

COST Action Final Achievement Report (19/09/2022 to 18/09/2026)

CA21115: Iron-sulphur (FeS) clusters: from chemistry to immunology

The Action was approved by the Committee of Senior Officials (CSO) on 27-5-2022 and has the MoU reference COST 029/22.

This report shows the data entered into e-COST to enable the Action Chair to verify the completeness and accuracy of the report with the MC prior to submitting the report via e-COST in fulfilment of the rules for COST Action Management, Monitoring and Final Assessment.

Action leadership and participants

Leadership positions

Position	Name	Contact details	Country*
Chair	Dr Kourosh Ebrahimi	kourosh.ebrahimi@kcl.ac.uk +442078484834	United Kingdom

Position	Name	Contact details	Country*
Action Vice-Chair	Dr Smilja Todorovic	smilja@itqb.unl.pt +351214469717	Portugal

Working groups

#	WG Title	# of participants	WG Leader	Country*
1	FeS clusters and the immune system	99	Dr Suzanne Cloonan suzanne.cloonan@tcd.ie	Ireland
2	FeS clusters in viral replication	69	Dr Peter Leon Hagedoorn p.l.hagedoorn@tudelft.nl	Netherlands
3	Mechanistic studies of FeS biogenesis	150	Ms sandrine ollagnier sollagnier@cea.fr	France
4	Mechanistic studies of FeS chemistry	186	Prof Nick Le Brun n.le-brun@uea.ac.uk	United Kingdom
5	FeS clusters and proteins as drug targets	125	Prof Iztok Turel iztok.turel@fkkt.uni-lj.si	Slovenia

Other key leadership positions

Position	Name	Contact details	Country*
Science Communication Coordinator	Ms Thao Nghi Hoang	nghi.t.hoang@kcl.ac.uk	United Kingdom
GH Scientific Representative	Kourosh Ebrahimi	kourosh.ebrahimi@kcl.ac.uk	United Kingdom

* The country displayed is:

- for the Action Chair, the country that nominated that person to the Management Committee before they were elected Action Chair;
- for the Action Vice-Chair the country that nominated the person as a Management Committee Member,
- for all other leadership positions, if the person is a MC Member the country displayed is the country of nomination, otherwise it is the country of the person's primary work affiliation.

Participants

COST members having accepted the MoU

AL	22/06/2022	AM	09/01/2023	AT	22/06/2022	BE	22/06/2022	BA	22/06/2022
BG	22/06/2022	HR	22/06/2022	CY	22/06/2022	CZ	22/06/2022	DK	22/06/2022
EE	22/06/2022	FI	22/06/2022	FR	22/06/2022	GE	22/06/2022	DE	22/06/2022
EL	22/06/2022	HU	22/06/2022	IS	22/06/2022	IE	22/06/2022	IL	22/06/2022
IT	22/06/2022	LV	22/06/2022	LT	22/06/2022	LU	22/06/2022	MT	22/06/2022
MD	22/06/2022	ME	22/06/2022	NL	22/06/2022	MK	22/06/2022	NO	22/06/2022
PL	22/06/2022	PT	22/06/2022	RO	22/06/2022	RS	22/06/2022	SK	22/06/2022
SI	22/06/2022	ZA	22/06/2022	ES	22/06/2022	SE	22/06/2022	CH	22/06/2022
TR	22/06/2022	UA	22/06/2022	UK	22/06/2022				

Other participants

Institution Name	Country
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Summary

Main aim/ objective

address the chemistry and biology of Iron-sulphur (FeS) proteins' functions in the immune response and viral reproduction process. The Action will implement a multidisciplinary approach and provide translational opportunities for developing new therapeutics to address global challenges in human diseases like viral infections and cancer

The Action addressed this as described below

What if we could turn our own cells into medicine factories? That is the promise of COST Action FeSImmChemNet, a pan-European research network that brought together scientists from different fields to study iron-sulfur proteins—tiny molecular machines found in all living things. These proteins play essential roles in how our cells use energy, fight infections, and respond to stress. Understanding and engineering them could transform how we treat diseases and manufacture medicines.

This network achieved three major breakthroughs. First, they engineered a new type of antiviral therapy called iCARE. Instead of giving patients a drug, this approach delivers genetic instructions that tell our cells to produce their own antiviral enzymes. These enzymes then make molecules that stop viruses from multiplying. This could provide a rapid, flexible response to emerging viral threats, including future pandemics. Second, they built tiny protein cages called ferritin nanocages that can carry medicines directly to specific cells in the body, like a delivery service that knows exactly where to go. These cages are biocompatible, biodegradable, and can be engineered to target particular tissues, making treatments more effective and reducing side effects. Third, they showed that complex protein machinery from bacteria can be moved into plant cells, opening the door to crops that could one day produce their own fertiliser. This could reduce reliance on synthetic fertilisers and make agriculture more sustainable.

These achievements matter because they address some of society's biggest challenges: preparing for future pandemics, fighting drug-resistant infections, and making medicines in more environmentally friendly ways. The network also trained young researchers, created lasting partnerships with companies, and filed patents to protect their discoveries. By connecting scientists across Europe—from chemists and biologists to engineers and clinicians—FeSImmChemNet showed that the biggest problems can only be solved by working together.

The work continues. Members are now applying for new funding to train more scientists, develop these technologies further, and bring them closer to helping patients. Projects are being planned to advance mRNA-delivered antiviral enzymes toward clinical trials and to scale up sustainable manufacturing processes. FeSImmChemNet proved that when scientists from different countries and disciplines work together, they can achieve things no single laboratory could do alone. Their legacy is not just scientific knowledge, but a community of researchers ready to turn discoveries into real-world solutions for healthier lives and a cleaner planet. The network has laid the foundation for a new generation of therapies and technologies that could benefit patients, industry, and society for years to come.

Action website

<https://www.fesimmchemnet-cost.com/>

Achievement of MoU objectives, deliverables and additional outputs/ achievements

MoU objectives

Please self-assess and describe the level of achievement of each MoU objective. For any MoU objectives that were less than 76% achieved please provide justification.

Please provide proof to enable the Action Rapporteur to confirm the level of achievement.

Mou objective	1. Coordinating experimentation and data collection to (i) obtain insight into the mechanism of cellular FeS cluster biogenesis, (ii) investigate the role of FeS enzymes and biogenesis in cellular small and large molecule chemistry, and (iii) understand the mechanism of FeS cluster transfer target host and viral proteins.		
Type of objective	1.a Development of a common understanding/definition of the subject matter 1.b Coordination of information seeking, identification, collection and/or data curation 2.b Building a community around a new or emerging field of research		
Level of achievement of MoU objective	76 - 100%	Dependence of achievement on the action networking	High
Proof of achievement of MoU objective	To develop a common understanding of the role of FeS clusters in viral infection, coordinate data collection, and build a lasting research community, the Action organized a comprehensive programme of networking and training events over its four-year term. This included a total of four scientific meetings and two Young Investigator meetings, which brought together experts and early-career researchers from the fields of virology and bioinorganic chemistry. These meetings consistently received outstanding feedback, with over 90% of participants rating the quality of networking and knowledge transfer as excellent. Complementing these gatherings, the Action delivered a highly successful series of four Training Schools, each focusing on a critical methodology for the field: NMR Spectroscopy of Metalloproteins EPR Spectroscopy at Imperial College London Isothermal Titration Calorimetry (ITC) at TU Delft Metals in Biology at ITQB All four Training Schools received excellent feedback, with more than 90% of attendees evaluating the quality of content, training, and knowledge exchange as excellent or very good. Collectively, these events successfully bridged the traditionally separate disciplines of bioinorganic chemistry and virology, introducing a shared language, experimental techniques, and tools that enabled coordinated and collaborative data collection. Building on this momentum, the community consolidated around major collaborative funding applications, with two key outcomes: - MSCA Doctoral Network (MSCA DN): A consortium of 13 Action members prepared and submitted a Marie Skłodowska-Curie Actions Doctoral Network proposal. While the application was not successful on this occasion, the collaborative effort significantly strengthened the network. The consortium remains committed to resubmitting a refined proposal, and the communication channels generated during the Action continue to sustain the community's activity. - EIC Pathfinder/Transition Grant: A direct translational outcome of the Action is a new consortium of 5 Action members and an industrial partner that has submitted a grant to the European Innovation Council (EIC). The project aims to exploit FeS enzymes for the development of novel antiviral compounds. This high-profile application is currently under evaluation and represents a major step toward moving fundamental FeS cluster research into biotechnological and therapeutic applications.		

	This pipeline—from foundational networking and specialised training to coordinated funding bids, including those prepared for resubmission and those progressing through evaluation—demonstrates the Action's success in building a self-sustaining and impactful scientific community that continues to generate new research agendas and collaborations well beyond its four-year term.
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Mou objective	2. Coordinating experimentation and data collection to elucidate the mechanism of catalytic function of FeS enzymes and proteins involved in the innate immune response.		
Type of objective	1.a Development of a common understanding/definition of the subject matter 1.b Coordination of information seeking, identification, collection and/or data curation 2.c Bridging separate fields of science/disciplines to achieve breakthroughs that require an interdisciplinary approach		
Level of achievement of MoU objective	76 - 100%	Dependence of achievement on the action networking	High
Proof of achievement of MoU objective	Activities To develop a common understanding of the role of FeS clusters in viral infection and the immune system, coordinate data collection, and bridge the fields of virology, immunology, and bioinorganic chemistry, the Action organized four scientific meetings and two Young Investigator meetings over its four-year term. These gatherings brought together experts and young innovators, building a community around the emerging role of FeS proteins in viral infection and immune response, and linking the Action to the broader iron research community, including the European Iron Club. Complementing these meetings, the Action delivered four highly successful Training Schools: - NMR Spectroscopy of Metalloproteins- EPR Spectroscopy at Imperial College London- Isothermal Titration Calorimetry (ITC) at TU Delft- Metals in Biology at ITQB The meetings and Training Schools received excellent feedback, with over 90% of participants rating networking, knowledge transfer, and training quality as excellent or very good. These events successfully introduced the techniques and tools available across disciplines, enabling coordinated data collection. The feedback demonstrates research groups building new networks, developing research agendas, and establishing lasting collaborations. Outcomes and Outputs A total of 17 Short-Term Scientific Missions (STSMs) and 9 Dissemination activities were carried out. Approximately half were directly related to FeS proteins in the immune system and viral infection, reflecting the strong thematic focus of the network. Publications from STSM activities are under review and in preparation. The Action catalysed three major collaborative funding initiatives: - ERC Synergy Grant: Five Action members applied for an ERC Synergy Grant crossing immunology, virology, and bioinorganic chemistry. The application passed the first round with excellent feedback but was not invited for interview. The team will resubmit in the upcoming call. - MSCA Doctoral Network: A consortium of 13 Action members submitted an MSCA DN proposal. Although unsuccessful, the effort strengthened the network significantly. The consortium will resubmit a refined proposal next year, and communication channels generated during the Action continue to sustain community activity. - EIC Grant: Five Action members and an industrial partner submitted an EIC grant to exploit FeS enzymes for novel antiviral development. The application is under evaluation, representing a major translational step for the field.		

	This pipeline—from networking and training through mobility and dissemination to high-level funding bids, including those resubmitted and under evaluation—demonstrates the Action's success in building a self-sustaining community that continues generating collaborations and research agendas beyond its four-year term.
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Mou objective	3. Coordinating experimentation and data collection to investigate FeS proteins as a potential drug target to treat human diseases like viral infection and microbial pathogens.		
Type of objective	1.a Development of a common understanding/definition of the subject matter 1.b Coordination of information seeking, identification, collection and/or data curation 2.b Building a community around a new or emerging field of research		
Level of achievement of MoU objective	76 - 100%	Dependence of achievement on the action networking	High
Proof of achievement of MoU objective	This has been achieved through Action scientific meeting to coordinate new experiments and STSM activities to collect data. Examples of these activities include: - Through scientific meeting collaboration has been established between King's College London and TU Berlin to apply advanced computational methods in developing a new Nanocage technology as a platform for making new antiviral therapeutics. Subsequently, an STSM project was carried out to collect data. The results have supported a grant applications and are expected to be published within the next year. - In another project, the coordination between King's College and TU Berlin was achieved to combine experimentation and computational methods for discovering new FeS enzymes producing novel antiviral lead molecules. An STSM project was awarded to develop and apply the computational codes and protocols for selecting possible FeS enzyme candidates. These candidates were then screened and experimentally characterised. The data are expected to lead to a research article and have supported an EIC joint publication. - Another project involved collaboration between four research groups across the action, leading to new insights into the catalytic function of an antiviral FeS enzyme of the innate immune system. The insights were used to develop new engineered enzymes for mRNA delivery and antiviral synthesis from within the body to treat or prevent viral infections. The project was supported by two STSM activities and coordination of data collection. The collaboration was established at the first scientific meeting. It also led to a successful joint grant application from the Royal Society (£12,000). - During a research project named "Design and screening of inactivating Fe-S proteins – targets at antibiotic-resistant microorganisms", a Staphylococcus aureus MRSA and two Escherichia coli ESMB multidrug-resistant strains from hemo- and urine cultures, respectively, were isolated in the clinic in collaboration with the Infectious and Tropical Diseases Hospital "Dr. Victor Babes", Bucharest. In collaboration with colleagues from the National Medico-Military R&D Institute "Cantacuzino", Bucharest, and the Biochemistry Institute of the Romanian Academy, the DNA of the strains were sequenced, and the corresponding genes encoding two target proteins (apo-cysteine desulfurase of S. aureus and FNR of E. coli) were found and expressed in recombinant strains. The proteins were isolated and purified. Meanwhile, due to similarities to published bacterial protein structures, drug-design docking studies yielded corresponding ligand molecule structures. The best-scoring docking molecules will be synthesized in collaboration with the Institute of Organic and Supramolecular Chemistry "C.D. Nenitescu" of the Romanian Academy and checked against the protein targets and their producing microorganisms. - In another project, Members of the Action characterised the interaction of a GC-376-based PROTAC with CVB3 3CPro using X-ray crystallography, NMR, and biochemical assays. A 1.9 Å crystal structure was obtained, NMR backbone assignments were achieved, and micromolar inhibition was demonstrated. Results support its potential as a broad-spectrum antiviral agent, with data prepared for		

	publication.		
Mou objective	4. Coordinating S&T activities to develop new ideas and research directions for understanding role of FeS proteins in cell development and differentiation and as target for treating other human diseases like cancer.		
Type of objective	1.b Coordination of information seeking, identification, collection and/or data curation 1.c Coordination of experimentation or testing 1.f Achievement of a specific tangible output that cannot be achieved without international coordination (e.g. due to practical issues such as database availability, language barriers, availability of infrastructure or know-how, etc.)		
Level of achievement of MoU objective	76 - 100%	Dependence of achievement on the action networking	High
Proof of achievement of MoU objective	The Action has funded multiple S&T activities supporting Young Investigators and Innovators to study FeS protein in cell development, viral infection, and a drug target. Short-Term Scientific Mission grants: 1. One STSM supported a project to implement modern computational biochemistry methods to complement experimental methods facilitating the discovery of new antiviral FeS enzymes member of the radical-SAM enzymes and homologues of the human antiviral enzyme SAND (RSAD2). The results of this STSM activity has led to the discovery of new enzymes and the project is under way. 2. One STSM supported a project to study the reaction of reactive oxygen species with the FeS enzyme mitoNEET, a diabetic drug target. The outcomes from this STSM activity have led to new ideas and research direction in understanding how FeS proteins sense hypoxia in T cells and cancer. The results have led a publication, in revision. 3. One STSM supported a project to study the pathogenic mutation of the FeS enzyme FDX2. 4. An STSM supported the use of iPSC to study the role of mitochondrial iron deficiency, an essential pathway of FeS biosynthesis, on alveolar macrophage metabolism and function. 5. Two STSM supported two projects to reveal the activation mechanism of the innate immune FeS protein SAND (RSAD2). The outcome of these projects has resulted to a new discovery and new projects. The results are currently being prepared for a high impact publications involving 4 members of the action. 6. One STSM supported a project to study the Iron-sulfur protein NifB using NMR spectroscopy. This project has generated new ideas and new collaborations. 7. One STSM supported a project at Björnsson lab, CEA Grenoble, funded. The host group was not previously involved in the Action. This work established a new collaboration on QM/MM dynamics methods to model FeS clusters. 8. New COST Action. ACTION CA22147 European Metal Organic Framework network: combining research and development to promote technological solutions (EU4MOFs) (02/11/2023-01/11/2027) Scientific meetings led to several new collaborations. A number of examples are highlighted below. - Collaboration with Mario Piccioli to study nitrogenase iron-sulfur clusters by		

	paramagnetic NMR. Collaboration with Yvain - Nicolet to investigate atomic structures of nitrogenase proteins. - Through the networking opportunities provided by the COST Action CA21115, a member of the action established a collaboration with Prof. Simone Ciofi Baffoni. This contact led to a subsequent Erasmus+ Student Mobility for Traineeships at the Magnetic Resonance Center (CERM), University of Florence, Italy. - Another member of the Action started new collaboration with three teams: Groups of Prof. Simone Ciofi (Florence), Prof. Ingrid Span (Erlangen), Sandrine Ollagnier (Grenoble) - Another group established new collaborations with - Rafal Dutkiewicz, University of Gdansk, Poland - Bénédicte Burlat, Aix Marseille University, CNRS, Marseille, France - Simone Ciofi Baffoni, Magnetic Resonance Center, University of Florence, Italy - Sarah Dubrac, Institut Pasteur, Paris, France - Prof Ralf Wellinger started new collaboration with Prof. Antonio Pierik, University of Kaiserslautern (Germany) Analysis of Fe/S cluster containing proteins and Prof. Robert Sutak, Charles University, Vestec (Czech Republic) Analysis of mitochondrial translation
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Mou objective	5. Coordinating cooperation and research activities for future market applications. To facilitate the utilization of translational opportunities arisen from S&T activities to enhance Europe's economic competitiveness.		
Type of objective	1.a Development of a common understanding/definition of the subject matter 1.f Achievement of a specific tangible output that cannot be achieved without international coordination (e.g. due to practical issues such as database availability, language barriers, availability of infrastructure or know-how, etc.) 1.h Input for future market applications (including cooperation with private enterprises)		
Level of achievement of MoU objective	76 - 100%	Dependence of achievement on the action networking	Medium
Proof of achievement of MoU objective	To facilitate the utilization of translational opportunities arising from S&T activities and enhance Europe's economic competitiveness, the Action has actively pursued commercialisation pathways and industrial partnerships throughout its lifetime. Research activities have resulted in two granted patent applications (WO2026093724A1 and WO2024110757A1), protecting key innovations in engineered metalloenzymes and nanocage delivery systems. These patents have been exploited through participation in spin-out accelerator programs and engagement with potential commercial partners, including EvoEnzyme, a leader in directed evolution of metalloenzymes for sustainable chemistry, and Nanopharm, a specialist in formulation and scalable manufacturing. Members of the Action have applied for an EIC grant to pursue commercialisation and development of new antiviral technologies directly generated from the Action's research activities, including the iCARE mRNA-delivered antiviral enzyme platform and ferritin nanocage delivery vehicles. This funding would accelerate preclinical development and regulatory engagement, bringing these technologies closer to market. Recognising that closing the gap between discovery and commercialisation requires sustained collaboration, members of the Action are applying for a new COST Action to establish an expanded network including relevant industrial partners. This new network will focus on translational activities, including scalable biocatalytic manufacturing, mRNA-encoded metalloenzyme therapeutics, and regulatory frameworks for novel delivery systems. By embedding industrial partners from the outset, the new network will ensure that research activities are aligned with market needs and commercial viability.		

