**EPSRC Impact Acceleration Account – 2020-21 Application Form**

**ECR Kickstarter, Exploratory & Knowledge Transfer Secondment**

*Please read the separate Guidance Notes for the University of Bristol’s EPSRC Impact Acceleration Account at* <http://www.bristol.ac.uk/red/industry/impact-acceleration/>

*This Application Form should be completed in no more than 5 sides**(you may remove all notes).*

*When you submit this application form, please attach the following as relevant:*

* *Letter of support submitted with application from any partner organisation(s), detailing their reasons for engagement and their financial or in-kind support*
* *FEC costing number*
* *Head of School Approval, if partner involved, the partner organisation(s) Approval*
* ***Optional Workplan*** *of no more than 2 sides for additional technical information, project plan or diagrams*
* *Summary CV of up to 1 page for Knowledge Transfer Secondees (internal and/or external)*

*Please send your completed application form together with the requested attachments, to Lucy Beck (x84079) in RED at* [*lucy.beck@bristol.ac.uk*](mailto:lucy.stephens@bristol.ac.uk)

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| **1. Project Title (will appear online)** | | | |
| **Integrating ligand descriptors in a catalyst optimisation workflow** | | | |
| **2. Project Summary (will appear online) – 50 words max** | | | |
| **This project will support and enhance high-throughput screening workflows for catalyst optimisation at Pfizer. Calculated steric and electronic parameters will be adapted for Pfizer’s workflows. The data will be used to plan screening and will then be analysed, with a view to deriving transferable models suitable for catalyst selection.** | | | |
| **3. Start Date** | **17/08/2020** | **Finish Date** | **28/02/2021** |



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| **4. Type of Project** | | |
| Early Career Researcher Kickstarter | Exploratory | Knowledge Transfer Secondment  *If you are applying for a KTS, we encourage you to consider both inward and two-way secondments* |

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| **5. University Applicant(s)** | | | |
| Name | Dr Natalie Fey | Dr Ella Gale |  |
| Department/School | Chemistry | Chemistry |  |
| Telephone | 0117 95 46991 (currently 07946 603702) |  |  |
| Email | [Natalie.Fey@Bristol.ac.uk](mailto:Natalie.Fey@Bristol.ac.uk) | [Ella.Gale@Bristol.ac.uk](mailto:Ella.Gale@Bristol.ac.uk) |  |
| Role in Project e.g. PI, Co-I, PhD student, Secondee | PI | Secondee (Researcher Co-I) |  |
| Do you have an equity stake or other interest in the partner organisation(s)? Yes No  *If Yes, please provide details in a separate attachment* | | | |

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| **6. Non-University Partner (e.g. From business, industry, charity, public sector)**  *(repeat if more than one partner)* | | | |
| Name and department | Mr Steve Fussell, Senior Principal Scientist  Chemical Research & Development  Mr Andrew Derrick, Associate Research Fellow | Pfizer [Revenue](https://www.google.co.uk/search?q=pfizer+revenue&stick=H4sIAAAAAAAAAOPgE-LQz9U3SC9LKtdSySi30k_Oz8lJTS7JzM_Tzy9KT8zLrEoEcYqtilLLUvNKUxex8hWkZValFilABQC73FTwQwAAAA&sa=X&ved=2ahUKEwiy2ayp4pTqAhUIC-wKHeFZCi0Q6BMoADA4egQICxAC): 51.75 billion USD (2019)  [Number of employees](https://www.google.co.uk/search?q=pfizer+number+of+employees&sa=X&ved=2ahUKEwiy2ayp4pTqAhUIC-wKHeFZCi0Q6BMoADA5egQIBxAC): ~88,300 (2019) |  |
| Organisation | Pfizer | Telephone | 01304 646782 |
| Address or website | <https://www.pfizer.com/science/research-development/centers/uk_sandwich> | Email | [Steven.Fussell@pfizer.com](mailto:Steven.Fussell@pfizer.com), [Andrew.Derrick@pfizer.com](mailto:Andrew.Derrick@pfizer.com) |
| Role in project (e.g. secondee, collaborator) | Collaborator |  |  |
| **7. Have you held EPSRC IAA funds in the past?** | | | |
| No Yes | | | |
| *If yes, please outline the progress of that project, current activity and how impact is (or will be) realised.* | | | |

