

PLOS PROGRESS UPDATE
2014/2015

FROM THE CHAIRMAN AND CEO

PLOS is dedicated to the transformation of research communication through collaboration, transparency, speed and access. Since its founding, PLOS has demonstrated the viability of high quality, Open Access publishing; launched the ground-breaking *PLOS ONE*, a home for all sound science selected for its rigor, not its “significance”; developed the first Article-Level Metrics (ALMs) to demonstrate the value of research beyond the perceived status of a journal title; and extended the impact of research after its publication with the PLOS data policy, ALMs and liberal Open Access licensing.

But challenges remain. Scientific communication is far from its ideal state. There is still inconsistent access, and research is offered at a snapshot in time, instead of as an evolving contribution whose reliability and significance are continually evaluated through its lifetime.

The current state demands that PLOS continue to establish new standards and expectations for scholarly communication. These include a faster and more efficient publication experience, more transparent peer review, assessment though the lifetime of a work, better recognition of the range of contributions made by collaborators and placing researchers and their communities back at the center of scientific communication.

To these ends, PLOS is developing Aperta™, a system that will facilitate and advance the submission and peer review process for authors, editors and reviewers. PLOS is also creating richer and more inclusive forums, such as PLOS Paleontology and PLOS Ecology Communities and the PLOS Science Wednesday redditscience Ask Me Anything.

Progress is being made on early posting of manuscripts at PLOS. *PLOS Computational Biology* Topic Pages allow authors and editors to collaborate in a timely and transparent way. They then publish the work in both the journal and, along with the peer reviews and author responses, on Wikipedia for visibility and discussion.

What began as a movement to make research accessible and free now provides millions of readers around the world increasing opportunities to make important, positive impacts on global health, scientific discovery and science education.



Gary Ward, *Chairman*



Elizabeth Marincola, *Chief Executive Officer*

Transparent and Continual Assessment Advances Science

Ongoing Engagement Extends the Lifetime of Research

Advances in digital technologies have created opportunities to alter the way people work, communicate and cooperate. Leveraging the broad readership and technology of Wikipedia and editorial rigor of *PLOS Computational Biology*, **Topic Pages** [1] allow PLOS authors and editors a collaborative, timely and transparent approach to authoring, reviewing and editing. Manuscripts created and revised on the journal's **Wiki** undergo a peer review process made transparent to the public by publishing the work—as both a **journal article** [2] and a **Wikipedia page**—together with the **peer reviews and author responses**. Access to the work on Wikipedia increases visibility and invites discussion. Eight Topic Pages have been created with **Wikipedia versions** of articles updated as discoveries are made, allowing the research record to evolve.

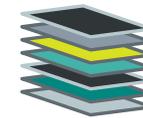
New Research Available Sooner Accelerates Science

PLOS believes that the early availability of research findings, expert commentary and informed scientific opinion benefits basic scientists, clinicians, policymakers and the public through improved decision making. To allow for fast and timely release of information to the community at the height of the Ebola epidemic, two manuscripts submitted to *PLOS Neglected Tropical Diseases* describing the social pathways of **transmission** and factors leading to the **emergence** of Ebola in West Africa were conditionally accepted before rigorous peer review and **posted** on the blog 'Speaking of Medicine.' On completion of the peer review process, the **articles** [3] were **published** [4] in the journal.

PLOS HIGHLIGHTS

100 PERCENT
OPEN ACCESS

12+ YEARS
AS A LEADER IN OPEN ACCESS PUBLISHING



7 PEER-REVIEWED JOURNALS



Industry Collaboration on Peer Review Ensures Integrity

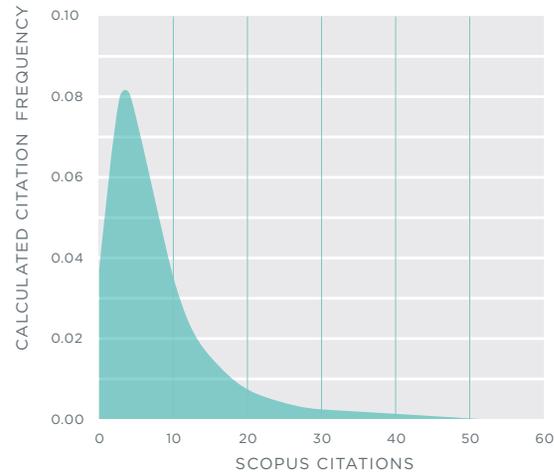
PLOS joined other publishers and the Committee On Publication Ethics (COPE) to improve the integrity and effectiveness of peer review by developing an industry-wide response to inappropriate and orchestrated manipulation of the review process. The response includes a **statement** with recommendations for individual publishers on retracting articles published on the basis of manipulated reviews, and guidelines to ensure the integrity of the scientific record, public trust in the scientific literature and author confidentiality.

“The balance tips towards the requirement for transparency. Readers need to be able to judge whether writers are commenting outside their areas of expertise.”

Hilda Bastian

Editor, PubMed Health and PubMed Commons
Academic Editor, *PLOS Medicine*

PLOS ONE— Measuring Article Impact



23,464 articles published in 2012

- 10% of articles ≥ 19 citations
- Median citations = 7

Courtesy of Martin Fenner. Scopus citation counts as of July 13, 2015 for *PLOS ONE* articles published in 2012

PLOS—A TOP TEN BIOMEDICAL PUBLISHER

Scientists in the UK identify their best work for the UK's 2014 Research Excellence Framework (REF), a periodic assessment of published research articles. A total of 2,403 PLOS articles across a wide range of disciplines that provide new understanding of disease processes, clinical insights or important basic scientific research discoveries were submitted to the assessment, reflecting high-quality research by UK university scientists published in PLOS journals.



Recognized Author Contributions Enhance Discovery

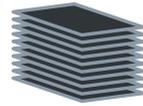
To encourage appropriate recognition of researchers for contributing resources such as antibodies and model organisms, authors of *PLOS Biology* and *PLOS Genetics* articles gained the ability to participate in the cross-publisher **Resource Identification Initiative** whereby materials described in an article are assigned a persistent and unique machine-readable resource identifier. The identifier links to a curated description of the resource, and other articles or online sources citing that resource, via the SciCrunch web portal. In addition to incentivizing appropriate credit, this facilitates better resource management, reproducibility and discovery.

Training Improves Assessment Quality

Assessment at multiple stages along a research project's lifecycle provides a comprehensive approach toward faster publication of quality work. Training in how to critique research, the ability to more rigorously capture the intellectual effort of commenting and acknowledgments of contributions will stimulate a stronger **post-publication culture** [5]. Towards this goal, those scientists engaged in discovery—from **basic science** [6] to **translational research** [7]—in discussion through **blogs** [8] can play a role in creating and enriching a scientific environment enhanced by critical thinking,

respectful dialogue and constructive commenting. PLOS supports these experiments through its editor and reviewer training available in the Academic Editor Knowledge Base.

ARTICLE HIGHLIGHTS*



ARTICLES PUBLISHED

33,000+

11.6 MILLION
MONTHLY ARTICLE VIEWS

1.9+ MILLION
MONTHLY ARTICLE DOWNLOADS

COLLECTIONS
LAUNCHED 18

135,000+ ARTICLES
PUBLISHED*

*2014

*Through 2014

OPENNESS FOSTERS INCREASED PUBLIC ENGAGEMENT

The **Public Engagement in Science Collection** [9] investigates through case studies the conditions under which the public is motivated to engage in scientific issues and decision making related to bio-science innovation. Recent articles address **open collaboration** [10] involving broadened participant groups to improve local environmental governance; increased **transparency** [11] in the grant review process to bolster confidence for public spending on research; **incremental changes** [12] to improve transparency of peer review for grant funding applications; and the fundamental technical and structural elements of a **trust-centric framework** [13] for genomic data.