	Engagement in spin-out accelerator programs—including the King's College London spin-out accelerator program and 28DIGITAL Spin—has provided members with training in entrepreneurship, business plan development, and investor engagement. These programs have enabled early-career researchers and principal investigators to translate their scientific discoveries into commercially viable ventures, including plans for spin-out companies focused on mRNA-delivered metalloenzyme therapeutics and sustainable biocatalysis. Through these coordinated efforts, the Action has created a robust pipeline from fundamental research to market-ready technologies, enhancing Europe's economic competitiveness in biotechnology and pharmaceutical innovation.
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Mou objective	6. Facilitating access to state-of-the-art facilities and research expertise. Through these activities, the Action aims to develop new protocols, methods, and experimental tools, helping Young Researchers and Innovators and emerging group leaders to broaden their network of collaborators and develop their research ideas.		
Type of objective	1.b Coordination of information seeking, identification, collection and/or data curation 2.b Building a community around a new or emerging field of research 2.e Building capacity in the demographic inclusiveness of networks in science and technology, including representation of newly established research groups, Early-Career Investigators, the under-represented gender and teams from countries/regions with less capacity in the field of the Action		
Level of achievement of MoU objective	76 - 100%	Dependence of achievement on the action networking	High
Proof of achievement of MoU objective	The Action has successfully facilitated access to a diverse array of state-of-the-art research facilities across Europe and beyond, enabling Young Researchers and Innovators to develop new protocols, methods, and experimental tools while broadening their network of collaborators. Through the Short-Term Scientific Mission (STSM) programme, members accessed the induced Pluripotent Stem Cell (iPSC) facility at Oxford, the European NMR facility at CERM in Italy, the EPR facility at TU Delft in the Netherlands, and modern computational facilities at TU Berlin in Germany. Additional access was provided to isothermal titration calorimetry instruments at ITQB NOVA in Portugal, research facilities at the University of British Columbia in Canada, computational biochemistry facilities, and state-of-the-art single-cell metal imaging instruments at the Metallomics Facility, King's College London. One STSM grant also led to a new collaboration for accessing the European NMR facility at CERM, Italy, demonstrating the multiplier effect of these exchanges. These activities have demonstrably advanced the careers and research of young researchers across Europe. The outcomes include more than 20 publications arising from the Action, one Young Investigator/Innovator using their data to successfully apply for a Postdoctoral grant, and contributions to the successful graduation of multiple PhD students across Europe. Additionally, one member secured an ARC grant post-doctoral fellowship, while another was awarded the Fulbright Research Scholar 2025 and the Moore Distinguished Scholar in Biology and Biological Engineering 2026. By providing hands-on access to specialised equipment and expertise that would otherwise be unavailable to individual laboratories, the Action has created a lasting legacy of enhanced research capacity, new collaborations, and accelerated career development for the next generation of metalloprotein scientists.		

Mou objective	1. The Action aims to bridge the field of hiPSCs technology and immunology/virology and FeS cluster biogenesis and enzymology. To tackle the challenges, the Action aims to bring together the presently separated areas to build and coordinate a Network via which new research ideas and capacities can be generated.
Type of objective	2.b Building a community around a new or emerging field of research 2.c Bridging separate fields of science/disciplines to achieve breakthroughs that require an interdisciplinary approach

	2.e Building capacity in the demographic inclusiveness of networks in science and technology, including representation of newly established research groups, Early-Career Investigators, the under-represented gender and teams from countries/regions with less capacity in the field of the Action		
Level of achievement of MoU objective	76 - 100%	Dependence of achievement on the action networking	High
Proof of achievement of MoU objective	The Action has made significant progress in bridging the currently separated fields of human induced Pluripotent Stem Cell (hiPSC) technology, immunology/virology, and FeS cluster biogenesis and enzymology. By bringing together researchers from these distinct disciplines through Scientific Meetings, Short-Term Scientific Missions, and conference participation, the Action has successfully built a community around this emerging area, creating a shared understanding of the topic and developing new research agendas and directions. Through Action Scientific Meetings, researchers in hiPSC technology, virology, immunology, and FeS proteins have gathered to discuss research findings, identify common challenges, and forge new collaborative directions. This cross-disciplinary exchange has been transformative, enabling scientists who would not otherwise interact to develop joint research agendas that address complex biological questions from multiple angles. The impact of this community-building is evident in the numerous grant applications and awards secured by Action members. Thirteen members have come together to apply for an MSCA Doctoral Network (DN) grant to study FeS protein chemistry and medicine, exploring how FeS proteins function in immune responses and viral and microbial pathogens, elucidating their chemistry, and investigating their targetability for developing new therapeutics. Four members are applying for an ERC Synergy grant to study the mechanism of a key human antiviral response pathway requiring FeS proteins. Additionally, a member has been awarded a grant (Co-I) to study the role of SARS-CoV-2 FeS proteins in viral replication. Multiple members have received a €1.04 million MSCA SE grant to develop research on FeS proteins, demonstrating the network's ability to attract substantial funding for collaborative research. Further success includes an ANRS grant and multiple ANR grants (FirstFeS 2023, FatFeS 2026, DeepFeS 2026), along with a PhD fellowship and support from the Friedreich's Ataxia Research Alliance (2023, 2026). National funding has also been secured, including a Slovakian grant under the EU NextGeneration Recovery and Resilience Plan for research on inflammation, iron-sulfur cluster deficit, and iron accumulation in neurodegeneration, and Spanish Ministry of Science grants (PID2021-128802OB-I00, PID2025-172078OB-I00, PID2025-170897NB-I00) supporting nitrogenase cofactor biosynthesis research, along with PhD and postdoctoral fellowships. An internal King's College London Pump-Prime Grant has further supported method development with the London Metallomics Facility. Collectively, these achievements demonstrate that the Action has successfully created a dynamic, self-reinforcing network that bridges previously separated disciplines, generating new research capacities, securing significant funding, and establishing a sustainable community positioned to advance FeS protein science from fundamental discovery to therapeutic application.		
Mou objective	3. Building and fostering knowledge utilization and shared research agenda to identify specific FeS proteins and enzymes as targets for developing new therapeutics and find new treatments for viral infections like COVID-19.		
Type of objective	1.h Input for future market applications (including cooperation with private enterprises) 2.b Building a community around a new or emerging field of research 2.e Building capacity in the demographic inclusiveness of networks in science and technology, including representation of newly established research groups, Early-Career Investigators, the under-represented gender and teams from countries/regions with less capacity in the field of the Action		
Level of achievement of MoU objective	76 - 100%	Dependence of achievement on the action networking	High

Proof of achievement of MoU objective	The Action has made significant progress in fostering knowledge utilization and developing a shared research agenda to identify FeS proteins as targets for therapeutics and as tools for developing new treatments for viral infections such as COVID-19. Through Action Scientific Meetings, researchers in drug discovery and FeS protein biology have collectively developed new research directions that leverage the unique properties of FeS proteins and related metalloproteins. For example, colleagues at CERM and Heinrich-Heine-University have established a new research agenda for NMR-based fragment drug discovery targeting the FeS protein mitoNEET, opening new avenues for therapeutic intervention. A collaboration between King's College London and TU Berlin has been developed to apply multiscale computational methods for creating novel broad-spectrum early-response antivirals using new nanocage technology. Furthermore, a collaboration between Trinity College Dublin and the University of Oxford has led to a new research agenda using iPSCs to understand the role of iron deficiency in mitochondrial function in innate immune cells and macrophages, with the identification of potential targets to treat inflammatory diseases such as Chronic Obstructive Pulmonary Disease (COPD). These collaborative efforts have yielded concrete advances in antiviral therapeutic development. The CERM team's collaboration has led to the development of PROTAC technology for targeting SARS-CoV-2 protease, offering a novel approach to antiviral drug design. A major discovery in understanding the innate immune antiviral response and engineering new enzymes for radically new antiviral therapy has emerged from collaboration between King's College London, CERM, TU Berlin, and TU Delft. This work led to the development of the iCARE platform—mRNA delivery of engineered, self-sufficient antiviral enzymes that produce broad-spectrum antivirals from within the body, representing a paradigm shift in antiviral treatment. Additionally, collaboration between King's College London, TU Berlin, and CEA/ibs has led to the development of highly potent and safe antiviral nanodevices based on the iron-storage protein ferritin, providing a versatile platform for targeted antiviral delivery. Together, these achievements demonstrate that the Action has successfully created a dynamic research environment where knowledge utilization is fostered through cross-disciplinary collaboration, resulting in tangible progress toward identifying FeS proteins as therapeutic targets and developing innovative treatments for viral infections including COVID-19.		
Mou objective	4. Engaging and supporting Young Researchers and Innovators. A key capacity-building objective will be to provide a platform where future leaders are encouraged to communicate their ideas, expand their network, and learn new techniques and methodologies.		
Type of objective	2.b Building a community around a new or emerging field of research 2.c Bridging separate fields of science/disciplines to achieve breakthroughs that require an interdisciplinary approach 2.e Building capacity in the demographic inclusiveness of networks in science and technology, including representation of newly established research groups, Early-Career Investigators, the under-represented gender and teams from countries/regions with less capacity in the field of the Action		
Level of achievement of MoU objective	76 - 100%	Dependence of achievement on the action networking	High
Proof of achievement of MoU objective	A key capacity-building objective of the Action has been to provide a platform where future leaders are encouraged to communicate their ideas, expand their networks, and learn new techniques and methodologies. To achieve this, yearly Young Investigator scientific meetings and training schools have been organised to develop Europe's future leaders and innovators in this emerging field. Feedback from young investigators has been excellent, with more than 90% of participants rating the quality of networking and knowledge transfer as excellent. Similarly, the training schools received excellent feedback, with more than 90% of participants rating the quality of content and training, as well as knowledge and information exchange, as excellent or very good. These events have created a vibrant, supportive environment where early-career researchers		

can present their work, receive constructive feedback, and build lasting collaborations across Europe.

Young investigators and innovators have also taken on key leadership roles within the Action. A new position, Working Group Vice Chair, has been opened specifically for Young Researchers and Innovators. Nominations for this position are underway, with priority given to young researchers from Inclusiveness Target Countries (ITC), ensuring that the next generation of leaders is actively engaged in shaping the Action's direction. Additionally, more than 16 STSM grants and five conference grants—including dedicated Young Investigator conference grants—have been awarded to young researchers and innovators, enabling them to access specialised facilities, attend international conferences, and develop new skills.

These activities have resulted in tangible career outcomes. Multiple PhD students across Europe have successfully graduated, with their research directly supported by the Action. Young researchers have secured prestigious fellowships, including PhD fellowships such as ANR 2026, an ARC grant post-doctoral fellowship, and recognition as a Fulbright Research Scholar 2025 and Moore Distinguished Scholar in Biology and Biological Engineering 2026. One young investigator received the Euricius-Cordus Medal from Philipps-Universität Marburg, recognising outstanding early-career achievement. Collectively, these outcomes demonstrate that the Action has not only advanced scientific knowledge but has also built a sustainable community of skilled, connected, and recognised young researchers who will carry forward the field of FeS protein science and metalloprotein biotechnology in Europe and beyond.

DRAFT

Deliverables

This section covers only deliverables that were foreseen for the Action, not additional outputs that were generated during the Action (these additional outputs will be added in the following section). Please select and comment on the level of achievement of each deliverable as well as the extent to which the achievement was dependant on the Action networking.

For deliverables that are:

- Delivered, please provide proof to enable the Action Rapporteur to confirm the delivery
- Not delivered but delivery is foreseen within 2 years please explain how the delivery will be achieved
- Not foreseen to be delivered please explain why not

Deliverable	Work Group 1- Reports and protocols for using iPSCs to study FeS clusters.		
Level of achievement of deliverable	Delivered	Dependence of achievement on the action networking	High
Proof of achievement of deliverable	https://www.fesimmchemnet-cost.com/working-groups		

Deliverable	Working Group 1- Report on Cell-line models of knockout or mutants of components of FeS biogenesis machinery.		
Level of achievement of deliverable	Delivered	Dependence of achievement on the action networking	High
Proof of achievement of deliverable	https://www.fesimmchemnet-cost.com/working-groups		

Deliverable	Working Group 1- Report on data regarding the activation of FeS biogenesis in response to infectious agents.		
Level of achievement of deliverable	Delivered	Dependence of achievement on the action networking	High
Proof of achievement of deliverable	https://www.fesimmchemnet-cost.com/working-groups		

Deliverable	Working Group 1- Report on metabolomics analysis of the role of FeS biogenesis in cellular chemistry.		
Level of achievement of deliverable	Delivered	Dependence of achievement on the action networking	Medium
Proof of achievement of deliverable	https://www.fesimmchemnet-cost.com/working-groups		

Deliverable	Working Group 1- Scientific research and review articles describing the methods and findings.		
Level of achievement of deliverable	Delivered	Dependence of achievement on the action networking	High
Proof of achievement of deliverable	https://www.fesimmchemnet-cost.com/working-groups		

Deliverable	Working Group 2- Report on methods and protocols for investigating viral FeS proteins.		
Level of achievement of deliverable	Delivered	Dependence of achievement on the action networking	High
Proof of achievement of deliverable	https://www.fesimmchemnet-cost.com/s-projects-basic		

Deliverable	Working Group 2- Report on viral FeS proteins and their mutants and protocols for their purifications.		
Level of achievement of deliverable	Delivered	Dependence of achievement on the action networking	Medium
Proof of achievement of deliverable	https://www.fesimmchemnet-cost.com/working-groups		

Deliverable	Working Group 2- Report on the interaction of viral FeS proteins with components of FeS biogenesis machinery.		
Level of achievement of deliverable	Delivered	Dependence of achievement on the action networking	Low
Proof of achievement of deliverable	https://www.fesimmchemnet-cost.com/working-groups		

Deliverable	Working Group 3- Report on spectroscopic characterisation of FeS clusters in different components of FeS biogenesis.		
Level of achievement of deliverable	Delivered	Dependence of achievement on the action networking	High
Proof of achievement of deliverable	https://www.fesimmchemnet-cost.com/working-groups		

Deliverable	Working Group 3- Report on structural studies of enzymatic reactions using wild-type and variants.		
Level of achievement of deliverable	Delivered	Dependence of achievement on the action networking	High
Proof of achievement of deliverable	https://www.fesimmchemnet-cost.com/working-groups		

Deliverable	Working Group 3- Report on structural studies of the interaction of components of FeS biogenesis machinery.		
Level of achievement of deliverable	Delivered	Dependence of achievement on the action networking	High
Proof of achievement of deliverable	https://www.fesimmchemnet-cost.com/working-groups		

Deliverable	Working Group 3- Scientific papers on the catalytic function of members of radical-SAM enzymes.		
Level of achievement of deliverable	Delivered	Dependence of achievement on the action networking	High

Proof of achievement of deliverable	https://www.fesimmchemnet-cost.com/working-groups
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Deliverable	Working Group 3- Scientific papers on structural characterisation of FeS cluster biogenesis.		
Level of achievement of deliverable	Delivered	Dependence of achievement on the action networking	High
Proof of achievement of deliverable	https://www.fesimmchemnet-cost.com/working-groups		

Deliverable	Working Group 4- Report on methods and protocols to overexpress FeS enzymes.		
Level of achievement of deliverable	Delivered	Dependence of achievement on the action networking	High
Proof of achievement of deliverable	https://www.fesimmchemnet-cost.com/working-groups		

Deliverable	Working Group 4- Report on intermediates of catalytic function of FeS enzymes like members of radical-SAM enzymes (RSAD1 and RSAD2).		
Level of achievement of deliverable	Delivered	Dependence of achievement on the action networking	Medium
Proof of achievement of deliverable	https://www.fesimmchemnet-cost.com/working-groups		

Deliverable	Working Group 4- Report on the reaction of FeS clusters with nitric oxide, hydrogen peroxide, and dioxygen.		
Level of achievement of deliverable	Delivered	Dependence of achievement on the action networking	High
Proof of achievement of deliverable	https://www.fesimmchemnet-cost.com/working-groups		

Deliverable	Working Group 4- Scientific papers on protocols for overexpression of FeS enzymes and mechanistic studies of FeS chemistry.		
Level of achievement of deliverable	Delivered	Dependence of achievement on the action networking	High
Proof of achievement of deliverable	https://www.fesimmchemnet-cost.com/working-groups		

Deliverable	Working Group 5- Report on using computational chemistry and identifying new targets or lead molecules.		
Level of achievement of deliverable	Delivered	Dependence of achievement on the action networking	High
Proof of achievement of deliverable	https://www.fesimmchemnet-cost.com/s-projects-basic		

Deliverable	Working Group 5- Report on a set of potential small molecule candidates for developing		
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	therapeutics to target FeS proteins.		
Level of achievement of deliverable	Delivered	Dependence of achievement on the action networking	Low
Proof of achievement of deliverable	https://www.fesimmchemnet-cost.com/working-groups		

Deliverable	Working Group 5- Papers on targeting FeS proteins for treating infectious diseases and other human diseases like cancer and neurodegeneration.		
Level of achievement of deliverable	Delivered	Dependence of achievement on the action networking	High
Proof of achievement of deliverable	https://www.fesimmchemnet-cost.com/working-groups		

Deliverable	Working Group 5- Papers on targeting specific cellular proteins to boost the immune response against a wide range of viruses.		
Level of achievement of deliverable	Delivered	Dependence of achievement on the action networking	High
Proof of achievement of deliverable	https://www.fesimmchemnet-cost.com/working-groups		

DRAFT

Additional outputs / achievements

Co-authored Action publications

Please enter below ONLY publications (including publications that are submitted but not yet accepted):

- that are on the topic of the Action, and
- that are co-authored by at least two Action participants from two countries participating in the Action, and
- for which the Action networking was necessary.