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| **8. Does the project fall within one of the Industrial Strategy Challenge Fund themes?** |
| No Yes |
| *If yes, please state the theme.*  Leading-edge healthcare – medicines manufacturing CR&D funding |

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| **9. Project details** |
| 1. *Describe the activities to be undertaken, including objectives, timescales, milestones and outputs.* 2. *What is the problem to be addressed at this stage and what do you expect to have achieved by the end of the award?* 3. *Outline the risks and contingencies* 4. *Describe how the work will be continued after the IAA funding; how will the impact be realised? What are the plans for after the end of the project?* 5. *If relevant, describe how you envisage the innovation will be commercialised e.g. through licensing to a third party, formation of a new company, a joint venture, sales from the University etc.*   *You may expand on this section in an Optional Workplan of up to 2 sides if required, with additional material, images or diagrams.*  b) Project Challenge: There is no single robust approach to developing a synthetic route for active pharmaceutical ingredients (APIs) or candidate molecules, and the selection and optimisation of each reaction step currently relies on extensive trials guided by the skills and experience of the researchers and process developers. In a field with multiple options, homogeneous organometallic catalysis holds great promise as it can deliver both exquisite selectivity when there are multiple sites for reaction in a molecular structure, as is common for APIs, and efficient chemical synthesis ([*React. Chem. Eng.*, 2019, **4**, 1530-1535](https://pubs.rsc.org/en/content/articlelanding/2019/re/c9re00067d#!divAbstract)), reducing cost and waste as well as increasing output. However, it remains a challenge to find the “right” catalyst for individual transformations in complex molecular structures and then to optimise reaction conditions to achieve the best yield and selectivity at an economically-viable cost for reagents, using reaction conditions that can be achieved in existing plants. Such considerations hamper the adoption of routes developed in academic settings for large-scale industrial processes, even though gains could be substantial.  In industrial settings, process development and optimisation is increasingly achieved by high-throughput experimentation (HTE, [*Org. Process Res. Dev.*, 2019, **23**, 1213-1242](https://pubs.acs.org/doi/abs/10.1021/acs.oprd.9b00140)) supported with Design of Experiment (DoE) methodologies, generating experimental datasets at considerable cost to optimise each process. These datasets are rarely utilised beyond addressing the immediate problem. Here, data curation holds considerable promise and Pfizer are keen to “leap into digital space” by integrating data-led design, data curation and predictive modelling into their current experimental screening and optimisation workflow.  One of the key variables in catalyst optimisation is the effect of ligands on the properties of organometallic catalysts and this is an area where the School of Chemistry in Bristol has significant expertise. Since 2002, a consortium of authors have contributed to the development of so-called ligand knowledge bases (LKBs, see section 10), which are databases of calculated stereoelectronic parameters capturing the effect of the ligand on the properties of transition metal complexes. By combining local expertise with HTE data and capability in the Chemical Research and Development team at Pfizer, we will use this KTS project to build a new collaboration, introducing ligand descriptors and predictive modelling to industrial workflows for catalyst optimisation.  a) The objectives of this project are:   1. Share LKB data with Pfizer and optimise the relevant databases for inclusion in Pfizer workflows. 2. Identify and develop links between existing HTE workflows and calculated catalyst descriptors, maximising the utility of experimental data across catalysis space. 3. Establish predictive models to inform screening and catalyst optimisation for model compounds. 4. Propose a revised workflow that fully integrates data and models into Pfizer’s catalyst optimisation efforts and demonstrate this to the wider community both within Pfizer and beyond, thus facilitating the industrial “leap into digital space”.   We plan to achieve these objectives through a targeted short-term secondments of a data science specialist (Dr Ella Gale, EG, machine learning subject specialist in the Technology-Enhanced Chemical Synthesis (TECS) CDT), which will occur alongside her other projects. The lead collaborator at Pfizer will be Steve Fussell (SF), along with Andrew Derrick (AD), the local lead for computational work in Chemical Research and Development.    **Figure 1**: Sketch of workplan, see full workplan document for details.  