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BIH QUEST
Center for Responsible Research

Einstein Foundation Award for Promoting Quality in Research

INTERNATIONAL RESEARCH AWARD – THE 2024 AWARDEES

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Einstein Foundation Award 2024 – The Awardees

The Einstein Foundation Berlin awards
€500,000 prize to advance research quality



The Einstein Foundation Berlin honors the Dutch microbiologist Elisabeth Bik, the platform PubPeer, and the initiative PixelQuality with the Einstein Foundation Award for Promoting Quality in Research 2024.

The recipient of this year's **Individual Award**, Elisabeth Bik, is a microbiologist, science whistleblower, and independent consultant for scientific integrity. Bik has uncovered the use of fraudulent or erroneous data for more than 7,600 scientific papers and has shed light on the practice of selling authorship for fabricated studies. This year's **Institutional Award** recognizes the relevance of PubPeer, a platform for rapid post-publication review and discussion of published scientific data. PubPeer's impact on the scientific community has been significant: it has helped identify flaws in the work of eminent scientists, combatted fraud, and fostered the emergence of an international, multidisciplinary community of research integrity experts. The 2024 **Early Career Award** goes to the project PixelQuality by Christopher Schmied and Helena Jambor, which aims to improve reproducibility in life sciences by establishing rigorous guidelines for research image publication and preparing for AI's role in their generation and analysis.

The €500,000 Einstein Foundation Award for Promoting Quality in Research honors researchers and institutions whose work helps to fundamentally advance the quality and robustness of research findings. The award is bestowed jointly with the QUEST Center for Responsible Research at the Berlin Institute of Health (BIH) at Charité. „The Einstein Foundation Award seeks to amplify the importance of quality and accountability in research, particularly as science plays a critical role in addressing global challenges,” explains Martin Rennert, Chair of the Einstein Foundation's Executive Board. „By honoring those who lead the way in improving research culture and practice, we promote a future where scientific findings are not only more robust but also more relevant for society.”

The award is presented in three categories to individual researchers, institutions, and early career researchers. Awardees are selected by a prestigious international jury of researchers from various disciplines. “The difficult choices that the jury faced in picking just three awardees from a very distinguished pool of contenders underscores the commitment of so many to fostering integrity in research and trustworthy science,” says jury president Marcia McNutt, president of the National Academy of Sciences of the United States of

America, which partners with the Einstein Foundation Berlin on the award. “The Einstein Foundation addresses a crucial gap by incentivizing reliable and transparent research practices that lead to robust solutions. We are excited to celebrate the dedicated activists who have championed this cause and are finally receiving the recognition they deserve,” says Ulrich Dirnagl, Founding Director of the QUEST Center at BIH and Award Secretary. “Together with our Early Career Award winner, they are driving essential change toward a responsible research culture.”

Jury member Mai Har Sham, Professor of Biomedical Sciences at the Chinese University of Hong Kong says: „Elisabeth Bik's work in uncovering manipulated images, fraudulent research data and publications has created enormous impact all over the world. Her work has led to heightened awareness of questionable research practices and generated widespread attention to responsible conduct of research in the scientific community.”

Dorothy Bishop, Emeritus Professor of Developmental Neuropsychology at the University of Oxford and nominator of the PubPeer Foundation explains: „PubPeer has transformed the way research is communicated. It offers a straightforward way to add commentary to published articles that was previously not available, providing an important line of defence against scientific fraud.”

Helena B. Nader, President of the Brazilian Academy of Sciences and member of the award jury says: “Research images are the proof of scientific findings, not just visuals. PixelQuality has set new standards for their reproducibility and transparency. This award will help further strengthen these efforts and drive change in the field.”

The award is funded by the Wübben Stiftung Wissenschaft. Additional resources are made available by the State of Berlin. The publisher Nature Portfolio, the Public Library of Science, the National Academy of Sciences, the Berlin University Alliance, the Max Planck Society and the Max Planck Foundation are supporting the Einstein Foundation Berlin and the QUEST Center for Responsible Research in promoting and implementing the award.