COMMUNITY HIGHLIGHTS*

25
BLOGS

2.1 MILLION
UNIQUE VISITORS
TO PLOS BLOGS

 190,000+
TWITTER FOLLOWERS

57 NOBEL LAUREATES
AS AUTHORS

*As of August 1, 2015

GLOBAL REPRESENTATION*

6,900+ EDITORS 
90,000+ REVIEWERS



190+ COUNTRIES
WITH AUTHORS

*Through 2014

AUTHOR SATISFACTION†

93%

PLOS AUTHORS WOULD
SUBMIT TO PLOS AGAIN



94%

PLOS AUTHORS WOULD
RECOMMEND PLOS TO A
COLLEAGUE

†2014 Author Survey

One PLOS, Many Communities

Richer and More Inclusive Venues for Interaction and Information Dissemination

Discussion of published research takes place online through PLOS Communities—venues that advance discovery through opportunities to share research, place findings into context and enable participants to stay current on the most relevant work by engaging in online dialogue. In joining the existing **PLOS Neuroscience** and **PLOS Synthetic Biology** Communities, **PLOS Ecology** and **PLOS Paleontology** support the robust engagement of authors in these disciplines. These Communities are led by independent researchers acting as community blog editors working in cooperation with PLOS staff and Academic Editors. Together they form open collectives of early and mid-career researchers and noted bloggers who interview authors, highlight articles, provide conference coverage and facilitate research-based debates and discussions directly on PLOS-hosted web properties and through social media networks.



“It makes [the research] more visible, and gives a chance for people who really want to engage with science to engage with it in a way that’s a little more personal than what’s offered by a newspaper article or a blog post.”

Andrew Farke

PLOS Science Wednesday on redditscience
Ask Me Anything participant
PLOS Paleontology Community Editor and
PLOS ONE Academic Editor
Augustyn Family Curator of Paleontology
Raymond M. Alf Museum of Paleontology

POST-PUBLICATION DISCUSSION VENUES EXPAND AUDIENCE

The value of scientific research resides in more than just the final publication. **PLOS Science Wednesday** on redditscience provides a venue for an interactive post-publication conversation and a place for select PLOS authors to communicate their science and interact with the eight million member extended community of readers, researchers and student scientists. The weekly Ask Me Anything (AMA) series is open to anyone with an internet connection and an interest in science or the story behind the science. Top AMAs covered **computer models** for artificial intelligence, **inflation bias** in science publications and the **importance of vaccination** related to the 2014-2015 measles outbreak. In its first eight weeks, the series generated 500,000 page views and 2,000 comments and questions for authors, while bringing more readers to their PLOS articles. Archived **AMA transcripts** are Open Access and available for remix and reuse.

Collaborative Blogging Generates Greater Reach

The rapidly changing scientific communication landscape offers opportunities for interaction among researchers at conferences and beyond.

Field Reports blogging sites, hosted on plos.org, allow live collaborative blogging and tweeting to bring conference coverage to colleagues near and far, amplifying dissemination of research and meeting highlights. At the Society for Neuroscience Annual Meeting, nearly 50 contributor attendees posted highlights of research news from conference presentations. Attendees of the American Society of Tropical Medicine and Hygiene Annual Meeting provided coverage of research discussions and keynotes—by Bill Gates and representatives of the World Health Organization—for international scientists including many prevented from attending due to travel restrictions on Ebola-affected countries, in an effort coordinated by *PLOS Neglected Tropical Diseases* staff and community editors.

Active Participation Strengthens Feedback Loops for Researchers

To develop the collective voice of communities while preserving the individual perspective, PLOS provides blogs on matters of interest to diverse audiences. **The PLOS Blogs Network** features staff and community scientists and science writers contributing on topics ranging from the discipline-specific **'DNA Science,'** focused on genomics research, to the broad interest **'Public Health Perspectives.'** Timely blogs include **'SciComm,'** an open platform for opinion and discussion on the art and science of science communication and **'Absolutely, Maybe,'** an independent blog exploring hot topics in biomedical research. Recent posts cover **meta-analysis,** scientists working **together** online and the **integration** of social media into public television health documentaries.

SCIENTISTS SHARE THE IMPORTANCE OF RESEARCH TO SOCIETY

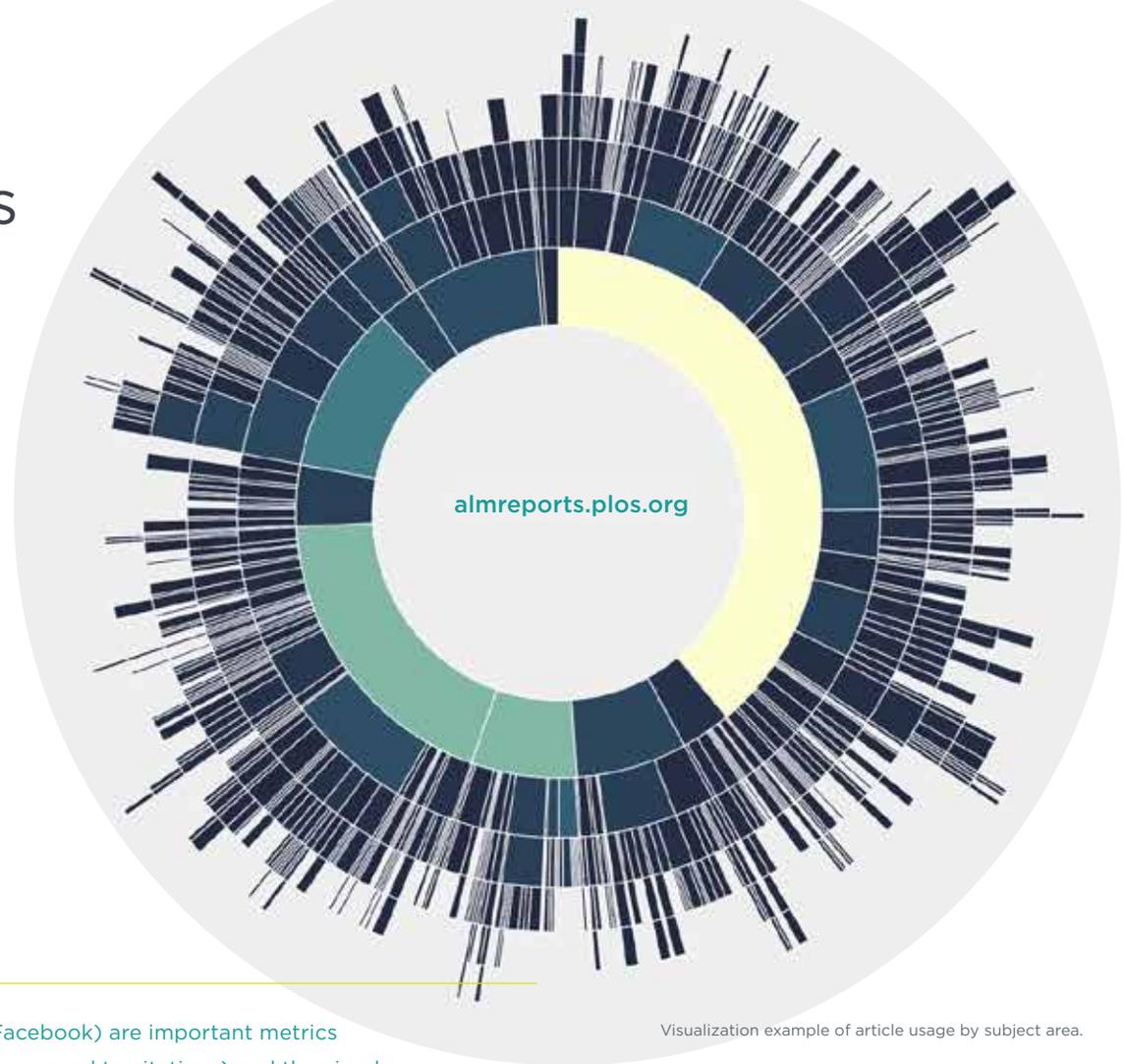
In a forum for active scientists to speak directly to the public about why basic research in their field is important, *PLOS Pathogens'* **Research Matters** [14] series provides an opportunity for individual scientists to communicate how diverse fundamental research into pathogens assures real and compelling impact on public health and human knowledge. The series launched with perspectives from the journal's Editors-in-Chief whose curiosity-driven research led them to get involved in **start-up biotech** [15] companies and **joint ventures** [16] with pharmaceutical companies, demonstrating the diverse ways basic science can have practical and unpredicted application.



