

Navigating the Funding Landscape

A Guide



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Foreword

This guide is designed to help you start building a solid track record of securing funding early in your career. Ultimately, it will help you get the funding you need to pursue your own research interests and develop an independent career.

Restrictions in the funding system can put many early career stage researchers off applying for funding, but there are actually many smaller funding sources that are open to PhD students and postdoctoral researchers. This guide describes these smaller amounts of money and identifies the key funders who support physics research in the UK and Ireland.

Whatever you are applying for, it is important to seek advice and guidance from senior staff. Interviews throughout the guide illustrate the value of this expertise and demonstrate how important it is to build relationships.

Although it is true to say that competition for funding is intense, it is also true that many people fail because they submit poorly thought-out proposals. To be successful in the funding landscape you need to:

- understand the expectations of funders and apply for a scheme that will suit your research aims
- know how to construct a successful proposal, having seen good examples and had your application thoroughly reviewed before submission
- understand the review and decision-making processes and write a proposal that is easy to evaluate fairly
- react effectively to feedback when your ideas are reviewed.

By following the advice, gathered from a wide variety of experts, you should be able to submit future proposals with confidence.

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Section 1

Introduction

This guide to physics funding has been written for researchers who are currently working towards a PhD or who are on fixed-term postdoctoral research contracts. It focuses on the funding schemes that are open to researchers at the start of their careers.

Many of the schemes available from major funders are only open to academics with permanent positions. It is increasingly difficult to secure such a position without demonstrating both independence as a researcher and a track record of securing funding. Thankfully, there is a way out of this apparent catch-22, as early-career researchers can apply for modest amounts of funding, or for specific career-development opportunities such as fellowships. These can pay your salary for three to five years – or sometimes longer – and most include some money to start research and perhaps to recruit a PhD student.

Fellowship funding will greatly increase your chances of an academic appointment, but competition is fierce. Very few people are successful on their first attempt, and funders expect to see evidence of independence and potential research leadership. As you read the interviews in the guide you will see a recurring theme, which is how important it is to seek advice from more experienced physicists. This will help you to identify the right funding, prepare a convincing application, and build a professional network. If you are serious about an academic career and funding, this guide should convince you of the value of mentoring.

This guide aims to take you from the first steps in independent funding, all the way through to prestigious fellowships, as these will significantly increase your academic employability. The first section looks at the funding landscape, explains who funds physics research and which schemes are suited to early-career researchers. The second comprises a series of interviews with senior academics, who share their advice for early-career researchers and demonstrate the value of good mentors. Finally, it looks at fellowships in detail from the approach to the host institution to the panel interview.

Although this guide has been written to encourage you to start thinking about funding early in your career, it is important to note that competition for research income and academic posts is intense. Only a small proportion of PhD students ultimately secure an academic position. A track record of funding will greatly improve your chances, but it will also improve your employability in other fields. Securing funding is evidence that you can convince people to support your ideas and ambitions: it demonstrates your initiative, independence and drive. These are attractive traits for a range of employers and another reason to engage with the funding landscape early.

It is important to note that competition for research income and academic posts is intense.

Section 2

Who funds physics research?

The funding landscape is complex and constantly evolving. This section of the guide explains who the key funders are and introduces you to the support that is available to help you develop a more personalised funding “map”. Later sections go into more detail about the schemes and opportunities that are suited to PhD students and postdoctoral researchers.

Government-funded research agencies

In the UK, there are seven research councils encompassing a broad range of disciplines, which also operate in a partnership as Research Councils UK (RCUK). Physics research funding is principally provided by the Engineering and Physical Sciences Research Council (EPSRC) and the Science and Technology Facilities Council (STFC). EPSRC invests in long-term, fundamental engineering and physical sciences research and training, covering topics from physics, chemistry and mathematics to materials, computing and engineering. STFC is the primary funder for astronomy and for nuclear, particle and astroparticle physics. With the UK Space Agency, STFC also supports space exploration. However, the scope of physics is such that it is important to map your research interests against the other Research Councils – NERC and BBSRC, covering environmental and biological research, may also be relevant. There are also an increasing number of schemes run jointly by councils aimed at stimulating inter- and cross-disciplinary research.

In Ireland, there are two principal government agencies: Science Foundation Ireland (SFI) and the Irish Research Council. SFI is the national

foundation for investment in scientific and engineering research and invests in academic researchers and research teams who are most likely to generate new knowledge, leading-edge technologies and competitive enterprises in the fields of science, technology, engineering and maths (STEM). The Irish Research Council manages a suite of inter-linked research schemes, funding scholars at various career stages including one to two year postdoctoral research fellowships.

European funding is another important source, but can appear confusing at first glance – largely because it is the biggest civil research programme in the world. More than €80 bn is available for research and innovation funding in the Horizon 2020 programme, including a number of schemes for early-career researchers. Although complex, there are three sets of schemes that university researchers should be aware of: researcher-led proposals, based on the interests of the individual, are managed by the European Research Council (ERC); Marie Skłodowska-Curie Actions (MSCA) focus on schemes to promote mobility of talented researchers and to develop careers, and, finally, there are the Societal Challenges calls, which ask researchers to propose research projects that relate to topics that will improve the quality of life across Europe and the world.

More than €80 bn is available for research and innovation funding in the Horizon 2020 programme.

Universities

Even early in your career, it is important to have an understanding of this funding landscape so that you know what you are aiming for in the longer term. It is also important to appreciate the breadth of funders and funding schemes so you can identify all the opportunities that are open to you. Universities in the UK and Ireland employ experts in research funding who can help you – ask your research supervisor or your school administrator who to talk to, and find out what support they offer to someone at your career stage. The research you have done in advance of this will help you to make a better approach and if you are currently outside a university but planning to apply for funding, you will be able to access support through your proposed host department.

A number of universities offer prestigious and competitive postdoctoral fellowships, usually on a tenure track – meaning they will lead to a permanent position. The expectation of the university is that you ultimately develop into a research leader. Some also have investments and endowments that are managed internally to fund research, travel expenses, exchange visits and small proof-of-concept projects. Your research office will know which funds you are eligible for and how to apply for them.

Government departments

Some researchers investigate topics that overlap with the interests of government departments. Open calls for these opportunities, which come from governments all over the world, are listed on funding databases – your research office will subscribe to one of these, such as ResearchProfessional or RESEARCHconnect International.

Industry and funds to promote academic–industrial collaboration

The UK and Irish governments are keen to ensure that there are better links between researchers in the academic and commercial sectors, and have made available a range of funding opportunities to facilitate this. Technology companies of all sizes will fund research if it will help them solve problems, develop their own research capacity or develop new products. Similarly, there are enterprise fellowships to take innovative ideas generated in universities closer to the market.

Charities and trusts

These often fund fellowship programmes and travel grants, and will support short visits to other research groups or facilities. Some, like the Leverhulme Trust, will fund research from any discipline, while others like the Wellcome Trust focus on biomedical sciences. There are also many hundreds of small organisations with funds for specific activities such as travel to a particular event or country, support for people from a narrowly defined background, or funding to study a particular topic or issue. These are best found through funding databases that you can gain access to through your university research support office.

Professional bodies and societies

Another rich seam of funding in the early stages of a career can be accessed from professional bodies and societies like The Royal Society, the Royal Academy of Engineering and the British Council. Other societies, including the Institute of Physics, do not provide substantial research funding, but have a range of schemes to support researchers as they build their networks and increase visibility by attending and contributing to conferences.

Gordon Marshall, opposite, explains his role and key activities in a large research office, The University of Edinburgh Research Office.

He regularly communicates with researchers with news of funding calls. One of the first things that you should do if you are serious about securing funding is to sign up for any newsletters available to researchers. Research offices also have excellent relationships with the funders who support their institutions. They will regularly attend workshops and events at which they will discuss upcoming calls and the strategies behind them. At a local level, they will know which applications have been successful in the past, allowing them to pass on insights into funding decisions that go beyond the published criteria and data.



Gordon Marshall

Research Support Advisor and Leader/Research Development for College of Science and Engineering, The University of Edinburgh

“ I work in the Research Office at The University of Edinburgh, with a focus on the College of Science and Engineering. My role is very varied but in simple terms, I help our researchers find and respond to external funding opportunities. This takes two forms – encouraging more of our researchers to apply for funding by offering training and information, then helping them to write stronger applications. The nature of funding is now so complex that my colleagues and I also invest a lot of time in understanding the many different schemes and funders so we can make the experience of applying for funding easier.

Many researchers are aware of the current success rates for grants and they make for depressing reading at first glance. The better news is that we do better than the national average so we can often give researchers a little more confidence when applying.

