Received: 21 January 2026 | Revised: 15 April 2026 | Accepted: 17 April 2026

DOI: 10.1111/jmi.70099

Journal of Microscopy RMS

ORIGINAL ARTICLE

People-centred funding as a catalyst for sustainable imaging infrastructure

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Funding information
Chan Zuckerberg Initiative DAF, Grant/Award Numbers: 2023–329682, 2024-337146, 2020-225445598, 2020-225439, 2021-240122, 2022-252604, 2021-244318, 2020-225273; NIH-NICHD Intellectual and Developmental Disabilities Research Center Support, Grant/Award Numbers: P50 HD103573, S10 OD032388, S10 MH130455; NIH, Grant/Award Numbers: #U01CA200059-06, #UM1HG011536-04S1, #U01CA260699; Wellcome Trust, Grant/Award Numbers: 313779/Z/24/Z, 221295/Z/20/Z; Fondo para la Convergencia Estructural del Mercosur, Grant/Award Number: COF03/11; NSF, Grant/Award Number: #2513921; Medical

Abstract

Advanced imaging core facilities are critical pillars of modern life sciences research, providing access to complex technologies, specialised expertise, and training. At the heart of these facilities are Imaging Scientists, whose work spans technology development, operations, training, data stewardship, and community coordination. Despite their central role, Imaging Scientists have rarely been the focus of coordinated funding at scale. Here, we evaluate the Chan Zuckerberg Initiative Imaging Scientist program—*to our knowledge, one of the first large-scale efforts to support this workforce*—through an anonymous survey and selected case profiles across diverse institutional, technical, and geographic contexts. Survey responses highlight the program's value in enabling structurally underfunded activities such as technology integration, scalable training, leadership, and community building. By abstracting across cases, we identify recurring impact themes, showing how support for Imaging Scientists strengthens core facility foundations, accelerates adoption of new technologies, and fosters national and international networks. These findings illustrate that investing in Imaging Scientists generates measurable scientific-, institutional-, and community-level

Yara Reis and Johanna Bischof contributed equally to this work.

Research Council, Grant/Award Numbers: MR/W029464/1, MR/Y008944/1, MR/Y503332/1; British Heart Foundation, Grant/Award Number: PG/24/11898

returns, complementing technology-focused funding and maximising the impact of research investments.

KEYWORDS
core facility, funding, imaging core facility, impact, policy, sustainability

Maximising research impact and return on investment from imaging infrastructures—*Six key messages for funders and decision-makers*:

1. **Imaging Scientists are critical enablers of modern research**.
   Their contributions underpin technology development, adoption, ensure operational excellence, training, data quality, and reproducibility across imaging core facilities.
2. **People-centred funding generates systemic returns**.
   Targeted support for Imaging Scientists enables technology validation, sustainable facility operations, workforce development, and institutional resilience—outcomes that extend well beyond individual projects.
3. **Impact scales through facilities, not individuals alone**.
   Investments in Imaging Scientists embedded within core facilities translate into broad user impact, infrastructure sustainability, and long-term return on investment.
4. **Training multiplies expertise**.
   Training and Train-the-Trainer models led by Imaging Scientists amplify expertise across institutions and regions, enabling scalable and durable skills development.
5. **Adoption and sustainability matter as much as technology innovation**.
   Imaging Scientists play a central role in operationalising new technologies, ensuring that investments in instrumentation translate into reliable, long-term research capacity.
6. **Community coordination accelerates discovery**.
   By coordinating networks, promoting shared standards, and trusted practices, Imaging Scientists reduce duplication, accelerate knowledge transfer, and strengthen research ecosystems.

1 | INTRODUCTION

Core facilities are the invisible backbone of modern life sciences

Despite the central role of core facilities in modern life sciences research, funding models rarely recognise the staff who operate and advance them. Infrastructure alone (e.g., instrumentation and reagents) is often eligible for grants, while the experts who develop new technologies, maintain access to a wide variety of biological samples, and enable the reproducible application of methods across multiple research programs are largely overlooked. These technical experts staffing core facilities contribute to a broad spectrum of research areas, develop and validate cutting-edge methodologies, rescue failing experiments and train thousands of researchers every year, yet their work often remains institutionally and structurally invisible, revealing a mismatch between how life sciences research is funded and how it is actually enabled in practice.[1]

1.1 | A unique funding model driving a structural shift in how scientific contributions are valued

Between 2019 and 2025, the Chan Zuckerberg Initiative (CZI) ran two rounds of the Imaging Scientist funding program.[1] To our knowledge, this program was the first of its kind to provide dedicated support to Imaging Scientists, with individual grants of up to $1,250,000 over 5 years. The program targeted scientists working both in laboratories focused on imaging research and in imaging core facilities, with awards distributed among technology developers, image analysts, and core facility leads. Round 1 was limited to Imaging Scientists based in the United States, resulting in 18 grantees, while Round 2 expanded eligibility to the global community, supporting 22 grantees.

For the Imaging Scientists grants, the Chan Zuckerberg Initiative defined a set of allowable budget categories within the published Request for Applications.[1] These included support for salary and associated fringe benefits for the Imaging Scientist position and a designated allocation for travel and teaching-related activities. The support opened a horizon of new opportunities for the people involved, and the facilitated activities were wide-ranging, contributing to diverse projects, and, importantly, were people-centred, giving Imaging Scientists the freedom to pursue initiatives and projects they had been working on beyond their regular workload with more independence, capacity, and focus.[2]

One of the direct outcomes of the Imaging Scientist funding scheme was the dramatic expansion of the capacity of funded individuals to take on community leadership roles. As a result, many of the supported Imaging Scientists assumed leadership roles in several regional or thematic bioimaging organisations and are active members in Global BioImaging (GBI) and its activities.[3,2] To further assess the extended impact and opportunities generated by this funding model, we conducted an anonymous survey among grantees. This survey provides the first systematic insight into how people-centred funding reshapes scientific ecosystems. The preliminary results were presented at a dedicated Imaging Scientists session during the Global BioImaging Exchange of Experience 2025 conference, highlighting both the impact of the Imaging Scientist program and the broader contributions of Imaging Scientists to the global scientific community.[4]

We share here the survey results alongside highlights from selected grantees, providing the broader community with evidence and stories that demonstrate the program's tangible impact. These examples show how targeted, people-centred support for often underfunded Imaging Scientists enables real-world research outcomes, strengthens local to global imaging ecosystems, accelerates technology adoption, and builds skills, capacity, and leadership within the scientific community—illustrating the clear return on investment for funders in both people and infrastructure

2 | SURVEY OUTCOMES

Our survey of Imaging Scientist program grantees aimed to capture both quantitative assessments and qualitative reflections on how the funding influenced individual careers, institutional capacity, and community engagement. Responses were received from 27 out of the 40 grantees—66% of grantees from Round 1 and 68% of grantees from Round 2. Due to the program's funding eligibility, only 12 respondents were from outside the United States. Nevertheless, although most survey respondents are based in the United States, the majority of international grantees of the program—including those from Africa, Latin America, Europe, and North America—are represented in the responses following regional information where it was provided by the respondents, and are centrally included in the individual profiles to ensure that the highlighted impacts and conclusions can be taken to be applicable beyond the US funding ecosystem. Most respondents (22 of 27) are Imaging Scientists working in Core Facilities, with expertise spanning the full range of imaging modalities, from electron and light microscopy to preclinical imaging, as well as image data analysis and management. Because the findings are based on self-reported data reflecting personally and professionally significant experiences, they should be interpreted with appropriate caution. The survey was conducted anonymously, and the underlying dataset is not publicly available, allowing respondents to provide open and honest reflections.

