

SCIENTIFIC AMERICAN

CONTENIDO

VOLUME 304 No. 1 JANUARY 2011

FEATURES

EVOLUTION

34

Dawn of the Deed.

Fish fossils push back the origin of copulation in backboned animals and suggest that it was a key turning point in our evolution.

John A. Long

SPACE

40

Contact: The Day After.

If we are ever going to pick up a signal from E.T., it is going to happen soon, astronomers say. And we already have a good idea how events will play out.

Tim Folger.

INFECTIOUS DISEASE

46

Flu Factories.

A new effort to monitor the evolution of influenza viruses in pigs faces resistance.

Helen Branswell.

ENERGY

52

In Search of the Radical Solution.

The greatest energy payoffs, sys investor Vinod Khosla, will come from fundamentally reinventing mainstream technologies.

Interview by Mark Fischetti.

ECOLOGY

56

Seeds of the Amazon.

Botanists have collected seeds from one the most biologically diverse places on earth.

Anna Kuchment.

NEUROSCIENCE

58

100 Trillion Connections.

The noise of billions of brain cells trying to communicate with one another may hold a crucial clue to understanding consciousness.

Carl Zimmer.

ENVIRONMENT

64

Casualties of Climate Change.

Shifts in rainfall patterns and shorelines will contribute to mass migrations

on a scale never before seen.

Alex de Sherbinin Koko Warner and Charles Ehrhart.

COMPUTER SCIENCE

72 **Rise of the Robo Scientists.**

Machines can devise a hypothesis, carry out experiments to test it and assess results — without human intervention.

Ross D. King.

PUBLIC HEALTH

78 **Radioactive Smoke.**

The tobacco industry has known for decades how to remove a dangerous isotope from cigarette smoke but kept the information secret. The government now has the power to force a change.

Brianna Rego.

DEPARTMENTS

8 **From the Editor**

10 **Letters**

12 **Science Agenda.**

A wish list for Washington, as a new Congress takes office.

The Editors.

14 **Forum.**

Developing nations aren't the laggards on climate.

16 **Advances.**

Sterile neutrinos, pancreatic cancer, animal mathematicians, breaching the brain barrier, floating giraffes, sleep science, James Watson on DNA, brain donations.

30 **The Science of Health.**

Curing the common cold: be careful what you wish for.

Veronique Greenwood.

32 **TechnoFiles.**

Privacy concerns are overblown, even in our always connected world.

David Pogue.

82 **Recommended.**

A tale of love and fallout: Marie and Pierre Curie.

Kate Wong.

83 **Skeptic.**

Can data determine moral values?

Michael Shermer.

84

Anti Gravity.

The young and restless college-student inventors.

Steve Mirsky.

86

50, 100 & 150 Years Ago.

88

Graphics Science.

Federal R&D spending shows the government's science priorities.

Mark Fischetti.

On the Cover

Fish fossils indicate that copulation in backboned animals originated more than 25 million years earlier than preciously thought and hint that it was a driving force in our evolution, helping to establish the anatomical foundation for legs, reproductive organs and perhaps even jaws in the lineage of creatures that ultimately led to humans.

Illustration by *Owen Gildersleeve.*