O1 will require EG to become familiar with the LKB databases and then work with collaborators at Pfizer to add standard nomenclature, Chemical Abstract Service (CAS) registry numbers, as well as data on commercial availability. **Milestone 1**: *LKBs fully accessible and documented* to SF team, reached in project month (PM) 1.)  To reach O2, SF team will execute reaction screening on model substrates (initially metal-catalysed coupling reactions (a and b) and then a chemoselective transformation (c)) with close involvement of EG, supported by the PI. **Milestone 2**: *Application of calculated data in Pfizer HTE workflows*, reached in PMs 2 and 3 for target coupling reactions, PM 4 for chemoselective reaction.)  Screening data generated will then be analysed further by EG to reach O3, exploring standard multivariate linear regression as well as more advanced machine learning approaches where data are suitable. These models will be used to inform further screening and optimisation, testing predictions for low, medium and high conversion and so creating a feedback mechanism to assess model performance. (**Milestone 3**: *Predictive models*, reached in PM2-4 for reactions a-c. Depending on outcomes, a further cycle of screening and validation for another cross-coupling reaction d may be considered in PM5.  We envisage that 6-8 screening runs will be feasible in the funded period, 3 “training” screens on the proposed initial transformations and an additional 3 to validate the regression models, with a further set of training and validation screens if these are successful. The Bristol costings are based on 6 screens and a 2 day contingency, while Pfizer costs are based on 25 days and a 3 day contingency.  Objective 4 will involve reporting to Pfizer internally, providing 3 interim reports, as well as preparing internal and external funding applications, conference presentations and a manuscript for publication. **Milestone 4**: *New workflow described, manuscript submitted for publication*, reached in PM 6.)  c) Risks: The current Covid-19 pandemic and ongoing lockdown has led us to reassess our plans for multiple site visits and plan for online interactions instead. While both UoB and Pfizer are set up well to allow continued research work in both labs and off-site, and have demonstrated this since the lockdown began, project management will be more challenging and might be affected by staff illness and more stringent restrictions on team sizes, affecting the set-up of HTE. Computational work/UoB can be carried out off-site. Pfizer has implemented stringent working practices within both lab and office area’s obeying social distancing (2m rule) and regular sanitisation of office and lab area’s. Only laboratory-based occupants have returned to site. The HTS laboratory is equipped with state of the art automated technologies which can be operated from remote locations. We are planning for a long project time-scale with short, focussed interactions to accommodate this, ensuring continuity through the close involvement of PI and SF. We would need to postpone academic publication and presentations on this work, but with the approach in hand, we could explore using Bristol’s automated synthesis platform to generate appropriate data if Pfizer are unable to screen reactions in the medium term, e.g. in collaboration with the TECS CDT. While the target cross-coupling reactions are well-established, they may not work reliably across all of ligand space, preventing the development of global models. In this case, local models would still be beneficial to Pfizeras well as highlighting where the project could be enhanced by working on more challenging cases, validating our models and approaches more fully.  d) Future plans: We plan to use this initial proof-of-concept to develop a longer-term, sustainable collaboration, expanding the databases to additional ligand classes, adding commercially available ligands to the existing data and exploring how current gaps in the known chemical space might be filled. In addition, the interaction of ligands and substrates in the metal coordination sphere is known to affect catalyst properties and an approach capturing these, built on a synergy of experimental and calculated data, would be a substantial target of considerable benefit.  Depending on the work needed to build our approach and the TRL assessment at Milestone 3, we will identify the most appropriate timescale and funding stream for such developments. SF has already indicated that an internal funding request at Pfizer may suit, but we will also consider EPSRC standard mode, UK Catalysis Hub, Innovate UK and iCASE and CDT projects or a future consultancy agreement.  e) Potential commercialisation: The LKB approach is in the public domain and our collaborators at Pfizer are keen to engage with their industrial peers and the wider community of users of catalysis about this workflow. Databases may be expanded in future interactions to reflect Pfizer’s needs and interests in this field, which may affect publication, but for this initial proof-of-concept, we do not envisage commercialisation. |