Having helped researchers find the right sources of funding, I then move into the second stage of my role, which is to help them produce stronger applications. During my career I've seen many thousands of applications and have seen many outstanding examples, some of which are available internally in a dossier of successful applications. I will often provide feedback on areas of the proposal that I can comment on or pass it onto specialists, such as our European bid writers.

Although each grant should be carefully tailored, there are often parts of the proposal that need generic text about the institution, how it supports researchers and what commitment it will give to your proposal. This commitment

may be access to staff and resources, but it could be financial in terms of match-funding or making up shortfalls in the Full Economic Costing. We can supply this text and also help you to identify what you can ask for from your school or department to demonstrate their commitment to your work.

We will also look at some of the specific headings and ensure that you have presented the best case for locating your research in our institution by highlighting our policies and successes where relevant. Some applications need to be approved internally before submission, so I will co-ordinate approvals, authorisations, collaboration agreements, contracts and the submission process ensuring that this happens well before a deadline.

By being involved from the beginning, it's easier to avoid problems as deadlines approach. We run training on the online application processes used by most funders and if we are included in the submission, we can keep track of the process and record the application in our system. These “start to finish” insights also help me if there is a need to negotiate with the funder once an award is offered.

Whatever stage you are at with developing a funding stream for your research, it's important to get to know your local research support staff. In the early stages we can make life a little easier by pointing you to sources of money that you might not have found otherwise, but in the long run I'd like to think that we make life a lot easier by helping you to use your time efficiently to produce stronger research proposals.

Gordon's story highlights the importance of seeking out specialists who deal with grant applications. They will be able to provide you with greater insight, support and information.

Section 3

Funding available to PhD researchers

Funding for PhD researchers to conduct their own research is very limited, so at this stage you are more likely to be looking at funding for travel, visits and training. Competition for these kinds of awards is much less intense than for fellowships and larger grants, and they are a great way to start building your track record, network and visibility.

Conference awards

The IOP has a research student conference fund open to all student members, as well as more tailored awards such as the Structural Condensed Matter Physics Group bursaries.

Other membership organisations also support conference attendance – look for support from the American Physical Society, European Molecular Biology Organisation (for physicists working at the life-science interface), the Royal Astronomical Society, British Society of Rheology and the American Association for the Advancement of Science among others.

Individual conferences will often have a small pot of money available for students who would otherwise be unable to attend – contact the organisers as soon as the conference is announced.

There are also many small trusts that fund career-development activities. These are best found through funding databases.

Travel grants and short visits

International experience is viewed very positively in physics research. If you are unable to work abroad

for a long period of time, an alternative is to spend a few weeks or months visiting another research group or facility. This will help you to develop future collaborations and give you skills and expertise that will help you start to build an independent line of research.

Funding is available from many of the organisations listed above – conference attendance and short research visits are often covered by the same scheme. There are also specific schemes to visit particular countries or to do research on particular topics, which are best found through funding databases, although some examples are given below.

UK – South Africa Researcher Links Grants from the National Research Foundation of South Africa support workshops and travel grants for research visits in order to enhance and strengthen collaboration, build research capacity and enhance career opportunities for researchers in South Africa and the UK. PhD students can apply through their supervisors.

The Japan Society for the Promotion of Science provides visiting scientist funding for researchers to spend 2–10 months in a Japanese research institute. Applications are made through the host institution. PhD students are eligible but must have three years' research experience. For most UK

The IOP has a research student conference fund open to all student members.

researchers, this may be more suited as a postdoctoral visit, although you could start the application process during your PhD.

The Don Claugher bursary from the Society of Electron Microscope Technology provides up to £1,000 funding to cover consumables, small equipment, scientific meetings, attendance expenses or access time on an electron microscope.

Competitions

There will be institutional, event-based or regional competitions for posters, publications, presentations and theses, awarding prizes to travel or to develop research ideas. There is also an international Three Minute Thesis competition, which awards a bursary to the winner to visit another university to benefit their research or career development.

Many competitions aim to help early-career researchers develop a more commercial mindset. You don't need to have a business idea in mind – you'll work with tutors and mentors to develop these in a team, usually with researchers from a range of disciplines. One of these is the International Genetically Engineered Machine (iGEM) Competition, which has run since 2004 and is open to a wide range of disciplines. Involvement in a competition like iGEM also develops a wide range of skills that will strengthen future projects. These include project planning and administration, resource and team management, fundraising, team work, international networking, entrepreneurial thinking and collaboration.

Look around your department notice boards for information on competitions. You'll also find help in the researcher development unit, careers service or research support office.

Summer schools, workshops and training

Many research networks run summer schools and masterclasses for research students. These take place over a week or two, and consist of lectures from experts, problem-solving seminars, short projects and networking. In the interview on p26, Professor Eugene Kennedy of Dublin

City University talks about the positive impact of summer schools on his own career. There are likely to be posters for these in your department and the organisers will usually be able to advise you about potential funding to cover course costs, accommodation and travel. Some examples include:

- Physics by the Lake (theoretical condensed matter physics) – recommended funding sources include the IOP and EPSRC
- Culham Plasma Physics – recommended funding source FUSENET
- HEP (high-energy particle physics) – the course is fully funded by the STFC for their students.

There are also many international networks running similar programmes. These include Innovative Training Networks, funded through the European Marie Skłodowska-Curie Actions programme. They run residential workshops for their own students and may make places available for other students.

Public engagement

In addition to being a potential source of money to develop ideas, experience of public engagement is identified by many of the people interviewed in this guide as being instrumental in their success. With funders increasingly expecting scientists to engage with non-academic partners and promote the value of science to the wider public, gaining experience early in your career will give you an advantage.

The IOP runs a public-engagement grant scheme that welcomes applications from all researchers. The STFC and UK Space Agency are also strong advocates of public engagement and have a range of funding opportunities.

The interview with Anne Pawsey opposite demonstrates how important it is to be proactive during your PhD. Anne has a strong track record in public engagement, having set up and co-ordinated the outreach activities of the Scottish Condensed Matter Doctoral Training Centre during her PhD. In 2013, she was awarded the Shell and Institute of Physics Very Early Career Woman Physicist of the Year as well as an EPSRC fellowship to fund a three-month position in the Parliamentary Office of Science and Technology (POST). She is able to use these experiences as evidence of leadership and initiative in the fellowship applications she is currently writing.



Anne Pawsey

Postdoctoral Research Associate, University of Aberdeen

“ I applied for the POST fellowship in the final year of my PhD. There are usually several opportunities per year, as the majority of the learned societies and all the Research Councils offer fellowships. The fellowship lasts for three months, and you spend it at POST, the House of Commons Library, as a select committee assistant, or with SPICE (the Scottish equivalent of POST). The funding body often decides the secondment host.

If based at POST, you produce a four-page “POSTnote” designed to inform parliamentarians about a scientific issue with policy implications. The funding body typically funds your PhD for an additional three months and pays your rent and travel in London.

To get the fellowship you need to be able to demonstrate that you can communicate complex scientific issues to a non-technical audience and that you have some understanding of how parliament and government work. In order to do this, you write a sample POSTnote. I was also able to demonstrate communication skills via my outreach work. As a PhD student I ran the outreach programme for a doctoral training centre – this meant that I could demonstrate that I knew how to translate my own and other peoples’ science into non-technical language, and that I was able to manage a budget and negotiate with senior academics. I was also able to demonstrate confident communication skills by taking part in FameLab and Bright Club.

The fellowship has given me a greater understanding of how parliament functions and a working level of fluency in science-policy language. I’m much more aware of how research is funded and who the main players are in terms of policy, from the ministers or government department to the funding bodies including Innovate UK and RCUK.

I’m currently a postdoc employed by the Rowett Institute, University of Aberdeen, but working full-time at The University of Edinburgh. I’m using soft-matter techniques to create a microcapsule to release nutrients in the correct part of the digestive tract and beginning to apply for my own funding. I’m also the outreach representative for my group. In practice, this means that I organise events and help other postdocs to take part in outreach activities. It’s already evident from the process of preparing applications that my wider activities in outreach enable me to present more evidence of leadership and initiative than would be the case from purely lab-based work.

There are many opportunities to get involved in scientific and scientifically related activities. My advice is to choose to do things that you enjoy in order to build your CV – it makes talking about them with enthusiasm easier.

Anne’s advice is a good reminder that applications for funding must include far more than a project plan and budget. The credibility and track record of the applicant are critically important.

Section 4

Funding available to postdoc researchers

Postdoctoral researchers can access most of the schemes outlined in the PhD student section, but, with additional experience and having achieved a PhD, more opportunities open up and success becomes more likely. Schemes for visiting other groups that are nominally open to PhD students also aim to foster new collaborations, and so are arguably better suited to more established researchers.