Metrics Enhancements Improve Assessment

ALM Reports Increase Usability

As more Article-Level Metrics (ALM) data are collected and made available, users can more quickly and easily understand their relevance and meaning in graphical presentation format. ALM Reports allow users to collect metrics for any set of PLOS articles as well as to summarize and visualize the results. The latest iteration of the visualization tool features three interactive formats that support granular assessment of large article sets by subject area, usage over time and author location to identify potential collaborators and users of the research content. A faceted search allows comprehensive discovery across the entire corpus of over 135,000 PLOS articles with results narrowed by journal, article type and publication date.



“Views and shares on social media (such as Twitter and Facebook) are important metrics because they are nearly instantaneous measures of impact (compared to citations) and they imply there is a public interest in the research.”

Chris Rands

PLOS Genetics author
Project Manager, Science
PHG Foundation, Cambridge, United Kingdom

Stakeholders Encourage Deeper Understanding of Metrics

The ability to know where published work is attracting attention beyond academia and to understand its influence before it has accumulated scholarly citation are author and funder interests addressed by use of ALMs. In their **expert commentary** [17] on the potential of metrics to provide a deeper understanding of the impact of the work they support, the Wellcome Trust recommends ALM developers work in concert with funders for the further benefit of all stakeholders. In turn, the Higher Education Funding Council for England (HEFCE) **report** on the role of metrics in research and performance assessment adopted many of the **recommendations** made by PLOS in May 2014 to take a rigorous and quantitative approach while developing necessary guidelines to protect against misuse. The report calls on publishers to reduce the emphasis on journal impact factors and recommends that data on quantitative indicators be openly available for analysis.

“Meaningful work is published in many places and the impact of each study cannot be dictated by the title of the journal in which it appears.”

Damian Pattinson

Editorial Director, *PLOS ONE*



IMPROVING THE READER EXPERIENCE

On each article, the redesigned ALM signpost provides better visibility of views, cites, saves and shares of individual articles together with improved display and feedback options for subject area terms. An updated format for the journal homepages highlights content and incorporates some of the striking images that accompany PLOS articles. Other improvements focus on quality assurance and typesetting processes, including implementation of a single column PDF design that enables a more efficient composition process and ensures readability of PLOS articles across a variety of devices. Additional improvements serve as the pillars of future initiatives and integrations.

Standards Enable Reproducibility

Streamlined Data Deposition Improves Access

The **PLOS Data Repository Integration Partner Program** simplifies data deposition, provides confidential access to data for editors and peer reviewers during the review process and allows public access to these data for readers following publication. Researchers deposit data and submit their manuscript through a single, streamlined workflow to ensure the article and its underlying data are fully paired—published and linked together. **Dryad** and **FlowRepository** currently support integration, laying the foundation for additional repositories in the future. PLOS worked with Dryad to develop an Application Programming Interface (API) that facilitates metadata exchange between journals and the repository, making the process more reliable and scalable.

Community Standards Facilitate Reproducibility

Without a discoverable relationship between datasets, their contributors, associated publications

and other research outputs, discovery and reproducibility are cumbersome and variable. PLOS is collaborating with Technical and Human infrastructures for Open Research (THOR) grant consortium partners ORCID, DataCite, Dryad, Zenodo, PubMed Central and others to ensure the increasingly complex network of digital identifiers and systems developing around research studies is linked and that digital identifiers are recognized across diverse systems.

Expert Insights Enhance Research Replication

Reproducibility is crucial for success of the scientific endeavor and a key topic of interest to an expansive readership; a 2014 **study** [18] describing the inability of authors to replicate their previously published findings made the front page of **redditscience** with over 850 comments. An Education article in *PLOS Computational Biology* **defines** [19] scientific communities and the value they bring to facilitating the exchange and development of ideas and expertise, including those related to fostering reproducible research, and an **Essay** [6] in

PLOS Medicine by John Ioannidis—with over 87,000 views—on how to make more published research true suggests benefits from enhancing a culture of replication and reproducibility practices in research science. PLOS' most viewed article to date, with over 1.3 million views, is a *PLOS Medicine* Essay on the implications of bias in research claims: “**Why Most Published Research Findings Are False**” [20]. The article is one of 15 must-reads on the **UC Berkeley Summer Reading List** for incoming students.



Resources Foster Early Career Researchers



Communicating Insights for Professional Development

PLOS encourages the next generation of scientists to couple creative ingenuity with rigorous inquiry in their research. **'The Student Blog'** is a platform to foster these skills while providing a forum to connect students with colleagues and PLOS authors. Written by a geographically diverse team of students from a variety of institutions, disciplines and levels of education, the blog provides insight into the current state of science education and work by early career researchers and their community, with posts covering student perspectives on **deep brain stimulation**, **public misunderstanding** of current scientific topics and the importance of the World Health Organization in **global health emergencies**.

Awards Program Recognizes Ideas to Improve Research Communication

Experience in becoming effective science communicators is an important component of

professional development for a successful career. The **PLOS Early Career Travel Award Program** recognizes efforts of PLOS authors in the early stages of their career and supports opportunities for them to present their research findings to a wider audience. Selected recipients provided thoughtful and creative written perspectives regarding the hindrances to early career researchers for communicating their science as well as solutions for change.

“As technology has evolved, the teaching of science communication should reflect this. In addition to traditional formal writing and presentation, universities should include tasks that provide students with the skills and confidence to become involved in social media (Facebook, Twitter), blogs, scientific forums and media audiences.”

Denice Higgins, PhD

Forensic Odontologist and Post-doctoral Research Associate,
The University of Adelaide, Australia
PLOS Early Career Travel Award Recipient

GUIDES TO ADDRESS CAREER CHALLENGES

With nearly 50 articles, the **Ten Simple Rules Collection** [21] published in *PLOS Computational Biology* has amassed over 1.8 million page views to date. Articles in the series provide quick, concentrated guides for mastering some of the professional challenges research scientists face in their careers. Favorite recent articles reflect the interests and concerns of young professionals: **Approaching a New Job** [22]; **Live Tweeting at Scientific Conferences** [23]; **Better (Scientific) Figures** [24]; **Win a Nobel Prize** [25]; **Successful Cross-Disciplinary Collaboration** [26] and **(Empirical) Rules for Writing Science** [27].

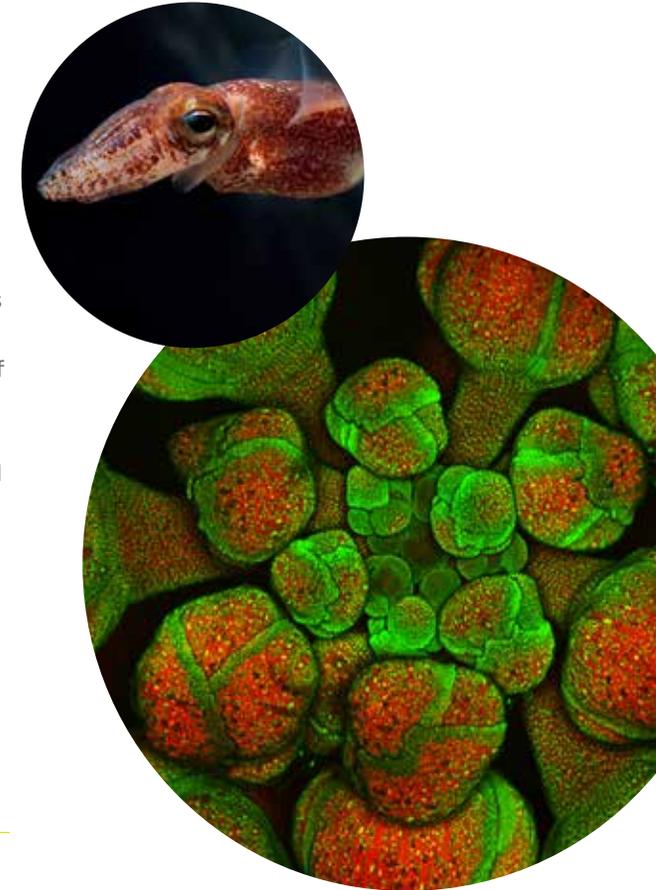
Open Access Advances Science

Global Policies Enable Access

With passage of **AB609**, the first state Open Access legislation, California became the first in the country to ensure that state Department of Public Health funded research is publically available, setting the stage for the acceleration of scientific discovery, innovation and economic growth. PLOS led the coalition that brought this legislation to the public. Around the world, governments released policies for institutions, funders and researchers to shift scholarly communication toward Open Access. Denmark created a **plan** for all researchers to publish any government-funded research Open Access by 2021 while The Netherlands' **vision** targets 2024. In the US, broad release of government access and data policies reflect that of the National Institutes of Health.