Across respondents, the CZI Imaging Scientist program was consistently rated as highly impactful, both in terms of overall effect and personal career development, indicating a strong perceived value of this funding model among supported Imaging Scientists. Grantees rated the program as highly impactful overall (4.8/5) and for their personal career development (4.7/5). Descriptions of the program underscored this as 'life-changing' and 'career-defining'.

The program's uniqueness lay in its explicit support for aspects of the Imaging Scientist role that both home institutions and conventional research grants structurally underfund. Grantees pursued diverse activities across their work (Figure 1), highlighting the wide-ranging impact of Imaging Scientists in core facilities and beyond.[1]

This broad engagement by the grantees resulted in a wide range of outcomes enabled by the program (Figure 2). Conference attendance was the program's most reported outcome—an opportunity that core facility professionals rarely have the budget or time to pursue. These events are essential for showcasing their work, staying current with new technologies and tools, acquiring new skills, and forging strong connections within the imaging community. Other key activities enabled by the Imaging Scientist program included leading training sessions for researchers and core facility professionals, publishing scientific work, developing and adopting new tools. The newly developed tools and developed technical solutions span the whole range of imaging technologies from lightsheet and label-free imaging to human imaging with PET as well as data management solutions, depending on the area of focus of the Imaging Scientist (see individual profiles below). At the same time, the support of the Imaging Scientist program also clearly impacted general core facility operations in the supported facilities—through improving facility operations and expanding of the facilities through hiring of new personnel. This indicates that while the supported Imaging Scientists were usually either more senior or more technical in profile, general core facility technical staff also benefitted from the support through a range of impacts on their facility.

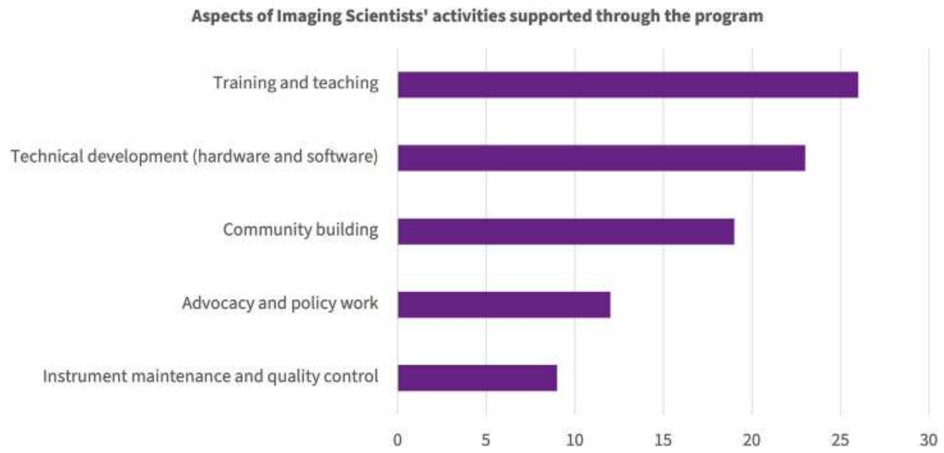

FIGURE 1 Overview of the areas of the Imaging Scientists' role that they were able to pursue through the provided funding. Multiple selections were possible ($N = 27$).

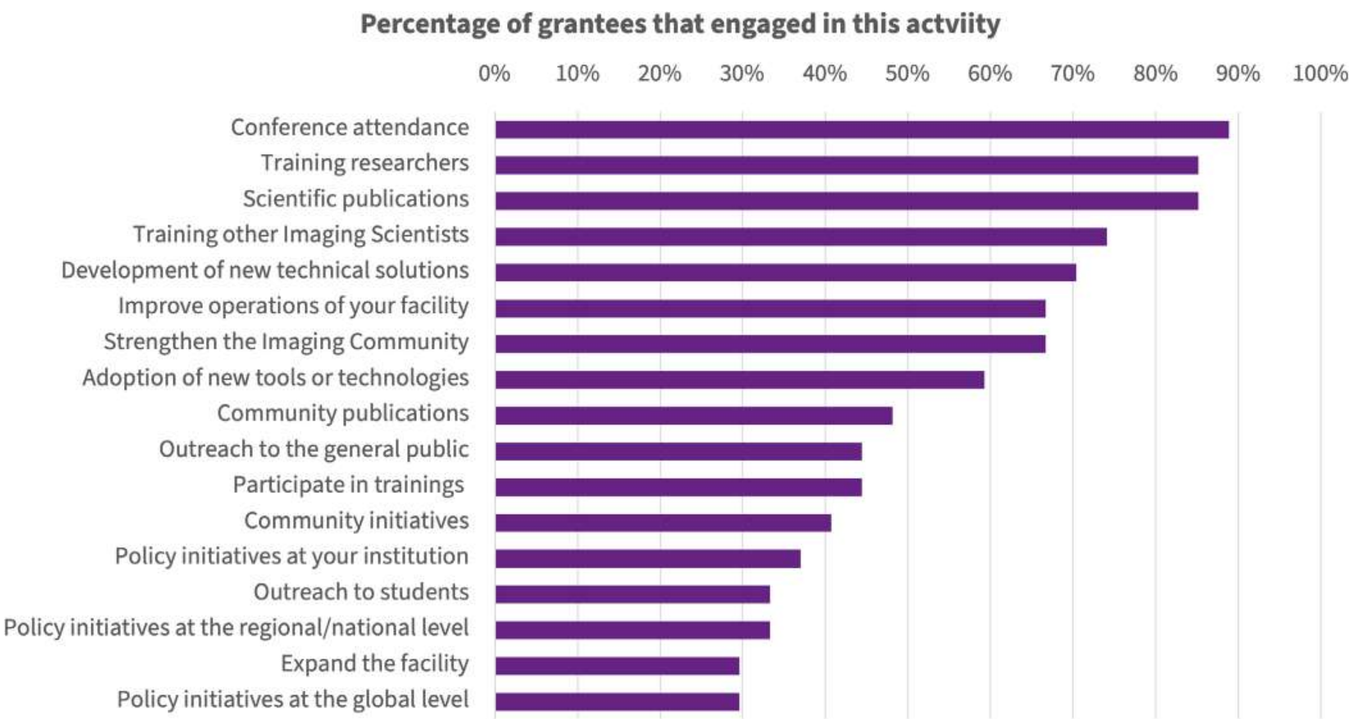

FIGURE 2 Activities enabled by the support of the Imaging Scientist program. Multiple selections were possible ($N = 27$).

In response to what outputs they perceived as most impactful and they were most proud of, the respondents highlighted the development of training courses and resources, increasing the capacity and visibility of their facility, the institutional impact, the new methods and scientific findings they contributed to, the sharing of tools and resources, and the building and connecting of communities with resulting policy impact. All respondents, as a direct result of the Imaging Scientist funding, became active in one or more community organisations—most (16/27) on both the regional and global level, but also in technical communities.