Research visits

One example of a scheme that would suit postdoctoral researchers is the Newton Fund that promotes economic development through research and innovation. Its Researcher Links programme provides funding for workshops and research visits and has a focus on early-career researchers, but eligibility requirements for many schemes include a completed PhD.

Working independently

As a postdoctoral researcher, you should be talking to your supervisor and mentor about your future ambitions. Your supervisor can make additional opportunities open to you and may be willing to allow you some time and resources to develop your own ideas, assuming that this doesn't affect your main project. Most academics will be happy to support talented researchers in this way, but you need to take the initiative and ask for this support. This won't involve direct funding, but will strengthen future proposals.

Short student projects

One way to begin to develop fresh ideas is to formulate a short project that could be completed by an undergraduate or masters student. If you are in a large university your supervisor will run a

number of these training projects and they may be willing to let you take control of one, even if they still need to be the named supervisor. In addition to the projects that form part of a degree, many departments also provide opportunities for talented school students funded by internal money or through the Nuffield Foundation. Both of these approaches give you a chance to write a project plan, supervise and train a young scientist, and gather some preliminary data.

Named researcher or co-investigator

Even if you aren't eligible to act as the principal investigator or grant holder because of your fixed-term employment status, don't be put off – you may be able to apply in partnership with an established academic. Talk to the funder about your status and plans, and find out what is possible. You can explain on your CV or in future applications that you were the driving force behind a project and managed it successfully.

Workshops

If you have attended workshops as a PhD student and become familiar with the format of them, you might want to apply for funding for a workshop of your own. This will give you an opportunity to position your research interests at the heart of a

As a postdoctoral researcher, you should be talking to your supervisor and mentor about your future ambitions.

network of experts, to build connections with these experts and to demonstrate your initiative. Not all workshop funding is available to contract-based researchers, but discuss your ideas with the funder and emphasise any planned fellowship applications, support from senior colleagues, and why you are well positioned to take the leading role. If you can't apply for the funds in your own right, it's important to seek advice about whether to postpone an application until you can or whether to apply in partnership with a colleague. This is the kind of conversation that a mentor is best suited for as they can provide objective but supportive advice.

Impact Acceleration Accounts

If your research has commercial implications, then in addition to the funding mentioned in the following section of this guide, you could also put together a proposal for an Impact Acceleration Account. These are funds administered within universities and aimed at boosting the societal and economic impact of research previously funded by Research Councils. Each institution can decide how to use the money, but it can be used to fund a postdoctoral project.

Research with a commercial end-point

Many researchers are working on fields with potential commercial applications and for those who are interested in seeing their work reach the marketplace there are other funding routes available.

There are additional considerations for researchers thinking about commercial partnerships with industry or spinning out their ideas into a new company. The definition of success is very different to that for a pure science project, with the expectation being that the technology produced will generate a return on the investment. There are very different attitudes to information that is produced during the project. This is likely to affect your freedom to publish or to talk about your research, and can even affect which funding and partnerships you can accept for other projects.

Funding provided for research with future commercial

exploitation brings other responsibilities. You will be expected to take a rigorous approach to record-keeping and will have to adhere to systems that ensure your ownership of data and discoveries can be verified in the future. It is important to be aware of these differences early on, as you will need to adopt strong data-management policies well in advance of any patent or product.

One research office gave the following advice: "Many institutions have a strong track record of commercialising research, so the research office can liaise with other experts who are familiar with the additional documentation and contracts required for commercial partnerships. They will also have existing relationships with the legal and contracts staff in many external organisations and understand how to manage negotiations about intellectual property."

If an industrial connection appeals, then there are many different funds available to facilitate academia–industry links. Some of these, such as the Knowledge Transfer Partnerships, place researchers in companies; others have university-based researchers working on projects with industrial co-supervision. The Industry Fellowship Programme from the Science Foundation Ireland (SFI) is aimed at academic researchers who want to spend time in industry (in any country), but also support industrial researchers who want to work in a university.

The push towards research that addresses societal challenges has created many opportunities to work in close collaboration with non-academic partners. Most funding available from Horizon 2020 requires the involvement of a small- to medium-sized enterprise (SME) and/or industrial partner, so there are clear long-term benefits to building these connections as an early-career researcher.

To get started, look for networking events where you can meet representatives from companies who are interested in developing projects with universities. These can be organised by universities, funding bodies, professional bodies or industry-sector associations. For academic researchers already employed on a permanent contract, and for scientists in industry, The Royal Society – Industry Fellowship scheme promotes collaborative projects.



Tiffany Wood

Director of Operations, Edinburgh Complex Fluids Partnership

Tiffany Wood combines academic research in complex fluids science at the Institute of Condensed Matter and Complex Systems at The University of Edinburgh with a Royal Society Industrial Fellowship and is the operations director and co-founder of Edinburgh Complex Fluids Partnership, which provides consultancy in formulation and soft-composite material science. She also works with companies from a wide range of industries including the pharmaceutical, cosmetic, food and drink, and agrochemical sectors.

“ I am active in supporting companies with product improvement and innovation through the transfer of knowledge from the academic to the commercial world. I work with small start-ups to multinational companies from across the UK and further afield.

Complex Fluid science is an interdisciplinary field that brings together physics, chemistry and biology to understand how small components (particles, droplets, bubbles, proteins, polymers, liquid crystals, microorganisms, etc) interact with one another. We hope to be able to design smart materials of the future, performing desirable functions such as controlled release, self-assembly, self-healing, high efficiency or made with sustainable resources.

I've always been interested in working in applied areas of physics. I find it exciting to work with industry and see the science behind products that I am familiar with as a consumer. This influenced my choice of PhD and postdoctoral projects, so I've developed my research approach in groups with strong industrial connections.

My former supervisor brought in my first consultancy project, doing rheology work with a company moving production to a new plant that wanted to ensure consistency in the product. This was a short, discrete piece of work set up using a standard consultancy service work contract – most universities will have these and they are relatively easy to work with. All the intellectual property from the project went to the company; that didn't create any issues for us and made it easy to establish the relationship.

I used the project as a way to understand more about how the company worked, the scientific challenges it was facing and to learn how researchers in industry approach problems. This experience made it much easier for me to talk to people in other companies, which was really helpful when I began to attend industry networking events. These included events organised by Innovate UK around calls for the Technology Strategy Board. This gave me the opportunity to meet innovation managers within companies and convince them of our capabilities. New consultancy projects evolved from these relationships.

Although useful, the Innovate UK events were themed around their interests, not mine. I developed a clear idea of the skills and services that our research group could offer to local companies, then telephoned them individually to explain how our research may be relevant to them and invited them to an event to network with our researchers. This brought in a number of SMEs who would otherwise have been unaware of the benefits of working with academics.

If you are interested in research with an industrial application, you need to be proactive and imaginative in finding and creating opportunities to meet scientists in industry. There are a number of funding opportunities that must be led by industry but can have academic partners, you can benefit from these if industrial scientists are aware of your capabilities. Many of these are listed on the Innovate UK website and are often supported by information and networking events that are useful to attend.



Not many academics will attend these as they are aimed at companies, but you learn a lot about the call during initial presentations from the relevant government organisation. After this there are opportunities to talk to people, so you need to have a clear, engaging pitch.

These events worked really well for me during the transition phase in my career from postdoc to independent researcher. Think carefully in advance about how to present yourself and to have the confidence to approach people to discuss your work and the value you could add. If you can develop a new consultancy project as a result of one of these conversations, it is great evidence of being proactive and showing initiative, which will support future fellowship and job applications.

It's important to invest time in being in the same room as people, as relationships with companies develop best face to face. Innovate UK used to have discussion boards but they were not used by the companies – perhaps because of the commercial sensitivity of industrial research. I found it was more effective to organise my own events to bring people together.

As a first step to commercial funding, postdocs could look at Innovation Vouchers. The university acts as a supplier to the company to provide research services and the funding is awarded based on a very simple application form completed by the company – it's designed to take around 30 minutes to submit.

The Innovation Voucher is attractive because it allows research to happen in a low-risk partnership. The company can benefit from your expertise without providing a salary as they usually provide in-kind funding through access to resources and materials. The university benefits from developing a new relationship, which could help them address the impact agenda in future proposals and REF2020*. Obviously, you will need to have the agreement of your school or department, but they are likely to be pleased to see a postdoc taking the lead and building a new line of research. The voucher will cover your salary for 2–3 months. This means that you will probably need to negotiate an extension to your current research contract, but, again, this is usually in the interests of both the school and the core funder.