Foundations Launch Progressive Policies

To make all outputs of the research that it supports freely accessible and fully usable to the public, the **Bill & Melinda Gates Foundation** required that as of January 2015, all articles and associated data sets derived from their funding must be made available under a CC BY 4.0 license, with no embargo period allowed beginning in 2017. To promote greater transparency and accessibility of materials, the **Ford Foundation** adopted an open licensing policy for all grant-funded projects and research, and in an effort to help speed the pace of discovery and innovation around the globe, the **Wikimedia Foundation** adopted a pilot Open Access policy.



“Published research resulting from our funding should be promptly and broadly disseminated. We have adopted an Open Access policy that enables the unrestricted access and reuse of all peer-reviewed published research funded, in whole or in part, by the foundation, including any underlying data sets.”

Bill & Melinda Gates Foundation

Open Access Policy

Efficient Article Processing Charge Management Improves Open Access Implementation

An **online tool** developed by the working group Efficiency and Standards for Article Charges (ESAC) includes a quiz and scoring matrix that enables institutions or organizations to assess their needs when administering Article Processing Charge (APC) funds. An APC is a fee that offsets the cost of publication. The **ESAC** tool provides customized recommendations on how to proceed, including suggestions on the ultimate goals of reduced administrative costs and compatible infrastructures for effective payments. Strategic information transfer of best practices in cost administration among member institutions of the working group comprised of PLOS, Co-Action Publishing, Copernicus Publications, Bielefeld University, the Max Plank Digital Library and DFG, the largest independent research funding organization in Germany, will ease widespread adoption of the APC model.

Unrestricted Text and Data Mining Allows Discovery

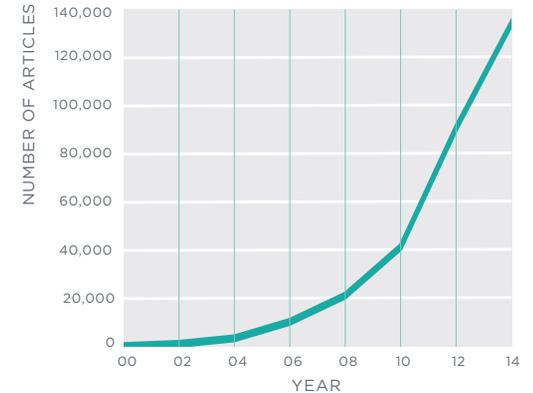
To support policies and public awareness that text and data mining for research purposes is compatible with current and future publishing industry practices,

PLOS participated in construction of **The Hague Declaration on Knowledge Discovery in the Digital Age**, a set of five core principles and a roadmap for action to enable researchers to carry out text and data mining of digital content on the web without legal repercussions. Unrestricted access to the scientific literature together with standards that promote machine readability of the facts, data and ideas contained within ensures that journal content is available for maximum discovery and reusability.

Updated Guide Increases Global Understanding of Open Access

The popular “HowOpenIsIt?”[®] Open Access Spectrum **guide** that standardizes Open Access terminology and describes a spectrum of implementation from open to closed access was updated based on a real-world pilot covering 100 journals’ policies. PLOS, the Scholarly Publishing and Academic Resources Coalition (SPARC) and Copernicus Publications, in consultation with Open Access Scholarly Publishers Association (OASPA), Securing a Hybrid Environment for Research Preservation and Access (SHERPA) and Infrastructure Services for Open Access (IS4OA) conducted the pilot. Scientific communities on a global scale benefit from the guide translated into seven languages.

Growth in Published Open Access Articles



Data from OASPA; OA-only journals using a CC BY license includes BMC, Copernicus, Ecancermedicalsecience, eLife, Frontiers, Hindawi, JMIR Publications, MDPI, PeerJ, PLOS, Springer Open

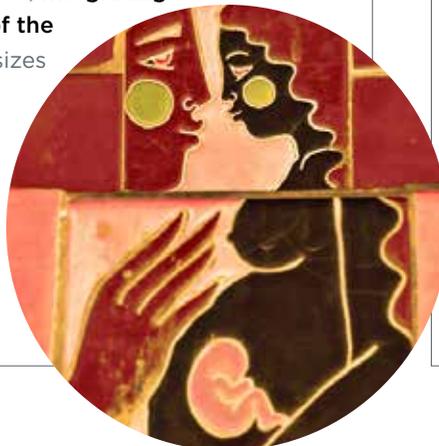


Curated Content Accelerates Discovery: Collections



Research to Improve Global Health

A **partnership** [28] between *PLOS Medicine* and the Maternal Health Task Force at Harvard School of Public Health produced a series of article collections focused on the better understanding of how and when to comprehensively integrate maternal and infant health care. From Argentina to Zimbabwe, articles come from authors in over 400 institutions around the world, ensuring global participation in and access to comprehensive maternal health data, programmatic experiences and critical areas of debate and consensus. The 2014 Collection, **Integrating Health Care to Meet the Needs of the Mother—Infant Pair** [29], emphasizes the importance of simultaneous considerations of treatment and prevention in the integration of care. A **‘Speaking of Medicine’** post highlights key articles over three years.



International Expertise for Deeper Understanding

In one of the largest collections of new material published by PLOS, experts from the World Health Organization (WHO) and the World Bank Group document and monitor progress towards a healthcare environment in which all people who need health services receive them—without excessive financial hardship. The *PLOS Medicine* **Monitoring Universal Health Coverage (UHC) Collection** [30] includes an **Overview** [31], 13 country case studies written by national experts and five technical reviews that provide insights related to the measurement of financial protection, service coverage and equity. The Collection provides in-depth analysis on interlinked components and integration of UHC monitoring into the overall monitoring of healthcare systems’ performance. The accompanying Editorial, **‘The PLOS ‘Monitoring Universal Health Coverage Collection: Managing Expectations’** [32], places this global effort by WHO and World Bank in historical context and describes its limitations.



Improved Diagnoses from Dedicated Resources

The Special Programme in Research and Training in Tropical Diseases (TDR) was formed in 1974 in response to the World Health Assembly's call for increased effort and strengthened training to combat diseases of poverty, particularly in developing countries. Resulting tools provide improvements in malaria control, tuberculosis diagnosis and assessment of the impact of climate change on vector-borne diseases. The **TDR Reflects on 40 Years Collection** [33] published in *PLOS Neglected Tropical Diseases* provides perspectives and historical profiles written by current and former staff at TDR on 40 years of disease and policy research and implementation. An **Historical Profile** [34] on bringing community viewpoints into research and application is highlighted on the WHO **website**.

Integrated Content for Broader Dissemination

To provide a complete picture of the latest research and commentary to the public in historical context, PLOS is able to leverage additional collection formats that may be sourced externally. As in the case of the Ebola outbreak, **Perspectives** [35], **Commentary** [36], **blog posts**, **Editorials** [37] and **Primers** [38] published across PLOS, early research rapidly published in ***PLOS Currents: Outbreaks*** [39] and older articles that provide **background** [40] are pulled together into a **PLOS Resources on Ebola** flipboard.



Global Media Extends Article Reach and Impact



the Atlantic

“When HIV Infects the Brain”

March 26, 2015
PLOS Pathogens



CNN

“Hope for Ebola Epidemic End in Liberia”

January 15, 2015
PLOS Biology



npr

“California Trees Nailed as the Source of Mystery Infections”

August 22, 2014
PLOS Pathogens



Science News
MAGAZINE OF THE SOCIETY FOR SCIENCE & THE PUBLIC

“Is Redoing Scientific Research the Best Way to Find Truth?”

