

CORPUS CHRISTI COLLEGE



CAREER DEVELOPMENT FUND REPORTS 2023

The Career Development Fund aims to provide financial support to students who would find it difficult to participate in an internship without financial support. Noting that the fund is open to internships across all disciplines, including those interested in a career in academia.

The funding benefits could be, but are not limited to, the following forms

- a grant of up to £2,000 for any current student to assist with the costs involved whilst undertaking a professional internship, research placement or professional training (anywhere in the world) which could enhance an undergraduates' CV and the chances of success either in graduate study or employment post undergraduate study.
- provide financial support whilst applying for graduate study e.g., application fee costs.
- a grant of up to £1,000 to assist with the transition to graduate study e.g., a rent deposit or initial living expenses

It is anticipated that we will fund a further group of students in 2024 and our intention is to continue to raise funds to enable us to offer this support in the years to come.

This booklet contains the reports of the 2023 recipients which we hope will inspire both donations towards continuing the fund for the years to come as well as to enable current students to find out what is possible and to encourage them to apply for support.

The recipients of the Career Development Fund 2023 were:

Jan Apolin – third year Physics student

Anna Beekmayer-Dhillon – second year Biomedical Sciences student

Imogen Haydon – third year Materials student

Sebastian Kenny – fourth year Literae Humaniores student

William McEwen-Benatar – second year Physics student

Robert Pascalau – third year Physics student

Emilia Schmid – third year Biomedical Sciences student

Jan Apolin

Introduction

My name is Jan, I am a Mathematical and Theoretical Physics Master's student at Corpus Christi Oxford, and I have received support from the Career Development Fund this summer to help me with my internship in quantum computing research at UCL. This report summarizes my experience, my usage of the grant, and describes the internship and what I gained from it.

Background

The internship programme I was selected for is part of the Undergraduate Summer Placement Programme¹ at UCL's EPSRC Centre for Doctoral Training in Delivering Quantum Technologies. Research experience intended for undergraduate physicists is few and far between and is often not listed publicly, and that has made it difficult in the past for me to get relevant experience in the field. That is why the opportunity at UCL has been so special to me - I have now experienced what it is like to conduct research in theoretical and computational quantum computing, which is exactly the field I intend to go into after my studies at Oxford.

Objectives

As for my goals coming into the internship, I wanted to get to (and learn how to) use recent scientific literature, gain knowledge in an area of active research, get to know academics in the field, and become more independent in problem-solving, including the use of programming. Because I want to work on quantum computers, all of the above are pretty much essential to my future success. Learning how to read and understand recent physics papers on platforms such as arXiv is a necessary skill for anyone looking to do research in the physical sciences, but it is not something you get to learn in an undergraduate physics degree. As for making contacts among prominent scientists, this will help me especially with this year's PhD applications through references. Lastly, programming is becoming one of the most useful and desirable skills whether it comes to research or most other career opportunities.

Grant Usage

The grant of £1500 has helped me cover the high costs of living, accommodation and travel associated with staying and working in London. The internship lasted 8 weeks, with one break week in August, when I went to visit my family in Prague. The grant covered my rent for one month plus about two weeks of other living expenses. The fund has been vital for me, because the first stipend payment from UCL came five weeks later than promised, leaving me in a very difficult situation; for about two weeks, I was living on almost nothing and it came to a point where I needed to urgently borrow money from my family (whose financial situation is not great), because I did not have money to take the tube the next day to get to UCL. Then, I received the grant, and that resolved the uncomfortable situation, which I did not plan for. Overall, the fund has been incredibly useful to me, and I am more than grateful for it.