The deadline for international nominations and applications for the Einstein Foundation Award 2025 will be published in January 2025 at award.einsteinfoundation.de.

The 2024 award winners at a glance

Individual Award | Elisabeth Bik is a Dutch microbiologist and independent consultant for scientific integrity. As a science whistleblower, she has detected and made public the use of fraudulent or erroneous data in more than 7,600 scientific papers. This has led to over 1,100 retracted papers. She has shed light on the practice of selling authorship for fabricated studies through so called „paper mills“ that generate counterfeit scientific articles. Bik is an expert on reviewing scientific images, tracking down manipulations and errors in studies. She regularly shares her findings on her blog ScienceIntegrityDigest and on social media. Bik completed her PhD at Utrecht University, conducted microbiome research at Stanford University and worked for a biotech company. In 2019 she started working as a crowd-funded freelance scientist and consultant focusing on scientific integrity. Despite her commitment to upholding scientific integrity, Bik has been disregarded, attacked on social media, and threatened with lawsuits. She will use the prize money of €200,000 to create a secure financial basis to continue her contested work.

Institutional Award | PubPeer is a widely used online platform for post-publication review and legitimate discussion of published scientific data. Founded in 2012, PubPeer set out to accelerate communication about scientific publications and make correction processes more transparent and efficient. PubPeer users can comment on any article with a Digital Object Identifier (DOI), allowing them to challenge the articles or ask questions, which are displayed after a short moderation delay to check compliance with internal guidelines. Authors can answer and correct their publication, if necessary. PubPeer has become an essential part of the research communication landscape, with over 300,000 comments logged so far. It is estimated that since 2012, 19 percent of all retracted papers worldwide in all academic domains had a prior discussion on the site. Beyond identifying flaws and fraud, PubPeer functions as an important tool to jointly improve scientific publications through „liquid feedback“. The PubPeer foundation receives €200,000 to further develop the platform.

Early Career Award | Awardee and finalists

The project **PixelQuality – best practices for publishing images** was selected from 109 global applications as the winner of this year's Early Career Award. The volunteer-based initiative brings together almost 150 researchers to enhance the quality of research images in the life sciences. PixelQuality has established guidelines and checklists for publishing clear and reproducible images. It now aims to disseminate and refine them to handle AI-assisted image generation and analysis. The team, led by Christopher Schmied at the Leibniz-Forschungsinstitut für Molekulare Pharmakologie Berlin, is awarded €100,000.

The following initiatives were shortlisted for the Early Career Award 2024:

1. Impact of research biases in ecology – a novel, replication-based approach The project seeks to estimate the impact of research biases on ecological knowledge production by generating access to all main components of the research life cycle. The team will conduct a publication bias experiment with up to 50 researchers to identify potential solutions to bias in ecological research. Lead Researcher: Antica Culina, Ruder Boskovic Institute, Zagreb.

2. IPD Integrity Tool – An Innovative Tool for Detecting Untrustworthy Medical Research The project will validate and implement an open tool to identify medical studies with integrity concerns so they can be removed from the evidence base that informs clinical guidelines and practice. This way, IPD Integrity Tool aims to prevent harm from patients and build trust in medical research. Lead Researcher: Kylie Hunter, University of Sydney.

3. Virtual Universe(s) Simulations in astrophysics and astronomy use immense amounts of data, making it difficult to analyse and reproduce them. Often, the code is not published at all. The project Virtual Universe(s) is developing a new data platform for transparently publishing results, together with methodology and code, in astrophysics and other research fields. Lead Researcher: Dylan Nelson, Heidelberg University.

4. The Global Infectious Disease Data Standard (GIDS) for Epidemic Settings When infectious diseases are spreading, observational studies help generate crucial data for policy decisions. GIDS aims to establish a much-needed unified infectious disease data standard to enhance the quality of observational studies and reduce the human cost of future epidemics. Lead Researcher: Emily Ricotta, Uniformed Services University of the Health Sciences, Bethesda.