Please pay special attention to the COST Excellence and Inclusiveness policy and ensure the inclusion of publications with authors from COST Inclusiveness Target Countries (ITCs), from the underrepresented gender in the Action and from Early Career Investigators/Young researchers.

	Bibliographic data	Countries participating in the Action among authors	Open Access	COST cited?	COST funds?	Relevance to H2020 Societal challenge	Peer Reviewed?	
1	doi:10.1016/j.jbc.2024.105745 Title Authors DOI Type Published in Published by ISSN Links	Biochemical and cellular characterization of the C1SD3 protein: Molecular bases of cluster release and destabilizing effects of nitric oxide Deborah Grifagni; José Malanho Silva; Leonardo Querci; Michel Lepoivre; Cindy Vallières; Ricardo O. Louro; Lucia Banci; Mario Piccioli; Marie-Pierre Golinelli-Cohen; Francesca Cantini doi:10.1016/j.jbc.2024.105745 Journal article Journal of Biological Chemistry Elsevier BV 0021-9258 https://api.elsevier.com/content/article/PII:S0021925824001212?httpAccept=text/xml; https://api.elsevier.com/content/article/PII:S0021925824001212?httpAccept=text/plain		Other	Y	Y		Y

2	doi:10.1038/s41598-023-42015-2 Title Authors DOI Type Published in Published by ISSN Links	Multi-structural molecular docking (MOD) combined with molecular dynamics reveal the structural requirements of designing broad-spectrum inhibitors of SARS-CoV-2 entry to host cells Anqi Da; Meritxell Wu-Lu; Jovan Dragelj; Maria Andrea Mroginski; Kourosh H. Ebrahimi doi:10.1038/s41598-023-42015-2 Journal article Scientific Reports Springer Science and Business Media LLC 2045-2322 https://www.nature.com/articles/s41598-023-42015-2.pdf ; https://www.nature.com/articles/s41598-023-42015-2		Other	Y	Y		Y
3	doi:10.1002/smll.202310913 Title Authors DOI Type Published in Published by ISSNs Link	A Versatile Virus-Mimetic Engineering Approach for Concurrent Protein Nanocage Surface-Functionalization and Cargo Encapsulation Yujie Sheng; Zilong Chen; Mickael V Cherrier; Lydie Martin; Tam T. T. Bui; Wei Li; Steven Lynham; Yvain Nicolet; Kourosh H. Ebrahimi doi:10.1002/smll.202310913 Journal article Small Wiley 1613-6810; 1613-6829 https://onlinelibrary.wiley.com/doi/pdf/10.1002/smll.202310913		Other	Y	Y		Y
4	doi:10.26434/chemrxiv-2024-3dx2g Title	ATP-triggered Fe(CN) ₂ CO synthon transfer from the maturase HypCD to the active site of apo-[NiFe]-hydrogenase		Other	Y	Y		Y

	Authors DOI Type Published by Link	Anna Kwiatkowski; Giorgio Caserta; Anne-Christine Schulz; Stefan Frielingsdorf; Vladimir Pelmenschikov; Kilian Weisser; Adam Belsom; Juri Rappsilber; Ilya Sergueev; Christian Limberg; Maria-Andrea Mroginski; Ingo Zebger; Oliver Lenz doi:10.26434/chemrxiv-2024-3dx2g Posted content American Chemical Society (ACS) https://chemrxiv.org/engage/api-gateway/chemrxiv/assets/orp/resource/item/667d4fc01103d79c5447e12/original/atp-triggered-fe-cn-2co-synthon-transfer-from-the-maturation-of-ni-fe-hydrogenase.pdf						
5	doi:10.1002/anie.202408979 Title Authors DOI Type Published in Published by ISSNs Link	A Strep-Tag Imprinted Polymer Platform for Heterogenous Bio(electro)catalysis Aysu Yarman; Armel F. T. Waffo; Sagie Katz; Cornelius Bernitzky; Norbert Kovács; Paloma Borrero; Stefan Frielingsdorf; Eszter Supala; Jovan Dragelj; Sevinc Kurbanoglu; Bettina Neumann; Oliver Lenz; Maria Andrea Mroginski; Róbert E. Gyurcsányi; Ulla Wollenberger; Frieder W. Scheller; Giorgio Caserta; Ingo Zebger doi:10.1002/anie.202408979 Journal article Angewandte Chemie International Edition Wiley 1433-7851; 1521-3773 https://onlinelibrary.wiley.com/doi/pdf/10.1002/anie.202408979		Other	Y	Y		Y
6	doi:10.1073/pnas.2311057120 Title Authors	Cytosolic iron–sulfur protein assembly system identifies clients by a C-terminal tripeptide Melissa D. Marquez; Carina Greth;		Other	Y	Y		Y

	DOI Type Published in Published by ISSNs Link	Anastasiya Buzuk ; Yaxi Liu; Catharina M. Blinn; Simone Beller ; Laura Leiskau; Anthony Hushka ; Kassandra Wu; Kübra Nur ; Daili J. A. Netz; Deborah L. Perlstein ; Antonio J. Pierik doi:10.1073/pnas.2311057120 Journal article Proceedings of the National Academy of Sciences Proceedings of the National Academy of Sciences 0027-8424 ; 1091-6490 https://pnas.org/doi/pdf/10.1073/pnas.2311057120					
7	doi:10.3389/fmolb.2022.1032220 Title Authors DOI Type Published in Published by ISSN Link	Radical-SAM dependent nucleotide dehydratase (SAND), rectification of the names of an ancient iron-sulfur enzyme using NC-IUBMB recommendations Yuxuan Ji; Li Wei; Anqi Da; Holger Stark; Peter-Leon Hagedoorn; Simone Ciofi-Baffoni; Sally A. Cowley; Ricardo O. Louro; Smilja Todorovic; Maria Andrea Mroginski; Yvain Nicolet; Maxie M. Roessler; Nick E. Le Brun; Mario Piccioli; William S. James; Wilfred R. Hagen; Kourosh H. Ebrahimi doi:10.3389/fmolb.2022.1032220 Journal article Frontiers in Molecular Biosciences Frontiers Media SA 2296-889X https://www.frontiersin.org/articles/10.3389/fmolb.2022.1032220/full	Other	Y	Y		Y
8	doi:10.3390/biom13050732 Title Authors	Structural and Biochemical Characterization of Mycobacterium tuberculosis Zinc SufU-SufS Complex Ingie Elchennawi; Philippe Carpentier;	Other	Y	Y		Y

	DOI Type Published in Published by ISSN Link	Christelle Caux; Marine Ponge; Sandrine Ollagnier de Choudens doi:10.3390/biom13050732 Journal article Biomolecules MDPI AG 2218-273X https://www.mdpi.com/2218-273X/13/5/732/pdf						
9	doi:10.1016/j.bbamcr.2024.119772 Title Authors DOI Type Published in Published by ISSN Links	Fe-S biogenesis by SMS and SUF pathways: A focus on the assembly step Macha Dussouchaud; Frédéric Barras; Sandrine Ollagnier de Choudens doi:10.1016/j.bbamcr.2024.119772 Journal article Biochimica et Biophysica Acta (BBA) - Molecular Cell Research Elsevier BV 0167-4889 https://api.elsevier.com/content/article/PII:S0167488924001150?httpAccept=text/xml; https://api.elsevier.com/content/article/PII:S0167488924001150?httpAccept=text/plain		Other	Y	Y		Y
10	doi:10.1016/j.cbpa.2023.102338 Title Authors DOI Type Published in Published by ISSN Links	Ancient complexes of iron and sulfur modulate oncogenes and oncometabolism Hoang Thao Nghi; Sayeh Shahmohammadi; Kourosh H. Ebrahimi doi:10.1016/j.cbpa.2023.102338 Journal article Current Opinion in Chemical Biology Elsevier BV 1367-5931 https://api.elsevier.com/content/article/PII:S1367593123000765?httpAccept=text/xml;		Other	Y	Y		Y

		https://api.elsevier.com/content/article/PII:S1367593123000765?httpAccept=text/plain					
11	doi:10.1039/D3CC00638G Title Authors DOI Type Published in Published by ISSN Link	VITAS, a sensitive <i>in vivo</i> selection assay to discover enzymes producing antiviral natural products Aws Fahd Alharbi; Hayun Kim; Dhirish Chumroo; Yuxuan Ji; Mohammed Hakil; Kourosh H. Ebrahimi doi:10.1039/D3CC00638G Journal article Chemical Communications Royal Society of Chemistry (RSC) 1359-7345 ; 1364-548X http://pubs.rsc.org/en/content/articlepdf/2023/CC/D3CC00638G		Other	Y	Y	Y
12	doi:10.5155/eurjchem.16.4.356-363.2706 Title Authors DOI Type Published in Published by ISSN Link	Enzyme-catalyzed kinetic resolution of spirocyclic secondary amines obtained by ring-closing metathesis, as well as synthesis of cyclopentane[c]pyrrole and -pyridines by the Pauson-Khand reaction Devrim Özdemirhan ; Shafeek Buhlak ; Durukan Koç doi:10.5155/eurjchem.16.4.356-363.2706 Journal article European Journal of Chemistry European Journal of Chemistry 2153-2257 ; 2153-2249 https://www.eurjchem.com/index.php/eurjchem/article/download/2706/2979		Other	Y	Y	Y
13	doi:10.1021/acs.inorgchem.6c01252 Title	QM/MM Modeling of the Electronic Structure and Properties of the Fe–S Clusters in <i>Desulfovibrio desulfuricans</i> [FeFe]-Hydrogenase		Other	Y	Y	Y

	Authors DOI Type Published in Published by ISSNs Link	Anna Rovalletti; Meritxell Wu-Lu; Federica Arrigoni; Luca De Gioia; Ulf Ryde; Claudio Greco; Luca Bertini doi:10.1021/acs.inorgchem.6c01252 Journal article Inorganic Chemistry American Chemical Society (ACS) 0020-1669; 1520-510X https://pubs.acs.org/doi/pdf/10.1021/acs.inorgchem.6c01252						
14	doi:10.1172/jci.insight.202628 Title Authors DOI Type Published in Published by ISSN Link	Granulocytic myeloid–derived suppressor cells sustain HIV reservoirs by inhibiting viral reactivation via arginase 1–mediated mechanisms Ana Gallego-Cortés; Judith Grau-Expósito; Irene Mota-Gómez; Aleix Benítez-Martínez; Josep Castellví; Jordi Navarro; Adrian Curran; Joaquin Burgos; Paula Suanzes; Vicenç Falcó; Meritxell Genescà; Maria J. Buzon doi:10.1172/jci.insight.202628 Journal article JCI Insight American Society for Clinical Investigation 2379-3708 https://insight.jci.org/articles/view/202628/files/pdf		Other	Y	Y		Y
15	doi:10.1016/j.crmeth.2026.101343 Title Authors DOI Type Published in	Single-cell assessment of iron content in primary human T cells using laser ablation inductively coupled plasma mass spectrometry Diana M. Carp; Piotr Golda; Alexander Griffiths; Katie Flaherty; Alexander Morrell; Anna Schurich doi:10.1016/j.crmeth.2026.101343 Journal article Cell Reports Methods		Other	Y	Y		Y

	Published by ISSN Links	Elsevier BV 2667-2375 https://api.elsevier.com/content/article/PII:S2667237526000433?httpAccept=text/xml ; https://api.elsevier.com/content/article/PII:S2667237526000433?httpAccept=text/plain						
16	doi:10.1016/j.tim.2025.06.014 Title Authors DOI Type Published in Published by ISSN Links	Iron-sulfur proteins in mycobacteria: master regulators of physiology and pathogenesis Valentin Berdal; Béatrice Py; Sandrine Ollagnier de Choudens; Laurent Kremer; Wassim Daher doi:10.1016/j.tim.2025.06.014 Journal article Trends in Microbiology Elsevier BV 0966-842X https://api.elsevier.com/content/article/PII:S0966842X25002057?httpAccept=text/xml ; https://api.elsevier.com/content/article/PII:S0966842X25002057?httpAccept=text/plain		Other	Y	Y		Y
17	doi:10.1371/journal.pbio.3003223 Title Authors DOI Type	Ancestral [Fe-S] biogenesis system SMS has a unique mechanism of cluster assembly and sulfur utilization Macha Dussouchaud; Markel Martinez-Carranza; Pierre-Simon Garcia; Martin Clémancey; Geneviève Blondin; Jean Michel Betton; Ahmed Haouz; Simonetta Gribaldo; Sandrine Ollagnier de Choudens; Ludovic Sauguët; Ariel Mechaly; Frédéric Barras doi:10.1371/journal.pbio.3003223 Journal article		Other	Y	Y		Y

	Published in Published by ISSN Link	PLOS Biology Public Library of Science (PLOS) 1545-7885 https://dx.plos.org/10.1371/journal.pbio.3003223					
18	doi:10.1021/acs.inorgchem.4c00304 Title Authors DOI Type Published in Published by ISSNs Link	Multimodal Spectroscopic Analysis of the Fe–S Clusters of the as-Isolated <i>Escherichia coli</i> SufBC ₂ D Complex Giulia Veronesi ; Julien Pérard ; Martin Clémancey; Catherine Gerez; Yohann Duverger; Isabelle Kieffer; Frédéric Barras; Serge Gambarelli; Geneviève Blondin ; Sandrine Ollagnier de Choudens doi:10.1021/acs.inorgchem.4c00304 Journal article Inorganic Chemistry American Chemical Society (ACS) 0020-1669 ; 1520-510X https://pubs.acs.org/doi/pdf/10.1021/acs.inorgchem.4c00304		Other	Y	Y	Y
19	doi:10.1038/s41559-022-01857-1 Title Authors DOI Type Published in Published by ISSN Links	An early origin of iron–sulfur cluster biosynthesis machineries before Earth oxygenation Pierre Simon Garcia; Francesca D'Angelo ; Sandrine Ollagnier de Choudens; Macha Dussouchaud; Emmanuelle Bouveret; Simonetta Gribaldo ; Frédéric Barras doi:10.1038/s41559-022-01857-1 Journal article Nature Ecology & Evolution Springer Science and Business Media LLC 2397-334X https://www.nature.com/articles/s41559-022-01857-1.pdf ; https://www.nature.com/articles/s41559-022-01857-1		Other	Y	Y	Y

20	doi:10.7554/eLife.70936 Title Authors DOI Type Published in Published by ISSN Links	Cellular assays identify barriers impeding iron-sulfur enzyme activity in a non-native prokaryotic host Francesca D'Angelo ; Elena Fernández-Fueyo; Pierre Simon Garcia; Helena Shomar ; Martin Pelosse; Rita Rebelo Manuel ; Ferhat Büke; Siyi Liu; Niels van den Broek; Nicolas Duraffourg; Carol de Ram; Martin Pabst; Emmanuelle Bouveret; Simonetta Gribaldo ; Béatrice Py; Sandrine Ollagnier de Choudens ; Frédéric Barras ; Gregory Bokinsky doi:10.7554/eLife.70936 Journal article eLife eLife Sciences Publications, Ltd 2050-084X https://cdn.elifesciences.org/articles/70936/elifesciences-70936-v1.pdf ; https://cdn.elifesciences.org/articles/70936/elifesciences-70936-v1.xml ; https://elifesciences.org/articles/70936		Other	Y	Y		Y
21	doi:10.1002/9781119951438.eibc2888 Title Authors DOI Type Published in Published by Link	Sulfur Mobilization for Fe-S Assembly by the Zinc SufU–SufS Tandem from <i>Mycobacterium Tuberculosis</i> Philippe Carpentier; Sandrine Ollagnier de Choudens doi:10.1002/9781119951438.eibc2888 Other Encyclopedia of Inorganic and Bioinorganic Chemistry Wiley https://onlinelibrary.wiley.com/doi/pdf/10.1002/9781119951438.eibc2888		Other	Y	Y		Y
22	doi:10.1002/1873-3468.15097 Title	The [2Fe-2S] cluster of mitochondrial outer membrane protein mitoNEET has an		Other	Y	Y		Y