*REF is the Research Excellence Framework (REF), the system for assessing the quality of research in UK higher-education institutions. The first results were published in 2014 and the next review is expected in 2020. Part of the assessment relates to “impact”, which refers to societal and commercial benefits from academic research.

Starting your own company

If your interest is in starting your own company, talk to people in your institution who manage this. They are likely to be in, or closely affiliated with, the research support office and will be able to advise you on the funding that will be available, including university or regional support. Many funders also support this kind of research activity, including:

STFC

Run in collaboration with the Royal Society of Edinburgh and Scottish Enterprise, the STFC Enterprise Fellowships are designed to increase exploitation from their research programme and enable an individual to advance the commercialisation of existing research results or technological developments.

Royal Academy of Engineering*

Enterprise Fellowships provide funding and support to outstanding entrepreneurial engineering researchers, working at a UK university at postdoc level or above, to enable them to develop a spin-out business around their technological idea.

Successful cross-sector collaboration is built on mutual understanding. It is worth seeking clarity and agreement as early as possible, on, for instance:

- motivation and reward can be different for academic and industrial researchers. Academic career progression depends on funding and publications – make sure that you discuss issues like publishing early in the planning
- definitions of success – will you and your potential collaborator both benefit from the outcomes of the

proposed project? Will you gain interesting insights and material to build on with future research projects? Will the commercial partner answer a question or gain a commercial advantage?

- contracts and legalese – be aware that any agreement involving a potential commercial product will need to be carefully contracted by the legal departments of both sides. Take advice and allow lots of time for this
- pace of research – check that the timescale that you have in mind for the project is the same as the company. Academic projects usually run for years, whereas industrial researchers may expect progress to be made in much shorter periods
- mobility of contacts – at this point in your career you may not stay with your current institution for more than a few years and the same may be the case for the industrial contact. How will you deal with key people leaving the project?

Good practice for academic–commercial collaboration

These smaller pockets of money provide critical support in building your independence and profile. As postdoctoral researcher you can find funding to:

- travel to world-leading groups for short training visits or to conduct work
- build networks by organising workshops
- engage with non-academic partners
- travel to key conferences to build your profile
- develop technology towards commercialisation.

*Despite its name, the Royal Academy of Engineering funds physics research. Their website explains that “Engineering is defined in its broadest sense, encompassing a wide range of diverse fields”. Their Programme Managers are happy to clarify eligibility with individuals.



Fiona Blighe

Programme Manager, Scientific Foundation Ireland

Fiona Blighe, a scientific programme manager at the Science Foundation Ireland (SFI) gives her advice to early-career researchers intending to apply for funding in Ireland.

“ The first step for an early-career researcher is to identify a programme call for which they are eligible to apply. We make this very explicit on our site with a simple schematic on our website and early-stage researchers should particularly look at the Starting Investigator Research Grant (SIRG). Once a suitable programme has been identified, read the call documentation carefully. I cannot stress the importance of this enough, especially for researchers who may not be experienced in grant writing. It is important that the researcher gets a feel for the spirit of the call. This will tell them if particular research areas are priorities, if it will be necessary to identify a mentor, whether the call requires industry engagement, and whether any budget constraints apply.

The call document is the best guide to what the reviewers will be looking for in an application during the review process.

If at all possible, find someone who has successfully applied to the programme and seek out their advice. Remember, research proposals are reviewed by other researchers who are experts in the field and funding decisions are based on their recommendations. Write the application with the reviewers in mind. Find an experienced researcher to read your application and get advice regarding the scope and budget of the application.

Each application is unique, but the characteristics we see of strong applications are that they:

- are interesting and aim to do something new
- contain excellent research

- directly answer the questions asked in the application form
- play to the strengths and experience of the applicant as well as to those of any collaborators
- have realistic goals that can be achieved within the time and budget requested.

The reviewers need to believe that the applicant has the capabilities required to carry out the proposed research. If there is a part of the proposed research programme in which the applicant is lacking in expertise, it is advisable to find a collaborator who has a strength in this area.

We only use international peer reviewers, but I would strongly encourage all researchers to participate in reviews for other funding bodies if they have the opportunity. It is a great way to get an insight into how funding decisions are made and to build collaborations with other reviewers.

On a last note, I would advise early-career researchers not to be put off for applying to SFI or any other funding agency by anecdotes regarding success rates. Find the call that's right for you and apply – that's the only way to get funded and the best way to progress in your career. ”

Section 5

Voices of experience

The very first page of this guide emphasised the importance of good advice for early-career researchers applying for funding. This section includes a range of interviews as examples of “mentoring conversations” and demonstrate the quality of support and advice that senior academics are willing to give to early-career researchers.

Mentoring comes in many different guises. There are formal schemes, such as that run by the IOP and your institution, but informal arrangements can be just as effective.

The IOP’s guide to mentoring will help you to identify and approach someone. Some people prefer to have a range of mentors who provide advice on different aspects of their career.

In this section, four “virtual mentors” share their advice and all stress how important it is for postgraduates and postdocs to be able to turn to others for feedback, information and access to networks.

The interviews on the following pages include advice that would help early-career researchers needing advice on how to:

- write more convincing applications
- structure the CV that accompanies your application
- overcome limited mobility in an environment that particularly values international experience
- prepare for future funding trends
- choose the right reviewers
- avoid common mistakes in proposal writing.

On p36, Rita Tojeiro explains how important mentoring has been in her career, particularly in terms of giving her the confidence to apply for funding and to persevere after unsuccessful applications.

It is vital to be able to turn to others for feedback, information and access to networks.



Professor Eugene Kennedy

Professor Emeritus and former Vice-President for Research,
Dublin City University

Professor Eugene Kennedy was the vice-president for research at Dublin City University and the founding director of the National Centre for Plasma Science and Technology. He is committed to supporting early-career researchers build academic careers and is typical of many senior academics, in being willing to offer advice and feedback.

“The key to good grant writing is to build a compelling evidence base and to present this so the reader really believes in your research and your ability to successfully deliver results.

In addition to the care you will put into constructing the case for support in your proposal, make sure that your CV works hard to impress the reviewers and panel. Too many CVs are simply a list of publications and activities, whereas they need to be a representation of your body of work. I recommend that early-career researchers think about the themes in their work, then format and arrange publications, visits and funding around these. Make it easy for reviewers to see the impact that your work has had by explaining how your work has influenced others (partly through citations, but also how their work has built on yours). A CV is doing its job for you if you can show it to someone outside your field and ask them to explain what you have achieved. If they can't do this relatively easily, think again.

The process of theming your publication and achievements will also help you see where you need to focus your energy. It will help you to see whether an additional publication is needed, which collaborative relationships you need to develop, who to approach for letters of support. You must learn to view your research vision within a “helicopter view” particularly if you are applying for a prestigious award such as an ERC Starter Grant. Your track record must create the impression of being someone who is on an upward trajectory.

To build a strong CV, early-career researchers need to get out and about. There are many funds available from different governments, scientific associations, charities and individual institutions to support short-term visits. It doesn't have to be a lengthy stay – even in four weeks you can mix with new people, build new international connections, develop technical skills and broaden your horizons. These fresh perspectives will help you to think outside the box and come up with a novel approach to your topic, particularly if you visit people working in other disciplines. Such visits can raise your profile with international research leaders who may be very useful as referees for your future career.

If your mobility is very limited, there is also great kudos to be gained by convincing people to come to you and visit your lab. If someone is interested enough in your work to come, it says something about your standing and influence in your field. You should also get out and engage people with your work by speaking at conferences, giving seminars in other departments, and sending key people copies of your publications. Don't sit at home waiting for people to find you.

There are also opportunities to travel to summer schools common in some areas of physics. These are intense residential courses focused around particular topics taught by international leaders and attended by people who could become future collaborators and peers. I found these particularly valuable in my own career for developing awareness of the international competition in my field.

My advice for writing stronger proposals is to start with the many small internal opportunities for funding from most institutions. In the early stages of applying you need to understand the weaknesses in your approach and you will often get better feedback from these internal competitions. You also need to find a mentor. I work with a number of early-career scientists and try to give constructive comments to help them find a way to tell the story of the grant proposal – a story that I know is there, and often better than the one they usually tell on the first attempt.

Write your proposal for an intelligent, but non-specialist reader. You cannot assume prior knowledge, familiarity with your local or national research environment or culture, the acronyms that are second nature to you, or the importance of what you are doing. All these things must be carefully spelled out. Don't worry about patronising the informed reader as they will always appreciate reading a well-told story.

