Spotlight on Science: Breakthroughs, Challenges and Insights

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1. Fake papers compromise research syntheses

"Systematic reviews" that aim to extract broad conclusions from many studies are in peril

By Holly Else

Fraudulent papers undermine systematic reviews, which are crucial tools for synthesising research evidence and drawing broad conclusions. Scientists such as Rene Aquarius have flagged numerous studies with fabricated data, dubious statistics, automated translations or manipulated images, many linked to 'paper mills'. This compromise has affected systematic reviews in fields as diverse as stroke therapies, mindfulness and animal models of depression, inflating effect sizes and contaminating evidence pools. Despite tools such as the Cochrane guidelines and the REAPPRAISED checklist, large-scale reviews remain vulnerable due to the volume of studies and the complexity of the reviews. Researchers face increased stress, longer timescales and ethical dilemmas in dealing with tainted reviews. Some, like PhD student Ananda Zeas-Sigüenza, question the integrity of science itself, highlighting a growing crisis in maintaining the reliability of research.

This article was previously published in *Science, Volume 386, Issue 6725*, on November 28, 2024.

Read the full article here

2. Researchers and scientific institutions flock to Bluesky

After recent changes to Elon Musk's X, a gradual migration in search of the "old Twitter" turns into a stampede

By Kai Kupferschmidt

The migration of researchers and scientific institutions to Bluesky has accelerated as dissatisfaction with Elon Musk's changes to X (formerly Twitter) grows. Originally a Twitter research project, Bluesky gained traction after becoming independent, offering a familiar interface, better content moderation and a thriving scientific community. By November 2024, the platform had grown to over 20 million users, with many influential scientists and organisations joining. Bluesky facilitates research sharing, networking and academic discussion, similar to the 'old Twitter'

that researchers valued for its collaborative and informative environment. While some remain on X to combat misinformation, many academics now find Bluesky a more reliable and welcoming space for networking and communication, supported by curated tools and established communities that ease the transition.

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Read the full article here

3. Systematic in vitro evolution in Plasmodium falciparum reveals key determinants of drug resistance

By Luth et. al.

The study investigates how Plasmodium falciparum, the parasite that causes malaria, develops resistance to antimalarial drugs. Using systematic in vitro evolution and whole-genome sequencing of 724 clones, the study showed that resistance mechanisms often involve specific mutations in genes related to drug action, including missense and copy number variations. These changes affect protein domains critical for parasite survival. The findings also highlight the role of multidrug resistance genes, such as PfMDR1, and transcription factors in culture adaptation. This research provides a robust dataset to support the development of tools to detect resistance markers in clinical settings and to advance the design of new antimalarial treatments.

This article was previously published in *Science, Volume 386, Issue 6725* on November 29, 2024.

Read the full article here

4. A new vision for American science

By Sudip S. Parikh, Marcia K. McNutt, Darío Gil

America's scientific progress owes much to decades of federal investment in research, coupled with policies that attracted top talent and translated discoveries into economic growth and societal benefits. But with industry now funding most R&D and global competitors stepping up investment, the US faces significant

challenges. Its share of global R&D has declined, patent leadership has slipped, and talent development is a growing concern. To address these issues, the Vision for American Science and Technology (VAST) Task Force, which includes nearly 70 leaders from science, industry, and academia, is working to redefine the nation's scientific priorities. Their recommendations will focus on modernising education, strengthening infrastructure and fostering collaboration across sectors. In this way, the US can maintain its role as a global innovation leader, ensuring economic prosperity and contributing to global scientific progress.

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5. 'Dark proteome' survey reveals thousands of new human genes

Database confirms that overlooked segments of the genome code for a multitude of tiny proteins

By Elizabeth Pennisi

A groundbreaking study of the "dark proteome" has revealed thousands of new genes coding for small proteins, significantly expanding our understanding of the human genome. These previously overlooked noncanonical genes, identified using advanced techniques like ribosomal profiling, challenge conventional definitions of protein-coding sequences. Many of these miniproteins play critical roles in childhood cancers and heart functions. Using ribosomal profiling and mass spectrometry, researchers confirmed that about 3,000 of 7,264 identified nontraditional open reading frames (ORFs) generate functional proteins. These findings not only increase the known number of human genes but also introduce a promising class of targets for drug development in diseases like cancer, obesity, and metabolic disorders. This discovery marks a significant leap in genomic research and therapeutic potential.

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Read the full article here

6. From eyes to algorithms: Announcing the 2024 World Laureates Association Prizes

The 2024 World Laureates Association (WLA) Prizes celebrated groundbreaking contributions in science, awarding Jon Kleinberg in Computer Science and Jeremy Nathans in Life Science. Kleinberg's work focuses on algorithms and their societal impact, exploring how they manage vast online information and influence social interactions. His efforts highlight the critical need to design algorithms with awareness of their broader consequences. Nathans, a pioneer in ophthalmic genetics, has spent decades uncovering the genetic basis of vision and related diseases. His research laid the foundation for breakthroughs like gene therapies for retinal diseases, advancing our understanding and treatment of vision disorders. These awards underscore the WLA's mission to honor scientific advancements that shape society and inspire global progress.

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Read the full article here

7. Misinformation exploits outrage to spread online

By Mcloughlin et. al.

A study analyzing misinformation's spread online highlights the powerful role of moral outrage in driving its circulation. Researchers discovered that posts from misinformation sources elicit more outrage than those from trustworthy sources, making such content highly engaging on platforms like Facebook and Twitter. Outrage motivates users to share misinformation without verifying its accuracy, often driven by nonepistemic motives such as signaling group loyalty or expressing moral stances. Behavioral experiments confirmed that outrage-evoking headlines are shared more, whether they are true or false, complicating efforts to curb misinformation. Notably, misinformation that exploits outrage may reduce reputational risks for users since they can justify sharing content as "outrageous if true," preserving credibility while spreading falsehoods. Addressing this issue requires rethinking current strategies. The study suggests focusing on strategies that address nonepistemic motives, like emotional and identity-based incentives. Additionally, greater transparency and accountability for algorithmic content

promotion are needed to reduce the amplification of misinformation. This multi-pronged approach could help mitigate the spread of false information and its negative impact on public discourse.

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