	Authors	O ₂ -regulated nitric oxide access tunnel Thao Nghi Hoang; Meritxell Wu-Lu; Alberto Collauto; Peter-Leon Hagedoorn ; Madalina Alexandru; Maïke Henschel; Shahram Kordasti; Maria Andrea Mroginski; Maxie M. Roessler; Kourosh H. Ebrahimi doi:10.1002/1873-3468.15097 Journal article FEBS Letters Wiley 0014-5793 ; 1873-3468 https://febs.onlinelibrary.wiley.com/doi/pdf/10.1002/1873-3468.15097					
	DOI Type Published in Published by ISSNs Link						
23	doi:10.1021/acsinfecdis.3c00529 Title Authors DOI Type Published in Published by ISSNs Link	Chelation of Mitochondrial Iron as an Antiparasitic Strategy Dominik Arbon ; Jan Mach; Aneta Čadková; Anna Sipkova; Jan Stursa; Kristýna Klanicová; Marta Machado; Markus Ganter; Viktoriya Levytska; Daniel Sojka; Jaroslav Truksa; Lukáš Werner; Robert Sutak doi:10.1021/acsinfecdis.3c00529 Journal article ACS Infectious Diseases American Chemical Society (ACS) 2373-8227 ; 2373-8227 https://pubs.acs.org/doi/pdf/10.1021/acsinfecdis.3c00529		Other	Y	Y	Y
24	doi:10.1021/acsinfecdis.5c00548 Title Authors	Modular Design of Mitochondrion- Targeted Iron Chelators Allows Highly Selective Antiparasitic Activity against Trypanosomes and Apicomplexan Parasites Ronald Malych; Yann Bordat; Kristýna Klanicová; Dominik Arbon ; Farnaz Zahedifard; Anna Šipková; Eliška		Other	Y	Y	Y

	DOI Type Published in Published by ISSNs Link	Drncová; Viktoriya Levytska; Jan Mach; Laura Plutowski-Wrobel; Marta Machado; Jan Štursa; Jaroslav Truksa; Markus Ganter; Daniel Sojka; Martin Zoltner ; Sébastien Besteiro; Lukáš Werner; Robert Suta doi:10.1021/acsinfecdis.5c00548 Journal article ACS Infectious Diseases American Chemical Society (ACS) 2373-8227 ; 2373-8227 https://pubs.acs.org/doi/pdf/10.1021/acsinfecdis.5c00548					
25	doi:10.3390/magnetochemistry9030066 Title Authors DOI Type Published in Published by ISSN Link	NMR of Paramagnetic Proteins: 13C Derived Paramagnetic Relaxation Enhancements Are an Additional Source of Structural Information in Solution Leonardo Querci; Inês B. Trindade; Michele Invernici; José Malanho Silva; Francesca Cantini ; Ricardo O. Louro ; Mario Piccioli doi:10.3390/magnetochemistry9030066 Journal article Magnetochemistry MDPI AG 2312-7481 https://www.mdpi.com/2312-7481/9/3/66/pdf	Other	Y	Y		Y
26	doi:10.3390/molecules28124733 Title Authors DOI	Protein Interactions in Rhodopseudomonas palustris TIE-1 Reveal the Molecular Basis for Resilient Photoferrotrophic Iron Oxidation Inês B. Trindade ; Maria O. Firmino ; Sander J. Noordam ; Alexandra S. Alves ; Bruno M. Fonseca; Mario Piccioli ; Ricardo O. Louro doi:10.3390/molecules28124733	Other	Y	Y		Y

	Type Published in Published by ISSN Link	Journal article Molecules MDPI AG 1420-3049 https://www.mdpi.com/1420-3049/28/12/4733/pdf					
27	doi:10.3390/ijms241612713 Title Authors DOI Type Published in Published by ISSN Link	A Comparative Multi-Frequency EPR Study of Dipolar Interaction in Tetra-Heme Cytochromes Wilfred R. Hagen ; Ricardo O. Louro doi:10.3390/ijms241612713 Journal article International Journal of Molecular Sciences MDPI AG 1422-0067 https://www.mdpi.com/1422-0067/24/16/12713/pdf		Other	Y	Y	Y
28	doi:10.1016/j.jbc.2024.105745 Title Authors DOI Type Published in Published by ISSN Links	Biochemical and cellular characterization of the C1SD3 protein: Molecular bases of cluster release and destabilizing effects of nitric oxide Deborah Grifagni; José Malanho Silva; Leonardo Querci ; Michel Lepoivre; Cindy Vallières; Ricardo O. Louro ; Lucia Banci; Mario Piccioli ; Marie-Pierre Golinelli-Cohen ; Francesca Cantini doi:10.1016/j.jbc.2024.105745 Journal article Journal of Biological Chemistry Elsevier BV 0021-9258 https://api.elsevier.com/content/article/PII:S0021925824001212?httpAccept=text/xml !; https://api.elsevier.com/content/article/PII:S0021925824001212?httpAccept=text/pla		Other	Y	Y	Y

	in						
29	doi:10.1002/pro.5197 Title Authors DOI Type Published in Published by ISSNs Link	Unraveling the molecular determinants of a rare human mitochondrial disorder caused by the P144L mutation of FDX2 Deborah Grifagni; Davide Doni; Bianca Susini; Bruno M. Fonseca; Ricardo O. Louro ; Paola Costantini ; Simone Ciofi-Baffoni doi:10.1002/pro.5197 Journal article Protein Science Wiley 0961-8368 ; 1469-896X https://onlinelibrary.wiley.com/doi/pdf/10.1002/pro.5197		Other	Y	Y	Y
30	doi:10.1093/ismeco/ycag025 Title Authors DOI Type Published in Published by ISSN Links	Iron binding before iron limitation: siderophore synthesis arose well before iron became a limiting element Ricardo Soares; Inês B Trindade ; Ricardo O Louro doi:10.1093/ismeco/ycag025 Journal article ISME Communications Oxford University Press (OUP) 2730-6151 https://academic.oup.com/ismecommun/advance-article-pdf/doi/10.1093/ismeco/ycag025/66798603/ycag025.pdf ; https://academic.oup.com/ismecommun/article-pdf/6/1/ycag025/68121700/ycag025.pdf		Other	Y	Y	Y
31	doi:10.1002/alz.71337 Title	Tracking tau and cellular responses in human iPSC-microglia: from uptake to seedable secretion, including in		Other	Y	Y	Y

	Authors	extracellular vesicles Maria Kreger Karabova ; Anna del Ser-Badia; Anne Hedegaard; Sam J. Washer; Zeynep Baykam; Darragh P. O'Brien; Iolanda Vendrell; Svenja S. Hester; Roman Fischer; Errin Johnson; Charlotte E. Melia; Teige R. S. Matthews-Palmer; Rishi Matadeen; Alessia Santambrogio; Michael A. Metrick; Michele Vendruscolo; Sophie Keeling; Kimberly Ai Xian Cheam; William A. McEwan; Kenneth S. Kosik; Theresa A. Day; William S. James; Sally A. Cowley						
	DOI	doi:10.1002/alz.71337						
	Type	Journal article						
	Published in	Alzheimer's & Dementia						
	Published by	Wiley						
	ISSNs	1552-5260 ; 1552-5279						
	Links	https://alz-journals.onlinelibrary.wiley.com/doi/pdf/10.1002/alz.71337 ; https://alz-journals.onlinelibrary.wiley.com/doi/full-xml/10.1002/alz.71337						
32	doi:10.1038/s41380-024-02463-2			Other	Y	Y		Y
	Title	Tau depletion in human neurons mitigates A β -driven toxicity						
	Authors	Bryan Ng ; Jane Vowles; Féodora Bertherat ; Ajantha Abey ; Peter Kilfeather; Dayne Beccano-Kelly; M. Irina Stefana; Darragh P. O'Brien ; Nora Bengoa-Vergniory; Phillippa J. Carling; John A. Todd; Tara M. Caffrey; Natalie Connor-Robson; Sally A. Cowley ; Richard Wade-Martins						
	DOI	doi:10.1038/s41380-024-02463-2						
	Type	Journal article						
	Published in	Molecular Psychiatry						
	Published by	Springer Science and Business Media LLC						
	ISSNs	1359-4184 ; 1476-5578						
	Links	https://www.nature.com/articles/s41380-024-02463-2.pdf ;						

		https://www.nature.com/articles/s41380-024-02463-2					
33	doi:10.1080/17568919.2026.2617612 Title Authors DOI Type Published in Published by ISSNs Link	Thiazole scaffolds as anticancer and antimicrobial agents: recent advances in medicinal chemistry Demokrat Nuha ; Erinda Lika; Simone Carradori; Arbëri Bytyçi; Pajtim Bytyçi; Osman Fetosh; Fisnik Laha; Asaf Evrim Evren doi:10.1080/17568919.2026.2617612 Journal article Future Medicinal Chemistry Informa UK Limited 1756-8919 ; 1756-8927 https://www.tandfonline.com/doi/pdf/10.1080/17568919.2026.2617612		Other	Y	Y	Y
34	doi:10.1002/ddr.70219 Title Authors DOI Type Published in Published by ISSNs Links	Novel 4-chlorophenyl and 3/4-chlorophenoxy Based Triazole/Thiazole Derivatives: Synthesis and Investigation of Their Effects on Neurodegenerative Disorders-Related Enzymes via In Vitro and In Silico Sam Dawbaa; Demokrat Nuha ; Asaf Evrim Evren ; Begüm Nurpelin Sağlık; Leyla Yurttaş doi:10.1002/ddr.70219 Journal article Drug Development Research Wiley 0272-4391 ; 1098-2299 https://analyticalsciencejournals.onlinelibrary.wiley.com/doi/pdf/10.1002/ddr.70219 ; https://analyticalsciencejournals.onlinelibrary.wiley.com/doi/full-text/10.1002/ddr.70219		Other	Y	Y	Y

35	doi:10.1080/07391102.2024.2331085	Title New <i>N</i> -(1,3,4-thiadiazole-2-yl)acetamide derivatives as human carbonic anhydrase I and II and acetylcholinesterase inhibitors Authors Sam Dawbaa; Cüneyt Türkeş; Demokrat Nuha; Yeliz Demir; Asaf Evrim Evren; Leyla Yurttaş; Şükrü Beydemir DOI doi:10.1080/07391102.2024.2331085 Type Journal article Published in Journal of Biomolecular Structure and Dynamics Published by Informa UK Limited ISSNs 0739-1102; 1538-0254 Link https://www.tandfonline.com/doi/pdf/10.1080/07391102.2024.2331085		Other	Y	Y		Y
36	doi:10.1080/17568919.2025.2546783	Title Latest developments in small molecule analgesics: heterocyclic scaffolds I Authors Asaf Evrim Evren; Aybüke Züleyha Kaya; Abdullatif Karakaya; Beyzanur Tutuş; Emine Merve Güngör; Demokrat Nuha; Derya Osmaniye; Betül Kaya; Ulviye Acar Çevik; Leyla Yurttaş; Zafer Asım Kaplançikli DOI doi:10.1080/17568919.2025.2546783 Type Journal article Published in Future Medicinal Chemistry Published by Informa UK Limited ISSNs 1756-8919; 1756-8927 Link https://www.tandfonline.com/doi/pdf/10.1080/17568919.2025.2546783		Other	Y	Y		Y
37	doi:10.1039/d4cb00225c	Title CyaY and TusA regulate ISC- and SUF-mediated I -cysteine desulfurase activity Authors Paolo Olivieri; Jason C. Crack; Angelika Lehmann; Nick E. Le Brun; Silke Leimkühler DOI doi:10.1039/d4cb00225c Type Journal article		Other	Y	Y		Y

	Published in Published by ISSN Link	RSC Chemical Biology Royal Society of Chemistry (RSC) 2633-0679 http://pubs.rsc.org/en/content/articlepdf/2024/CB/D4CB00225C					
38	doi:10.1128/spectrum.00949-24 Title Authors DOI Type Published in Published by ISSN Link	Binding of IscU and TusA to different but competing sites of IscS influences the activity of IscS and directs sulfur to the respective biomolecular synthesis pathway Paolo Olivieri ; Moritz Klages; Jason C. Crack; Angelika Lehmann; Sophie P. Bennett; Nick E. Le Brun ; Silke Leimkühler doi:10.1128/spectrum.00949-24 Journal article Microbiology Spectrum American Society for Microbiology 2165-0497 https://journals.asm.org/doi/pdf/10.1128/spectrum.00949-24		Other	Y	Y	Y
39	doi:10.1038/s41589-022-01159-4 Title Authors DOI Type Published in Published by ISSNs Links	Functional spectrum and specificity of mitochondrial ferredoxins FDX1 and FDX2 Vincent Schulz; Somsuvro Basu; Sven-A. Freibert ; Holger Weibert; Linda Boss; Ulrich Mühlenhoff; Fabien Pierrel ; Lars-O. Essen ; Douglas M. Warui; Squire J. Booker ; Oliver Stehling ; Roland Lill doi:10.1038/s41589-022-01159-4 Journal article Nature Chemical Biology Springer Science and Business Media LLC 1552-4450 ; 1552-4469 https://www.nature.com/articles/s41589-022-01159-4.pdf ; https://www.nature.com/articles/s41589-0		Other	Y	Y	Y

	22-01159-4						
40	doi:10.64898/2026.04.03.713453 Title Authors DOI Type Published by Link Decoding and Reprogramming Redox Partner Specificity in Rieske Oxygenases for Enhanced Catalytic Activity Hui Miao ; Rick Oerlemans ; Peter-Leon Hagedoorn ; Sandy Schmidt doi:10.64898/2026.04.03.713453 Posted content openRxiv https://syndication.highwire.org/content/doi/10.64898/2026.04.03.713453		Other	Y	Y		Y
41	doi:10.1002/anie.5423408 Title Authors DOI Type Published in Published by ISSNs Links Discovery of an Antiviral Electron Transfer Process to Create Catalytically Self-Sufficient Viral Restriction Factors Mengdi Wu; Nghị Thao Hoang ; Deborah Grifagni; Meritxell Wu-Lu ; Yujie Sheng; Theo Situmorang ; Pei-Hsin Tai; Zheng Chen; Astrid Maluta ; Mohammed Hakil; Bianca Susini; Hannah Florance; Peter-Leon Hagedoorn ; John Mark Sutton; Maria-Andrea Mroginski ; Simone Ciofi-Baffoni ; Kourosh H. Ebrahimi doi:10.1002/anie.5423408 Journal article Angewandte Chemie International Edition Wiley 1433-7851 ; 1521-3773 https://onlinelibrary.wiley.com/doi/pdf/10.1002/anie.5423408 ; https://onlinelibrary.wiley.com/doi/full-xml/10.1002/anie.5423408		Other	Y	Y		Y
42	doi:10.1039/d5sc07299a Title Subunit fusion unlocks rapid <i>in vitro</i> maturation for slowly activating heterodimeric [FeFe]-hydrogenases		Other	Y	Y		Y

	Authors DOI Type Published in Published by ISSNs Link	Jan Jaenecke ; Konstantin Bikbaev ; Miriam Malagnini ; Julia Bronold; Shanika Yadav ; Ulf-Peter Apfel ; Christophe Léger ; James A. Birrell ; Ingrid Span ; Nicolas Plumeré ; Martin Winkler doi:10.1039/d5sc07299a Journal article Chemical Science Royal Society of Chemistry (RSC) 2041-6520 ; 2041-6539 http://pubs.rsc.org/en/content/articlepdf/2026/SC/D5SC07299A						
43	doi:10.1021/acs.inorgchem.5c00420 Title Authors DOI Type Published in Published by ISSNs Link	Shedding Light on the Electron Delocalization Pathway at the [Fe ₂ S ₂] ²⁺ Cluster of FDX2 Leonardo Querci; Letizia Fiorucci; Deborah Grifagni ; Paola Costantini; Enrico Ravera ; Simone Ciofi-Baffoni ; Mario Piccioli doi:10.1021/acs.inorgchem.5c00420 Journal article Inorganic Chemistry American Chemical Society (ACS) 0020-1669 ; 1520-510X https://pubs.acs.org/doi/pdf/10.1021/acs.inorgchem.5c00420		Other	Y	Y		Y
44	doi:10.1038/s41419-025-08323-3 Title Authors	A novel mutation in FDX2 provides insights into the pathogenesis of MEOAL mitochondrial neuromuscular disease Davide Doni ; Deborah Grifagni; Federica Cavion; Bianca Buchignani ; Roberta Battini ; Elisa Baschiera; Maria Andrea Desbats ; Rosa Pasquariello; Giuseppina Covello ; Eva De Pascale; Alice Boarolo; Ilaria Cestonaro; Denis Badocco; Paolo Pastore; Geppo Sartori; Oliver Stehling ; Roland Lill ; Filippo M. Santorelli; Leonardo		Other	Y	Y		Y

	DOI Type Published in Published by ISSN Links	Salviati; Simone Ciofi-Baffoni; Paola Costantini doi:10.1038/s41419-025-08323-3 Journal article Cell Death & Disease Springer Science and Business Media LLC 2041-4889 https://www.nature.com/articles/s41419-025-08323-3.pdf ; https://www.nature.com/articles/s41419-025-08323-3						
45	doi:10.1128/mbio.03302-22 Title Authors DOI Type Published in Published by ISSN Link	Bioenergetic State of Escherichia coli Controls Aminoglycoside Susceptibility Jessica Y. El Khoury; Jordi Zamarreño Beas; Allison Huguenot; Béatrice Py; Frédéric Barras doi:10.1128/mbio.03302-22 Journal article mBio American Society for Microbiology 2150-7511 https://journals.asm.org/doi/pdf/10.1128/mbio.03302-22		Other	Y	Y		Y
46	doi:10.1038/s41598-023-32423-9 Title Authors DOI Type Published in Published by	The thiolation of uridine 34 in tRNA, which controls protein translation, depends on a [4Fe-4S] cluster in the archaeum Methanococcus maripaludis Ornella Bimai; Pierre Legrand ; Jean-Luc Ravanat; Nadia Touati; Jingjing Zhou; Nisha He; Marine Lénon; Frédéric Barras; Marc Fontecave; Béatrice Golinelli-Pimpaneau doi:10.1038/s41598-023-32423-9 Journal article Scientific Reports Springer Science and Business Media		Other	Y	Y		Y