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| **10. Background - underpinning research and expertise / current state of the art** |
| **EPSRC GRANT NUMBER/S underpinning this IAA proposal:** EP/E059376/1 |
| *Describe*   1. *Existing research and expertise that will feed into this project; include individuals, publications, outputs, grants or awards. Nb. there is a requirement for a strong connection to EPSRC research or studentships* 2. *How do the planned activities and outputs compare with existing practice, state-of-the-art, alternative or competing approaches to the problem?* 3. *Please summarise Pathway to Impact (PtI) plan/s on relevant grants to show plans and activities to date.*   a) The Ligand Knowledge Base (LKB) approach has been developed in Bristol by a consortium of authors (Orpen, Harvey, Fey, Lloyd-Jones), initially funded by an EPSRC e-Science project (2002-2003), and then supported by generous funding from AstraZeneca, as well as the PIs Advanced Research Fellowship (EP/E059376/1, Development of Organometallic Catalysts with a Knowledge-Based Computational Approach, 2007-2012). Data for more than 1000 systems have been published, with further held in-house.  The PI is an experienced computational chemistry who has applied a broad range of statistical approaches to the interpretation and prediction of data in chemistry, often in collaboration with synthetic chemists in both academia and industry, as well as statisticians and data specialists to access new developments in modelling. These interactions have been funded by EPSRC (EP/E059376/1, EP/L016443/1 (Derek Durand, Catalysis CDT)), industry, the Welsh Government, and Bristol’s Jean Golding Institute and have led to a number of publications (full publication list at: <https://feygroupchem.wordpress.com/publications-papers/>). She has worked on the LKB project since starting in Bristol in 2003 as a PDRA and is thus well-placed to capitalise on the opportunities offered by the present project, and to lead future projects in this domain.  Current projects in the Fey group continue to build on such knowledge bases, most recently focussing on using calculated mechanistic data to predict catalysts reactivity and integrating this with experimental data (Catalysis CDT PhD project, Derek Durand, 2018-2021, EP/L016443/1).  EG [Ella, please add]  b) The databases continue to be applied and expanded in new directions by the PI (e.g. [Angew. Chem. Int. Ed. 2012, **51**, 118-122](http://dx.doi.org/10.1002/anie.201105954), [Organometallics, 2014, **33**, 1751-1791](http://dx.doi.org/10.1021/om500114u), *Chem. Commun.*, 2019, **55**, 7021-7024, [*Dalton Trans*. 2020, ASAP](http://pubs.rsc.org/en/content/articlepdf/2020/DT/D0DT01694B?page=search)) and they have been used by other authors as well, e.g. the Sigman group ([*J. Am. Chem. Soc.* 2017, 139, 31, 10613–10616](https://pubs-acs-org.bris.idm.oclc.org/doi/10.1021/jacs.7b05409)). The PI has also recently published a review of work in this field, which has attracted renewed interest in databases of stereoelectronic parameters, including our own contributions in this area ([Chem. Rev. 2019, **119**, 6561-6594](http://dx.doi.org/10.1021/acs.chemrev.8b00588)); this has already attracted 34 citations and led to the initiation of the present collaboration, in recognition of the tremendous potential of data-led prediction in homogeneous catalysis.  More broadly, our key aim in the development of ligand knowledge bases and the expansion done since has been to make them accessible to synthetic chemists and so we have had to strike a balance between the sophistication of statistical models used and the engagement of our community. This latter aspect has become easier since the recent surge in interest in machine learning/big data/artificial engagement, but it remains key to the long-term viability of data-led approaches in chemistry. Some recently published work from a collaboration between the Doyle group and researchers at Merck ([*Science* 2018, **360**, 186−190](https://science.sciencemag.org/content/360/6385/186)) has served as a cautionary tale here (<https://www.chemistryworld.com/news/dispute-over-reaction-prediction-puts-machine-learningspitfalls-in-spotlight/3009912.article>, <https://blogs.sciencemag.org/pipeline/archives/2018/11/20/machine-learning-be-careful-what-you-ask-for>),  where data scientists criticised published work strongly, while other recent approaches have focussed on demonstrating the potential of data analysis while perhaps sacrificing chemical understanding to build large datasets ([*Chem. Sci.,* 2020, **11**, 4584-4601](https://pubs.rsc.org/en/content/articlelanding/2020/sc/d0sc00445f#!divAbstract), [*Chem. Sci.*, 2018, **9**, 7069-7077](https://pubs.rsc.org/en/content/articlelanding/2018/sc/c8sc01949e#!divAbstract)). With LKBs and our local expertise in hand, we are well-placed to continue to influence this field and indeed to lead in terms of engaging with the wider community of synthetic practitioners.  c) The PIs ARF project finished in 2012 and there are no further funds available. The PI has engaged with industrial collaborators (AZ were a project partner) and the academic community through multiple publications. The work needed here will enable Pfizer’s adoption of our approach and so accelerate impact. There needs to be collaborative work to enable this to happen, integrating the academic know-how with the industrial practicalities. |