The referees will have clear review criteria, and you must write the grant proposal to make it easy for them to review against these. Use formatting, language and structure to present them with the evidence they need to judge your proposal. One trick you can use is to highlight your own work in the publications you refer to in making your case – this helps the reviewer see your position within the field and how you are building on a strong track record. Also make sure that any supporting material on the web is clearly linked to – don't make your referees work harder than they need to. Provide them with short, strong statements directly addressing the criteria that will help them to make favourable comments in their reviews.

Once you have reviewed your own work it should go to your own internal review panel. I read proposals at this stage with a set of fairly simple questions in mind. What is the researcher proposing? Why is this important? Who is involved, and why? Why is this person uniquely positioned to do this? When does this work need to be done? If you have some experience of public engagement, you will find that the skills you've developed answering the constant "why" questions of curious children will stand you in good stead.



One key role that a mentor can play for researchers preparing proposals, is to help them articulate their case in a fluent and convincing way. After many years of writing, reviewing and grading grants, senior academics will quickly identify flaws and weaknesses in your approach and help improve it.



Andrew Derrington

Parker Derrington Ltd

Andrew Derrington is a senior academic with vast experience of writing successful grants and reviewing proposals. He has 15 years' experience of sitting on and chairing grant panels, so is familiar with how funding decisions are made. He has distilled his experience into the *Research Funding Toolkit* book (co-authored with Jacqueline Aldridge) and a website that publishes frequent articles on grant writing, www.parkerderrington.com.

“ Although the structures used by funders for their schemes vary hugely, the essential message of a grant application's case for support is carried in 12 key sentences, which make the case in headlines. The rest of the document fleshes out that case, provides evidence, and makes it believable. But the key sentences set out what has to be believed. They say what the research project will achieve, why it is important, how it will achieve its goal and what you will do with the results. That is the sense in which they carry the essential message.

Sentence 1 is very important. Its function is to make the reader want to read on by giving them a sense of what your research project will deliver. A good way to do this is to state the overall goal of the project and to specify enough detail about the project to make it seem both feasible and distinctive. For example, the sentence “This project will develop a new potential treatment for stroke based on a family of synthetic metabolic inhibitors that our group has discovered, tested and synthesised” does all this. Like many introductory sentences, it is quite long. The length is due to extra information that makes it clear both what the approach is and that the project is building on previous work by the applicants. The project would have seemed less feasible and less distinctive if the sentence had stopped at the word “stroke”.

Sentence 2 should state the importance of the problem to be solved. A good sentence 2 (assuming it's true) would be “Stroke is the most common cause of death and disability in the working population: each year it kills x and disables

y people”. It is a common mistake to say something like this in the first sentence, but it does not engage the reader as effectively as a promise that the project will solve the problem.

Sentences 3–6 state the aims of the research project. Their function is to make the reader appreciate how important it is to carry out each of the four sub-projects for which you are seeking funding. Each can be a simple statement that “we need to know” whatever the sub-project will discover.

Sentence 7 introduces the research project. It is an introductory sentence and it can help to add some complexity to make the project seem more feasible and more distinctive. For example, the hypothetical stroke project would be helped by some reference to the achievements of the research team or to the distinctive facilities available.

Sentences 8–11 introduce each of the sub-projects. Each sentence needs both to say something about what the sub-project entails and something about what it will discover. It is crucial that the discoveries match exactly the things that sentences 3–6 said that we need to know.

Sentence 12 says something about what will be done with the results to maximise the benefit that will accrue from the project.

Once you've written them, each of the key sentences should be used three times. First they appear consecutively in

the introduction of the case for support. The introduction may also include some linking statements but no other substantive messages. The sentences appear again in the main body of the case for support. This time each sentence introduces a significant section of text that fleshes out and justifies its message. Third, the summary of the project should be virtually an exact copy of the introduction to the case for support.

Don't worry that your sub-projects don't answer the big question completely. They never do. The knack is to find a big question that fits loosely, but not too loosely, around your project. It has to be clear that your project will contribute to answering the big question you have chosen. It is accepted that there is a trade-off between how completely you answer the question and how big it is – everybody knows that it took more than one research project grant to find the Higgs particle. You cope with the fact that your project will not answer your big question completely by choosing your words carefully.

Writing these sentences plays another important role in the grant-writing process, as they force you to articulate all the ideas that will go into the proposal. If it takes you more than two hours, then you are not ready to write.





Professor Miles Padgett

Vice-Principal for Research (Research Strategy and Innovation Office) and Kelvin Chair of Natural Philosophy (Physics and Astronomy), University of Glasgow

Professor Miles Padgett from the University of Glasgow heads an Optics Research Group covering a wide spectrum from blue-sky research to applied commercial development, funded by a combination of government, charity and industry. Since 2014, he has been the university's vice-principal for research and is committed to developing the careers of early-career researchers.

“ Many universities (including our own) now run grant-writing workshops specifically targeting ECRs. These will cover the basics and help you get started, but you also need to find a more experienced colleague who is willing to offer you informal help and advice. While you are establishing a reputation in your field, never pass up the opportunity to review grant applications for the funding bodies to help understand how to write your own. What's better still, is to get onto a review panel. As soon as you see a scheme that looks right for your research, ask around your network and find a colleague willing to show you a copy of a previous grant to the same funding body that has been successful. I've been an academic for 25 years and still do this.

In those 25 years, the funding landscape has changed hugely. However, no-one has ever got a multimillion pound grant at their first attempt, so my advice is to start small. Look for travel grants and small equipment funds – the more grant applications you write the better you will get.

Sometimes, referees are wrong, but more typically they score applications badly when those applications are not easy to understand. Don't blame them – it is your responsibility to explain it better. You must invest time and effort into carefully crafting the first paragraph of any document. This is the most important as it should explain

what your idea is; what the benefits are and to whom do these benefits apply. You also need to demonstrate that you understand what others are doing and why your idea is different and better. My first grant for £15,000 from The Royal Society was the result of a lot of help and advice from my (informal) mentor.

I'm wary of trying to predict future funding trends – fortune-telling crystal balls are cloudy and often highly reflective... However something that is critical now and I think will remain so, is the need to articulate why your research will make a difference and to whom. It also looks as though in the future, larger (but fewer) grants will be awarded and that consequently more of these grants will be collaborative with others, often across disciplines. Start to build your network early as you want to get to know people and to know you can work with them on small things before moving onto these larger grants.

As an early-career researcher you must find someone who is willing to listen and advise – most HEIs (including our own) offer formal mentoring schemes, but my personal experience is that the informal ones work best.

As networking is so important, you need to think about how you introduce yourself to people, particularly more senior people. My advice is that if you ever pitch your research idea to me then be prepared to answer the following:

- what's the state of the art?
- what are you going to do differently?
- why will anyone in the wider world care?

If you can answer these questions in a convincing way, in writing as well as in person, your proposals will be more successful.





Professor Diana Worrall

Professor of Physics, University of Bristol

Professor Diana Worrall is the principal contact for prospective fellowship applicants to the University of Bristol.

“ My first piece of advice to potential applicants, particularly for fellowships, is not to underestimate the importance of the referees and letters of support. The levels of competition for funding are now so high that everything about an application must jump out, including the parts you haven't written. You must cultivate and brief your referees, keeping them informed about the application as it develops, and giving them time to think about how best they can support it and you. I'm aware that referees' reports are the first part of an application that some reviewers read.

I also want the proposal to successfully convey where the research sits in a wider stage. You can't be sure who is reviewing your work and which boxes they are looking to

Although these case studies give advice on a wide range of issues relating to funding, you will have questions that aren't answered by this guide. Hopefully you now feel more confident about asking similarly experienced people to advise you. Look for opportunities to find a mentor at conferences, university events, through social media, and at summer schools. Your supervisor will obviously be a key source of advice and support, but they may be too close to give objective feedback, or only have experience of a limited range of funding schemes. Look for someone who supplements their experience and is willing to offer some time to help you. Don't forget your external examiner – they will be one of the few people who has read your thesis in detail and spoken to you in depth about your early work. Once you've found someone that you trust and who is willing to help you, start thinking about the questions you want to ask them. Some might include:

tick. With a fellowship application it is key that there is a good fit with the hosting institution, but also a good fit in terms of future funding opportunities. The expectation on a fellowship applicant is that you're planning a longer-term academic career, so link your research to a broader vision.

A poor application is usually a combination of things, but it is obvious when it has been rushed. Give yourself plenty of time, get plenty of help, and it will show in the final product. It is quite possible that your first application may not be successful, so try to prepare yourself for this and be ready to start again. Perseverance is an important quality in academics, especially with regard to funding.