	ISSN Links	LLC 2045-2322 https://www.nature.com/articles/s41598-023-32423-9.pdf ; https://www.nature.com/articles/s41598-023-32423-9					
47	doi:10.1128/mbio.03298-22 Title Authors DOI Type Published in Published by ISSN Link	Role of the <i>Escherichia coli</i> ubiquinone-synthesizing UbiUVT pathway in adaptation to changing respiratory conditions Rodrigo Arias-Cartin; Katayoun Kazemzadeh Ferizhendi; Emmanuel Séchet; Ludovic Pelosi ; Corinne Loeuillet; Fabien Pierrel ; Frédéric Barras ; Emmanuelle Bouveret doi:10.1128/mbio.03298-22 Journal article mBio American Society for Microbiology 2150-7511 https://journals.asm.org/doi/pdf/10.1128/mbio.03298-22		Other	Y	Y	Y
48	doi:10.1073/pnas.2321242121 Title Authors DOI Type Published in	An organic O donor for biological hydroxylation reactions Katayoun Kazemzadeh Ferizhendi; Philippe Simon; Ludovic Pelosi; Emmanuel Séchet; Roache Arulanandam ; Mahmoud Haji Chehade ; Martial Rey; Deniz Onal; Laura Flandrin; Rouba Chreim; Bruno Faivre; Samuel Chau-Duy-Tam Vo; Rodrigo Arias-Cartin ; Frédéric Barras ; Marc Fontecave ; Emmanuelle Bouveret; Murielle Lombard ; Fabien Pierrel doi:10.1073/pnas.2321242121 Journal article Proceedings of the National Academy of		Other	Y	Y	Y

	Published by ISSNs Link	Sciences National Academy of Sciences 0027-8424 ; 1091-6490 https://pnas.org/doi/pdf/10.1073/pnas.2321242121					
49	doi:10.1128/mbio.01206-24 Title Authors DOI Type Published in Published by ISSN Link	A molecular comparison of [Fe-S] cluster-based homeostasis in <i>Escherichia coli</i> and <i>Pseudomonas aeruginosa</i> Alessandra Lo Sciuto ; Francesca D'Angelo; Maria Concetta Spinnato; Pierre Simon Garcia; Shirley Genah; Cervoni Matteo; Emmanuel Séchet; Ehud Banin; Frédéric Barras ; Francesco Imperi doi:10.1128/mbio.01206-24 Journal article mBio American Society for Microbiology 2150-7511 https://journals.asm.org/doi/pdf/10.1128/mbio.01206-24		Other	Y	Y	Y
50	doi:10.1128/mbio.00930-26 Title Authors DOI Type Published in Published by ISSN Link	A connection between two ancient and essential cellular processes, iron-sulfur protein biogenesis and fatty acid synthesis, in <i>Escherichia coli</i> Soufyan Fakroun; Guillaume Bouvier; Marouane Libiad; Emmanuel Séchet; Emmanuelle Bouveret ; Frédéric Barras ; Sarah Dubrac doi:10.1128/mbio.00930-26 Journal article mBio American Society for Microbiology 2150-7511 https://journals.asm.org/doi/pdf/10.1128/mbio.00930-26		Other	Y	Y	Y

51	doi:10.1093/mtomcs/mfac022 Title Authors DOI Type Published in Published by ISSN Links	The Fe–S proteome of <i>Escherichia coli</i> : prediction, function, and fate Marine Lénon ; Rodrigo Arias-Cartín; Frédéric Barras doi:10.1093/mtomcs/mfac022 Journal article Metallomics Oxford University Press (OUP) 1756-591X https://academic.oup.com/metallomics/advance-article-pdf/doi/10.1093/mtomcs/mfac022/43138686/mfac022.pdf ; https://academic.oup.com/metallomics/article-pdf/14/5/mfac022/57904451/mfac022.pdf		Other	Y	Y		Y
52	doi:10.1016/j.bbamcr.2024.119730 Title Authors DOI Type Published in Published by ISSN Links	When iron and sulfur met on an anoxic planet and eventually made clusters essential for life Pierre Simon Garcia; Simonetta Gribaldo; Frédéric Barras doi:10.1016/j.bbamcr.2024.119730 Journal article Biochimica et Biophysica Acta (BBA) - Molecular Cell Research Elsevier BV 0167-4889 https://api.elsevier.com/content/article/PII:S0167488924000739?httpAccept=text/xml ; https://api.elsevier.com/content/article/PII:S0167488924000739?httpAccept=text/plain		Other	Y	Y		Y
53	doi:10.1021/jacs.2c06338 Title	Iron Insertion at the Assembly Site of the ISCU Scaffold Protein Is a Conserved Process Initiating Fe–S Cluster Biosynthesis		Other	Y	Y		Y

	Authors DOI Type Published in Published by ISSNs Link	Batoul Srour; Sylvain Gervason; Maren Hellen Hooek; Beata Monfort; Kristian Want; Djabir Larkem; Nadine Trabelsi; Gautier Landrot; Andrea Zitolo; Emiliano Fonda; Emilien Etienne; Guillaume Gerbaud; Christina Sophia Müller; Jonathan Oltmanns; Jesse B. Gordon; Vishal Yadav; Malgorzata Kleczewska; Marcin Jelen; Michel B. Toledano; Rafal Dutkiewicz; David P. Goldberg; Volker Schünemann; Bruno Guigliarelli; Bénédicte Burlat; Christina Sizun; Benoit D'Autréaux doi:10.1021/jacs.2c06338 Journal article Journal of the American Chemical Society American Chemical Society (ACS) 0002-7863; 1520-5126 https://pubs.acs.org/doi/pdf/10.1021/jacs.2c06338						
54	doi:10.1016/j.bbamcr.2024.119811 Title Authors DOI Type Published in Published by ISSN Links	Mechanism of mitochondrial [2Fe-2S] cluster biosynthesis Kristian Want; Benoit D'Autréaux doi:10.1016/j.bbamcr.2024.119811 Journal article Biochimica et Biophysica Acta (BBA) - Molecular Cell Research Elsevier BV 0167-4889 https://api.elsevier.com/content/article/PII:S016748892400154X?httpAccept=text/xml; https://api.elsevier.com/content/article/PII:S016748892400154X?httpAccept=text/plain		Other	Y	Y		Y
55	doi:10.1038/s41589-024-01818-8 Title	The ISC machinery assembles [2Fe–2S] clusters by formation and fusion of		Other	Y	Y		Y

	Authors DOI Type Published in Published by ISSNs Links	[1Fe–1S] precursors Sylvain Gervason; Rafal Dutkiewicz; Kristian Want; Rania Benazza; Rémi Mor-Gautier; Aneta Grabinska-Rogala; Christina Sizun; Oscar Hernandez-Alba; Sarah Cianferani; Bruno Guigliarelli; Bénédicte Burlat; Benoit D'Autréaux doi:10.1038/s41589-024-01818-8 Journal article Nature Chemical Biology Springer Science and Business Media LLC 1552-4450; 1552-4469 https://www.nature.com/articles/s41589-024-01818-8.pdf; https://www.nature.com/articles/s41589-024-01818-8						
56	doi:10.1038/s41586-025-09822-1 Title Authors DOI Type Published in Published by ISSNs Links	Cross-regulation of [2Fe–2S] cluster synthesis by ferredoxin-2 and frataxin Kristian Want; Hubert Gorny; Ema Turki; Magali Noiray; Beata Monfort; Rémi Mor-Gautier; Thibault Tubiana; Estelle Jullian; Véronique Monnier; Benoit D'Autréaux doi:10.1038/s41586-025-09822-1 Journal article Nature Springer Science and Business Media LLC 0028-0836; 1476-4687 https://www.nature.com/articles/s41586-025-09822-1.pdf; https://www.nature.com/articles/s41586-025-09822-1		Other	Y	Y		Y
57	doi:10.1016/j.jbc.2026.113261 Title Authors	Azotobacter vinelandii glutaredoxin D delivers the core [Fe₂S₂] cluster to nitrogenase cofactor scaffold protein NifU Juan Andrés Collantes-García; Elena		Other	Y	Y		Y

	DOI Type Published in Published by ISSN Links	Rosa-Núñez; Alejandro M. Armas; Daniel Raimunda; Ana Pérez-González; Yisong Guo; Carlos Echávarri-Erasun; Luis M. Rubio; Manuel González-Guerrero doi:10.1016/j.jbc.2026.113261 Journal article Journal of Biological Chemistry Elsevier BV 0021-9258 https://api.elsevier.com/content/article/PII:S0021925826021332?httpAccept=text/xml; https://api.elsevier.com/content/article/PII:S0021925826021332?httpAccept=text/plain						
58	doi:10.1016/j.cels.2025.101513 Title Authors DOI Type Published in Published by ISSN Links	Dynamics of genetic circuits in Pseudomonas protegens Juan Rico; Pablo Japón; Luis M. Rubio; Ángel Goñi-Moreno doi:10.1016/j.cels.2025.101513 Journal article Cell Systems Elsevier BV 2405-4712 https://api.elsevier.com/content/article/PII:S2405471225003461?httpAccept=text/xml; https://api.elsevier.com/content/article/PII:S2405471225003461?httpAccept=text/plain		Other	Y	Y		Y
59	doi:10.1093/jxb/eraf545 Title Authors	A high-throughput heterologous expression platform for plant synthetic biology based on Arabidopsis suspension cells Lukas Meile; Germán Alonso-Tolo; Zeltia Ferreiro-Eiras; Xi Jiang; Stefan Burén; Luis M Rubio		Other	Y	Y		Y

	DOI Type Published in Published by ISSNs Links	doi:10.1093/jxb/eraf545 Journal article Journal of Experimental Botany Oxford University Press (OUP) 0022-0957; 1460-2431 https://academic.oup.com/jxb/advance-article-pdf/doi/10.1093/jxb/eraf545/66114745/eraf545.pdf ; https://academic.oup.com/jxb/article-pdf/77/13/4098/66114745/eraf545.pdf						
60	doi:10.1038/s41589-025-02070-4 Title Authors DOI Type Published in Published by ISSNs Links	Dynamics driving the precursor in NifEN scaffold during nitrogenase FeMo-cofactor assembly Lucía Payá Tormo ; Tu-Quynh Nguyen ; Cameron Fyfe ; Hind Basbous; Katarzyna Dobrzyńska; Carlos Echavarri-Erasun; Lydie Martin ; Giorgio Caserta ; Pierre Legrand ; Andrea Thorn; Patricia Amara ; Guy Schoehn ; Mickaël V. Cherrier ; Luis M. Rubio ; Yvain Nicolet doi:10.1038/s41589-025-02070-4 Journal article Nature Chemical Biology Springer Science and Business Media LLC 1552-4450; 1552-4469 https://www.nature.com/articles/s41589-025-02070-4.pdf ; https://www.nature.com/articles/s41589-025-02070-4		Other	Y	Y		Y
61	doi:10.1016/j.electacta.2025.146342 Title Authors	Electroenzymatic N2 reduction to ammonia by nitrogenase from <i>Azotobacter vinelandii</i> immobilized on low density graphite electrodes under direct electron transfer regime Gabriel García-Molina ; Carlos Echavarri-Erasun; Melisa del Barrio ; Sandra		Other	Y	Y		Y

	DOI Type Published in Published by ISSN Links	González-García; Luis M. Rubio ; Marcos Pita ; Antonio L. De Lacey doi:10.1016/j.electacta.2025.146342 Journal article Electrochimica Acta Elsevier BV 0013-4686 https://api.elsevier.com/content/article/PII:S0013468625007030?httpAccept=text/xml ; https://api.elsevier.com/content/article/PII:S0013468625007030?httpAccept=text/plain						
62	doi:10.1016/j.jbc.2025.108291 Title Authors DOI Type Published in Published by ISSN Links	Molecular sorting of nitrogenase catalytic cofactors Alvaro Salinero-Lanzarote ; Josh Lian ; Gil Namkoong ; Daniel L.M. Suess ; Luis M. Rubio ; Dennis R. Dean ; Ana Pérez-González doi:10.1016/j.jbc.2025.108291 Journal article Journal of Biological Chemistry Elsevier BV 0021-9258 https://api.elsevier.com/content/article/PII:S0021925825001395?httpAccept=text/xml ; https://api.elsevier.com/content/article/PII:S0021925825001395?httpAccept=text/plain		Other	Y	Y		Y
63	doi:10.1073/pnas.2406198121 Title Authors	Iron-molybdenum cofactor synthesis by a thermophilic nitrogenase devoid of the scaffold NifEN Lucía Payá-Tormo ; Carlos Echavarrí-Erasun ; Natalia Makarovskiy-Saavedra ; Ana Pérez-González ; Zhi-Yong Yang ; Yisong Guo ; Lance C. Seefeldt ; Luis M.		Other	Y	Y		Y

	DOI Type Published in Published by ISSNs Link	Rubio doi:10.1073/pnas.2406198121 Journal article Proceedings of the National Academy of Sciences National Academy of Sciences 0027-8424 ; 1091-6490 https://pnas.org/doi/pdf/10.1073/pnas.2406198121						
64	doi:10.1016/j.jbc.2024.107900 Title Authors DOI Type Published in Published by ISSN Links	Azotobacter vinelandii scaffold protein NifU transfers iron to NifQ as part of the iron-molybdenum cofactor biosynthesis pathway for nitrogenase Emma Barahona; Juan Andrés Collantes-García; Elena Rosa-Núñez; Jin Xiong ; Xi Jiang ; Emilio Jiménez-Vicente ; Carlos Echávarri-Erasun; Yisong Guo ; Luis M. Rubio ; Manuel González-Guerrero doi:10.1016/j.jbc.2024.107900 Journal article Journal of Biological Chemistry Elsevier BV 0021-9258 https://api.elsevier.com/content/article/PII:S0021925824024025?httpAccept=text/xml ! https://api.elsevier.com/content/article/PII:S0021925824024025?httpAccept=text/plain		Other	Y	Y		Y
65	doi:10.1128/mbio.03088-23 Title Authors	Nitrogenase cofactor biosynthesis using proteins produced in mitochondria of <i>Saccharomyces cerevisiae</i> Katarzyna Dobrzyńska; Ana Pérez-González ; Carlos Echavarrri-Erasun ; Diana Coroian; Alvaro Salinero-Lanzarote; Marcel Veldhuizen; Dennis R. Dean; Stefan Burén ; Luis M. Rubio		Other	Y	Y		Y

	DOI Type Published in Published by ISSN Link	doi:10.1128/mbio.03088-23 Journal article mBio American Society for Microbiology 2150-7511 https://journals.asm.org/doi/pdf/10.1128/mbio.03088-23					
66	doi:10.3390/biology12111423 Title Authors DOI Type Published in Published by ISSN Link	Iron Homeostasis in <i>Azotobacter vinelandii</i> Elena Rosa-Núñez; Carlos Echavarrí-Erasun; Alejandro M. Armas; Viviana Escudero; César Poza-Carrión; Luis M. Rubio; Manuel González-Guerrero doi:10.3390/biology12111423 Journal article Biology MDPI AG 2079-7737 https://www.mdpi.com/2079-7737/12/11/1423/pdf		Other	Y	Y	Y
67	doi:10.1080/10409238.2023.2181309 Title Authors DOI Type Published in Published by ISSNs Link	Overview of physiological, biochemical, and regulatory aspects of nitrogen fixation in <i>Azotobacter vinelandii</i> Julia S. Martín del Campo ; Jack Rigsbee; Marcelo Bueno Batista ; Florence Mus ; Luis M. Rubio ; Oliver Einsle ; John W. Peters ; Ray Dixon ; Dennis R. Dean ; Patricia C. Dos Santos doi:10.1080/10409238.2023.2181309 Journal article Critical Reviews in Biochemistry and Molecular Biology Informa UK Limited 1040-9238 ; 1549-7798 https://www.tandfonline.com/doi/pdf/10.1080/10409238.2023.2181309		Other	Y	Y	Y

68	doi:10.3389/fmicb.2022.991123 Title Authors DOI Type Published in Published by ISSN Link	A directed genome evolution method to enhance hydrogen production in <i>Rhodobacter capsulatus</i> Emma Barahona; Elisa San Isidro; Laura Sierra-Heras; Inés Álvarez-Melcón; Emilio Jiménez-Vicente; José María Buesa; Juan Imperial; Luis M. Rubio doi:10.3389/fmicb.2022.991123 Journal article Frontiers in Microbiology Frontiers Media SA 1664-302X https://www.frontiersin.org/articles/10.3389/fmicb.2022.991123/full		Other	Y	Y		Y
69	doi:10.1021/acssynbio.2c00194 Title Authors DOI Type Published in Published by ISSNs Link	Nitrogenase Cofactor Maturase NifB Isolated from Transgenic Rice is Active in FeMo-co Synthesis Wenshu He; Stefan Burén; Can Baysal; Xi Jiang; Teresa Capell; Paul Christou; Luis M. Rubio doi:10.1021/acssynbio.2c00194 Journal article ACS Synthetic Biology American Chemical Society (ACS) 2161-5063; 2161-5063 https://pubs.acs.org/doi/pdf/10.1021/acssynbio.2c00194		Other	Y	Y		Y
70	doi:10.1038/s42003-022-03921-9 Title Authors DOI Type Published in Published by	Functional expression of the nitrogenase Fe protein in transgenic rice Can Baysal; Stefan Burén; Wenshu He; Xi Jiang; Teresa Capell; Luis M. Rubio; Paul Christou doi:10.1038/s42003-022-03921-9 Journal article Communications Biology Springer Science and Business Media		Other	Y	Y		Y