Imaging Scientists are trusted mentors and enablers, guiding thousands of researchers per year, facilitating access to critical technologies, and performing a broad range of responsibilities—from training and tool development to core facility management.[1] By strengthening this particular role, the program demonstrated how targeted funding can create a wide-reaching impact across the scientific community. However, the unique nature of this

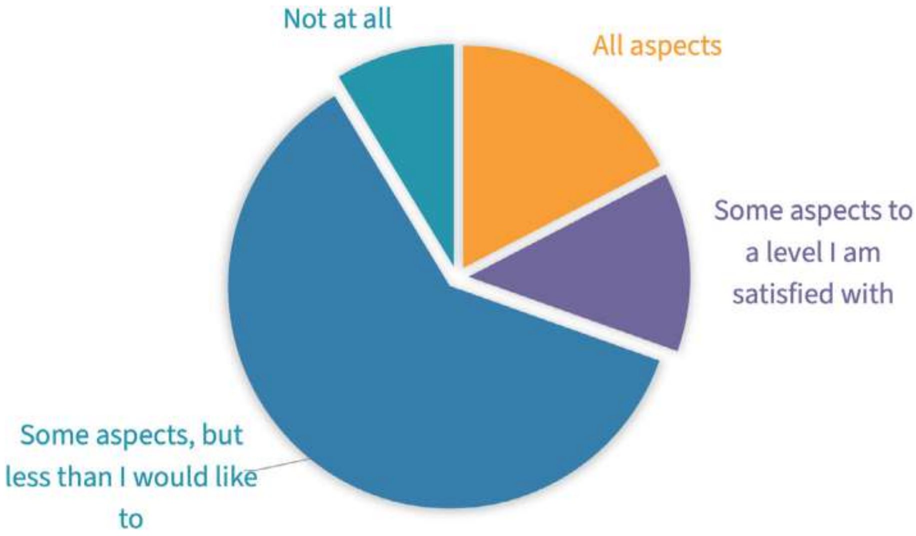

FIGURE 3 The degree to which respondents report being able to continue activities supported during the funding period ($N = 27$).

grant also means that, once the funding cycle ends, 52% of grantees report that they can sustain these activities only to a limited extent and 7% will not be able to sustain any of the supported activities (Figure 3) —underscoring the need for ongoing support to maintain and expand these gains. As reflected in the survey responses, Imaging Scientists often lack institutional mechanisms or alternative funding streams to sustain efforts in training, community building, outreach, and infrastructure development after dedicated support ends. A loss of momentum in these areas risks reversing gains in capacity, visibility, and coordination that extend well beyond individual institutions.

Taken together, the survey results and individual examples (see below) highlight that by providing people-centred support, the program empowered Imaging Scientists to expand their contributions, elevate their visibility, enhance job satisfaction, and pursue new career paths—while simultaneously advancing scientific quality, innovation, and community resilience, demonstrating the broad and lasting returns of targeted investment.

The program was an important milestone in recognising Imaging Scientists as essential contributors to research ecosystems—often overlooked in traditional funding models and institutional hierarchy—and provided them with protected time to focus on infrastructure development, training, technical expertise, policy, and community building (Figure 2).

3 | INDIVIDUAL PROFILES OF IMAGING SCIENTISTS

While the survey data provide a quantitative overview of the outcome of the Imaging Scientist program, they cannot fully capture the diverse ways in which this support translated into concrete outcomes and impacts across different institutional, technical, and geographical contexts. Many Imaging Scientists work in isolated roles, which can limit opportunities to exchange knowledge, adopt best practices, or build collaborative networks. Lack of dedicated support can constrain protected time for innovation, training, and community leadership.

To complement the aggregated analysis, we therefore include here select profiles of individual Imaging Scientist grantees that provide more detailed insights into how the program addressed these gaps in practice. Each profile offers a glimpse of different ecosystem-level impacts and is deliberately selected to reflect the breadth of the cohort, spanning different regions, facility and institutional types, career stages, and areas of impact—including technology development, technology dissemination, training, data stewardship, facility leadership, and community building. Together, they serve not as exhaustive or exceptional case studies, but as representative illustrations of the mechanisms through which flexible, role-focused funding can empower Imaging Scientists to generate sustained scientific-, institutional-, and community-level impact.

Michelle S. Itano
Affiliation: University of North Carolina at Chapel Hill
Role: Associate Professor, Director of the Microscopy Core at the Neuroscience Center
Imaging Scientist Grant name: Enhancing the Role of a Microscopy Core Facility to Catalyze Biomedical Research
City & Country: Chapel Hill, North Carolina, USA

Impact highlights

The Imaging Scientist funding has been pivotal in my transition from a staff role to faculty, enabling me to expand from managing a single-person core facility to administratively overseeing a merged institutional microscopy core. It also provided support for contributions to faculty governance, including serving as Chair of the Faculty Committee on Research, and allowed me to explore new technologies such as light-sheet microscopy. Collaborations with fellow CZI grantees, including Abhishek Kumar and Holly Gibbs, led to funded NIMH S10 grants, workshops, and co-edited special issues in Frontiers in Cell & Developmental Biology. Engagement with Global BioImaging and the MicroTutor initiative further broadened my network, enhanced leadership skills, and strengthened my ability to mentor early-career Imaging Scientists.

The funding enabled the acquisition of cutting-edge instrumentation, including a Zeiss LSM980 AiryScan2 confocal microscope (NIH S10 OD032388) and an ASI ct-diSPIM isotropic light-sheet imaging system (NIH S10 MH130455), along with software and server infrastructure for image analysis. This support allowed our core to grow from a single-person operation to a team of four, attracting both internal and external funding, and establishing partnerships with industry through initiatives like the Leica Partner in Microscopy program and PAIR-UP grants. These investments significantly increased visibility, research capacity, and the number of publications from our core facility.

The funding facilitated extensive training and community engagement, including organising PAIR-UP live-cell imaging workshops at UNC,[5] chairing the BioImaging North America (BINA) Communications Working Group,[6] and contributing to global networks like the Global BioImaging (GBI) Career Path Working Group.[7] I also participated in international meetings, including the Launch of LABI & EoE2022,[8] Imaging Africa 2,[3–5] AMI, and Okinawa Microscopy Workshop,[9,6] and delivered keynote lectures and hands-on workshop sessions, sharing expertise and fostering collaboration across institutions.[10,11,12,13,14]

Without this support, our core facility would not have achieved full representation in university governance, nor would we have been able to implement training programs, workshops, and collaborative initiatives that generate shared resources and publications. Personally, the funding was essential for leadership development and professional coaching, supporting career transitions during both challenging and high-growth periods.

Impact pipelines summary

High-resolution light-sheet microscopy expansion
Imaging core initially limited in size and instrumentation, lacking high-resolution light-sheet capability → CZI Imaging Scientist Award enabled collaboration with Abhishek Kumar, Visiting Scientist exchanges, LSFM workshops, and co-development/acquisition of ASI ct-dSPIM[15] → Core expanded to multi-instrument, multi-person facility; drove advanced technology co-development and imaging workflows; supported multi-lab collaborations, user training, and co-edited publications.[7]

Leonel Malacrida
Affiliation: Advanced Bioimaging Unit, Institut Pasteur de Montevideo and Universidad de la República; Unidad Académica de Fisiopatología, Hospital de Clínicas, Facultad de Medicina, Universidad de la República
Role: Principal Investigator, Associate Professor, Head of Advanced Bioimaging Unit
Imaging Scientist Grant name: Developing an Advanced Bioimaging Core in Latin America
City & Country: Montevideo, Uruguay

Impact highlights

The Imaging Scientist funding has had a transformative impact on my career, enabling me to strengthen Uruguay's capacity in advanced fluorescence microscopy and establish the Advanced Bioimaging Unit (UBA) as a joint scientific platform between the Institut Pasteur de Montevideo and the Hospital de Clínicas (Universidad de la República). Through this support, I developed and implemented new technologies—including the DIVER-FLIM, PR-LScope photon-resolved microscope, and fibre-based metabolic imagers—expanding our capabilities in deep-tissue and quantitative imaging.[16]

The program also fostered my professional growth through one-on-one leadership coaching, grant-writing mentorship, and engagement with global networks, including Global BioImaging, Latin America Bioimaging (LABI),[17] the Africa Bioimaging Consortium (ABIC),[18] and flIMAGIN3D.[19] These experiences enhanced my leadership, collaboration, and management skills and expanded my international partnerships to more than 50 research groups worldwide. Recognition through the Morosoli de Bronce Award (2023), the Young Fluorescence Investigator Award from the Biophysical Society (2023), and inclusion in *The Photonics 100* (2026) reflect the visibility and impact of this support.[20]

At the institutional level, funding enabled the UBA to grow from three to fourteen instruments, supported by high-performance computing, dedicated wet labs, and a team of 12 researchers and trainees. This expansion resulted in 27 funded projects—including seven CZI grants—and more than 30 publications. It strengthened both national and international collaborations, positioning the UBA as a regional hub for advanced bioimaging.