The Einstein Foundation Berlin is an independent, not-for-profit, science-led funding organization established as a foundation under civil law in 2009. Since then, its task has been to promote cutting-edge international science and research across disciplines and institutions in and for Berlin. To date, it has funded eight Einstein Centers, over 70 projects, and more than 240 researchers, including three Nobel laureates.

Further information

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2024 Individual Award Winner: Portrait of Elisabeth Bik

The independent researcher Elisabeth Bik, this year's individual winner of the Einstein Foundation Award, identifies misconduct and potential fraud in scientific publications, highlighting science's problems policing itself.

What if your pastime could change science? For Elisabeth Bik, the 2024 Einstein Foundation Award winner, that's what happened. A decade ago, after noticing suspiciously similar images in a PhD dissertation, Bik started looking at images of Western blots – a lot of images of Western blots. The images are a decades-old tool used to show the presence or absence of proteins in biology research and are often included as part of the data set in scientific papers.

For two years, after work and on the weekends, Bik scanned scientific publications for Western blots and other photos that had been altered, duplicated or mirrored. She eventually looked at over 20,621 papers from 40 different journals. "It became my hobby," she says.

What Bik found shocked her. "One in 25 papers I looked at had image problems," she says. "I thought, 'that's a lot.'" When letters to researchers and journal editors responsible for the publications about the problems yielded no response, Bik decided to go public. In 2016, she and two colleagues published a paper in the journal *mBio*, highlighting potential scientific misconduct in hundreds of papers.

**"Her work as a scientific whistleblower is essential for ensuring the credibility of scientific research."
(Csaba Szabo)**

The trio estimated that their findings represented a tiny fraction of the overall problem. Over a million biomedical research papers are published each year, part of an industry worth billions of dollars that drives untold billions more in medical research. If her sample was representative, tens of thousands of papers might include fraudulent or erroneous data, leading to wasted money and effort for researchers building on the bad science or even harm to patients receiving treatment based on faulty studies.

Since blowing the whistle on fraud for the first time, Bik has become a lonely crusader on behalf of scientific integrity. "Her work as a scientific whistleblower is essential for ensuring the credibility of scientific research," says University of Freiburg biologist Csaba Szabo, who nominated Bik for the Einstein Foundation Award. "Her work should contribute to the initiation of systematic changes and improvements in the field of scientific integrity."

So far, it's been slow going. When Bik challenges them to explain duplicated or altered images, authors often claim the photos are just there as illustrations and the changes were made to "clean them up" for publication. When pressed, they claim they made honest mistakes, "or come up with the weirdest excuses – everything from plane crashes to pregnancies," Bik says. "There's always some kind of sob story."

But Bik believes tweaked or altered images are usually an indicator of a larger problem – and evidence of scientific malpractice on its own. Western blots, for example, are visual evidence that a specific protein is present – or not – in a cell. If an experimental treatment works to stimulate or suppress production of such a protein, the blot is proof. "Those photos aren't just illustrations, they're part of the data," she says. Recent cases, including several Bik helped verify, have included falsified or duplicated images in studies of treatments for Alzheimer's and Parkinson's disease.

"The journals don't seem to be very responsive, in some cases I'm not believed, or they don't reply at all." (Elisabeth Bik)

Her efforts have sparked angry backlash: She's faced online harassment, and lawsuits from prominent scientists angry with her for exposing their errors or misconduct. Journals, meanwhile, often seem reluctant or unwilling to address the issue. "They don't seem to be very responsive," she says. "In some cases I'm not believed, or they don't reply at all."

In the years since her 2016 paper was published, fewer than half of the papers she flagged have been retracted or corrected. Institutions, too, tend to react defensively, moving to preserve their reputation and protect staffers rather than punish misconduct.