- Have you ever reviewed proposals for this funding body, and, if so, what do you look for?
- I'm in the early stages of preparing a proposal. Would you be willing to give me some advice?
- What are the characteristics of the outstanding proposals that you've seen?
- Are there common mistakes made by inexperienced applicants?
- What would you advise me to do over the next year as I prepare my proposal?
- Is it critical to include preliminary results?
- What do you look for in the applicant's CV?
- What convinces you to support an application from an inexperienced researcher?

If you can't identify a suitable mentor in your own network, remember you can select one based on your needs and their experience through the IOP's mentoring service.

Section 6

Applying for a fellowship

If you have completed one or more postdoctoral contracts, a fellowship looks like the next step. In reality, it is a significant step up from working on projects devised by other scientists.

Competition for the prestigious fellowships offered by the Research Councils, Science Foundation Ireland, The Royal Society, Royal Academy of Engineering and Leverhulme Trust is intense, and the quality of applicants and applications is very high. Most funders will expect you to present:

- an idea for a novel line of independent research that you can follow and develop for the next 10 years of your career (fellowships establish independent research careers but they will expect you to have plans that go beyond the funding period)
- evidence that you have the potential to lead research projects and manage people, as many fellowships come with a PhD studentship or will expect one to be provided by your host institution
- a strong publication record that shows that your work has influenced and benefited your field – this might be through citations, invitations to speak or involvement in collaborations

- the commitment of a host institution that is unmistakably the right place for you and your research.

If you take control of your postdoctoral contract and focus on building a good track record, developing an interesting scientific hypothesis and have a strong support network, you should be ready to approach a fellowship application. Most funding bodies have extremely informative websites that try to convey everything you need to know to decide if a particular scheme is right for you. Eligibility criteria should be evident and will often ensure that applicants to schemes are at a similar career stage. In recent years, some funders have recognised the need to ensure that eligibility criteria don't unfairly discriminate against people who have taken time away from research in the early years of their career.

Competition for the prestigious fellowships is intense.

Renée van de Locht, Programme Manager at EPSRC with particular responsibility for Fellowships and Leadership Development explains some of their funding options.

“The key thing that you should be aware of as an early-career researcher is that the EPSRC now takes a more flexible approach to fellowship funding. You can take your fellowship at 50–100% of full-time equivalent to allow for part-time working or for people to retain certain duties alongside their research. We’ve also abolished the time restriction on fellowships. Rather than opening the scheme to people with a set number of years of postdoctoral experience, instead we’ve developed a competency profile, so don’t be put off if you’ve had years away or worked part-time after your PhD.

Fellowships are still open to researchers who don’t have a permanent academic position, although you will need a UK Higher Education Institute as host. We are also being more explicit about the support we expect them to provide for our fellows in terms of career development.

Our general fellowship framework explains which fellowships are open in specific areas at each career stage, although we will occasionally run separate fellowship calls, which are listed on our general funding page.”

Identifying a host institution

If you are planning a fellowship application, there is another critical piece of preparation that must take place before writing begins, which is to secure the agreement of a school or department to host you. Fellowships are extremely attractive to institutions for a number of reasons:

- they cover the salary of the fellow and research costs (the maximum amount depends on the funder)
- they are prestigious awards that reflect well on the school and institution
- the levels of competition are such that only the best candidates are awarded them.

The funding body will usually expect a significant commitment from the host institution. This may be in terms of match funding (providing the applicant with resources such as lab space and/or a PhD studentship), personal development (allocating a mentor and leadership training) and often a tenure-track guarantee (meaning that the fellow will be offered a permanent academic position during the life of the award).

None of this is trivial, so the hosting school or department must be sure that, in addition to the funding that you will bring, you also offer long-term benefits in terms of your research interests, your likely contribution to the Research Excellence Framework assessment in 2020 and your wider benefit to the school or department through public engagement, future teaching and course development or commercialisation.

Professor Helen Gleeson OBE from the University of Leeds runs workshops for potential principal investigators that emphasises the long lead-in to an application.

“I have a timeline in the presentation I give to potential investigators that is particularly important for those applying for fellowships. This starts well before the application, making the candidate as competitive as possible through getting publications submitted and networking for both collaborators and referees. A proposal takes much longer to write than expected and most institutions or groups will have their own internal deadlines. For example, I’m unlikely to support an application through my group if the approach isn’t sufficiently far in advance of the external deadline. Six months isn’t unreasonable.”

If you wish to stay in the same institution for your fellowship, you have an advantage in terms of the existing relationships and knowledge, but can also be at a disadvantage because your interests may be judged to be too similar to existing staff or because staying in the same institution can be judged to reflect a lack of ambition.

Most institutions would welcome an approach from a potential fellowship candidate and will often have internal processes to support them. One example of this is the approach of the School of Physics at the University of Bristol. Their website includes information on potential funding schemes, the current departmental strengths and research groups and a named contact through whom to make your initial contact.

Professor Diana Worrall explains more about the approach taken at the School of Physics at the University of Bristol.

“By the time a candidate contacts us we expect them to have researched the school and identified a likely match in research interests. If someone phones or e-mails me I will explore matches, and broker contacts, but ultimately, there needs to be a member of academic staff who champions the application from a “research fit” point of view – usually this will be a research group leader. This person is very important and will become what we call the science contact.

After this initial contact, if a mutually beneficial match between us and the fellow is apparent, we begin the process of pre-award administration. Ultimately, it is the head of school and the finance department who sign off on applications. We have a series of steps that enable us and the fellow to get to these critical points. They can take some time to complete, so it's important to start as early as possible.

Internal costing forms must be completed and reviewed before the funding application will be signed off by the university. In our school, these forms are initiated by the science contact who works closely with the fellow to accurately describe the cost of their post and proposed activities. The science contact will approach the head of school with details of the fellow, their work and the benefits to the school in supporting the application. Depending on the nature of the research and the funder, other internal approvals may need to be sought, and the science contact is a key person to secure these.

We will also help with the proposal sections that are less obvious to new applicants. This includes help writing impact statements, checking that all criteria have been addressed in the application and providing information about our institution in support of the proposal. We liaise closely with the university's research and enterprise development unit who may have additional expertise with the funder and its requirements.

Given the level of commitment we have to provide in advance of the application, we scrutinise potential fellows carefully. There are multiple aspects to this. Some funders restrict the number of applications an institution can submit, so the candidate needs to first get over the hurdles of the internal competition. From the applicant's point of view, they should consider our criteria to be those that they would expect to be in place for a job application. The science contact, head of school and other people involved in the decision to support them need to be fully informed of their strengths. The more we know at this stage, the better. I'd encourage anyone considering a fellowship to spend as much time in their intended host institution as they can, meeting the staff and exploring potential connections and collaborations. A great way to do this in the early stages is to contribute to our seminar series. We are always looking for good speakers to come and share their interests and it can be challenging to find new people. Take the initiative and approach us – it's exactly the kind of behaviour expected from the future research leaders that fellowships are designed to develop.

There's another important reason for building the connection with your host school or department as soon as possible. Even for an excellent candidate, sometimes the fit isn't right. If we can't see potential collaborators amongst our staff or can't offer them the opportunities that they will need to flourish, we won't encourage the application. A fellowship proposal needs to be really strong in all aspects, including the host. There's no point wasting your and our time if that won't be the case.”

Liaison with the host institution is one reason that fellowship applications take so long to complete. You must also factor the possibility of initial rejection in your

timeline. Fellowship funding is very competitive, and funders have high expectations from applicants.



Rita Tojeiro

Research Fellow, University of St Andrews

Rita Tojeiro of the University of St Andrews was recently awarded a L'Oréal-UNESCO UK and Ireland Fellowships For Women in Science, and is an STFC Ernest Rutherford Fellow. Her story is one of perseverance and she emphasises the value of seeing other peoples' proposals to help you learn how to improve the writing of your own.

“ My research focuses on exploring large spectroscopic galaxy redshift surveys, which collect spectra for millions of galaxies in the near and distant universe. I use these to learn not only how galaxies themselves have evolved, but also to understand the content, geometry and expansion history of the universe. Currently, I'm particularly interested in understanding how knowing more about the evolution of galaxies can help us derive more robust information about the evolution of the universe as a whole.

I first applied for funding for my PhD because I wanted to remain in the UK after doing my first degree here, but I'm from Portugal and funding for non-UK residents was very limited at that time. I won a competitive four-year scholarship awarded by the Portuguese government, which allowed me to stay. As I approached the end of my PhD, I began to apply for fellowship funding to continue my research as an independent scientist.