The program also had a broad community impact. It supported more than 10 regional training programs and workshops, reaching over 400 participants from 15 countries, and contributed to the creation and administration of LABI. These efforts have helped build a vibrant, interconnected Latin American imaging community with lasting scientific and collaborative capacity.

Without this support, the UBA would not have reached its current technological sophistication or scale, nor would I have been able to cultivate the international collaborations and leadership capacity that now position Uruguay as a regional leader in advanced bioimaging.

Impact pipelines summary

Advanced fluorescence & deep-tissue imaging in Uruguay

Limited access to advanced fluorescence and deep-tissue imaging in Uruguay → CZI Imaging Scientist support enabled leadership development, global network integration, and technology build-out → Deployment of DIVER-FLIM, photon-resolved PR-LScope light-sheet microscopy, and fibre-based metabolic imaging → Growth of the Advanced Bioimaging Unit into a multi-instrument national platform and regional training hub → Strengthened Latin American bioimaging capacity through LABI, international collaborations, and cross-border training.

Adriana Tavares

Affiliation: Preclinical PET facility—University of Edinburgh

Role: Head of Preclinical PET Facility, Professor in Translational Molecular Imaging

Imaging Scientist Grant name: Kinetic Modelling and Analysis of Total-Body PET Imaging Datasets

City & Country: Edinburgh, United Kingdom

Impact highlights

The Chan Zuckerberg Initiative (CZI) Imaging Scientist Award has provided critical funding to protect my research time for the development of new imaging tools to deliver whole-person Positron Emission Tomography (PET) methodologies, including new kinetic modelling techniques and network analysis. It also provided a fantastic opportunity to expand my network, foster new collaborations and learn a number of new skills in bioimaging techniques beyond PET imaging. I found the CZI grantees' annual meetings very insightful and well structured to include discussion sessions with funders, relevant advocacy and policy institutions, as well as other Imaging Scientists. The CZI Imaging Scientist Award support has been pivotal in supporting my career development from Senior Fellow to Professor.

The funding received from CZI was a catalyst for the preclinical PET facility by increasing visibility of available infrastructure, supporting tool development in Edinburgh for local and international benefit, and attracting non-Imaging Scientists to PET imaging projects. Following the CZI award, funding from the Medical Research Council (MRC) was secured to expand the facility to include simultaneous PET/MRI capabilities. This project resulted in the expansion of the preclinical PET facility from one PET/CT scanner to 3 PET scanners (2 PET/CTs and 1 PET/MRI). Furthermore, throughout the duration of the CZI award, I was able to secure >£3 M as principal investigator and supported proposals totalling >£7 M as co-investigator. Through our PET is Wonderful and CZI annual meetings, symposiums and workshops, we were able to successfully bid for the Total-Body PET conference to take place in Edinburgh in 2021/2022. That event was a major success, and through continued lobbying of the UK funding ecosystem, the University of Edinburgh was successful at securing a bid to host a Total-Body PET national facility as a joint bid with the University of Glasgow (a project totalling c. £34 M). Since starting the CZI Imaging Scientist Award, I have published over 50 scientific papers as senior author, first author or co-author. These included original manuscripts, review papers, book chapters and methods papers.

With the CZI Imaging Scientist Award, we were able to start a new summer scholarship programme for hands-on training on PET kinetic modelling and network analysis in Edinburgh. This has been a highly competitive programme, and we have received applications from all continents. Furthermore, the CZI award enabled the creation of free online teaching materials on PET imaging as well as the delivery of two in-person workshops on PET imaging principles and innovation.[21,22,23]

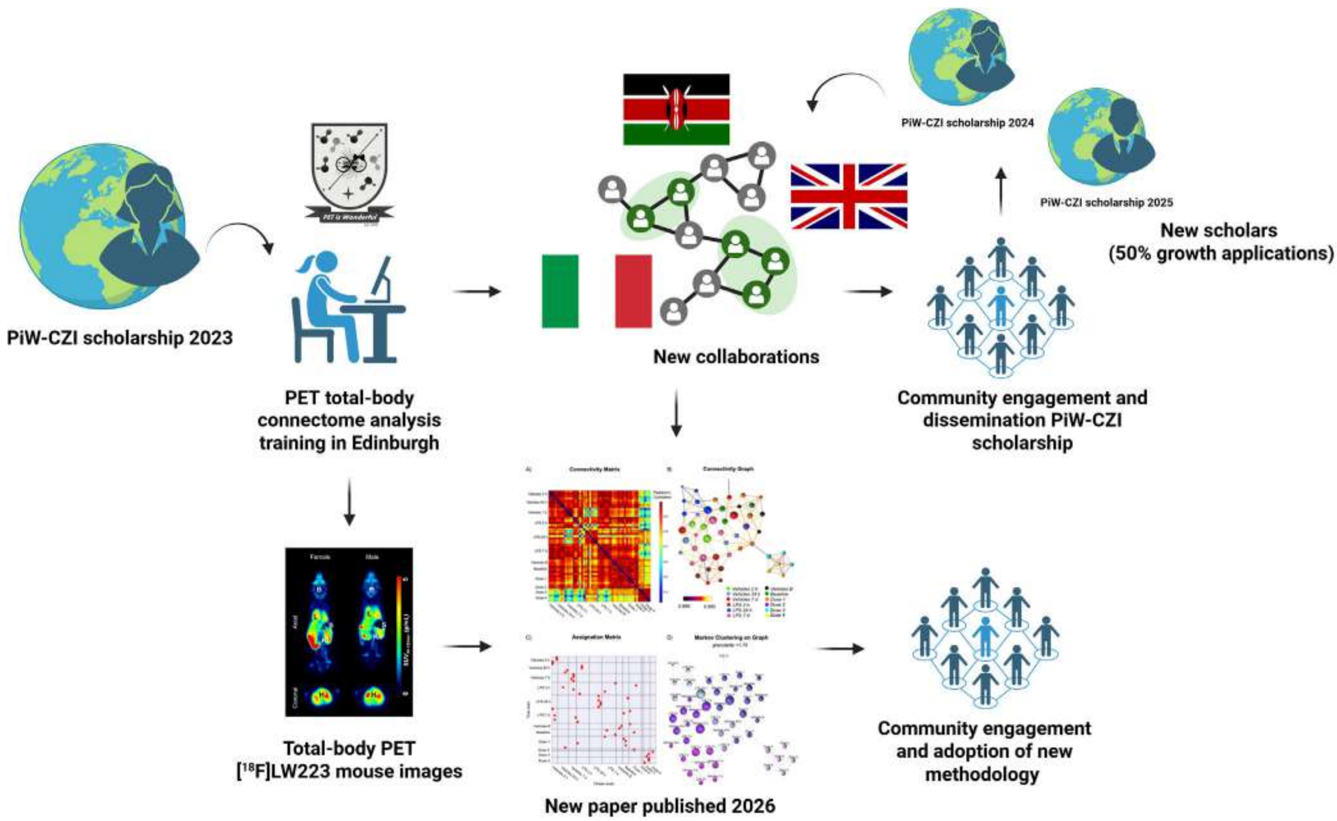

FIGURE 4 Illustration of the PET is wonderful—Chan Zuckerberg Initiative (PiW-CZI) Scholarship Programme.[24]

Without the CZI Imaging Scientist Award support, we would not have been able to start any of these community training programmes. Furthermore, we would not have been able to advance whole-body PET network analysis as a new tool for multi-organ disease assessments. This new tool is poised to revolutionise the way we think about disease from the current paradigm of organ/system-centric view to multi-organ and multi-system integrative medicine.[8–10]