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| **11. Outcomes and benefits** |
| *Describe the expected outputs and the benefits and potential impacts for*   1. *The partner(s)* 2. *The University and staff* 3. *Any other beneficiaries or users (e.g. businesses, manufacturers, policy makers, practitioners, commercial users, direct beneficiaries)*   a) Transition metal catalysed cross-coupling reactions are amongst the most effective strategies in organic  synthesis. Despite their importance and popularity, a systematic approach to identifying the best reagents for a given transformation (metal, ligand, base and solvent) has yet to be realised. The current experimental program requires 1000’s of reactions to be explored, taking considerable time and resources, often still relying on chemical intuition. The implementation of predictive models would significantly reduce the experimental burden, accelerating the development of the chemical process whilst maximising the likelihood of identifying the best catalyst-ligand combination. This will result in considerable cost savings for Pfizer.  Palladium-catalysed reactions deployed late in a synthetic sequence often result in high levels of metal entrained in the final API, conflicting with key ICH guidelines, so further purification is required. Identifying the optimal ligand in a palladium catalysed reaction can often result in a reduction in the amount of metal required, significantly reducing the overall cost, whilst also removing the need for additional costly/time-consuming purification operations prior to product isolation. Crucially, the process improvements obtained by correct ligand selection not only afford an increase in efficiency but also the environmental performance of the chemical processes.  b) This project will strengthen links with industry, in this case a large pharmaceutical company, raise the profile of Bristol-led research in the area of data-led catalyst optimisation and the development of predictive models useful to practitioners in chemical synthesis. The project will also help to build EG’s career, allowing her to develop a fellowship application and to progress towards independence. The project will give the PI and EG insights into industrial processes and access to data generated in an industrial setting, interacting fruitfully with other projects in both the PI’s group and the TECS CDT. Finally, this work will lay the foundation for further collaborative projects with Pfizer, for which funding will be sought (see section 9d).  c) The Chemical Research & Development team in the UK is primarily focused on the development of commercial synthetic routes for late stage development projects in key therapeutic areas; Oncology, inflammation & immunology, rare disease, vaccines and anti-infectives, with a strong commitment to global health. Ultimately, process savings translate into improved access of patients to modern medicines, leading to improvements in health and quality of life.  Our collaborators at Pfizer are also keen to describe the outcomes of this project at suitable industry conferences and discussions (Scientific update – Organic Process Research & Development, SCI – Automated Intelligent Chemistry, Smart Labs & Lab Informatics Congress, Unchained Labs Virtual Automation Workshop, Mettler Toledo User group meeting) and to publish key outcomes from this work, allowing all involved to contribute to sector-leading advances in this field and engage with beneficiaries in both industry and academia to promote a data-led approach in the field. . |