January 13, 2015
PLOS Medicine



BBC

“Deep Sea ‘Mushroom’ May Be New Branch of Life”

September 3, 2014
PLOS ONE



NATIONAL GEOGRAPHIC

“Watch Death Valley’s Rocks Walk Before Your Eyes”

August 27, 2014
PLOS ONE



WIRED

“New Algorithms Search for Signs of Consciousness in Brain Injury Patients”

October 16, 2014
PLOS Computational Biology



The New York Times

“Tracking Worms Troubles to Monitor a Country’s Health”

May 4, 2015
PLOS Neglected Tropical Diseases



Newsweek

“BPA Disrupts Sperm Development, Linked to Declining Male Fertility”

January 23, 2015
PLOS Genetics

PLOS publishes a suite of influential Open Access journals from diverse areas of science and medicine that contain rigorously peer-reviewed research articles, together with expert commentary, analysis and educational material. PLOS journals fully comply with Open Access mandates from funders, institutions and policymakers; upon publication all articles are immediately deposited in PubMed Central. Together with high-quality reporting of interesting research itself, deep dives into key topics with Collections, Perspectives and Editorials bring readers to the more than 135,000 articles published in PLOS journals since 2003.

10-YEAR ANNIVERSARIES

2014

PLOS Medicine

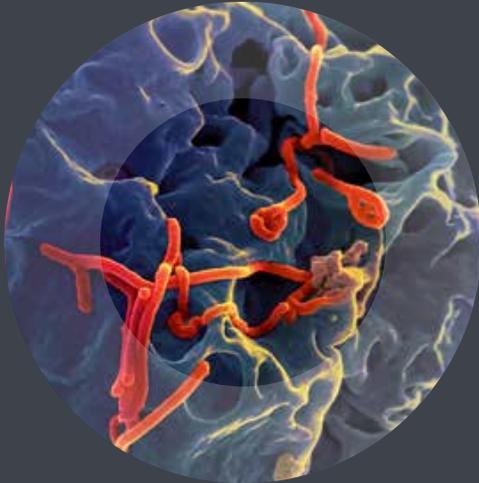
2015

PLOS Computational Biology

PLOS Genetics

PLOS Pathogens

PLOS Biology



With a readership that encompasses the scientific community as well as educators, policymakers and members of the public, *PLOS Biology* publishes articles of exceptional significance, originality and relevance in all areas of biological science, from molecules to ecosystems, including work at the interface of other disciplines, such as chemistry, medicine, physics and mathematics. In addition to primary research, the journal publishes Primers, Perspectives and Community Pages.

The search for effective Alzheimer's disease progressed with the **identification** [41] of an inhibitor targeting an enzyme involved in learning and memory found to be overactive in the disease. In a mouse model of Alzheimer's, treatment with the novel compound—a tyrosine phosphatase inhibitor—improved cognitive function. A **Synopsis** [42] summarizes the significance of the work.

Widespread poor practice of data representation in the scientific literature as described in a **Perspective** [43] struck a chord with readers, with 100,000 page views in less than a month following publication—the most meteoric rise in Article-Level Metrics (ALMs) to date for *PLOS Biology*. The article presents data on the misuse of the bar graph and includes Excel **templates** for creating scatterplots with the discussion continuing **post-publication**, as engaged readers added code for generating plots in other statistical software. The work is part of the **PLOS Reporting Guidelines Collection** [44].

An integrative approach combining the analysis of modern bird development and dinosaur fossil data **clarified** [45] how wrist bones evolved during the dinosaur—bird transition and resolved previous disparities challenging support for the dinosaur—bird link. A **description** [46] of how the wrist was remodeled bone by bone and honed for flight discusses the benefits of combining paleontology and embryology to piece together evolution.

An industrial revolution may be on its way to the **laboratory** with the increasing availability of 3-D printers in combination with designs and assembly instructions placed in Open Access repositories that include the National Institutes of Health 3-D Print Exchange and peer-reviewed journals. A **Community Page** [47] details how the Open Labware movement originated, its current state, capabilities and resources, as well as lessons learned from introducing the concept to educators in sub-Saharan Africa and Latin America. A **PLOS Science Wednesday** on redditscience Ask Me Anything with the authors received nearly 800 comments.

An **Essay** [48] considering the nature of evolution and the concept of language proposes a recent and rapid emergence of language, in evolutionary terms. The authors explain the development of simple phrases and ultimately sentences as a series of merged word sets of increasing size and complexity.

The Perspective “**Life in a World without Microbes**” [49] considers life without the human gut microbiome, a hypothetical scenario of a radically different world lacking bacteria and archaea to regulate the environment, and the deadly implications of eliminating microbial eukaryotes and viruses. This work was widely viewed in the era of what some have called the age of the microbiome.

Moving from the stomach to the head, scientists **discovered** [50] that the mammalian circadian clock in the brain is synchronized not only by the presence of light but also by the color information contained in that light. The work, implying a more complex sensory mechanism than previously realized for telling time of day, is accompanied by a **Primer** [51] explaining the research.



PLOS Medicine



An influential venue for research and commentary on the major challenges to human health worldwide, *PLOS Medicine* publishes articles across all areas of medical science with potential to directly and substantially inform clinical practice or health policy, including research that provides mechanistic insights into disease processes. The journal emphasizes work that advances understanding of conditions or risk factors impacting human health through clinical, epidemiological or translational research.

The journal celebrated its 10th Anniversary in 2014 at a Symposium with guest speakers John Ioannidis speaking on truth in published research and Hilda Bastian discussing post-publication evaluation. Complete presentations and an interview with Ioannidis are available on the **PLOS Video Channel**.

A malaria clinical trials partnership published a **milestone** [52] in the development of a vaccine with the work receiving the **Charles C. Shepard Science Award** in the category of 'Prevention and Control' for best manuscript published in a reputable, peer-reviewed journal by a Center for Disease Control or Agency for Toxic Substances and Disease Registry scientist. The impact of this trial demonstrating safety and even partial vaccine efficacy in infants and children in seven African countries cannot be underestimated as there currently is no licensed malaria vaccine. The article acquired more than 12,000 views in the first two weeks following publication.

A **study** [53] documenting more than a decade-long effort in the 1960s–1970s by the sugar industry to influence national dental health research and policy

garnered widespread media **coverage, comment** from the World Sugar Research Organization and an author **rebuttal** recommending scrutiny of industry opposition to current policy proposals. On Speaking of Medicine, the Executive Director of the Center for Science in the Public Interest **remarks** on the debate in the context of sugary beverages and 2015 national dietary guidelines.

A statement calling for public access to data from all clinical trials went live on the World Health Organization (WHO) website in concert with an **Essay** [54] in *PLOS Medicine* by WHO leaders explaining that conduct of human research without publication and dissemination of the results is unethical and a **Perspective** on practical approaches to achieving transparency by Ben Goldacre, co-founder of AllTrials.net.

A **Health in Action** article—which provides a venue for groups or individuals not regularly represented in a medical journal to describe important issues from their perspective—**reports** [55] on a coalition campaign in Nigeria involving imams and other

leaders, doctors and polio survivors working to reverse local opposition to polio vaccination.

In the aftermath of the massive earthquake that devastated Haiti in 2010, an ongoing epidemic of cholera introduced by United Nations peacekeepers reached over 730,000 cases and 8,700 deaths. An **Essay** [56] calls for measures such as pre-deployment screening and treatment to prevent the spread of drug-resistant malaria by UN peacekeeping troops reassigned from areas where resistance is prevalent.

An **Essay** [57] from Bernard Pécoul and colleagues from Médecins Sans Frontières, Wellcome Trust, Institut Pasteur and other public health experts called for the creation of a global biomedical research and development (R&D) fund for innovation in drug research for Ebola, antibiotics and other drugs for neglected diseases. The publication of the essay coincided with the World Health Assembly in Geneva and the WHO Ebola R&D summit.



PLOS ONE



The world's largest journal, *PLOS ONE* publishes scientifically rigorous research in all areas of science and medicine including interdisciplinary work as well as replication studies and negative results, vital components of the scientific record. Publication criteria require research be conducted and reported according to high technical and ethical standards rather than subjective assessment of significance, providing a faster path for disseminating research to the public.