Impact pipelines summary

From fragmented PET analysis to a global whole-body imaging and training ecosystem (Figure 4)

Fragmented PET methodologies and limited whole-body connectome analysis → CZI Imaging Scientist funding enabled open PET training (online courses, PiW-CZI scholarships), international workshops, and community building → Development and validation of new whole-body PET methodologies with improved physiological insight, survival prediction, and drug-response assessment → Global uptake through training, lectures, and the PET is Wonderful network → Sustainable international PET ecosystem supporting new careers, grants, and multi-organ systems research

Caterina Strambio De Castillia
Affiliation: Program in Molecular Medicine, University of Massachusetts Chan Medical School
Role: Principal Investigator, Assistant Professor
Imaging Scientist Grant name: Bridging the Gap between Quantitative Bioimaging and Bench Scientists
City & Country: Worcester, MA, USA

Impact highlights

The Chan Zuckerberg Initiative (CZI) Imaging Scientist Award provided the protected time and flexibility needed to focus on pre-publication image-data management and community-driven standards development, rather than solely on technology delivery. This support enabled sustained engagement with international imaging initiatives, allowing me to work at the intersection of metadata specification, tooling, and community coordination.

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The award was a decisive catalyst for my career, enabling my development as a specialist in image-data management and metadata standards. During the award period, I produced 14 peer-reviewed publications and 15 preprints, delivered more than 80 invited and conference presentations, and contributed to the development of five software tools for capturing and standardising microscopy metadata.[25] Crucially, the visibility and credibility associated with the CZI award strengthened recognition of my work within my institution and among international collaborators. As such, I was able to launch the BioImage Data Management and Sharing Core facility.

The award enabled me to forge consensus within the imaging community around the LiMi metadata standards. This effort culminated in the recent endorsement of the LiMi-Model, created under the 4DN and BINA projects and now championed by the QUAREP-LiMi initiative.[26] The endorsement of the LiMi-Model marked a turning point that allowed us to bring microscopy hardware manufacturers into the standards-development process.[11] Their input helped refine the specification and paved the way for the Imaging-Persistent Hardware Descriptor (PHD) Initiative. This initiative assigns permanent identifiers to individual instrument instances and publishes citable hardware-descriptor files that conform to community-approved standards. Through the coordinated efforts of the QUAREP-LiMi community, aligned with multiple international initiatives, a realistic path toward a global microscopy metadata standard is now within reach.[27]

This work provides a critical foundation for data interoperability and reuse, supports large-scale imaging studies across laboratories, and enables artificial intelligence and machine-learning approaches to extract value from combined biomedical imaging datasets. Without support from the CZI Imaging Scientist award, my contributions to this work would simply not have been possible. The award gave me the credibility, confidence, and freedom to pursue community-centred coordination and consensus-building activities that are essential for shared infrastructure development, yet rarely supported by conventional funding schemes—now benefiting every member of the imaging community.

Impact pipelines summary

LiMi metadata: A community pathway to AI-ready microscopy data

Fragmented and inconsistent microscopy metadata practices → CZI Imaging Scientist Award provided protected time and resources for standards development → Iterative community-driven evolution of OME-based metadata models (4DN-OME → BINA-OME → QUAREP-LiMi) and engagement with imaging consortia and hardware manufacturers → Endorsement of the LiMi Model and initiation of the Imaging-Persistent Hardware Descriptor (PHD) initiative → Progress toward interoperable, AI-ready microscopy data standards and broader adoption across international networks and training programs.[11,27]

Caron Jacobs
Affiliation: Institute of Infectious Disease & Molecular Medicine Microscopy Platform (IDM-μ), University of Cape Town (UCT)
Role: Imaging Scientist and Platform Manager
Imaging Scientist Grant name: Democratizing Imaging for Infectious Disease Research in Africa
City & Country: Cape Town, South Africa.

Impact highlights

The Imaging Scientist funding had a transformative impact on my career, allowing me to transition from a postdoc to a hybrid role as both an Imaging Scientist/core facility manager and an academic researcher at the University of Cape Town (UCT). This support gave legitimacy to my position locally, enabling me to initiate new imaging collaborations, teaching activities, and the formalisation of the imaging platform at UCT while it was still being established.

The award provided a period of stability and freedom during which I was able to establish several key initiatives, including the formalisation of the IDM-μ core facility,[28] co-founding the African BioImaging Consortium (ABIC),[18] and supporting the early development of the Africa Microscopy Initiative (AMI).[29]

I invested in operations and management systems, leveraged existing equipment, and implemented training and visibility programs, including seminars, hands-on workshops, and the annual Cape Light Microscopy Course, modelled on the Montreal Light Microscopy Course at McGill.

The award generated significant local interest in bioimaging, attracting additional staff support, and grant-funded equipment contributed from local principal investigators. This excitement around bioimaging at UCT was part of the impetus for launching the groundbreaking Africa Microscopy Initiative, which has further built momentum and attracted more investment in this space. The IDM-μ is also home to a growing research program focused on technology development, training, and applications. This includes exciting collaborative work with local tuberculosis and plasmodium researchers, and

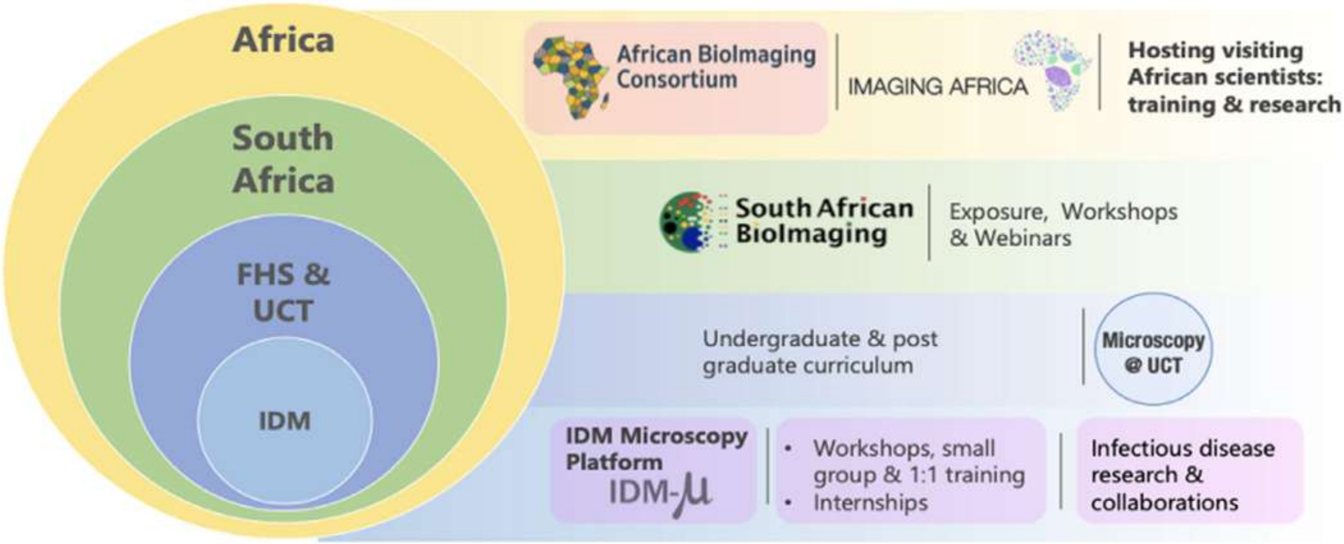

FIGURE 5 Illustrative figure on the scaling bioimaging: from IDM-UCT to the continent.

international collaborations with Ricardo Henriques at ITQB Nova, funded by CZI and Wellcome Trust, and with Paul French and colleagues at Imperial College, London, funded by CZI and, more recently, by Wellcome Trust, which has grown to include colleagues from Côte d'Ivoire, Kenya and Uganda.