The response from the media has been more positive. Over the past few years, Bik has emerged as a crucial source for journalists working to expose scientific fraud and misconduct. Bik has been cited in investigations that appeared in *Nature*, *Science* and *The Scientist*. She's been profiled in the *New Yorker*, *Die Zeit*, and *Stat News*, and wrote about her research for the *New York Times*. "Bik's work as a scientific whistleblower is incredibly useful for journalists worldwide to scrutinize publications competently and publicly," microbiologist Szabo says.

A native of the Netherlands, Bik began her scientific career at Utrecht University, where she earned a PhD in microbiology. After moving to the U.S. in 2001, she got a job at Stanford University studying the microbiome of humans and dolphins. For many years, she ran a blog focused on developments in microbiome research.

For the last five years, Bik's investigations into scientific misconduct have been her full-time job. In addition to working with journalists, she posts her findings publicly, on social media sites like X and on her blog, scienceintegrity-digest.com. She often calls attention to problematic papers on the website PubPeer, a forum for scientists to discuss published work that was honored with the Einstein Foundation's Institutional Award this year; she's one of the few contributors to do so under her real name.

The frequent image manipulation, she believes, is connected to the increasing pressure on researchers to publish often and in high-impact journals. "As scientists, these metrics are used to assess our value as researchers," Bik says. "But if we focus on metrics, people are going to find a way to game those metrics." A key part of the issue is the growth of so-called "paper mills," shady services that charge fees to write and publish low-quality papers that are often rife with shortcuts and outright fake data.

Wherever it's published, fraudulent papers are bad for science. They can lead to useless or dangerous drugs making it into the development pipeline, or simply waste taxpayer money as other researchers chase fake results into dead ends.

In the future, Bik fears, finding them may be harder. Many of the problematic papers Bik identified in her pioneering 2014 study were taken in the analog age, or with early digital tools. Scientists at the time, she says, were less sophisticated when it came to doctoring images and had less sophisticated tools at their disposal.

"It's always an arms race between us and the fraudsters, and I feel like I'm running behind more and more every day." (Elisabeth Bik)

Today, particularly with the advent of artificial intelligence tools capable of quickly generating or altering images, it's much easier to conceal telltale signs an image has been altered or duplicated – or generate fake images from scratch. Bik has begun using digital tools to augment her pattern-recognition abilities, but she's honest about her limitations. "I can only catch the dumb fraudsters," she says. "I can't find the ones who cover their tracks ... It's always an arms race between us and the fraudsters, and I feel like I'm running behind more and more every day."

Bik hopes the Einstein Foundation Award will help her keep up and overcome the many obstacles in her work. She plans to use the prize to subscribe to more journals and pay for digital tools to analyze images, and to pay herself a salary and get help organizing her increasingly busy travel and speaking schedule. "I feel immense gratitude for this award," she says. "Hopefully it will play an important part in normalizing this work."

In the meantime, what keeps her going? "I have a very strong sense that I'm right. I see these problems and I want to convince people there's fraud in science," Bik says. "What fuels me is anger at people who cheat."

2024 Institutional Award Winner: Portrait of PubPeer

It has typically been a long and sometimes difficult process to notify researchers about mistakes in published articles. This year's institutional winner of the Einstein Foundation Award, the online platform PubPeer, has sought to make this process quicker and easier by placing discussions about article quality in a public forum, strengthening research integrity.

Once an article has been published in a highly regarded journal, it is considered indisputable for many researchers. This view of scientific knowledge production is widespread. But reality shows that it is worth taking a closer look. The online platform PubPeer has made it much easier to raise concerns about published academic research. Prior to its launch, the only way to do this was formally, via an official letter to the editor of the journal in question, or informally, through methods such as posting on social media or blogs. Often, this was a dead end.

PubPeer allows everyone to post anonymous or signed comments about research that has been published in the scientific literature, open a discussion on its content and integrity, and point out shortcomings or commend good methodology. Any article with a Digital Object Identifier (DOI) can be reviewed. The site has gone from strength to strength and has already logged 57,600 comments so far this year, compared to 2129 in its first full year after its launch, with over 300,000 comments recorded in total since 2012.