Without the publication of negative, null and inconclusive results the research record is **incomplete**. These missing pieces in the scientific literature—when published and discoverable—help prevent duplication of research endeavors and accelerate research progress. The **PLOS Missing Pieces Collection** [58] highlights the importance of publishing all sound science, including negative findings, which are valuable to the community in context of previous work and as a measure against unnecessary research efforts.

The mystery of the sliding rocks in Death Valley National Park may now be **solved** [59] with the first observations of rocks in motion, made using GPS sensors and time-lapse photography. The article captured the global imagination, with international media **coverage** in more than 60 unique outlets and over 215,000 views less than one year following publication.

The **Foldscope** [60], an origami-based paper microscope that costs under \$1 and assembles in 10 minutes, has the potential to excite the next

generation of scientists as well as bring diagnostic techniques to developing countries. The article is accompanied by assembly instructions and **video** and received international **media coverage**.

Four species described in *PLOS ONE* were chosen for inclusion in the **Top Ten New Species for 2015** curated by the International Institute for Species Exploration. One of the more popular discoveries is *Dendrogramma* [61], a deep sea mushroom-like organism that may be a novel classification of life. Others include a **dinosaur** [62] with bird-like features, unique reproductive practices by a **frog** [63] that gives birth to live tadpoles and distinct practices by a **wasp** [64] that uses dead ants as a nest protection strategy.

A widely-shared **study** [65] was the first to compare all sizes of plastic afloat at sea—more than 5 trillion pieces weighing over 250,000 tons. Circular currents known as ocean gyres may shred large plastic items into smaller microplastics that are then ejected across the ocean.

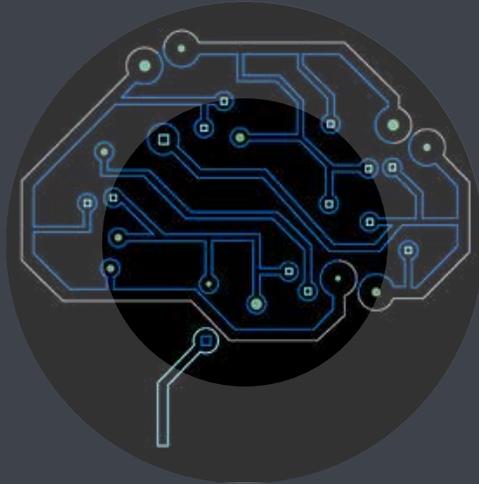
Research [66] that caught the attention of **readers** suggests that for older adults, being unable to identify scents may be a predictor of mortality

within five years. A genetic **sequencing study** [67] of supercentenarians, an exploration of human longevity, was widely covered by the **media**.

A conferences page on ‘EveryONE,’ the official blog of *PLOS ONE*, provides an **integrated location** for information regarding scientific meetings that PLOS attends, including when and where to meet with journal staff; key PLOS articles are also curated according to the focus of each conference. Blog post highlights on EveryONE include top **research videos** from published articles and a **post** that places in context two articles on patient-reported outcomes (PRO) in clinical trials. The articles document **insufficient guidance** [68] for protocol writers in a broad sampling of protocols and **incomplete PRO information** [69] on clinical trials registered with the UK National Institute for Health Research Health Technology Assessment program.



PLOS Computational Biology



Research, special features and practical career advice are regular features of *PLOS Computational Biology*. The journal publishes work on the application of computational methods to biological problems in order to provide substantial insights into living systems at all scales, from the nano to the macro, and across multiple disciplines, from molecular science, neuroscience and physiology to ecology and population biology.

In honor of the journal's tenth year, the **10th Anniversary Collection** [70] showcases the wide range of articles published with a **retrospective look** [71] at the journal by Founding Editors Philip E. Bourne, Steven E. Brenner and Michael B. Eisen and a discussion of **advances to come** [72] by Editor-in-Chief Ruth Nussinov. A **message** [73] from the International Society for Computational Biology celebrates the successful collaboration between the organization and the journal.

Focus Features serve as a nexus of work of central concern in the field, addressing key areas of computational biology, from research to how the journal can best serve the biological community. The first covers the "**Ethics of Big Data**," an increasingly important consideration for researchers. Additionally, a **guide** [19] to building a successful bioinformatics community discusses the benefits to the exchange and development of ideas and expertise, interactions and engagement with professionals from other fields, coordinated funding activities and more.

Analyzing page views of Wikipedia articles facilitates the ability to **monitor and forecast** [74]

diseases around the globe, an important consideration for halting infectious disease outbreaks before they reach epidemic or pandemic stages. The work fueled a public dialogue, was featured by the global **media** and was the subject of a radio **interview** on NPR Science Friday. The article is accompanied by an author **interview and comment** from the editor on the emerging field of Digital Epidemiology, the intersection of science, everyday technology and public health.

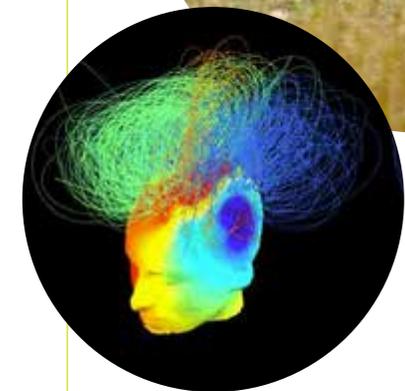
Key articles described development of computational methods for genetic analysis. A team of scientists developed **SciClone** [75] to identify the number and genetic composition of tumor subclones for improved tracking of tumor evolution and to identify the spatial origin of cells resistant to therapy. Ultimately deep sequencing combined with an understanding of intra-tumor heterogeneity can lead to improved therapeutic strategies.

Research demonstrating that modular **neural networks** [76] have high overall performance suggests that a benefit of modularity in animal brains may be to help organisms evolve to learn new skills without forgetting old ones. The work was

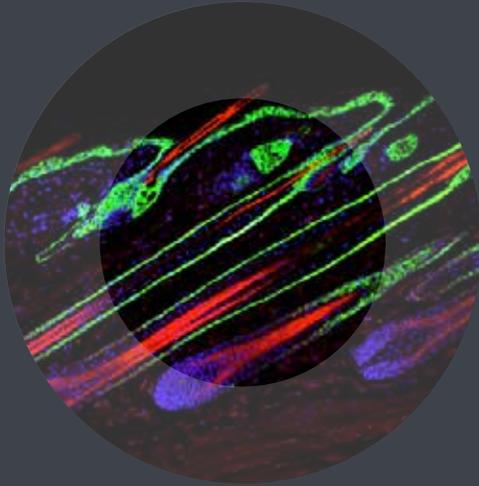
the focus of a **PLOS Science Wednesday** on reddit-science Ask Me Anything on computational models for artificial intelligence. In a separate study, scientists discovered distinctive neural network **signatures** [77] in the brains of people in a vegetative state, which could improve clinical assessment and help identify patients who are aware despite being unable to communicate. The work inspired **comment** and extensive media **coverage**.

Investigators also approached a key problem in understanding gene regulatory networks through application of the bioinformatics program **iRegulon** [78]. The method identifying master regulators of biological processes and mapping their downstream gene targets was highlighted in a **sequencing industry blog**.

“**Web-Based Computational Chemistry Education with CHARMing**” [79] in the *PLOS Computational Biology Education Collection* [80] describes the development, implementation and use of web-based lessons to introduce students and other newcomers to computer simulations of biological macromolecules. The **lessons** take the form of interactive step-by-step instructions for performing common molecular simulation tasks.



PLOS Genetics



By publishing outstanding original contributions in genetics and genomic biology, *PLOS Genetics* reflects the full breadth, interdisciplinary nature and impact of these fields on science and medicine. The journal's emphasis is to reflect the interests of a broad genetics community by highlighting studies with significant biological insight across a wide range of systems and fields, including human and model organisms.

2015 marks the **10th Anniversary** for *PLOS Genetics* and to recognize the valued contributions of its Editorial Board, select members will reflect on developments in their area of research and projections for future research in posts on '**PLOS Biologue.**' The first in this series covers the last ten years of **chromosome biology**, providing insight into the challenges and achievements over the decade.