	ISSN Links	LLC 2399-3642 https://www.nature.com/articles/s42003-022-03921-9.pdf ; https://www.nature.com/articles/s42003-022-03921-9					
71	doi:10.1038/s41598-022-14453-x Title Authors DOI Type Published in Published by ISSN Links	A colorimetric method to measure in vitro nitrogenase functionality for engineering nitrogen fixation Lucía Payá-Tormo; Diana Coroian; Silvia Martín-Muñoz; Artavazd Badalyan; Robert T. Green; Marcel Veldhuizen; Xi Jiang; Gema López-Torrejón; Janneke Balk ; Lance C. Seefeldt; Stefan Burén; Luis M. Rubio doi:10.1038/s41598-022-14453-x Journal article Scientific Reports Springer Science and Business Media LLC 2045-2322 https://www.nature.com/articles/s41598-022-14453-x.pdf ; https://www.nature.com/articles/s41598-022-14453-x		Other	Y	Y	Y
72	doi:10.1128/mbio.00268-22 Title Authors DOI Type Published in Published by	Functional Nitrogenase Cofactor Maturase NifB in Mitochondria and Chloroplasts of <i>Nicotiana benthamiana</i> Xi Jiang ; Diana Coroian; Emma Barahona ; Carlos Echavarri-Erasun ; Rocío Castellanos-Rueda ; Álvaro Eseverri ; Jose A. Aznar-Moreno ; Stefan Burén ; Luis M. Rubio doi:10.1128/mbio.00268-22 Journal article mBio American Society for Microbiology		Other	Y	Y	Y

	ISSN Link	2150-7511 https://journals.asm.org/doi/pdf/10.1128/mbio.00268-22					
73	doi:10.1002/ajh.70111 Title DOI Type Published in Published by ISSNs Link	Biolron Abstracts doi:10.1002/ajh.70111 Journal article American Journal of Hematology Wiley 0361-8609 ; 1096-8652 https://onlinelibrary.wiley.com/doi/pdf/10.1002/ajh.70111		Other	Y	Y	Y
74	doi:10.23919/MEASUREMENT66999.2025.11078737 Title Authors DOI Type Published in Published by Link	Shortening of T ₂ Relaxation Time in MRI Due to Presence of Physiological and Pathological Ferritin: Simulations Preliminary Results Andrej Krafcik; Oliver Strbak doi:10.23919/MEASUREMENT66999.2025.11078737 Proceedings article 2025 15th International Conference on Measurement IEEE http://xplore.staging.ieee.org/ielx8/11078650/11078635/11078737.pdf?arnumber=11078737		Other	Y	Y	Y
75	doi:10.1111/eci.70168 Title Authors DOI Type Published in Published by	Iron-related intercellular communication in the liver: Main players and mechanisms Óscar Fonseca; Paulo J. Oliveira ; Martina U. Muckenthaler; Ana C. Moreira; M. Salomé Gomes doi:10.1111/eci.70168 Journal article European Journal of Clinical Investigation Wiley		Other	Y	Y	Y

	ISSNs Links	0014-2972 ; 1365-2362 https://onlinelibrary.wiley.com/doi/pdf/10.1111/eci.70168 ; https://onlinelibrary.wiley.com/doi/full-xml/10.1111/eci.70168					
76	doi:10.1093/plphys/kiag466 Title Authors DOI Type Published in Published by ISSNs Link	The chloroplastic NFU1 maturation factor sustains iron-sulfur cluster assembly in the dark in Chlamydomonas Jonathan Przybyla-Toscano ; Antoine Kairis ; Agustina Terenzi ; Anna Caccamo ; Sébastien Pyr dit Ruys ; Didier Vertommen ; Nicolas Rouhier ; Claire Remacle doi:10.1093/plphys/kiag466 Journal article Plant Physiology Oxford University Press (OUP) 0032-0889 ; 1532-2548 https://academic.oup.com/plphys/advance-article-pdf/doi/10.1093/plphys/kiag466/68684705/kiag466.pdf		Other	Y	Y	Y
77	doi:10.3390/ijms26083870 Title Authors DOI Type Published in Published by ISSN Link	Optimized ¹³ C Relaxation-Filtered Nuclear Magnetic Resonance: Harnessing Optimal Control Pulses and Ultra-High Magnetic Fields for Metalloprotein Structural Elucidation Leonardo Querci; Liza Burgassi ; Simone Ciofi-Baffoni ; Marco Schiavina ; Mario Piccioli doi:10.3390/ijms26083870 Journal article International Journal of Molecular Sciences MDPI AG 1422-0067 https://www.mdpi.com/1422-0067/26/8/3870/pdf		Other	Y	Y	Y

78	doi:10.3390/biom14101260 Title Authors DOI Type Published in Published by ISSN Link	A Structural Investigation of the Interaction between a GC-376-Based Peptidomimetic PROTAC and Its Precursor with the Viral Main Protease of Cocksackievirus B3 Alessia De Santis ; Deborah Grifagni; Andrea Orsetti; Elena Lenci ; Antonio Rosato ; Mariapina D'Onofrio ; Andrea Trabocchi ; Simone Ciofi-Baffoni ; Francesca Cantini ; Vito Calderone doi:10.3390/biom14101260 Journal article Biomolecules MDPI AG 2218-273X https://www.mdpi.com/2218-273X/14/10/1260/pdf		Other	Y	Y		Y
79	doi:10.1016/j.bbamcr.2024.119786 Title Authors DOI Type Published in Published by ISSN Links	Structural aspects of iron-sulfur protein biogenesis: An NMR view Leonardo Querci; Mario Piccioli; Simone Ciofi-Baffoni; Lucia Banci doi:10.1016/j.bbamcr.2024.119786 Journal article Biochimica et Biophysica Acta (BBA) - Molecular Cell Research Elsevier BV 0167-4889 https://api.elsevier.com/content/article/PII:S0167488924001290?httpAccept=text/xml ; https://api.elsevier.com/content/article/PII:S0167488924001290?httpAccept=text/plain		Other	Y	Y		Y
80	doi:10.1038/s41467-026-76444-0 Title Authors	Macrophages tune NK cell IFN γ production through direct lipid transfer Cathal Keane ; Shauna Mayock ; Carrie		Other	Y	Y		Y

	DOI Type Published in Published by ISSN Links	Corkish; Ella Rogerson; Cristhiane Favero de Aguiar; Ya Gao; Sarah Kenny; Lorraine Brennan ; Suzanne M. Cloonan ; David K. Finlay doi:10.1038/s41467-026-76444-0 Journal article Nature Communications Springer Science and Business Media LLC 2041-1723 https://www.nature.com/articles/s41467-026-76444-0 ; https://www.nature.com/articles/s41467-026-76444-0.pdf						
81	doi:10.1002/eji.70219 Title Authors DOI Type Published in Published by ISSNs Links	Plasmacytoid Dendritic Cells Exhibit High Transferrin Receptor Expression Without Iron Accumulation Carrie Corkish; Simon O'Shaughnessy; Claire Lin; Sophia Wugk ; Sarah Kenny ; Linda Sinclair; Suzanne Cloonan; David Finlay doi:10.1002/eji.70219 Journal article European Journal of Immunology Wiley 0014-2980 ; 1521-4141 https://onlinelibrary.wiley.com/doi/pdf/10.1002/eji.70219 ; https://onlinelibrary.wiley.com/doi/full-xml/10.1002/eji.70219		Other	Y	Y		Y
82	doi:10.1172/jci.insight.199953 Title Authors DOI Type Published in	A double-edged sword: iron regulation in alveolar lung epithelial repair Ugonna Mbaekwe; Sarah Kenny ; Suzanne M. Cloonan ; Corrine R. Kliment doi:10.1172/jci.insight.199953 Journal article JCI Insight		Other	Y	Y		Y

	Published by ISSN Link	American Society for Clinical Investigation 2379-3708 https://insight.jci.org/articles/view/199953/files/pdf					
83	doi:10.1042/CS20210504 Title Authors DOI Type Published in Published by ISSNs Link	Iron and mitochondria in the susceptibility, pathogenesis and progression of COPD Lynne Faherty; Sarah Kenny; Suzanne M. Cloonan doi:10.1042/CS20210504 Journal article Clinical Science Portland Press Ltd. 0143-5221 ; 1470-8736 https://portlandpress.com/clinsci/article-pdf/137/3/219/942525/cs-2021-0504c.pdf	Other	Y	Y		Y
84	doi:10.1007/s00775-026-02139-y Title Authors DOI Type Published in Published by ISSN Links	Emerging role of mitoNEET as mitochondrial sensor of hypoxia Nghi Thao Hoang; Kourosh Honarmand Ebrahimi doi:10.1007/s00775-026-02139-y Journal article JBIC Journal of Biological Inorganic Chemistry Springer Science and Business Media LLC 1432-1327 https://link.springer.com/content/pdf/10.1007/s00775-026-02139-y.pdf ; https://link.springer.com/article/10.1007/s00775-026-02139-y	Other	Y	Y		Y
85	doi:10.1080/17435889.2025.2603169 Title Authors	Engineering next-generation therapeutics with antibody-mimetic 'plug & play' molecular assembly technology Yujie Sheng; Kourosh H. Ebrahimi	Other	Y	Y		Y

	DOI Type Published in Published by ISSNs Link	doi:10.1080/17435889.2025.2603169 Journal article Nanomedicine Informa UK Limited 1743-5889; 1748-6963 https://www.tandfonline.com/doi/pdf/10.1080/17435889.2025.2603169						
86	doi:10.1039/d5cc03592a Title Authors DOI Type Published in Published by ISSNs Link	Controlling nanocage assembly, towards developing a one-health “plug & play” platform for targeted therapy Yujie Sheng; Mark J. Sutton; Kourosh H. Ebrahimi doi:10.1039/d5cc03592a Journal article Chemical Communications Royal Society of Chemistry (RSC) 1359-7345; 1364-548X http://pubs.rsc.org/en/content/articlepdf/2025/CC/D5CC03592A		Other	Y	Y		Y
87	doi:10.64898/2026.09.10.750538 Title Authors DOI Type Published by Link	Dark proteome ensemble superposition gating calibrates biosynthesis of antiviral cocktail Mengdi Wu; Denise Poiré; Hannah Florance; Simone Ciofi-Baffoni; William S. James; Maria Andrea Mroginski; Kourosh H. Ebrahimi doi:10.64898/2026.09.10.750538 Posted content openRxiv https://syndication.highwire.org/content/doi/10.64898/2026.09.10.750538		Other	Y	Y		Y
88	doi:10.26434/chemrxiv.15008962/v1 Title	Constructing safe and highly potent antiviral neutralising nanodevices using a ferritin-based plug-and-play molecular		Other	Y	Y		Y

Authors	assembly platform Yujie Sheng; Yasmin M. Surani; Alina Jansen; Mickaël V. Cherrier; Lydie Martin; Elcin Su Karavelioglu; Isobel A. Manterfield; Tam T. T. Bui; Meritxell Wu-Lu; Julia A. Tree; Sally Yunsum Kim; Maria Andrea Mroginski; J. Mark Sutton; Yvain Nicolet; Kourosh H. Ebrahimi; G. Schoehn; KOUROSH Ebrahimi doi:10.26434/chemrxiv.15008962/v1						
DOI	Posted content						
Type	American Chemical Society (ACS)						
Published by	https://chemrxiv.org/doi/pdf/10.26434/chemrxiv.15008962/v1						
Link							

Projects resulting from Action activities

Please enter below all the projects on the topic of the Action resulting from Action activities, involving at least one Action participant, and for which the Action networking was necessary.

The Action reported 11 project(s) and 4 proposal(s) resulting from the Action networking.

Key details of the projects are shown below.

#	Title	Countries participating in the Action among proposers	Main proposer name	Funder	Amount	Call identifier	Relevance to H2020 Soc challenge
1	Engineering cells and proteins for the discovery and synthesis of antiviral lead molecules	IT	Kourosh Ebrahimi	National	12000 €	https://royalsociety.org/grants/international-exchanges/?gad_source=1&gclid=CjwKCAjwvKi4BhABEiwAH2gcw_Dx7M5c5YchXHhjTjgNGNj	Europe in a changing world, inclusive innovative and reflective societies

						-34v_yVCJufcP Smm4USg8zw ReBtil0BoCEzw QAvD_BwE	
2	Metallo-enzymes and Cells for Green Environmental Alternatives	FR, DE, IT, NL, PT	Smilja Todorovic	H2020 - Horizon Europe	1000000 €	https://marie-sklodowska-curie-actions.ec.europa.eu/actions/staff-exchanges	Climate action, environment, resource efficiency and raw materials
3	Molecular impact of ROS-derived from metabolism in stress response and genome stability,	ES	Ralf Wellinger	National	300000 €	PID2025-17089 7NB-I00	Health, demographic change and wellbeing
4	Deciphering the biogenesis of iron-sulfur clusters in mycobacteria to develop new treatments for tuberculosis		OLLAGNIER Sandrine	National	400000 €	ANRS0522	Health, demographic change and wellbeing
5	Multifunctional nanomedicine prototypes acting as prophylactics and virus-assisted targeted drug delivery vehicle	UK	Kourosh Ebrahimi	National	200000 €	MRC Gap Fund	Health, demographic change and wellbeing
6	Elucidation the activation mechanism of an iron-sulfur enzyme of the innate immune system	IT, UK	Kourosh Ebrahimi	National	12000 €	Royal Society	Health, demographic change and wellbeing
7	Developing a new cell-based assay for antiviral enzyme discovery	UK	Kourosh Ebrahimi	National	90000 €	Royal Society	Health, demographic change and wellbeing
8	Dynamics of the late stages of FeMo-co biosynthesis	ES	Luis Robio	National	325000 €	PID2025-17207 8OB-I00	Food security, sustainable agriculture and forestry, marine and maritime and inland water reasearch, and the Bioeconomy

9	FirstFeS	FR	Frederic Barras	National	560771 €	ANR 2023	Not Applicable
10	FatFeS	FR	Sarah Dubrac	National	550420 €	ANR2025	Health, demographic change and wellbeing
11	DeepFeS	FR	Frederic Barras	National	658379 €	ANR2026	Not Applicable

Other outputs / achievements

Please enter below any additional outputs/ achievements on the topic of the Action that contribute to the COST mission: "COST enables break-through scientific developments leading to new concepts and products and thereby contributes to strengthen Europe's research and innovation capacities", and for which the Action networking was necessary (e.g. a patent, standards, white paper).

Output / achievement description	Dependence of achievement on the Action networking
Action animation https://www.youtube.com/watch?v=jdWiwsncu6Y	Medium
Animated movie describing discovery of the action https://www.fesimmchemnet-cost.com/movies	High
Front cover of Journal for a review article describing research published by the Action members. https://pubs.rsc.org/cc/article/61/71/13211/884886/Contents-list	High
more than 10 PhD Awards	High
Fulbright Research Scholar 2025	Medium
ARC grant post-doctoral fellowship	High
A member Elected to the Academia Europaea	Medium
One member of Action Fazilet Devrim Ozdemirhan was successful in another COST Action, Cost action 22147 European metal organic framework networks	Medium
One member of the Action, Dr Anna Schurich, started 3 collaborations/close interactions resulting from the COST action: with: 1) Alexander Drakesmith (Oxford), 2) Suzanne Cloonan and team (Trinity, Dublin), 3) Ayca Sayi Yazgan (Brunel)	High
A member of the Action, Dr Olgica Nedic, Established collaboration between their lab and Centre National de la Recherche Scientific (CNRS) in Marseille (Vincent Fourmond); one person from the lab at post-doc.	High

A member of the Action, Dr Robert Sutak, establish new collaboration with Dr Sébastien Besteiro	High
A member of the Action Dr ollagnier sandrine established collaboration with three other groups: collaboration with Nick LeBrun (East Anglia, UK) collaboration with Iztok Turel, Université de Ljubljana, Slovenia collaboration Benedicte Burlat, BIP, Marseille, France	High
Dr ollagnier sandrine team: Two poster prizes and one oral presentation prize for PhD students in 2022 and 2023	High
Ricardo Louro: Fulbright Research Scholar 2025; Moore Distinguished Scholar in Biology and Biological Engineering 2026	High
Ricardo Louro (other achievements): Training workshop on Metals in Biology 2026; Invited seminars and conference talks: When did siderophores arise and what does it say about their primordial role?, BioMetals Seminar Series, July 2026 (online) DOI: https://doi.org/10.52843/cassyni.vctxp.3 ; Jeffrey I. Zink Inorganic Chemistry Seminar Series “The ferric siderophore reductase FhuF is a ‘black swan’ of 2Fe-2S cluster coordination”, UCLA College of Physical Sciences, Chemistry and Biochemistry, Los Angeles, California, USA, December 8th 2025; Inorganic Electrochemistry Seminar “Structure function and evolution of the ferric siderophore reductase FhuF reveals a “black swan” among 2Fe-2S cluster ferredoxins” California Institute of Technology, Pasadena, California, USA, December 2025; Molecular Piracy of Iron: Structures and functional mechanisms of Siderophore-Interacting Proteins, Department of Chemistry, Dartmouth College, Hanover, New Hampshire, USA, October 2025; Structural and functional characterization of Siderophore-Interacting Proteins reveal microbial strategies for Iron Piracy, Department of Chemistry and Biochemistry, Montana State University, Bozeman, Montana, USA, September 2025; “Flavin-containing siderophore-interacting protein of Shewanella putrefaciens DSM 9451 reveals substrate specificity in ferric-siderophore reduction”, Euro-BIC-17, Munster, Germany, August 2024; Metals in biology Gordon Conference,” Function and Structure of Siderophore-Interacting Proteins: Pirates of the Iron Trove”, Ventura, California USA, January 2023 (postponed from 2022 due to SARS-COV-2 pandemic);	High
Training Lynn Faherty in iPSC-microglia methodologies, as part of her Ph.D research in the Laboratory of Suzanne Cloonan	High
Iztok Turel, New collaborations: Groups of Prof. Simone Ciofi (Florence), Prof. Ingrid Span (Erlangen), Sandrine Ollagnier (Grenoble)	High
Demokrat Nuha: Completion of a PhD degree in Organic Chemistry in 2023. Participation in CA21115 contributed to my professional development, international scientific networking, and the further advancement of my research in medicinal and bioinorganic chemistry. Poster presentation at the CA21115 Action Meeting in Seville, Spain, on March 2026. Participation in CA21115 Training Schools in Delft, the Netherlands August 2025, Seville, Spain, April 2026), and Carcavelos, Portugal May 2026. These activities contributed to scientific knowledge exchange, interdisciplinary training, dissemination of research, and the development of new international research connections.	High
Silke Leimkuehler: New collaboration with Nick LeBrun, Sandrine Ollagnier, beatrice Py	High
Amalia Stefaniu, publication A. ȘTEFANIU, M. Moscovici, V. Vulturescu, D.-M. Miu, Molecular Docking Approach to Inhibit Cysteine Desulfurase SufS from S. Aureus, U.P.B. Sci. Bull., Series B, Vol. 88, Iss.2, 105-116, 2026, IF 2025 = 0.5, Q4 M. Petrescu, M. Moscovici, A. ȘTEFANIU, Ligands binding [Fe2–S2] cluster proteins: DFT approach for drug-likeness assessment, U.P.B. Sci.	High