“It is crucial that the scientific community gets a grip on fraud, and without PubPeer that would be much harder.” (Dorothy Bishop)

It is estimated that since PubPeer's inception, 19 percent of all retractions of papers worldwide in all academic domains had a prior discussion on the site. The site has also helped to raise concerns in some much-publicized fraud cases. Perhaps the first case that brought PubPeer to the attention of a wider audience was that of Olivier Voinnet, a highly-regarded researcher whose work, from his PhD onwards, was discovered to contain many manipulated images.

“Fraud used to be regarded as a very rare problem, but over the past 10 years or so, it's become clear that it is a very serious issue, not least because of the growing number of so-called paper mills, criminal companies that sell authorship and use illicit methods to get articles published,” commented Dorothy Bishop, Emeritus Professor of Developmental Neuropsychology at the University of Oxford, who nominated PubPeer for the 2024 Institutional Award. “It is crucial that the scientific community gets a

grip on fraud, and without PubPeer that would be much harder. Having discussions out in the open makes a big difference to the quality of scientific debate.”

PubPeer was initially founded as an anonymous corporation by neuroscientist Brandon Stell, co-leader of the Cerebellar Neurophysiology team at the Centre National de la Recherche Scientifique (CNRS), based at Université Paris Cité. Stell set up the site with the help of developer George Smith and his brother Richard Smith.

“It was frustrating that evaluation of research scientists seemed to be based entirely on where they had published.” (Brandon Stell)

“The idea for PubPeer came in grad school, where we had journal clubs to discuss newly published articles. It was clear that articles were getting a lot of respect based on the journal that they were published in. We would discuss papers published in highly ranked journals, and we would often find problems with the science or interpretation,” explained Stell.

“It was frustrating that evaluation of research scientists seemed to be based entirely on where they had published. I thought it would be great to capture some of these other conversations happening about articles and make them public. Scientists could then add a second layer of evaluation of the paper, regardless of where it was published.” Although it was not the original aim of the site, it quickly became clear that PubPeer could be a useful tool for rooting out fraudulent research. A few years after the site was launched, a researcher identified on PubPeer as a perpetrator of alleged scientific fraud took PubPeer to court to try and identify an anonymous commenter on the site who had criticized their work.

The case was not successful, but it did prompt Stell and colleagues to consider the future of PubPeer. They decided to create a nonprofit called the PubPeer Foundation, with help from the Laura and John Arnold Foundation, to run the site. This was announced in 2015 and at the same time, Stell and the rest of the inaugural board came out from anonymity.

“The initial funding and formation of the Foundation allowed us to create a subscription service,” explained Stell. “Institutions, publishers, journals, or other interested parties can subscribe to receive alerts whenever one of their publications is commented on. That is what now funds the website.”

The PubPeer website has been criticized for its partly anonymous model, but Stell emphasizes that anonymity does not mean that comments are not rigorously moderated.

“We have heavy moderation of the website. It’s a misconception that, because it’s anonymous, people can leave whatever comment they want on the site, but actually we have a strict moderation policy,” he said.

“You can leave a comment in your name. If you do that, your first few comments are going to be moderated before they go live, but then you can be ‘whitelisted’ so that they are reviewed after they’ve gone live. It’s the same for an anonymous account.”

“It is important to underline that any utility or influence that PubPeer has earned is thanks to the community of experts that contribute to discussions on the platform.” (Brandon Stell)

Currently, there are at least 5500 anonymous and 1000 signed comments posted a month. Although the anonymous posters are still in the majority, Stell says they are starting to see a turn in the tide. “As the site has grown, the acceptance of commenting is gaining speed. A lot of people now want credit for their comments,” he explained.

“People that were really hesitant about the idea at the beginning, thinking that having anonymous comments on the site was going to be a disaster, now support us. I think that’s a major accomplishment to show just how useful these comments are,” says Stell, “In general, it is important to underline that any utility or influence that PubPeer has earned is thanks to the community of experts that contribute to discussions on the platform.”