This funding also provided a bridge to the international imaging community, directly enabling my leadership in ABIC, which has grown to span over 25 countries in under 5 years. Through ABIC, we have hosted 4 continent-wide hybrid community meetings and had the privilege to co-host, in partnership with South Africa BioImaging, the annual Global BioImaging Exchange of Experience meeting in 2023 in Stellenbosch, alongside the first GBI Facility Managers training in South Africa.[30]

Without the Imaging Scientist award, the IDM-μ, our training programs, research collaborations, and continental-wide community initiatives would not exist. The award catalysed significant investment and momentum in microscopy across South Africa and Africa, supported the first comprehensive mapping of imaging technologies, research interests, and expert networks across the continent, enabled ABIC's growth, and strengthened connections between the African imaging community and the global bioimaging network, helping to prevent fragmentation and isolation of bioimaging efforts.

Impact pipelines summary

Mapping, connecting, and scaling bioimaging in Africa (Figure 5)

The African imaging landscape has been largely fragmented, siloed and unknown → CZI Imaging Scientist funding enables ABIC formation → Creation of regional working groups & continental survey → Mapping of capacities, technologies, research interests, and experts → Targeted training programs, workshops, and community events → Stronger continental network, visibility, and coordination of imaging resources → Facilitated international collaborations and integration into global bioimaging community.

Claire M. Brown
Affiliation: Advanced BioImaging Facility (ABIF), Department of Physiology, McGill University
Role: ABIF Director, Principal Investigator
Imaging Scientist Grant name: Training and Mentoring Imaging Scientists and Building Imaging Communities
City & Country: Montreal, Quebec, Canada

Impact highlights

Over the past two decades, as Director of the Advanced BioImaging Facility (ABIF),[31] I have witnessed first-hand how strategic investment in Imaging Scientists transforms technology training and research. Leveraging funding from the CZI Imaging Scientist Program enabled me to secure sustained institutional support, expand our team to myself plus four full-time Imaging Scientists, and serve more than 300 users across 120 research laboratories spanning five faculties. This investment transformed both the facility and the research community it supports.

With expanded human resources, I was able to focus on training, education, and mentorship, ensuring that the next generation of Imaging Scientists is equipped to lead innovation. Beyond local impact, the funding strengthened national and international networks, enabling ABIF to share best practices and solutions globally. These efforts elevate the visibility of Imaging Scientists, highlight the importance of stable career paths, and create a community focused on advancing research through access to cutting-edge technology.

One of the most rewarding milestones in my career has been leading our Train-the-Trainer program over the past 2 years.[32] This initiative had two core goals:

1. Equip Imaging Scientists with the resources and training needed to deliver high-quality courses on light microscopy fundamentals.
2. Build an international network of expert trainers.

In just over 2 years, the program reached 273 participants across 23 countries, trained 67 new Imaging Scientists as expert trainers, and catalysed six microscopy courses worldwide in English, French, and Spanish. By providing ready-to-use materials and structured instruction, we empower early-career researchers to adapt and expand content,[33] rather than starting from scratch, thereby accelerating knowledge transfer and innovation on a global scale. The success of the program was built on support from the global bioimaging networks including Canada BioImaging (CBI),[34] BioImaging North America (BINA),[35] Latin America BioImaging (LABI),[17] Microscopy Australia (MA)[36] and Global BioImaging (GBI).[3]

Another key area was the development of the Canada BioImaging (CBI) user groups of technology experts[37] built around key technologies at the ABIF. The international user groups are coordinated by the Royal Microscopical Society (RMS)[38] and BINA and are focused on rapid advancement of technology adoption through knowledge sharing. Early career Imaging Scientists are leading these groups as co-chairs and gaining international recognition, accelerating their own research programs while helping the global community and supporting key technologies at the ABIF.

Without the CZI Imaging Scientist Program, ABIF's expansion, the Train-the-Trainer program, and the international community-building initiatives would not have been possible. The award catalysed a multiplier effect—strengthening expertise, infrastructure, and networks that now benefit hundreds of laboratories and thousands of researchers worldwide. Much of the foundational work is in place, but as the program comes to an end, the risk is a loss of momentum.

Impact pipelines summary

Train-the-Trainer & expert user networks

Facility with extensive training expertise and resources, advanced technology expertise, but lack of capacity and funding for international training and technology dissemination → CZI Imaging Scientist Award increased FTE, enabling development of the Train-the-Trainer program and expert user groups → Supported course organisation, mobility, and logistics → Empowered early-career Imaging Scientists as trainers and built networks around advanced technologies → Outcome: established an international network of expert trainers and technology experts, trained 273 participants across 23 countries, catalysed six microscopy courses, and strengthened global technology adoption.

4 | CROSS-CASE IMPACT THEMES

Rather than interpreting the individual profiles as isolated success stories, the following impact themes reflect recurring *mechanisms* observed across case studies through which people-centred funding for Imaging Scientists translated into sustained scientific, institutional, and community-level outcomes. These themes highlight how targeted support for Imaging Scientists can generate a durable impact that extends well beyond individual projects or facilities. The highlighted themes are clearly applicable in diverse regional contexts and can certainly also be translated beyond the Imaging Core Facility context to other Core Facilities.

4.1 | Technology development and validation within core facilities

Across multiple case studies and survey responses, protected time, role recognition, and stable support enabled Imaging Scientists to advance the development and validation of new imaging methods, analysis software solutions, and experimental workflows within core facility environments. In several instances, this included the maturation of advanced microscopy and imaging modalities, the development of quantitative analysis pipelines, and the establishment of robust metadata and data-management frameworks. Importantly, these activities did not occur as isolated research outputs, but as facility-embedded processes that translated experimental innovation into reliable, reproducible methods accessible to broad user communities. This pattern is evident across cases involving advanced light-sheet microscopy, fluorescence lifetime imaging, total-body PET analysis, and community-driven data standards development, demonstrating how Imaging Scientists play a central role in de-risking and validating emerging technologies before wider dissemination.

4.2 | Adoption and operationalisation of new technologies

Distinct from technology development, the profiles illustrate how Imaging Scientists enabled the adoption and operational integration of new technologies into routine facility service. Funding enabled facilities to embed new instrumentation into daily workflows, establish quality control procedures, and train users, bridging gaps where innovation had previously outpaced operational adoption and ensuring that new capabilities reached researchers efficiently. In several cases, facilities expanded or diversified their technology portfolios—such as integrating new imaging modalities or analysis platforms—while maintaining the highest service standards. These examples underscore that successful adoption of new cutting-edge technologies depends not only on equipment acquisition but on sustained human expertise capable of translating innovation into stable, long-term infrastructure.

4.3 | Strengthening core facility foundations and leadership

A recurring cross-case impact was the strengthening of core facility foundations at the institutional level. This included expansion, recruitment, or stabilisation of staff teams/roles, improved governance and visibility within institutions, enhanced access to space or infrastructure, and formal recognition of facilities as strategic research assets at their institutions. Support also elevated professional recognition and leadership development for Imaging Scientists, boosting career trajectories and increasing institutional visibility. The Imaging Scientists were empowered to take on strategic roles in facility governance, institutional decision-making, and international community coordination and policy development, thereby reinforcing the long-term sustainability and visibility of imaging infrastructures and communities worldwide.

In many cases, these investments directly resulted in the mobilisation of significant new external grant funding. These impacts underscore that strengthening core facility foundations is not a secondary outcome, but a prerequisite for sustainable service provision, effective technology adoption, and long-term workforce retention, directly contributing to institutional resilience and competitiveness, reducing vulnerability to staff turnover and enabling facilities to plan beyond short funding cycles.[12]

While it is clear that several awardees of the Imaging Scientist program were already established leaders within the bioimaging community at the time of funding, which may have influenced the scale and visibility of certain outcomes, the case studies and survey responses consistently show that the programme not only amplified the impact of already well-positioned individuals but also enabled significant career progression, leadership development, and increased institutional recognition for others. Due to the size and structure of the cohort, a systematic comparison across career stages is not possible within this study.