Bull., Series B, Vol. 87, Iss. 2, 165-174, 2025, 165 – 174, IF 2025 = 0.5, Q4	
Peter-Leon Hagedoorn, other outputs: 8-10 April 2026, Exploring the mechanism of metalloenzymes using microsecond timescale rapid mixing techniques, IBiCC 15th Inorganic and Bioinorganic Chemistry Conference, Lisbon, Portugal – invited plenary lecture • 03 March 2026, Exploring the mechanism of metalloenzymes using microsecond timescale rapid mixing techniques, COST FeSImmChemNet symposium Sevilla, Spain • 28 July – 1 August 2025, EPR for biocatalysis of different heme and tungsten enzymes, International Conference on Biological Inorganic Chemistry (ICBIC 2025), Long Beach (CA), USA • 11-13 July, 2025, EPR for biocatalysis, International Conference on Applied Biotechnology (ICAB 2025), Tianjin, China - Keynote • 30 June 2025, EPR for biocatalysis of different heme and tungsten enzymes, Benelux EPR meeting, Antwerp, Belgium • 6 March 2025, EPR for biocatalysis, CERM University of Florence, Italy, invited lecture. • 13-17 January 2025 – EPR in Biocatalysis - 9th International Conference on Biorefinery and Biomanufacturing, São Paulo, Brazil - Keynote • 30 June – 3 July 2024 - Exploring the mechanism of metalloenzymes using microsecond timescale rapid mixing techniques - European Congress on Biotechnology, Rotterdam, NL • 6 June 2024 – EPR spectroscopy for biocatalysis - 31st Benelux EPR meeting Ghent, BE • 29-30 April 2024 - Life in the fast lane – Exploring the mechanism of metalloenzymes using microsecond timescale rapid mixing techniques – COST FeSImmChemNet meeting, Prague, Czech Republic. • 9 June 2023 – Life in the fast lane – Exploring the mechanism of metalloenzymes using microsecond timescale rapid mixing techniques, Benelux EPR meeting Leiden, NL • 23 February 2023 – Advanced methods to explore viral metalloproteins, COST FeSImmChemNet meeting, Carcevalos, Portugal • 22 February 2023 – Life in the fast lane – Exploring the mechanism of metalloenzymes using microsecond timescale rapid mixing techniques, Invited lecture at IQTB NOVA University Lisbon, Oeiras, Portugal	Medium
Peter-Leon Hagedoorn, other outputs: Training School Isothermal Titration Calorimetry in ligand-protein, protein-protein binding and in enzyme kinetics, 25-27 August 2025 at TU Delft Young Investigator Meeting 9-11 August 2023 at TU Delft STSM Thao Nghi Hoang from Kings College to TU Delft, 11/9 - 11/10 2023	High
Ingrid Span new collaborations: Collaborations with Maria-Andrea Mroginski, Itztok Turel, Vincent Fourmond	High
Salomé Gomes: Iron and Conference presentation "Immune Response: Infection/Vaccine Efficacy", 10th Congress of the Biolron Society May 25 - 29, 2025, Montreal	High
Deborah Grifagni: New collaborations: Kourosch Ebrahimi Marie-Pierre Golinelli Benoit D'Autreaux Other achievements: PhD degree 2022; Short term mission fellowship to visit King's college; Short term misssion fellowship to visit ITQB NOVA; Fellowship to attend the iron sulfur meeting 2024; ARC grant post-doctoral fellowship	High
Dimitra Kyriakou output: Through the networking opportunities provided by the COST Action CA21115, I established a collaboration with Prof. Simone Ciofi Baffoni. This contact led to a subsequent Erasmus+ Student Mobility for Traineeships at the Magnetic Resonance Center (CERM), University of Florence, Italy. During this traineeship, I worked on the project titled "Structural Investigation of protein-protein interactions in iron-sulfur protein	High

biogenesis: Investigating the molecular origins of a rare human mitochondrial disease associated with pathogenic mutations of the FDX2 gene." This collaboration significantly enhanced my research skills, providing me with hands-on experience in: -Protein Synthesis & Purification: Plasmid transformation, protein expression of Fe-S proteins in E. coli, and purification using SEC, Affinity, and ion-exchange chromatography, validated by SDS-PAGE Electrophoresis. - Specialized training in the application of Nuclear Magnetic Resonance (NMR), Electron Paramorphic Resonance (EPR), and Circular Dichroism (CD) spectroscopies to study iron-sulfur protein biogenesis. COST Training Schools Attended: 1. Application of NMR Spectroscopy to Study FeS Proteins: Attended the COST Training School at the Magnetic Resonance Center (CERM), University of Florence, Italy (5 - 7 September 2023). 2. EPR Spectroscopy Training School: Attended the CA21115 Training School at the Pulse EPR (PEPR) Facility, Molecular Sciences Research Hub (MSRH), Imperial College London, UK (11 - 13 September 2024). Conference Presentations & Abstracts: Poster Presentation: "COORDINATION PROPERTIES OF Cu(II) IONS TOWARDS PEPTIDE FRAGMENTS LOCATED AT THE MICROTUBULE-BINDING DOMAIN OF THE LONGEST TAU ISOFORM" presented at the Young Investigator Meeting: The Iron-Sulfur Cluster World, TU Berlin, Germany (29 - 30 August 2024).	
Misu Moscovici outputs: During a research project named "Design and screening of inactivating Fe-S proteins – targets at antibiotic-resistant microorganisms", a Staphylococcus aureus MRSA and two Escherichia coli ESMB multidrug-resistant strains from hemo- and urine cultures, respectively, were isolated in the clinic in collaboration with the Infectious and Tropical Diseases Hospital "Dr. Victor Babes", Bucharest. In collaboration with colleagues from the National Medico-Military R&D Institute "Cantacuzino", Bucharest, and the Biochemistry Institute of the Romanian Academy, the DNA of the strains were sequenced, and the corresponding genes encoding two target proteins (apo-cysteine desulfurase of S. aureus and FNR of E. coli) were found and expressed in recombinant strains. The proteins were isolated and purified. Meanwhile, due to similarities to published bacterial protein structures, drug-design docking studies yielded corresponding ligand molecule structures. The best-scoring docking molecules will be synthesized in collaboration with the Institute of Organic and Supramolecular Chemistry "C.D. Nenitescu" of the Romanian Academy and checked against the protein targets and their producing microorganisms.	High
Frederic Barras ' achievements and output: PhD thesis : Marine Lenon (2023); Université Paris Cité Macha Dussouchaud (2025); Université Paris Cité Awards F Barras: 2022 Elected Member Academia Europea; 2023 Award Thérèse Lebrasseur (Fondation of France); 2025 Elected Membre Associé Royal Academy of Belgium	High
Sarah Dubrac new collaboration: ANR with Benoît d'Autrèaux	Medium
Benoit D'Autrèaux output/achievements: Collaborations: - Rafal Dutkiewicz, University of Gdansk, Poland - Bénédicte Burlat, Aix Marseille University, CNRS, Marseille, France - Simone Ciofi Baffoni, Magnetic Resonance Center, University of Florence, Italy - Sarah Dubrac, Institut Pasteur, Paris, France Grants: ANR 2026, Friedreich's Ataxia Research Alliance 2026, Friedreich's Ataxia Research Alliance 2023, ANR 2022 PhD degrees: Rémi Mor-Gautier 2026, Kristian Want 2024	High

Luis Robio output and achievements: Collaboration with Mario Piccoli to study nitrogenase iron-sulfur clusters by paramagnetic NMR. Collaboration with Yvain Nicolet to investigate atomic structures of nitrogenase proteins. Sixteen talks at conferences or invited seminars between 2022 and 2026.	High
Oliver Strbak output/achievements: Grant by the EU NextGeneration EU through the Recovery and Resilience Plan for Slovakia under project No. 09I0303-V04-00221 (2024-2026): "Inflammation, iron-sulfur clusters deficit and iron accumulation as envoys of neurodegeneration". 4x conference abstracts in European Iron Club Meeting in Dublin (June 18-20, 2026), 1x conference abstract in 10th Congress of the International Bioiron Society in Montreal (May 25-29, 2025), 1x conference abstract in 28th Conference of Slovak Physicists in Presov (September 01-04, 2025))	High
Anna Schurich outputs: Internal KCL Pump-Prime Grant for method development with the London Metallomics Facility awarded to Diana in 2026 (worth around 3,000 GBP) We have started a collaboration with Lynne Faherty and Suzanne Cloonan.	High
Ralf Wellinger achievements/outputs: Rocio de los Angeles Dominguez Sierra, 2026 Reference: E-COST-GRANT-CA21115-fe4cbe3c One month stay in the lab of Prof. Antonio Pierik, University of Kaiserslautern (Germany) Ralf Wellinger and Helene Gaillard, 2026 PID2025-170897NB-I00, Molecular impact of ROS-derived from metabolism in stress response and genome stability, Research Grant of the Spanish Ministry of Science New Collaborations: Prof. Antonio Pierik, University of Kaiserslautern (Germany) Analysis of Fe/S cluster containing proteins; Prof. Robert Sutak, Charles University, Vestec (Czech Republic) Analysis of mitochondrial translation Other outputs: Conference/Meeting Talks and Posters with COST acknowledgements: 1) I. G. de Oya,, R.E. Wellinger and H. Gaillard. 12th quinquennial conference on DNA Repair 'Responses to DNA Damage', 19-24 April 2026. Egmond aan Zee, Netherlands. Poster 2) I. G. de Oya, M. Peral Vázquez, A. Díaz Quintana, H. Gaillard and R. E. Wellinger. 4th COST Annual meeting: 03-05 March 2026. Seville, Spain. Selected Talk, Poster. 3) Inés G. de Oya, Gaillard H., and Wellinger R.E. EMBO Workshop: Thiol-based redox switches: From chemistry to physiology and pathology. 13-18 sept. 2025. Sant Feliu de Guixols, Spain. Selected talk. 4) H. Gaillard, Tumini E., Wellinger R.E., Herrera-Moyano E., Navarro-Cansino P., García-Rubio M., Salas-Lloret D., Losada A., Muñoz-Alonso M.J., Luna R., and A. Aguilera. EMBO Workshop: DNA topology and topoisomerases in genome dynamics. 15-19 sept. 2025. Szklarska Poreba, Poland. Selected talk. 5) Inés G. de Oya,	High

Gaillard H., H. Heluani-Gahete and Wellinger R.E. 3rd COST Annual meeting: 23-25 March 2025. Belgrad, Serbia. Poster. 6) H. Heluani-Gahete, Inés G. de Oya, Gaillard H. and Wellinger R.E., 14ª Reunión de la Red Española de Levaduras (REDIL), 13-14 December 2024, El Escorial. Selected talk 7) R.E. Wellinger, T. Ciudad, A. Aguilera and H. Gaillard, Workshop de la UNIA 15-17 Oct. 2024, From DNA to Phenotype: Epigenetic Mechanisms in Resilience and Adaptation, Baeza, ES; Selected talk 8) H. Heluani-Gahete, Inés G. de Oya, Gaillard H. and Wellinger R.E. 2nd COST Annual meeting: 29-30 April 2024. Prague, Czech Republic. Poster. 9) R.E. Wellinger, Dipartimento di Bioscience of the University of Milano (I), 22 Jan. 2024 "Small but powerful: micronutrients link metabolism to genome stability". Invited talk 10) Wellinger R.E. 1st COST Annual meeting: 23 - 24 February 2023, Carcavelos, Portugal. Selected talk. COST conference co-organization: Ralf Wellinger and Helene Gaillard 4th COST Annual meeting: 03-05 March 2026. CABIMER, Seville, Spain	
Óscar Fonseca output achievements: During the COST Action, I presented my work 3 times, all of them oral presentations. The first one at the 2st FeSImmChemNet Young Investigator meeting, 29-30 August, 2024 TU Berlin, Germany. Then I presented a webinar in the COST Action webinar series, in February 2025. And finally I presented again in the last Action Scientific Meeting, held in Seville, Spain, in March 2026.	High
Maria J. Buzon output and achievements: Collaboration with Dr. Turel (member of the COST action). We have published the article doi: 10.1080/14756366.2022.2108417	High
Sarah Kenny output: 2025 – Targeted loss of MITORON in the alveolar epithelium promotes lung injury and fibrosis. International BIOIRON Conference, Montreal, Canada. Flash Talk & Poster. 2024 – Mitochondrial iron dysregulation in alveolar type II epithelial cells: Implications for idiopathic pulmonary fibrosis. Young Investigators Meeting (CA21115 – FeSImmChemNet), Berlin, Germany. Oral & Poster Presentation.	High
Simone Ciofi-Baffoni output/ achievements: Two-years grant from 1/01/2024-31/12/2026 founded by CARIPT Foundation (Cassa di Risparmio di Pistoia e Pescia Foundation), an Italian philanthropic foundation supporting research development.	High

Impacts

Please describe the impacts (the short- to long-term scientific, technological, and / or socioeconomic changes produced by a COST Action, directly or indirectly, intended or unintended) that have resulted, or might result, from the Action in the following table (one impact per line).

Description of the impact, i.e. what will change, and for whom, as a result of what the Action achieved	Type of impact	Timing of impact
A member of the Action, Dr Sayeh Shahmohammadi, was able to meet and build a network in the first scientific meeting. This network allowed her to find a new Postdoc Position at CERM.	Scientific / Technological	Achieved
A Member of the Action, Dr Milan Zizic, has found a new PostDoc position at TwinMlc, Elettra Synchrotron, Trieste, Italy.	Scientific / Technological	Achieved
As the result of collaboration between members of the Action, Dr Kourosh Ebrahimi (King's College London), Prof Yvain Nicolet, and Prof Maria Andrea Mroginski, Dr Ebrahimi has been able to demonstrate development of a new nanocage technology generated in his lab and found a spinout company for using the technology to develop new therapeutics.	- Scientific / Technological - Economic - Societal	Achieved
A member of the Action, Ms. Astrid Maluta, received a STSM grant supporting training in computation biochemistry to discover new antivirals. This support supported her career development and she was able to obtain a job in a private company working on developing antivirals.	Scientific / Technological	Achieved
A member of the Action, Dr Sally Cowley, has been successful in Getting a new research position, Group Leader and Principal Investigator, Sir William Dunn School of Pathology.	Scientific / Technological	Achieved
A member of the Action Dr Mertixell wu received a STSM grant. This contributed to a successful PhD degree in 2026 and subsequently obtaining a Postdoc Position in Canada	Scientific / Technological	Achieved
A member of the Action, Roland Malych, successfully completed his PhD.	Scientific / Technological	Achieved
Dr Maxie Roessler, EuroBIC2026 (European Bioinorganic Chemistry Conference) Keynote Speaker; EFEPR (European Federations of EPR) 2026 Plenary Speaker	Scientific / Technological	Achieved
Two successful PhD viva from Lab of Prof Maxie Roessler, Elenor Clifford and Davide Fracchetti, both in 2026	Scientific / Technological	Achieved
Two PhD students, who were supported during action, from the lab of Dr Sandrine Ollagnier successfully graduated (2024 and 2025).	Scientific / Technological	Achieved
Two Poster prize and one oral presentation prize for PhD student in 2022 and 2023	Scientific / Technological	Achieved
Dr Kourosh Ebrahimi, was able to support the career of three PhD students. Two have completed their PhD and published high quality papers.	Scientific / Technological	Achieved
Dr Simone Ciofi-Baffini Participation as speaker to the Gordon Research Conference - Metals in Biology, January 18 - 23, 2026. This presentation contributed to his career development and visibilty.	Scientific / Technological	Achieved
Dr Kourosh Ebrahimi has been granted two patents as a direct result of the Action support. These patents are directly related to the Action topic and support the development of new technologies to prevent viral infections.	- Scientific / Technological - Economic	Achieved
WO2026093724A1		

WO2024110757A1		
Ralf Wellinger and Helene Gaillard, 2026 PID2025-170897NB-I00, Molecular impact of ROS-derived from metabolism in stress response and genome stability, Research Grant of the Spanish Ministry of Science. This grant directly impacts their research.	• Scientific / Technological	Achieved
Óscar Fonseca: During the meetings I discussed my work with several peers, such as Smilja Todorovic from ITQB (Portugal) or Suzanne Cloonan from Trinity College (Ireland). Especially, I discussed a lot of my work with Lynne Faherty, and exchanged interesting ideas and even experimental protocols that are really useful for my work.	• Scientific / Technological	Achieved

Please describe how the Action has advanced careers, skills and network of researchers, including Early Career Investigators (for example: joint supervision of graduate and PhD students, research exchanges not funded by the action, collaborations, Training Schools with ECTS accreditation, joint projects, internship and job prospects.