When asked about his goals for PubPeer for the future, Stell says he would like to see even more people in the academic community accepting the site and recognizing that it can be a very useful tool for maintaining research standards, promoting open discussion and building analytical skills. For example, he would like to see young scientists who regularly post helpful comments on the site being able to use this to their advantage when looking for jobs, in the same way that reviewing articles the more traditional way is regarded as beneficial for an academic career.

“This sort of award from the Einstein foundation is just fantastic for PubPeer and its users, because it puts a little bit of a stamp on the site and gives a validation of its utility,” said Stell. “The prize money will enable us to accelerate the development and expansion of the site. For example, we would like to explore ways to support the creation of communities of site users.”

Stell added that he and the PubPeer team would also like to revisit the original goal of having more journal club like discussions on the site, less based on fraud, and more on scientific discussion and evaluation of newly published articles. “I think that body of evaluation could make a big contribution to science. It could help relieve the need to publish in non-open access journals and focus the evaluation on the content of the article instead of the journal title,” he explained.

2024 Early Career Award Winner: Portrait of PixelQuality

Improving the Image of Science – Einstein Foundation Early Career Researcher Award winners seek to provide the tools researchers need to publish better images.

Scientists learn a lot of things in their years of graduate school and lab work, but how to present images and visual data is often overlooked. “It’s just not something that’s covered in the curriculum,” says Helena Jambor, a professor of data visualization at the University of Applied Sciences of the Grisons in Switzerland.

Too often, the result is illustrations and images that don’t live up to their potential: confusing, hard to compare, and difficult for people with common disabilities like color-blindness to access. Even in top journals, the figures that accompany research papers often lack key information or are presented in ways that are not easy to understand.

The winners of the Einstein Foundation 2024 Early Career Award would like to change that. As part of a project called “PixelQuality: Best Practices for Publishing Images,” Jambor and data scientist Christopher Schmied are working to create a common set of guidelines researchers in different fields can use to maximize the potential of the images they publish.

For Jambor, the effort can be traced back to her post-doctoral work. In preparing to turn her PhD research into publications, Jambor was faced with a huge task: she had 50 terabytes of images, gene sequences and protein data, and had to condense it all into just a few figures in a paper. Rather than picking out the ones she liked best, she set about tackling the task with scientific rigor, applying lessons learned from art and cartography to sort her images into spreadsheets and find the ones that best illustrated the points she was trying to make.

**“We have rules on formatting of text, on how to reference other people’s work, but no rules on how figures are to be represented? That’s a huge gap.”
(Helena Jambor)**

The work made her more aware of how other researchers were presenting their images. Too often, she says, they seemed to be afterthoughts, or confusing. To quantify the problem, she decides to screen hundreds of images from high-impact publications and found that 4 out of 5 failed in some basic way: scales were missing, making it hard to understand how big the cell or cell structure in the microscope image was. Images were presented out of context or missing key details. Sometimes color legends were

missing, making it hard to understand what the image was showing. And often images were presented in shades of red and green, colors that color blind people can’t distinguish. “I was appalled to see how many incomprehensible pictures and visualizations are published, and how many images aren’t accessible to people who are colorblind,” Jambor says.

Jambor asked editors at a well-known, high-impact journal if they had a set of minimum standards to hand out to prospective authors – and was surprised to find out they did not. “We have rules on formatting of text, on how to reference other people’s work, but no rules on how figures are to be represented? That’s a huge gap,” she says. “We can do better.”

“In reality, the problem here isn’t that people fake data, it’s that we have a training gap – which we can fill.” (Helena Jambor)

The issue, Jambor says, isn’t one of scientific misconduct, laziness or ignorance. “Ninety-nine percent of scientists are striving to do good science and work very, very hard to do everything right,” she says. “In reality, the problem here isn’t that people fake data, it’s that we have a training gap – which we can fill.”