In the journal, researchers **identified** *ICARUS1* [81], a universal gene required for cell proliferation and plant growth at high temperatures, a discovery that might be important in optimizing plant growth as rising temperatures across the world are predicted to have negative impact on agricultural productivity.

Scientists discovered gene variants that may be **predictors** [82] of facial shape based on 3-D images of faces from populations with mixed European and West African ancestry, in combination with genetic analysis and superimposed maps of more than 7,000 detection points. The author's predictive modeling considers how genes, sex and racial ancestry affect

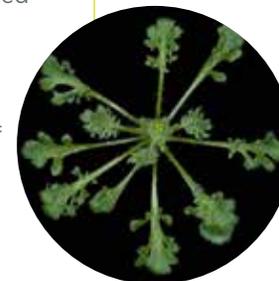
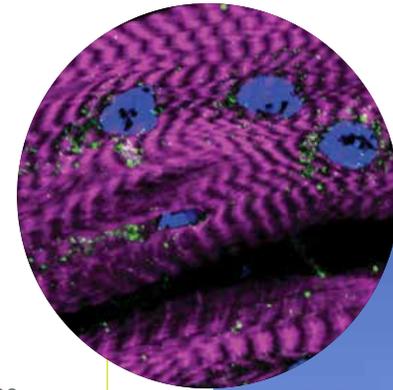
the position of these points and therefore overall face shape. The concept sparked **Formal Comment** [83] and extensive global and foreign language media **coverage**.

In a **Review** [84] of machine learning and predictive modeling for clinical outcomes, the authors discuss concerns and challenges of machine learning-based models for optimum prediction of complex phenotypic traits. Genotype to phenotype prediction has relevance in prediction of medical treatment outcomes and of economically beneficial traits in agriculture.

Current estimates on how much of the human genome is functional range from less than 5% to nearly 80%. In a **study** [85] based on variation in rates of sequence turnover across functional elements, approximately 8% of human DNA was found to be necessary. A PLOS Biologue post **describes** the relevance of the findings in context of previous larger estimates by the Encyclopedia of DNA Elements (ENCODE) consortium and analyzes the article's Article-Level Metrics (ALMs), boosted by a general interest science website story that was shared over 12,000 times on social media.

The series **Deep Reads** continues to provide the genetics and genomics community a place to explore how the discipline is portrayed outside the scientific literature, in relationship to the wider public. Book topics that influenced today's genetics researchers include the use of DNA in **tracking** patterns of human migration, mechanisms of **heredity** and evolution and species **diversity**. An original series on PLOS Biologue, **Understanding Images**, brings greater appreciation and insight to research articles through detailed explanation of select monthly issue **images**. The series initiated with an image of the tight junctions in hair follicle skin cells.

Based on extreme-high depth coverage of mitochondrial DNA (mtDNA) sequencing of human mother-father-child trio DNA samples, no evidence of paternal transmission of mtDNA was **detected** [86], findings that agree with the accepted dogma of exclusive maternal transmission of mtDNA. A companion **Perspective** [87] puts the controversy in context and compares two models of paternal DNA reduction for non-transmission of paternal mtDNA.



PLOS Neglected Tropical Diseases



The first journal devoted to chronic infectious diseases that primarily occur in rural and poor urban areas of low- and middle-income countries, *PLOS Neglected Tropical Diseases* (*PLOS NTDs*) is dedicated to advancing research in pathology, epidemiology, treatment, control and prevention of NTDs, as well as public policy. The journal promotes the efforts of scientists, health practitioners and public health experts from endemic countries, building capacity in the areas most in need.

Dengue is the most common mosquito-transmitted viral disease. To help public health officials prioritize resources and improve decision making, an international collaboration of health policy experts propose **strategies** [88] surrounding better data collection. Improved measurements of the global distribution of Dengue and the resulting economic burden should accompany current development in tools for diagnosis, vaccination, vector control and treatment.

In “**Outbreak of Ebola Virus Disease in Guinea: Where Ecology Meets Economy**” [37], Editor Daniel Bausch and colleague Lara Schwarz discuss the interrelated ecological and economic factors that may underlie the Ebola outbreak, from poverty to drought to poor healthcare systems. The Editorial is the sixth most viewed article in *PLOS NTDs*’ history, receiving extensive media **coverage** including ***The Washington Post*** and ***This Week in Virology***.

From Innovation to Application articles provide authors opportunity to discuss novel technologies, including drugs, vaccines and diagnostics. “Integrating Data and Resources on Neglected Tropical Diseases for Better Planning: The NTD

PLOS Neglected Tropical Diseases

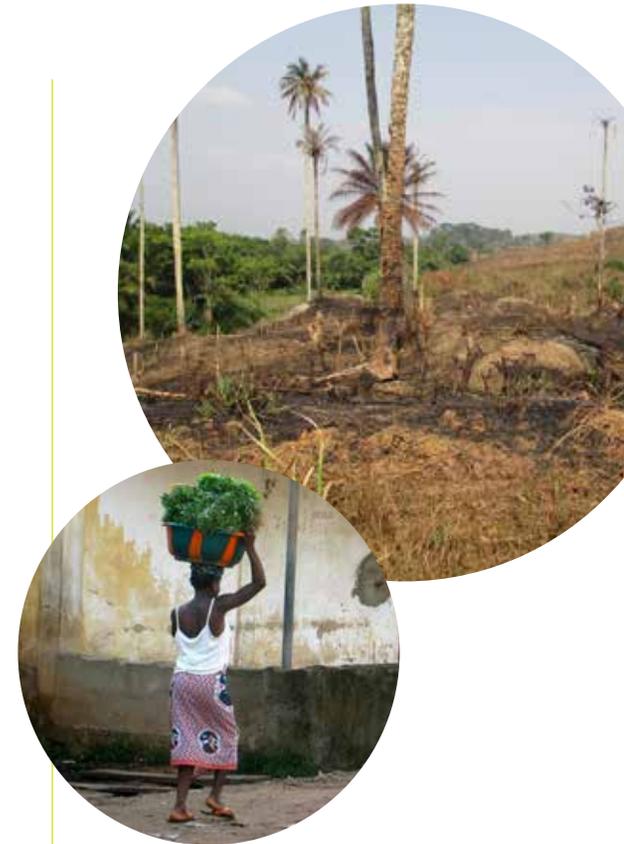
Mapping Tool (NTDmap.org)" **describes** [89] the creation of an innovative tool which allows users to visualize the geographic distribution of selected NTDs. Since cost-effectiveness of intervention is greatest when targeted to areas with a high burden of multiple diseases, distribution maps are essential for planning and implementing interventions, as well as for visualization of program progress in advocacy efforts.

A research article assessing **interactions** [90] between schistosomiasis and malaria transmission in sub-Saharan Africa concludes that mass schistosomiasis treatment and control programs in regions where both pathogens are highly prevalent may have indirect benefits on reducing malaria transmission, perhaps as a result of general reduction of immune burden.

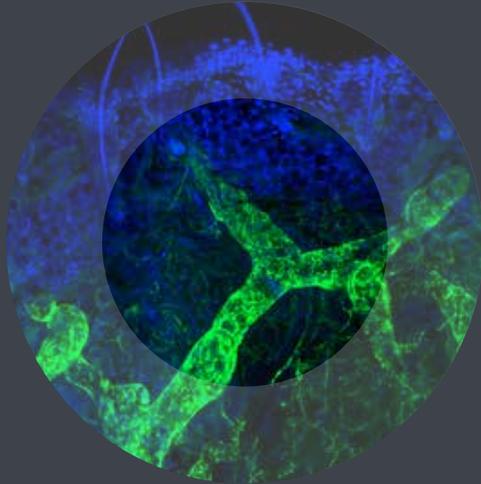
A **Viewpoint** [91] by researchers at the Smithsonian Tropical Research Institute in Panama discusses the implications of the appearance in North America of the tropical viruses Dengue and Chikungunya as a result of geographic expansion of an invasive mosquito variety across Panama. Chikungunya is a worldwide emerging pathogen that causes fever, fatigue and joint swelling in humans.