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| **12. Status of intellectual property** |
| *Outline:*   1. *Any intellectual property that already exists or would be developed e.g. patent applications, design rights, copyright, materials, software, know-how etc.* 2. *What is already in the public domain and how it was funded (and hence may be owned by other parties or available under restricted terms)* 3. *What is not yet protected and needs to be protected.* 4. *If a patent search has been undertaken or is needed, and any IP advice you have received from RED Research Commercialisation or your partners.*   *---------*  *NB You should discuss expectations on IP use and ownership with company partners at this stage. The University must ensure that the intellectual assets obtained in the course of the research are used to the benefit of society and the economy. Intellectual property created by University employees during IAA projects will be owned by the University in line with the University’s terms of employment. To comply with State Aid rules and to develop fair collaborations we cannot agree to licence or assign IP to company partners without a firm, project-related justification and significant partner contributions to the project in cash or in kind. A formal collaboration agreement will be required and collaboration arrangements must not prevent the future progression of research and the dissemination of research results in accordance with academic custom and practice.*  a/b) The project builds on the LKB approach and databases, published in the following papers and connected electronic supporting information:  [Chem. Eur. J. 2006, **12**, 291-302](http://dx.doi.org/10.1002/chem.200500891); [J. Chem. Inf. Model. 2006, **46**, 2591-2600](http://dx.doi.org/10.1021/ci600212t); [Organometallics, 2008, **27**, 1372-1383](http://dx.doi.org/10.1021/om700840h); [Dalton Trans., 2009, 8183-8196](http://dx.doi.org/10.1039/b909229c); [Organometallics, 2010, **29**, 6245-6258](http://dx.doi.org/10.1021/om100648v); [Angew. Chem. Int. Ed. 2012, **51**, 118-122](http://dx.doi.org/10.1002/anie.201105954); [Organometallics, 2012, **31**, 5302-5306](http://dx.doi.org/10.1021/om300312t); Dalton Trans., 2013, **42**, 172-181; [Phosphorus, Sulfur, and Silicon and the Related Elements, 2015, **190**, 706-714](http://dx.doi.org/10.1080/10426507.2014.983599); Organometallics 2018, **37**, 1062–1073; Chem. Rev. 2019, **119**, 6561-6594; [Dalton Trans. 2020, DOI: 10.1039/D0DT01694B](http://dx.doi.org/10.1039/D0DT01694B).  The work has been funded through a variety of mechanisms as set out in section 10. All work in this project will be based on published data only and we do not anticipate conflicts with previous funders/collaborators.  c/d) We have sought advice from Katie Cooper and Ros Darby about IP. Background IP is covered above. For foreground IP, the planned outputs from this work are screening data and models – Pfizer conduct the screening, so will keep control of screening data itself, including using it in models developed by their in-house team of statisticans/data scientists. The university’s preferred model, in line with the nature of this funding scheme, is that any results produced in this project by EG and NF will be owned by the university. Presentation of results and publication would be beneficial to all sides and all external publications (presentations/manuscripts) with Pfizer data will have to be approved internally and can take up to 4 to 8 weeks to reach approval – this will be set out in a collaboration agreement if the project is funded.  If we report success with the model compounds investigated in this project, we will agree a CDA in order to discuss more IP sensitive substrates or the opportunity to share blinded data. This will be dealt with separately, most likely through a focussed consultancy agreement and does not form a part of the current project. Again, this will be set out clearly in a collaboration agreement. |