To address the problem, Jambor teamed up with Schmied, a biologist specializing in microscopy and digital imaging now working at the EU-OPENSOURCE project based in Berlin. The pair’s first step was to collaborate on a set of “cheat-sheets” for time-pressed researchers, published in 2021. The guidelines caught on quickly, passed from researcher to researcher and even posted on lab walls. “We had a lot of feedback,” Schmied says. “People were sharing it widely and it was clear they really wanted these tools.”

But Jambor and Schmied – who met as labmates at the Max Planck Institute in Dresden – were conscious of the paper’s limitations. Both of them were biologists, and their expertise shaped their approach to data and presenting it. “Those were just our opinions,” Jambor says. “It was important to talk to people in different communities about how to make this better.”

To make their guidelines as broadly applicable as possible, Jambor and Schmied have gathered dozens of colleagues into a working group from a variety of fields as part of QUAREP, or the Consortium for Quality Assessment and Reproducibility for Instruments and Images in Light Microscopy. Collaborators include over 150 researchers from 27 countries, visualization experts and journal editors. Last year, the team co-authored a well-received paper in *Nature Methods* entitled “Community-developed checklists for publishing images and image analyses.”

The work is already having a quantifiable impact. Several journals have adopted their guidelines as submission requirements, and since the publication of their Nature Methods paper the Nature Springer group has expressed interest in adopting them as well.

Both researchers came to the problem from different places. Before going into biology, Jambor grew up surrounded by visual thinkers, with family members who work as artists, architects, cartographers and designers. Schmied, meanwhile, focused on microscopy and image analysis as part of his PhD in biology. When he approached Jambor for help presenting the visual aspects of his PhD dissertation, they found a common interest in communicating science better.

“With the award, we have more freedom and initiative to write, publish and create training material without begging for someone to support us.” (Christopher Schmied)

The Einstein Foundation Early Career Award gives the PixelQuality team key resources to expand their impact. Both Schmied and Jambor have full-time jobs elsewhere, and the project has relied on the goodwill of publishers and unpaid collaborators to move forward. “With the award, we have more freedom and initiative to write, publish and create training material without begging for someone to support us,” Schmied says.

And they hope the award makes people outside the biology and microscopy communities more aware of the importance of properly presenting visual data. Images are important components of research in everything from physics and chemistry to digital humanities – and researchers across all those fields can benefit. “People want to do it, and want to do it better,” Schmied says. “We just have to give them the right tools.”

The Early Career Researcher Award Finalists 2024:

Opening the black box: Impact of research biases in ecology – a novel, replication-based approach

Ecology research constantly generates a lot of output: data-sets, analytical codes, and results derived from these analyses. Only a small percentage of these outputs are published, and the published results are likely to be only a biased subset of all results. The data collection and analysis they are based upon, may also be biased. “We still have not quantified the true extent of research biases, nor their impact on our ability to reach valid conclusions,” says Antica Čulina, an ecologist at the Ruđer Bošković Institute in Zagreb and a pioneer of open science in ecology. One main reason is that the research life-cycle is not transparent: In ecology and other fields, potential biases are commonly estimated retrospectively, inferring the processes that underlie them from published results. Čulina wants to change that by studying the influence of research biases more holistically. “What I propose is to open the black box to observe and study the process directly, from data analysis to result publication,” says Čulina. In her project “Impact of research biases in ecology – a novel, replication-based approach,” she will use datasets of the [SPI-Birds database](#) on individually marked birds to conduct an innovative publication bias experiment: Up to 50 teams of researchers will test a case-study hypothesis using different datasets, choosing and later sharing their analytical codes and submitting their findings, which will be reviewed by external researchers – thus mimicking a publication process. “If successful, the approach will change the way research and publishing is done and help us test some potential solutions such as the benefits of pre-registration or data quality checks.”