It took me five years to secure a fellowship from my first application, and during most of that time I worked as a postdoctoral researcher on someone else's grant. I was lucky to have a strong and supportive mentor during these years, who ensured that I stayed motivated. He assured me that the rejections were not down to bad science, poor preparation or my quality as a scientist (all of these things go through your mind when another grant is rejected), but that they were a consequence of the extremely high levels of competition. He was confident that I would succeed and this helped me to believe in myself.

The quality of my applications improved over time as I matured as a scientist and took more and more ownership of my work. I also learned how to convey the excitement I feel about my work and my determination to understand the universe. Your proposal is more likely to be judged positively

if it is assessed by people who share your enthusiasm. This isn't just about them having the same scientific interests, but often taking a similar approach to tackling scientific problems. I see fantastic fellowship applications that seemingly completely fail to engage reviewers. In the year I was awarded the Ernest Rutherford Fellowship, I submitted two other applications for similar schemes with an identical science case. Both failed to engage the reviewers to the same extent – you can't take this personally.

My approach to grant writing has been helped by seeing good and bad examples from colleagues, and by assessing applications for PhD and postdoctoral positions. This can be very effective, as you see your own mistakes and realise the damage they do. I now take care to draw the reader through the proposal – they have to be excited by my work in the first line, so they want to read on. There's no point in having a beautifully crafted summary on page three if the reader never makes it past page one.

As an early-career researcher, I would encourage you to get hold of as many examples as possible, but also to talk to people about their experiences – and especially their failures. You need to be resilient, and it's easier if people who you view as very successful can explain that they too get rejected, and encourage you to persevere. I am chronically under-confident and often would only apply after severe – but very well-meant – pressure from my mentor. One thing is certain: each application will be a little bit stronger. Eventually you will get there.

In addition to my PhD funding, I also found smaller pots of money during the early years. Initially, I wasn't aware that as a PhD I could apply for anything, but there are prizes, travel grants and small awards aimed at early-career researchers. In Scotland, where I did my PhD, there is an annual award

for the best paper published by a PhD student, which I won; I was a runner-up in the Royal Astronomical Society's thesis competition, and the STFC has a public-engagement award scheme on which early-career researchers can act as the principal investigator.

Public engagement is more than a route to funding. I have found it has had a real impact on my confidence and gave me critical skills for the fellowship interview. The panel will not be experts in your field, so being able to express your research in general terms will help them to understand and judge your work positively. There is also little to fear from the questions asked by a panel of five scientists if you are used to facing dozens of 10-year-olds.

I was awarded the STFC Ernest Rutherford Fellowship while pregnant and was able to delay the start until I had finished my maternity leave. Although it has helped me establish myself as an independent researcher, I reached a stage where I really needed to have a more generous travel budget so I applied for the L'Oréal-UNESCO UK and Ireland Fellowships For Women in Science. This award was designed to provide practical help to undertake research, with the freedom to spend the fellowship on buying scientific equipment, paying for childcare costs, travel costs, or anything needed by the fellow.

I can understand why the prospect of applying for funding when so few applications are successful is daunting for early-career researchers, but my message is that you must keep trying. My research is driven by my curiosity alone, so I'm evidence that there is funding available for pure research. My path to success has been to start small; to have really strong mentors; to develop my confidence and resilience, and let my excitement for my work shine through.



Review and panels

After submission to the funding body, your proposal is sent to experienced researchers for review. (These experts are known as reviewers or referees and often academics will use these terms interchangeably as they have been used in this guide. Both terms refer to the same role – someone who is deemed by the funder to have the expertise to judge your proposal.) Their experience will in part be based on mistakes that they have made in their own research career – mistakes that they may spot in your proposal. Be very conscious of making the connections between the ambitions you have for your research and the plans that you are presenting. Whatever is included in your proposal keep asking yourself “how will I achieve this?” and “where in the proposal am I going to explain how I will achieve it?”.

Professor Helen Gleeson is the Cavendish Professor of Physics at the University of Leeds. She is an experienced reviewer and panel member, and explains that the communication of ideas is key, particularly to help the reviewer address their criteria:

Funded proposals tend to have clearly articulated visions and address important questions. If the vision behind a proposal isn't clear on the first page, then it is at risk. Communication is vital – a proposal written to help the referees to answer their questions positively is also likely to find favour.

You must write your proposal with your reviewer in mind and construct your arguments in a way that allows them to easily complete their report. Don't be afraid to use the headings from the reviewer report to help them navigate the text. Encourage internal reviewers to provide feedback using the same headings as the external reviewer, making sure they have a copy of this form if available.

A proposal written to help the referees to answer their questions positively is also likely to find favour.

Choose pre-submission reviewers who you would describe as critical friends. You don't want gentle reassurance as you approach submission – you need robust but constructive comments to improve the writing and structure of your idea. As mentioned before, you also need to prepare yourself for the point at which you will receive the reviewer's reports and need to respond to them. The harsher the review before submission, the more resilient and prepared you will be for the real thing.

In ideal circumstances, once your proposal has reached the point where you and your colleagues feel you cannot improve it further, you are ready to submit. The reality is that the deadline usually dictates the submission, rather than the applicants feeling that there is no room for improvement.

After submission, provided you meet the eligibility criteria for the scheme and the proposal passes a quality threshold, it will be sent for review by experts in your field. As the proposal author you are uniquely positioned to decide who might be the best person to review your ideas, and you will usually be invited to suggest two or three people for this purpose. Alongside your suggested names, the funder will usually select one or more other referees drawn from their networks comprising of experts who are well placed to evaluate your research. Sometimes a funder will give you the opportunity to list any referees that you do not want to view your proposal, and/or the opportunity to suggest referees you feel suitable to review your application. Your motivations for submitting names to this exclusion list must always be about protecting novel research approaches from competing groups and not about protecting weak ideas from critics.

As you will be personally invested in your proposal, it may be tempting to suggest reviewers who you know will look kindly on you. Unfortunately, this is often obvious to the funder, particularly if there is evidence of a previous connection. Ultimately, it will undermine your proposal as it suggests that you are not confident about subjecting it to a more open evaluation. Having said that, you don't want to suggest anyone who fundamentally disagrees with your approach.

It might help to think about the actual purpose of the referee, which is to provide an appraisal of the research and of the applicant. You need to choose somebody who can comment on the value of your proposed research in your field. The reviewer needs to have a deep understanding of the context in which you are working. Ideally, you want your reviewer to be somebody who has expressed an interest in your work and perhaps engaged with you at conferences. However, you should be aware that someone who has been

friendly and positive about your work when face to face won't necessarily be the same under the veil of anonymity.

Your reviewer should also be familiar with the funder and know how their systems work. Many funders have a network of reviewers that they draw upon regularly to help address this. A growing proportion of funding is aimed at addressing societal challenges and these proposals are likely to be interdisciplinary. Traditionally, these can struggle during review, but there is now an increasing pool of people with personal experience of working between disciplines. You will serve your interdisciplinary proposal well if you recommend a reviewer who understands the challenges of this type of research and will review it with a broader perspective.

Some weeks after submission you will be sent the reviewers' reports and asked to respond. Don't underestimate how great a challenge this can be. Even the most experienced applicants feel anger, frustration and despair when unfavourable reviewer reports appear. It is part of academic life to grow a slightly thicker skin during each proposal and important to remind yourself that the comments are not personal. The first reading of the reports is probably not going to leave you with a reliable basis for responding. Allow yourself the emotional, irrational reaction and get it out of your system.

A good approach is to write a list of all the points that need to be addressed. As you do this, you may see some themes developing across the different reviewers. Some questions that might help you:

- Did the reviewer fail to grasp the importance of the project?
- Did the reviewer fail to grasp exactly what you propose to do?
- Did the reviewer fail to grasp how your research will answer the question you posed?

This will help you to cluster criticisms around headings such as design, track record, resources, methods, dissemination, clarity of evidence, amount of evidence and impact to produce a coherent framework for your response. It might be useful to see how a more experienced researcher has reacted to reviewers in the past and you should definitely have your response reviewed before it goes to the programme manager. An experienced academic can help you find the right language to deal with inconsistencies between reviewers, tackling comments that are based on "gut reaction" rather than fact and factual inaccuracies without being deleterious about the reviewers. Remember that the panel will probably feel more affinity with the reviewer than the applicant, so treat them with respect.

It might be useful to see how a more experienced researcher has reacted to reviewers in the past.

The final stage of the proposal's path to funding is the panel discussion. The panel is a group of senior researchers (and sometimes beneficiaries of research) who will meet to decide a ranking order of all the proposals they have considered. The EPSRC describes their panel meetings in detail on their website. Even if you are applying to other funders, it is worth reading this as the process will be similar for other panels.