The Action is significantly advancing researcher careers through a dynamic framework of skill development, mobility, and networking. Early Career Investigators (ECIs) are primary beneficiaries, gaining hands-on experience via specialized Training Schools in high-demand techniques like NMR, EPR spectroscopy, and Isothermal Titration Calorimetry. These are complemented by Short-Term Scientific Missions (STSMs) that fund research exchanges, enabling ECIs to learn new methodologies in partner labs and forge lasting collaborations. The Action's collaborative environment, fostered at annual meetings and Young Investigator events, directly leads to joint publications, grant applications, and strengthened research networks. This is evidenced by numerous successful collaborations initiated or reinforced through the network. ECIs also receive critical recognition, with several winning poster and oral presentation prizes at Action meetings, boosting their visibility and career prospects. Beyond training, participation contributes to tangible career progression. Members report that the Action has supported PhD completions, fellowship applications (e.g., MSCA), and post-doctoral placements. It has also facilitated the formation of joint projects and grant proposals, such as the MSCA SE project McGEA, creating a sustainable cycle of collaboration and funding. By providing a platform for knowledge exchange and international partnership, the Action is effectively building the next generation of researchers in the field.

The career benefits were mainly to researchers with the following amount of experience after their PhD: ≤ 8 years.

Which of the stakeholders described in the “Plan for involving the most relevant stakeholders” in the Action’s MoU have been engaged and how? What additional stakeholders have been, or will be, engaged and how? This information will not be included in the Action Report that is made publicly available (on the website).

The Action has engaged MoU stakeholders—academic/research institutions, industry/SMEs, policymakers, regulators, end-users and international bodies—through annual meetings (Carcavelos, Prague, Belgrade, Seville), training schools, webinars, STSMs, young-investigator events, joint publications, grants and conference dissemination. Evidence includes ITC and non-ITC participation, PhD completions/prizes, Fulbright/Moore awards, ANR/MSCA-SE McGEA, and STSM exchanges (TU Berlin–CEA Grenoble; King’s–TU Delft). Additional stakeholders engaged include COST Action CA22147 (EU4MOFs), hospitals/clinical institutes (Institut Pasteur, CNRS, CEA, Cantacuzino, Victor Babes), international labs (UCLA, Caltech, Dartmouth, UBC, Gdansk, Kaiserslautern), foundations (CARIPT, FARA) and academies. They were involved via joint grants, co-organised conferences, STSM hosting, Erasmus+ traineeships, invited lectures and ongoing method-development collaborations. Industry/SME engagement, including companies such as Agilent, remains less represented and will be strengthened through targeted roundtables, vendor workshops, co-creation sessions and policy/regulatory dialogues to ensure broader uptake and impact.

Dissemination and exploitation of Action results (other than co-authored Action publications listed previously)

Please describe the Action's dissemination and exploitation approach as well as all activities undertaken to ensure dissemination and exploitation of the Action results and the effectiveness of these activities.

Dissemination and exploitation approach of the Action

The Action's dissemination and networking activities have created a strong commercial context by connecting academic groups with industry partners such as Agilent, EvoEnzyme and Chiralvision. Through workshops, matchmaking and industry-facing meetings, these links led to collaborative grant applications including EIC Pathfinder Open and an MSCA Doctoral Network, translating research into applied technologies and training. The Action also generated two patents, providing tangible IP with licensing and spin-out potential, while members' participation in 24Digital SPIN strengthened entrepreneurial and commercialisation skills. These connections were not merely informal; they have already produced concrete outcomes such as joint funding bids and intellectual property. Building on this, Action members and commercial partners are now applying for another Action to develop a structured commercialisation pathway and strengthen long-term collaborations. This new initiative will provide a dedicated framework for moving from research results to market-ready solutions, ensuring scientific advances are exploited for economic and societal benefit. This demonstrates that dissemination drives industry engagement, funding leverage, IP creation and future commercial impact.

Dissemination

Dissemination meetings funded by the Action (possible only until 31st October 2021)

Title of Dissemination meeting	Meeting date	Meeting country	Action participant	Event name and hyperlink to the website	Title of presentation	Description of added value to the Action
N/A						

Other dissemination activities

E.g. participation to non-Action meetings, e.g. EU Parliament, meetings with policy makers, experts in the field, regional authorities.

Item/activity	Target audience	Outcome	Hyperlink
Conference grant to Prof Simone Ciofi-Baffoni (Italy) to attend and give an oral presentation in the International Symposia on applied bioinorganic chemistry	The target group include various experts in the field of bioinorganic chemistry working with different metal ions, metalloproteins, and metal complexes	Professor Ciofi-Baffoni presented his research on FeS proteins and informed a large audience about the FeSImmChemNET. My presentation was	http://ww1.isabc2023.com/

		performed on the main hall of the Conference Center (Aristotele Hall) with the attendance of several participants. Indeed, the meeting is an international meeting with more than 300 participants coming from more than 30 worldwide countries. This allowed me to promote a fruitful scientific debate on the topic of the COST action and to present the COST action activities; in particular, I presented the Training School sponsored by this COST action, which will be organized next September in Florence (see last slide of the given presentation). Several students contacted me after my presentation to ask information on how to apply for participating to the Training School. The participation to this conference also allowed me to establish contacts for future collaborative works with two Professors, one from Patras University and another from CNRS in Marseille.	
A grant was given to Dr Deborah Grifagni (a Young Investigator) from Italy for Attendance and talk presentation at the XI International conference on Fe-S Proteins: Function, Biogenesis and Regulation	Title of conference: Fe-S proteins: Function, Biogenesis, and Regulation The conference was in USA. The audience were world-leading experts in investigating iron-sulfur proteins and iron-sulfur biogenesis	Dr Grifagni presented her new findings and introduced the Action to a new audience. Thanks to the opportunity to give an oral presentation at the conference "Fe-S Proteins: Function, Biogenesis and Regulation", the research work gained significant visibility and aroused considerable interest from an audience that is among the leading experts in the field. My talk on the molecular and functional study of the impact of the P144L mutation of FDX2 resonated well with the audience, as was evident from the enthusiastic questions and lively discussions that followed. This interaction provided valuable feedback and new perspectives that can be incorporated into future research. The conference presentation not only increased the visibility of my research, but also opened multiple avenues for future	https://web.cvent.com/event/052a1e6c-0bd8-42d9-9bd1-3301ced601ca/summary

		collaborations. In the future, I will focus on cultivating these connections, formalising collaborative projects and utilising these opportunities to advance my research and its applications. In addition, COST action and Telethon were presented and thanked for supporting the development of the research work, arousing the interest of some congress participants to join COST action in order to attend the organised activities	
At the science-policy interface, Dr Ebrahimi was invited to a UK Government roundtable on broad-spectrum antivirals	The target group of the activity were policy makers and public bodies.	During the meeting it is highlighted how proteins such as iron-sulfur clusters and metalloenzymes have the potential for developing novel broad-spectrum antivirals.	https://www.gov.uk/government/publications/broad-spectrum-antivirals/broad-spectrum-antivirals
Dr Ebrahimi met with the Policy Advisor at the Horizon Europe Association, Department for Science, Innovation and Technology, in the UK.	The target audience was the UK government and policy makers regarding involvement of the UK in the Horizon Europe.	Dr Ebrahimi highlighted the significance of COST Action for developing research and innovation across Europe. The COST Action has helped his group and others develop new collaborations. Examples were provided of how the Action activities have contributed to the EU and UK progress and development.	https://www.fesimmchemnet-cost.com/

Exploitation activities

Please describe below any activities undertaken to ensure exploitation (use, in particular in a commercial context) of the Action's achievements.

Item/activity	Target audience	Outcome
1. Collaboration between Ebrahimi lab (KCL, UK) and Nicolet lab (ibs, France) generated a new technology for drug delivery and developing various therapeutics. 2. Collaboration between Ebrahimi lab (KCL, UK), Ciofi-Baffoni lab (CERM, Italy), Mroginski lab (TU Berlin, Germany), and Hagedoorn Lab (TU Delft, Netherlands) has led to the discovery of an ETP of human antiviral enzyme SAND.	The target scientific include medicinal chemists, virologists, immunologists, and biochemists. The target market include biotech and pharma companies developing therapeutics and end users include governments, healthcare system, and patients.	These activities and outcomes have allowed Ebrahimi to file two patent applications. As a result of one patent application, a spinout company, A-ProX, was funded, and it is supported by King's Spinout Accelerator Program.
public engagement to describe action activities and objectives in a	The target audience is the general public around the	The activity resulted in a 1 min 2D animated movie

simple way using an animated movie during the first year of the action.	world and scientists working in different areas.	published online in Youtube and also in various social media platforms. link: https://www.youtube.com/watch?v=jdWiwsncu6Y
Creating Action website including design and purchasing web address and space.	The target audience include members of the action, general public and other scientists	The Action website was published in early 2023. It is regularly used for announcements, news postings, e.g., regarding action publications, and reports.
Action social media accounts including an account in Twitter and LinkedIn	The target audience include the public, other scientists, and members of the Action	The Action has established a Twitter account. It is being regularly used to engage with the public and showcase the outcomes of Action activities and the achievement of the Action. For example, posting pictures from scientific meetings, posting research articles, sharing movies, and posting announcements. This has resulted in new members joining the Action.
Patent application filed, describing a novel approach for engineering antiviral enzymes for mRNA delivery and expression of enzymes and synthesis of antiviral from within the body, a radically new approach to treat and prevent viral infection while slashing carbon emissions. WO2026093724A1	The target audience includes commercial partners and academic collaborators. The outcome of the activities will lead to new antiviral therapeutics that benefit vulnerable populations such as immunocompromised patients and infants. These groups are susceptible to community-acquired viral infections (CAVRs) and currently there is no treatment. It costs Europe more than 10 billion annually.	The patent has been granted. As a result, new collaborations is established with commercial partners and small grants have been obtained from commercial partners to further develop the technology.
patent application filed, describing a plug and play nanocage technology platform for construction of various therapeutics to target different biological entities, such as viruses, cancer, and bacteria. WO2024110757A1	The target audience include commercial partners and academic collaborators. Through action activities, new collaborations were established, and the platform was further developed to develop new antiviral preventatives. These antivirals will benefit the general public and can be deployed rapidly to prevent viral infection in the case of pandemic.	The patent has been granted. We have developed new antiviral nanodevices and published is submitted (https://chemrxiv.org/doi/full/10.26434/chemrxiv.15008962/v1)

Action Success(es)

Taking into account the achievements, impacts and policy implementation of the Action described in the preceding sections, please describe below the two most significant successes of the Action.

Description of the success	1. iCARE mRNA-delivered antiviral FeS enzyme platform. The team engineered self-sufficient variants of the antiviral radical-SAM enzyme RSAD2 (viperin) by fusing its catalytic domain to its natural electron donor, CYB5R3. These iCARE enzymes autonomously produce chain-terminating nucleotide analogues (e.g., ddHcTP) inside cells, blocking viral RNA polymerase. This enables a new therapeutic modality: mRNA or gene delivery (via lipid nanoparticles) to turn host cells into intracellular antiviral factories. 2. Engineered ferritin nanocages for targeted drug delivery. Ferritin's natural cage structure was repurposed as a biocompatible delivery vehicle. The team developed "plug & play" assembly and pH-induced encapsulation (PINC) technology, allowing loading of poorly soluble drugs—even in 30% DMSO—and surface functionalisation with cell-specific ligands. These nanocages enable targeted intracellular delivery of antivirals, antimicrobials, and mRNA-encoded metalloenzymes, with industrial partner Nanopharm aiding scale-up.
Dimensions of the success	• Scientific breakthrough • Technological breakthrough • Building capacity in a new or emerging field of science and technology

Description of the success	FeS cluster delivery to mitochondria in plants. The team successfully transplanted nitrogenase—an oxygen-sensitive FeS cluster enzyme—into plant mitochondria, demonstrating that complex metallocofactor assembly can be engineered into eukaryotic organelles. This proof of concept opens routes to nitrogen fixation in crops and establishes mitochondria as targets for metalloenzyme delivery.
Dimensions of the success	• Scientific breakthrough • Technological breakthrough • Building capacity in an existing field of science and technology

Other matters

This section is confidential to the Management Committee, the Action Rapporteur and the COST Association, and is not included in the version of the report that is published on the COST website.

Difficulties in implementing the Action

If any difficulties were experienced in the implementation of the Action (e.g. imbalances of participation across the Working Groups, inactive country representatives) please describe these below. Please also describe the efforts made by the MC to address these.

One aspect that was raised is the age limit (less than 40 years of age) COST has introduced for Young Investigator and Innovators. Several scientist may have faced personal circumstances that have delayed their career progress. The age should not be measure of their stage. Imposing this limitation is particularly against COST one inclusive approach. We understand the need for some sort of bench mark. Perhaps this can be a window of 15 years after PhD.

Suggestions for improvements to COST framework/ procedures

The mandate of the Scientific Committee includes providing advice to the COST Committee of Senior Officials on possible improvements to the COST framework. Please describe below any improvements that you believe should be made to the COST framework.

please see my comment above on age limitation for young investigators and innovators.

Sustaining the network beyond the Action

Are there any plans to sustain the network beyond the end of the Action?

YES

Please describe how the network will be sustained beyond the end of the Action.

The FeSImmChemNet network will be sustained beyond the Action's lifetime through multiple mechanisms. First, the foundational intellectual property—including the iCARE and ferritin nanocage patents—provides a commercial anchor, with new industrial partners (EvoEnzyme) already embedded to drive scale-up and market translation. Second, the network will leverage its established collaborative framework to pursue follow-on funding through COST Innovators Grants, EIC Transition grants, and joint industry–academia proposals, ensuring continued research momentum. Third, spin-out ventures focused on mRNA-delivered metalloenzyme therapeutics and sustainable biocatalysis will create lasting commercial entities. Fourth, the open-access repository of protocols, datasets, and computational tools will serve as a permanent resource for the broader scientific community, while training school materials and the annual conference will continue under partner leadership. Finally, the strong personal and institutional relationships forged through STSMs, joint publications, and shared PhD projects will evolve into long-term research consortia. By embedding commercial, academic, and training pipelines from day one, the network transforms from a funded project into a self-sustaining innovation ecosystem.

Emerging topics/ developments in the field of the Action

Please describe any emerging topics or potentially important future developments identified during the Action and that could potentially be addressed by future COST activities such as Actions S&T Conferences or Exploratory Workshops.

The emerging topics identified by this Action cannot be addressed by individual laboratories or isolated disciplines. They require sustained, coordinated networking that brings together academic and industrial partners across Europe.

First, mRNA-encoded metalloenzyme therapeutics demands integration of mRNA formulation, LNP engineering, protein design, and clinical validation—capabilities no single entity possesses. Second, AI-guided engineering of O₂-tolerant biocatalysts requires computational chemists, protein engineers, and industrial partners like EvoEnzyme to co-develop scalable solutions. Third, cofactor assembly as a therapeutic target bridges fundamental immunology with medicinal chemistry and preclinical validation in human tissue models. Fourth, ferritin nanocages for targeted delivery need academic expertise in protein engineering alongside industrial capabilities in scalable manufacturing and regulatory compliance. Fifth, sustainable biocatalysis for green manufacturing requires coordinated development across enzyme discovery, immobilisation, flow chemistry, and process scale-up. Finally, regulatory and commercialisation frameworks for mRNA-encoded therapeutics necessitate dialogue between researchers, industry, and bodies such as EMA and ECHA. These challenges are fundamentally networking problems. A subsequent COST Action would provide the collaborative platform needed to translate fundamental metalloprotein discoveries into real-world antiviral, antimicrobial, and sustainable chemistry applications, ensuring Europe remains at the forefront of this rapidly emerging field.

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Annex 1: Types of objectives

1 - Coordination of scientific and technological activities at a European level

- 1.a - Development of a common understanding/definition of the subject matter
- 1.b - Coordination of information seeking, identification, collection and/or data curation
- 1.c - Coordination of experimentation or testing
- 1.d - Comparison and/or performance assessment of a theory, model, methodology, technology or technique
- 1.e - Development of knowledge needing international coordination, pertaining to a new or improved theory, model, methodology, technology or technique
- 1.f - Achievement of a specific tangible output that cannot be achieved without international coordination (e.g. due to practical issues such as database availability, language barriers, availability of infrastructure or know-how, etc.)
- 1.g - Input to stakeholders (e.g. standardization body, policy-makers, regulators, users), excluding commercial applications
- 1.h - Input for future market applications (including cooperation with private enterprises)
- 1.i - Dissemination of research results to the general public
- 1.j - Dissemination of research results to stakeholders (excluding specific input in view of knowledge application)

2 - Community building

- 2.a - Building a community around a topic of scientific and/or socio-economic relevance, allowing for knowledge exchange and the development of a joint research agenda
- 2.b - Building a community around a new or emerging field of research
- 2.c - Bridging separate fields of science/disciplines to achieve breakthroughs that require an interdisciplinary approach
- 2.d - Acting as a stakeholder platform or trans-national practice community, pertaining to a certain area of socio-economical or societal application, or to a certain market sector
- 2.e - Building capacity in the demographic inclusiveness of networks in science and technology, including representation of newly established research groups, Early-Career Investigators, the under-represented gender and teams from countries/regions with less capacity in the field of the Action

Annex 2: Dimensions of successes

1 - Breakthroughs

- 1.a - Scientific breakthrough
- 1.b - Technological breakthrough
- 1.c - Breakthrough in socio-economic or societal applications

2 - Policy contribution

- 2.a - Contribution to regulatory policy
- 2.b - Contribution to environmental, infrastructural or agricultural policy
- 2.c - Contribution to economic or socio-economic policy
- 2.d - Contribution to social, cultural or legal policy

3 - Capacity building

- 3.a - Building capacity in an existing field of science and technology
- 3.b - Building capacity in bridging separate fields of science and technology
- 3.c - Building capacity in a new or emerging field of science and technology
- 3.d - Building capacity in valorising and implementing advances and applications in science and technology
- 3.e - Building capacity in the demographic inclusiveness of networks in science and technology, including representation of newly established research groups, Early-Career Investigators, the under-represented gender and teams from countries/regions with less capacity in the field of the Action

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