Avoiding harm to patients: IPD Integrity Tool – An Innovative Tool for Detecting Untrustworthy Medical Research

Around two percent of scientists admit to engaging in scientific misconduct, while 34 percent admit having used questionable research practices. Misconduct, fraud and low-quality data are especially dangerous in medical studies, since they can expose patients to potential harm. They also fuel an integrity crisis in medical research. To ensure integrity, usually only the summary data at the publication level are checked, while the important underlying raw data (known as individual participant data, or IPD) is ignored. The project “[The IPD Integrity Tool – An Innovative Tool for Detecting Untrustworthy Medical Research](#)” aims to improve the standard of quality control in the

medical sciences and beyond. “We aim to finalise, validate, disseminate and implement an integrity tool for individual participant data to identify studies with integrity concerns,” says Kylie Hunter, a Research Fellow at the University of Sydney. Hunter joined forces with biostatistician Anna Lene Seidler at Universitätsmedizin Rostock to develop the IPD Integrity Tool. The tool, which will be validated with a broad range of data – including fake data sets generated by artificial intelligence – will be able to identify untrustworthy studies and remove them from the evidence base. It can be used by journals editors, meta-analysts and anyone who wants to assess the trustworthiness of research. “Our overarching goal is to protect the integrity of the evidence base that informs clinical guidelines and practice,” Hunter says, “thereby protecting patients and fostering trust in research.”

Making cosmic simulations reproducible: Virtual Universe(s)

Astronomy and astrophysics simulate the fundamental forces of our universe. These digital simulations include recreations of dark matter, gas, stars, and supermassive black holes, all producing enormous amounts of data that can only be handled by large supercomputers, making them hard to analyse and reproduce. “Most of those immense data sets and the development of the models happen behind closed doors,” says Dylan Nelson, an astrophysicist and Emmy Noether Research Group Leader at Heidelberg University. “This results in a crisis of reproducibility in astrophysics and astronomy with many key results being ambiguous.” For example, the code for models simulating cosmic events like supernovae explosions is often not published together with the findings – making it impossible to confirm them. So far, few international collaborations in the field have managed to transparently document, homogenize, and publish large simulation data sets. One of them is [IllustrisTNG](#). Based on the success of IllustrisTNG, the Virtual Universe(s) project will develop a new data platform combining large simulation models, homogenized datasets, analysis tools, and reproducible analysis workflows. “We aim to create an ecosystem that incentivizes researchers to make not only their results available, but also the corresponding methodology and the code,” says Nelson, who also aims to open the platform for other fields like Earth sciences and computational sociology. “It will be a field-leading demonstration of open science in action across disciplines.”

**Being prepared for the next epidemic:
The Global Infectious Disease Data Standard (GIDS) for
Epidemic Settings**

When infectious diseases spread, it is of utmost importance to base timely policy decisions and practical instructions for healthcare on high-quality data to avoid high human cost. Observational population studies, if well designed, can facilitate a comprehensive picture of disease progression in natural contexts while also identifying high-risk populations for prevention and treatment. “Their speed, affordability, and flexibility make them widely implementable,” says Emily Ricotta, an Assistant Professor of Epidemiology at the Uniformed Services University of the Health Sciences (USUHS) in Bethesda. In contrast to randomized controlled trials (RCTs), efforts to standardize data collection using observational studies are surprisingly neglected, especially in epidemic settings. This can lead to studies

which are biased, lack validity, are small and underpowered, and not possible to compare. The project “The Global Infectious Disease Data Standard (GIDS) for Epidemic Settings,” led by Ricotta, aims to establish the first global data standard for enhancing the quality of observational studies on infectious diseases. Ricotta has been working on improving methodological rigor and improving the validity of clinical studies on infectious diseases for many years. In a [comment in Nature](#) in 2023, she pointed out the methodological shortcomings in observational studies and offered ways out. With GIDS, she now aims to initiate a broad research process, including a scoping literature review and expert consultations, to establish a global standard. “I am confident we can significantly improve the reliability and generalizability of research findings, ultimately translating to better health outcomes for all,” she says.