The main features of a panel discussion are:

- Each member of the panel will be allocated a number of proposals a few weeks in advance of the meeting. They will focus on the reviewer reports and the principal investigator's response, and give the proposal a score and write a short report. At the meeting they will "introduce" each of their allocated proposals to the wider panel
- Each proposal will have been allocated to a small number of the panel members, so a discussion can take place during the meeting. Other panel members will join in the discussion
- The meeting starts with an introduction from the programme manager to summarise the process and address any issues that have arisen
- The proposals are discussed in turn – for some panels this is based on the pre-panel scores produced by the "introducers"
- The panel agrees a score in order to create a rank order
- Panels usually discuss a large number of proposals and can only give a few minutes to each one. Some will require more discussion, others will be dealt with very quickly
- The ranking order is passed to the programme manager who identifies where the cut-off point is for funding and then informs the principal investigators.

A great way to get a feel for how the process works is to take part in a mock panel, should your university department organise one. The School of Physics and Astronomy at The University of Edinburgh run an annual event for their postdocs where they look at a selection of real proposals and reviewer comments under the guidance of a senior professor with panel experience. The event was instigated by Professor Cait MacPhee to help postdocs start thinking about research funding early and is now run by the research staff society, supported by academics around the school who provide the proposals and reviewer reports.

Fellowships are awarded in a slightly different way. In addition to the panel discussions, there is an interview and presentation for the shortlisted candidates. While this gives you a chance to interact with the panel and address any misconceptions, the process is usually very demanding. Once the panel has made its decision, the principal investigator receives the result and feedback from the panel. If the grant has been awarded, they can begin to recruit onto the project and make plans. However, the majority of applicants aren't successful, for some schemes more than 90% are unsuccessful.

Preparing for a fellowship interview

If you are invited for a research fellowship interview, your host university should help by arranging a mock interview with senior staff. This is a rigorous and challenging way to test your preparedness for the big day. Speak to your school or department, or the host institution, to ask whether a mock interview can be arranged. If not, you can use the questions here to arrange your own mock interview with supportive colleagues.

No mock questions can really prepare you for the scrutiny and pressure of the day, but these questions should help

Mock interviews are a rigorous and challenging way to test your preparedness for the big day.

you to prepare your thinking in advance. As you can see, the questions are structured into three themes – the person, the project and the place. These “three Ps” are the basis of all fellowship programmes.

Person

- Why do you deserve this fellowship?
- What impact have you had in your professional community?
- If successful, what would the fellowship enable you to do? (this is a chance to talk about your career objectives)
- Whose work has influenced your research interests?
- Where do you hope to be in 10 years time?
- Tell me about your approach to managing research projects.

Project

- What is the importance of this project?
- Why does your approach to this problem deserve this award?
- Convince me that your project is feasible
- If you could only do one experiment or study, which is key?
- What will you do if your hypothesis is proved wrong?
- What would the ideal outcome of this project be?
- Who are your main competitors? Can you compete with them?

Place

- Why have you chosen that department for your fellowship?
- How will you complement the existing departmental strengths?
- What value will you add to the department and institution?
- If you are staying in the same place:
 - Why are you staying in department X to do this project?
 - How will you ensure your independence?

The presentation will be fairly short – each funder has their own schedule for these selection days so they will give you clear instructions. Around 20–30 minutes is a fairly typical length, but the panel may interrupt with questions, so you need to be able to present the material in a flexible way. As with all aspects of funding, practice and feedback are critical. You need to encourage your local peer reviewers to challenge you in a range of ways, including in very robust and critical ways! If you can learn how to manage your reaction and response to a hostile audience whilst on “safe

ground” you will feel more confident on the day. Although you should seek advice from experienced candidates, remember that they will tend to remember the more negative moments from their day. Panels are increasingly aware that they need an environment on the day that creates a level playing field for all applicants, which should reduce some of the more combative approaches from panel members. Having said that, being able to handle criticism and challenges without becoming defensive or confused is an important trait for future leaders and it could be argued that a challenging interview is a valid selection tool.

Only fellowship schemes use an interview and presentation as part of the proposal ranking process, reflecting the fact that these are career development awards and the benefit of the award to the applicant is the most important aspect being considered. Although challenging at the time, going through a fellowship interview will give you invaluable practice for future job applications as academic interviews will typically cover much of the same ground.

What if my application is unsuccessful?

The levels of competition for funding and the number of high-quality applications mean that a high proportion of

excellent research projects fail to secure funding each year. The success rates for some schemes, particularly prestigious fellowships, are in single figures – so it’s important to plan for rejection even if you’ve done everything possible to avoid it.

The better news is that the process of putting a grant through an application process will improve it. The feedback that you get should be the basis of the plan to strengthen the proposal and many schemes aimed at early-career researchers expect and encourage improved re-submissions. Don’t expect to get a fellowship award on your first attempt, but do be aware throughout the process of where the weaknesses are and how you could address them with another year of experience.

Even as the proposal is being submitted, you should be developing an action plan to improve it for the next deadline. Go back to the advice earlier in the guide and think about how you can strengthen your CV, your idea and the presentation of the proposal.

Even in the face of disappointment, you must be enthusiastic and clear on why your research needs to be done. Enjoy it, and good luck navigating the funding landscape.

Useful links

See www.shintonconsulting.com/physics for all these links and many others referred to throughout the guide

Key funding bodies

In the UK:

- EPSRC www.epsrc.ac.uk/funding/howtoapply/basics/eligibility/
- STFC www.stfc.ac.uk/funding/research-grants/

In Ireland:

- www.sfi.ie/funding/funding-calls/programmes-for-early-and-mid-career-researchers.html
- www.sfi.ie/funding/sfi-women-in-science.html
- <http://research.ie/funding/postdoctoral-funding>

Fellowships and funding for independent research

- Ernest Rutherford Fellowship (STFC) www.stfc.ac.uk/funding/fellowships/ernest-rutherford-fellowship/
- EPSRC Areas in which fellowships are available www.epsrc.ac.uk/skills/fellows/areas/
- EPSRC list of other fellowships (including post-career break/flexible working awards) www.epsrc.ac.uk/skills/fellows/areas/other/
- SFI programmes for ECRs (Ireland) www.sfi.ie/funding/funding-calls/programmes-for-early-and-mid-career-researchers.html
- Royal Commission 1851 Fellowship www.royalcommission1851.org/awards/?award=research
- Overview of Marie Skłodowska-Curie Actions (funding for early-career researchers with mobility) http://ec.europa.eu/research/mariecurieactions/about-msca/actions/index_en.htm
- ERC (European Research Council) Starting Grants <http://erc.europa.eu/starting-grants>
- Leverhulme Trust www.leverhulme.ac.uk/funding/
- Royal Society University Fellowship <https://royalsociety.org/grants/>

Funding to help academic-commercial collaborations

- RAEng – grants to build links between academia and industry www.raeng.org.uk/grants-and-prizes/schemes-for-people-in-industry
- Royal Society Industry Fellowship (funded by the Royal Society, EPSRC, BBSRC, NERC and Rolls-Royce plc)

<https://royalsociety.org/grants/schemes/industry-fellowship/>

- SFI Industrial Fellowship Programme www.sfi.ie/funding/funding-calls/open-calls/sfi-industry-fellowship-programme-2015.html
- STFC Working with Industry funding www.stfc.ac.uk/funding/working-with-industry/research-in-industry-funding/
- STFC/RSE Enterprise Fellowship www.stfc.ac.uk/funding/fellowships/rse-stfc-enterprise-fellowships/
- Royal Academy of Engineering Enterprise Fellowship www.raeng.org.uk/grants-and-prizes/support-for-entrepreneurs/enterprise-fellowships

Reviewing grants

- EPSRC advice on reviewing proposals www.epsrc.ac.uk/funding/assessmentprocess/review/
- Andrew Derrington's blog on the difference between reviewers and committees www.parkerderrington.com/committees-and-referees/
- Research Funding Toolkit – questions for five minute feedback www.researchfundingtoolkit.org/five-minute-feedback/
- Advice on choosing a referee from the Leverhulme Trust www.leverhulme.ac.uk/funding/advice-choosing-referee
- Advice for fellowship interviews <http://shintonconsulting.com/fellowships>

Smaller awards

- EPS – European Physics Society with links to events and funding opportunities www.epsnews.eu/
- STFC Public Engagement funding www.stfc.ac.uk/funding/public-engagement-funding/
- IOP Public Engagement grant www.iop.org/about/grants/outreach/page_38843.html
- Space for All (public engagement) www.gov.uk/apply-for-funding-academic-community-and-educational#space-for-all-community-funding-scheme
- STFC – POST Fellowships www.stfc.ac.uk/funding/fellowships/stfc-post-fellowships/

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