope of discovering what truly

sets chickens apart from their wild forebears.

From their initial domestication, Lawler traces the chickens’ journey to Mesopotamia and ancient Egypt, where the earliest known depiction of the bird was made, and then on to Polynesia and South America, where DNA from ancient chicken bones offers contentious evidence for a pre-Columbian trans-Pacific chicken trade. The author does not dwell on such controversy for long. For much of the book, science has a supporting role to history, ethnography and even advocacy.

Lawler’s discussion of cockfighting is among the book’s most compelling material. In ancient Greece, Babylon and China, pitting roosters against each other was embedded in religious practice. Now mostly illegal, it still thrives in parts of South America and Asia, especially the Philippines, as Lawler demonstrates with a harrowing dispatch

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