The **40 Years of the APOC Partnership Collection** [92] marks the anniversary of the landmark African Onchocerciasis Control Program, one of the most successful private-public partnerships for health in Africa. Collection articles present the challenges, solutions and lessons learned from the success of disease control with programs launched in 1974 that now reach more than 100 million people annually across Africa.

In keeping with its mission of scientific capacity building in disease endemic countries and recognizing the benefits of providing early career researchers with tools to successfully communicate their work, *PLOS NTDs* organizes free manuscript writing workshops geared toward helping young scientists understand the publication process and best practices for manuscript writing. The workshop program provides materials and support for seminars conducted by volunteer members of the *PLOS NTDs* Editorial Board, with resources and information freely **available**. Since the formalization of the program in 2014, the journal has supported nearly a dozen workshops in five countries spanning four continents.



PLOS Pathogens



Committed to educating the pathogens community as well as the public at large, *PLOS Pathogens* publishes outstanding primary research, compelling analysis and educational content to significantly advance the understanding of bacteria, fungi, parasites, prions, viruses and their interactions with host organisms. The journal provides a forum for interdisciplinary community and fosters exchange of ideas across all areas of pathogens research through Opinion pieces on topical, emerging or controversial issues.

A proof-of-concept **study** [93] of the first hematopoietic stem cell transplant in simian human immunodeficiency virus-infected rhesus macaques provided evidence that anti-retroviral therapy and irradiation therapy are not effective for long-term treatment of HIV. A unified interpretation of the results has yet to emerge, demonstrating the ongoing need to understand why there is only one person thought to be cured of HIV to date. Media coverage placed this work in perspective for a **general audience**.

A gut microbe in mosquitos that serve as vectors for dengue and malaria pathogens makes the mosquito less **susceptible** [94] to infection and thus less likely to transmit disease. Researchers also found that the bacterium secretes metabolites with anti-pathogenic properties that could potentially be developed into prevention or treatment therapies.

An experimental drug that stabilizes transcription factor Hypoxia Inducible Factor-1 α **protects** [95] human bladder cells and mice against a pathogen

PLOS Pathogens

responsible for the majority of urinary tract infections, providing a potential therapeutic alternative or complement to antibiotics.

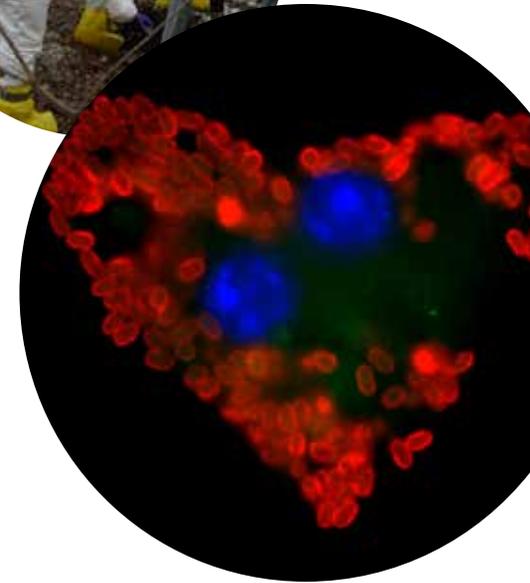
The sources of four subtypes of environmentally-acquired human pathogens causing infections in Canada, Washington, Oregon and HIV/AIDS patients in southern California were **identified** [96] as three novel tree species. This unique discovery, in part the work of a middle school student, was highlighted in **AllGov California** and **US News & World Report**.

Scientists **discovered** [97] that shed glycoprotein of Ebola virus triggers immune activation in non-infected immune cells, increasing vascular permeability even in the absence of whole virus. The massive release of pro- and anti-inflammatory cytokines by infected macrophages and dendritic cells may be central to the excessive and dysregulated inflammatory host reactions to infection, contributing to high virus pathogenicity.

The ongoing **Pearls Collection** [98], short educational articles addressing topics of relevance and importance that span the pathogens field, provides

concise and practical insights tailored to early career researchers. Select additions to the series bridging current research to traditional textbook content describe the impact of the Syrian civil war on **infectious disease** in the region [99]; the skin **microbiome**, related diseases and research [100]; and modeling of **virulence evolution** [101].

PLOS Pathogens marked several disease awareness days with topical posts on Speaking of Medicine. **World Pneumonia Day** featured an author interview covering vaccines, the importance of continued clinical research in the elderly population and more; **World Oral Health Day** highlighted journal content and the role of the oral microbial community; and **World Malaria Day** presented a discussion of challenges for drug development and the path to malaria control, elimination and eradication.

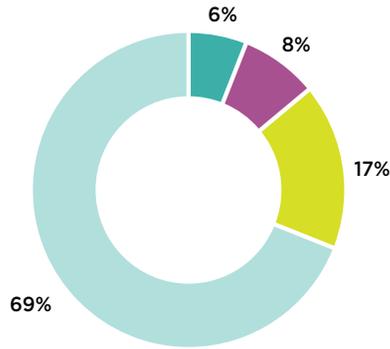


Reinvesting to Transform Research Communication

PLOS experienced increased submissions year over year resulting in over 33,000 research articles published in 2014. This brings the total number of Open Access articles published by the organization to more than 135,000. The 2014 financial year brought gross revenue and support to PLOS of \$48.5 million and an increase in net assets of \$4.89 million. Expenses neared \$40.7 million, driven by investments in two key areas:

- **Development of resources to create Aperta, a submission system that will provide a more efficient publishing experience. Aperta will provide a foundation for additional innovations. The spending associated with these R&D investments has been capitalized due to the multi-year nature of their anticipated future use.**
- **Enhancement and implementation of sophisticated content management systems for optimum handling of web and article content, as well as architectural advances to the publishing platform, Ambra™.**

PLOS believes that lack of funds should not be a barrier to Open Access publication. Globally authors have benefited from the increased availability of institutional, government and foundation Open Access funds in 2014. To supplement these funds, PLOS supported those who were still unable to pay all or part of their publication fees with assistance totaling almost \$3.0 million; included in this amount is the PLOS Global Participation Initiative providing assistance to authors from low- and middle-income countries. PLOS also expanded to over 40 institutions its Institutional Account program through which PLOS administers payment on behalf of participating institutions and their authors.



Total Expenses Plus Publication Fee Assistance \$46.5 Million

- 69% Publishing**
 Efforts related to editorial and production operations and advocacy, including staffing, productivity tools and enhancement of Ambra
- 6% Publication Fee Assistance**
 Fee assistance provided by PLOS to authors unable to pay all or part of their article publication fees; including those qualifying under the PLOS Global Participation Initiative
- 8% Research & Development**
 Efforts include innovations in content management systems and publishing architectures, enhancements to PLOS Article-Level Metrics (ALMs) and development of Aperta® inclusive of capitalized development
- 17% General & Administrative**
 Non-publishing costs that support staff and outsourced services in human resources, legal and accounting; also includes rent and bank fees

BALANCE SHEET

(\$000's)

ASSETS 2014

Current Assets

Cash and cash equivalents	1,838
Program and accounts receivable, net	1,333
Prepaid expenses and other	739
Total current assets	<u>3,909</u>

Noncurrent Assets

Investments	27,298
Loan Receivable	54
Property and equipment, net	2,288
Deposits	8
Total noncurrent assets	<u>32,682</u>
Total assets	<u>36,591</u>

LIABILITIES AND NET ASSETS 2014

Current Liabilities

Accounts payable	2,891
Accrued liabilities	1,539
Deferred revenue	863
Total current liabilities	<u>5,293</u>
Deferred rent liability	669
Total liabilities	<u>5,962</u>

Net Assets

Unrestricted	30,010
Temporarily restricted	618
Total net assets	<u>30,629</u>
Total liabilities and net assets	<u>36,591</u>

STATEMENT OF ACTIVITIES

(\$000's)

REVENUE AND SUPPORT 2014

Contributions	62
Publication fees, gross	47,137
Membership fee	20
Advertising and other	1,301
Total gross revenue and support	<u>48,520</u>
Less: Publication Fee Assistance	2,962
Total net revenue and support	<u>45,557</u>

Expenses

Publishing	33,011
General and administrative	7,655
Total expenses	<u>40,666</u>
Increase in net assets	<u>4,891</u>

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