4.4 | Capacity building through training and train-the-trainer models

All case studies demonstrated significant capacity-building effects through training activities led by Imaging Scientists. Beyond individual skill development, several profiles highlight *Train-the-Trainer* approaches, in which Imaging Scientists trained cohorts of researchers and facility staff who subsequently disseminated expertise within their own institutions or regions. This multiplier effect substantially amplified impact relative to the initial investment, enabling sustainable knowledge transfer, reducing reliance on external expertise, and strengthening regional imaging ecosystems. Importantly, training activities addressed technical skills, training methodology, and data management frameworks, supporting reproducible and responsible use of advanced imaging technologies.

4.5 | Enabling collaboration and community formation

A prominent cross-case theme was the role of Imaging Scientists in enabling collaboration through community building and network development. Several profiles demonstrate how Imaging Scientists acted as connectors across disciplines, institutions, and geographical boundaries, contributing to the formation or strengthening of national (e.g., United States, South Africa, Uruguay), regional (e.g., Latin America, Africa, Europe), and international imaging networks (e.g. Global BioImaging, QUAREP-LiMi). These efforts not only facilitated knowledge exchange, coordinated standards development, joint training activities, and follow-on funding opportunities but also promoted the adoption of shared data practices, FAIR principles, and AI-ready imaging datasets. By lowering coordination barriers and investing time in community leadership, Imaging Scientists helped transform isolated facilities into interconnected research ecosystems and supported mapping and understanding of regional network capabilities, research priorities, and capacities.

5 | NETWORKS AS A CATALYST FOR INNOVATION AND ACCESSIBILITY

While technology development and adoption are critical, their impact is maximised only when integrated into coordinated networks. Across case studies, Imaging Scientists leveraged national, regional, and international communities to connect fragmented facilities, share expertise, and ensure that innovations were broadly accessible. These networks facilitated:

- **Knowledge exchange**—sharing best practices, standardised workflows, and training resources across institutions.
- **Community-wide adoption of technology and standards**—ensuring reproducible, interoperable, and AI-ready data.
- **Capacity building at scale**—enabling multiplier effects through Train-the-Trainer approaches and collaborative initiatives 'copy/pasted' in different regions and languages.
- **Coordination of research priorities**—mapping regional expertise and technology capacities to align resources with emerging scientific needs.

By embedding Imaging Scientists into these networks, the program transformed isolated successes into ecosystem-level impacts, amplifying the reach of funding and enabling sustainable, community-driven innovation. This dedicated coordination is difficult to achieve through individual project-based funding alone but is essential to translate advances in imaging technology into tangible scientific and societal outcomes.

> Such networks are critical for funders: they ensure that investments in imaging technology are accessible, reproducible, and positioned to accelerate discovery across institutions, regions, and continents.

What the individual profiles show is that relatively modest investments in Imaging Scientists can unlock broad, ecosystem-level impacts, accelerating technology adoption, research output and scientific capability, protocol and metadata standardisation, AI-ready data generation, and network formation (Table 1). Rather than producing isolated outcomes, people-centred investments create enabling conditions that allow imaging facilities to innovate, adapt, and act as long-term pillars of a resilient and interconnected global research ecosystem (Figure 6). The recurrence of the impact themes across diverse geographic, institutional, and technological contexts underscores the scalability, transferability, and enduring significance of this funding model.

TABLE 1 Summary of outputs from individual Imaging Scientist profiles. Metrics include publications, grants (excluding the CZI award), new or stabilised core facility staff/FTE, new or upgraded equipment, trainings/workshops, tools developed, and engaged imaging networks. These metrics capture both traditional research outputs and tangible investments in people, infrastructure, and community capacity.

Category	Total (from all profiles)
Publications	64+
Grants received/funding (excluding the CZI imaging scientists award)	35+
New/stabilised core facility staff/FTE	12+
New or upgraded equipment/instrumentation	15+
Trainings/workshops	60+
Tools developed (instruments/software)	13
Imaging networks mentioned	9

6 | FUTURE PERSPECTIVES

The cross-case impact themes identified in this paper provide a robust evidence base for public and private funders seeking to maximise long-term returns on investments in life science research, imaging technologies, research infrastructures, and the experts who sustain them. The Imaging Scientist program here demonstrates that supporting personnel embedded in core facilities generates durable scientific-, institutional-, and community-level outcomes, extending well beyond individual projects or equipment acquisition. However, it has to be clear that while people-centred funding can catalyse significant institutional- and community-level impact, these gains are not inherently self-sustaining. This finding underscores that one-off or time-limited investments, although highly effective in initiating change, need to be complemented by longer-term funding mechanisms or institutional integration to ensure continuity of training, community coordination, and infrastructure development.

Investing in Imaging Scientists recognises their dual role: driving technological innovation and ensuring its successful integration into routine facility operations, as demonstrated by the recurring development–adoption

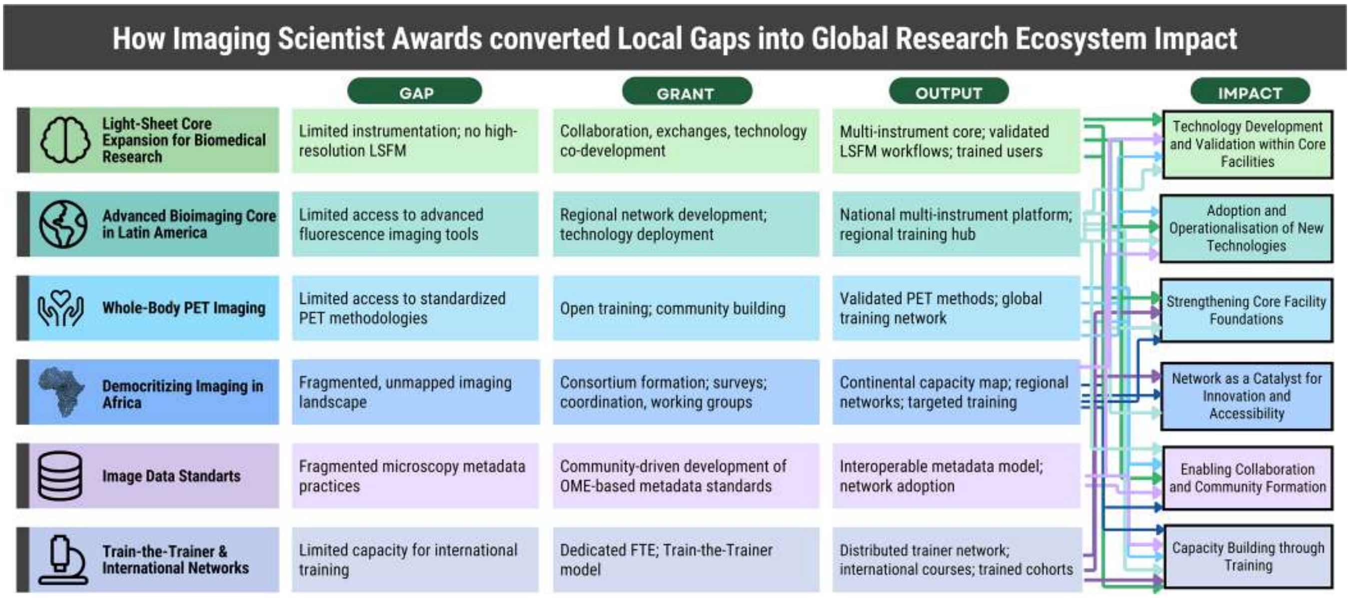

FIGURE 6 From targeted funding to global imaging ecosystems: how Imaging Scientists translate methods, training, and collaboration into sustained scientific impact.

pathway identified across the case studies. By explicitly supporting these roles, funders can catalyse high-leverage activities—technology validation, adoption, reproducible workflows, Train-the-Trainer programs, and community coordination—that conventional project- or equipment-based grants often leave underfunded. These investments create multiplier effects, strengthen networks, and enable sustainable access to advanced imaging capabilities across institutions, regions, and globally and the community-wide production and sharing of high-quality, FAIR and AI-ready datasets.