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| **13. Justification of resources** |
| *Please describe briefly why the project represents good value and why funds are needed. Please note any funds already available or used from in RCUK grants (e.g. Pathways to Impact), other research grants or directly from stakeholders. Could this project be funded within a standard research grant?*  We were approached by our partners at Pfizer because they consider the LKB approach and data one of the most promising routes enabling their transition into “digital chemistry”, i.e. data-led synthesis and process optimisation. HTE screening is only possible with a significant investment into the robotic platform for automation. While Bristol have recently acquired such a platform, our partners at Pfizer have very specific requirements and are seeking integration with their in-house workflow, offering a substantial in-kind contribution to this project. This has allowed us to focus the Bristol contribution on supporting the integration of our LKBs and academic know-how into Pfizer’s workflow, assessing the utility of screening data beyond the initial experiments and fitting and validating models relevant to their reality, constrained by industrial concerns and practicalities. The time required is 37 days from Bristol, with EG as the secondee for 24 days and NF contributing 13 days for LKB training, project management, funding applications and reporting/publication, and 28 days from Pfizer and represents very good value for money because of the significant expertise all partners have in this area already. We are also requesting funds for travel to meet for discussions and reporting, provided that the current restrictions are eased and it is safe to do so, as well as a small contribution to costs for software licenses. This is a proof-of-concept leading to further projects, and there are no funds outside of this scheme which can support the work as planned. |

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| **14. Project Budget** | | | |
| **Please supply the FEC ID:** | | 498833 | |
|  | | Description/detail | Costs (£) |
| Directly Incurred | Staff costs | Dr Ella Gale, 24 days | 5795.90 |
| Travel | If allowed, £1000 + VAT | 1226.08 |
| Equipment (Each item may not exceed £10k) |  | 0.00 |
| Consumables | Contribution to software costs, £500 + VAT | 613.04 |
| Other (please specify) |  | 0.00 |
| Directly Allocated | Investigators | Dr Natalie Fey, 13 days | 4500.24 |
| Indirect costs |  | 10,727.88 |
| Estates |  | 2,048.18 |
| Technicians |  | 100.38 |
|  | **Total Project Costs at 100% fEC (A)** | | **25,011.70** |
|  | **Total Direct (invoiceable) Partner Contribution(s) (B)** | | **0.00** |
|  | **Indirect, Estates and any other School Contribution\* (C)** | | **17,376.68** |
|  | **IAA Grant Requested (D = A - B - C)** | | **7,635.02** |

*\* Indirect and Estates costs are not eligible under EPSRC’s rules for the Impact Acceleration Award. They must be covered by the School or Department(s) hosting the project.*

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| **Breakdown of Direct Partner Contributions (to be invoiced by the University)** | | |
| Partner Name | Pfizer |  |
| Direct Contribution (B) |  | 0.00 |
| **Breakdown of In-kind Partner Contributions** | | |
| Staff Time | 28 days shared between SF & AD | 34,020.00 |
| Equipment/Consumables | consumables for screen. | 1,500.00 |
| Travel | If allowed, £1000 + VAT | 1226.08 |
| Other (please specify) |  |  |
| Total In-kind Contribution (£) |  | **£36,746.08** |

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| 15. Signatures | | |
| Applicant (Principal Investigator) | | |
| Name | Signature | Date |
| Head of School: I confirm that I have seen and authorise this application | | |
| Name | Signature | Date |
| Partner organisation: I confirm that I have seen and authorise this application | | |
| Name | Signature | Date |

**Submission deadlines:** **5pm Wed 6th May, Tues 30th June and then every 10-12 weeks.**  
Please send your completed application form together with the requested attachments, to Lucy Beck (x84079) in RED at lucy.beck@bristol.ac.uk