While this study focuses on a people-centred funding model targeting individual Imaging Scientists, an important open question for funders is how such approaches compare to direct investment in core facility teams or institutional structures. As no equivalent large-scale programmes supporting entire facilities by institutionally external funders in a comparable manner currently exist, a direct empirical comparison is not possible within this study. However, the findings presented here consistently demonstrate that funding directed at individuals embedded within core facilities translates into broader institutional- and community-level impacts, including team expansion, enhanced facility operations, and increased access to training and technologies. This suggests that individual- and facility-level funding should not be viewed as mutually exclusive models, but rather as complementary approaches that can jointly contribute to long-term infrastructure sustainability.

Practical design considerations for future programmes include enabling Imaging Scientists and core facility staff to apply directly as principal investigators, providing protected time for innovation, community leadership, policy engagement, training, and quality control. Such grants need to recognise outputs beyond traditional publications (e.g., training sessions delivered, data stewardship contributions, expertise on unique infrastructure) as metrics of success and impact. Embedding support for professional development, leadership training, and career progression for Imaging Scientists in core facilities within technology- or infrastructure-focused grants would help ensure that funded instruments and platforms remain scientifically effective, accessible, and aligned with evolving research needs. The consistent effectiveness of Train-the-Trainer approaches across diverse contexts suggests that future programmes should prioritise capacity-building models that deliberately embed multiplier effects, enabling impact to scale beyond individual institutions. At the global scale, access to advanced imaging technologies and associated expertise remains uneven, particularly in regions such as Africa, Latin America, and Southeast Asia. In this context, imaging scientists and core facility professionals can play an important role in the ongoing democratisation of access through training, knowledge exchange, and international collaboration. Strengthening support mechanisms and funding schemes aimed at building capacity in underrepresented regions will be essential to fostering more equitable participation in life sciences research.

Engaging with existing Imaging Scientist communities and international networks when designing such programmes can further enhance impact. These communities hold crucial knowledge of local and global capacities and research interests, enable coordination and standardisation across institutions and regions, serve as platforms of knowledge exchange, and help translate funder priorities into sustainable, community-driven processes and outcomes.[3] Embedding both people, core facilities, platforms, and community networks at the heart of scientific discovery within funding strategies is essential for creating a resilient, innovative, and inclusive global research ecosystem—and for ensuring that research investments translate into tangible, lasting impact.

Although these considerations are here specifically focussed on Imaging Scientists in Imaging Core Facilities, given the focus of the funding program, the conclusions and recommendations can likely also be extended to other Core Facilities types and the experts that staff them. In fact, there are increasing efforts to connect and jointly advocate for technical specialists in core facilities through initiatives and communities such as the Technician Commitment and the UK Technical Specialist Network, as well as the Core Technologies in Life Sciences (CTLS) and the Association of Biomolecular Resource Facilities (ABRF).[39,40,41]

Advanced instruments and platforms alone cannot achieve maximal scientific impact without the experts who operate, validate, disseminate, and connect them. The experiences reported here underscore that long-term scientific, institutional, and community outcomes in imaging science rely on sustained, people-centred investment: in the Imaging Scientists themselves, in the facilities they lead, and in the networks that connect them. Now is the time for funders and institutions to continue this proven model, ensuring that the globally connected imaging research community remains strong, innovative, and collaborative.

ENDNOTES

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Yara Reis: Conceptualisation; methodology; investigation; formal analysis; writing—original draft; writing—review and editing; project administration; endorsement. **Johanna Bischof**: Conceptualisation; methodology; investigation; formal analysis; writing—original draft; writing—review and editing; visualisation; endorsement. **Claire M. Brown**: Writing—original draft; writing—review and editing; endorsement. **Michelle S. Itano**: Conceptualisation; writing—original draft; writing—review and editing; endorsement. **Caron A. Jabobs**: Conceptualisation; writing—original draft; writing—review and editing; endorsement. **Leonel Malacrida**: Writing—original draft; writing—review and editing; endorsement; **Caterina Strambio-De-Castillia**: Conceptualisation; writing—original draft; writing—review and editing; endorsement. **Adriana A.S. Tavares**: Conceptualisation; writing—original draft; writing—review and editing; endorsement. **Antje Keppler**: Conceptualisation; supervision; funding acquisition; writing—review and editing, endorsement.

ACKNOWLEDGEMENTS

We sincerely thank all grantees of the Imaging Scientist program who have completed the survey and provided insights into their experiences in the program. We thank Vladimir Ghukasyan, Senior Program Manager Imaging at the Chan Zuckerberg Initiative, for feedback on the draft. YR's contribution was made possible by grant number 024–337146 from the Chan Zuckerberg Initiative DAF, an advised fund of Silicon Valley Community Foundation. CMB's contribution was made possible in part by grant number 2023–329682 from the Chan Zuckerberg Initiative DAF, an advised fund of Silicon Valley Community Foundation and the McGill University Advanced BioImaging Facility (ABIF), RRID:SCR_017697. The UNC Neuroscience Microscopy Core (RRID:SCR_019060), supported, in part, by funding from the NIH-NICHD Intellectual and Developmental Disabilities Research Center Support Grant P50 HD103573, S10 OD032388 (Zeiss LSM 980 confocal microscope system) and S10 MH130455 (ASI ct-dSPIM microscope system). CJ is supported by grant number 2020–225445 598 from the Chan Zuckerberg Initiative DAF, an advised fund of Silicon Valley Community Foundation, and 313779/Z/24/Z from the Wellcome Trust. LM is supported by the grants 2020–225439, 2021–240122, 2022–252604 of Chan Zuckerberg Initiative DAF, an advised fund of Silicon Valley Community Foundation. LM was supported by FOCEM—Fondo para la Convergencia Estructural del Mercosur (COF 03/11). CSDC was supported by grant #2021-244318 (5022) awarded by the Chan Zuckerberg Initiative DAF, an advised fund of Silicon Valley Community Foundation, as part of their Imaging Scientist RFA. Major funding also came from NIH grants #U01CA200059-06, #UM1HG011536-04S1 and #U01CA260699 and NSF grant #2513921. AAST is a recipient of a Wellcome Trust Technology Development Award (221295/Z/20/Z), Medical Research Council awards (MR/W029464/1, MR/Y008944/1 and MR/Y503332/1), a British Heart Foundation award (PG/24/11898) and a Chan Zuckerberg Initiative DAF grant (2020-225273). JB and AK are funded by Euro-BioImaging ERIC (https://ror.org/05d78xc36). This publication has been made possible in part by CZI grant DAF2021-225273 and grant DOI https://doi.org/10.37921/690910twdfoo from the Chan Zuckerberg Initiative DAF, an advised fund of Silicon Valley Community Foundation (funder DOI 10.13039/100014989).

Open access funding enabled and organized by Projekt DEAL.

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How to cite this article: Reis, Y., Bischof, J., Brown, C. M., Itano, M. S., Jacobs, C. A., Malacrida, L., Strambio-De-Castillia, C., Tavares, A. A. S., & Keppler, A. (2026). People-centred funding as a catalyst for sustainable imaging infrastructure. *Journal of Microscopy*, *302*, 295–311. https://doi.org/10.1111/jmi.70099