¹ <https://www.ucl.ac.uk/quantum/study-here/cdt-delivering-quantum-technologies/undergraduate-summer-placements>

Internship Experience

As the coordinator of the Summer Programme said to me, this internship was essentially a PhD for two months, in all aspects. The purpose of my internship was to investigate the topic of “Long Range Qubit Gates” under the guidance of Professor Sougato Bose. I worked closely with one of his final year PhD students, Dylan Lewis, who studied at Oxford before starting a doctorate at UCL. I was to read up on a specific part of Dylan’s project (simulating XY interactions in ion traps) and then contribute original research and ideas. I met up with Dylan frequently and adjusted the course of my work. For the first couple of weeks, I read a lot of papers to understand the problem at hand, and I set out to program a way to manipulate relevant mathematical expressions on a computer, to obtain formulas automatically, as the number of manipulations necessary to get to an answer for prohibitive for a human. However, after five weeks of working on it, when I reached the point of getting to use my program, I found that it was simply impossible for me to scale up the program to systems large enough to be interesting at all. This was a difficult, but important experience true to the PhD-like nature of the internship: with original research, one will inevitably go the wrong way, and that can lead to great things. Following this setback, I changed my approach: instead of doing the “heavy lifting” symbolically, I would try and work out the theory on paper, finding new simplifications which would allow me to proceed. The nature of the problem forced me to change my perspective and finally, I found a general solution that I could easily implement in a numerical simulation. So, I simulated an ion trap on my computer, set up my proposed scheme, and compared the “real” simulated result to my simplified solution. I then summarized my findings to the whole of Sougato’s group in a presentation in September.

Conclusions

Overall, this internship has surpassed my expectations in multiple ways. I feel like I have gained a huge amount of knowledge and useful skills, especially when it comes to working independently, programming in Python, reading scientific literature, and finding new ways to approach problems. There have been difficulties, whether financial, scientific, or personal, but somehow, I always found a way to manage and came out the other end a little bit more prepared for the future. Moving forward, I intend to continue pursuing my passion for quantum computing and will continue to build on the foundations laid during this internship.

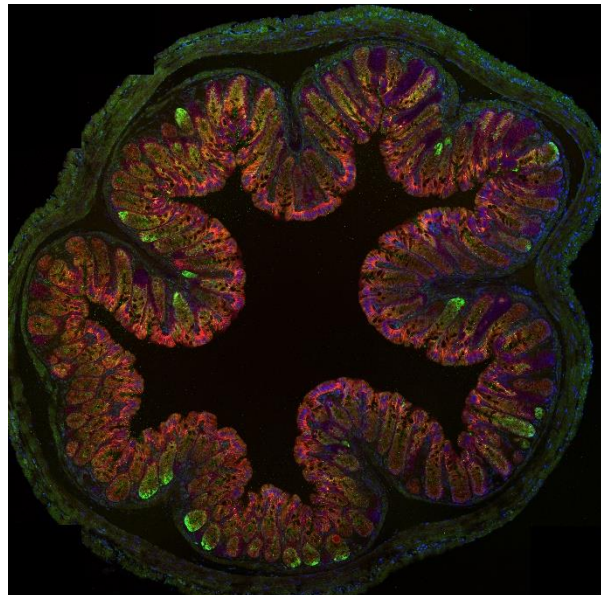
I would like to sincerely thank the Career Development Fund for believing in me, allowing me this opportunity, and investing in my growth. I look forward to sharing more successes and achievements as I progress in my journey through the fascinating world of quantum computing.

Anna Beekmayer-Dhillon

This summer, I was given the opportunity to spend seven weeks at the Chiu Lab in the Immunology Department of Harvard Medical School. I am incredibly grateful for this valuable experience that has helped me to develop my research and laboratory skills, which will benefit both my degree and career.

During my internship, I had two main research topics. The first area of study focussed on the neuro-immune axis with the gut, and the implications of stress and inflammation on the physiology of the mouse colon. We used mouse models to further investigate the neuroepithelial crosstalk, where nociceptor neurons direct goblet cells via a CGRP-RAMP1 axis to drive mucus production as well as gut barrier protection. The other area of research considered the role of vagal Trpv1+ neurons in mediating survival after influenza infection. We again utilised mouse models to understand how ablation of Trpv1+ neurons (via RTX treatment) worsens survival after Influenza A PR8 infection. During one experiment, we intranasally injected Influenza A PR8 into a Vehicle group (n=5) and an RTX treated group (n=5) and monitored changes in weight, food and water intake, movement, and survival over eight days. On the eighth day of infection, we sacrificed any surviving mice and performed a whole-body perfusion. We analysed the lung tissue samples (for both groups) using flow cytometry to separately identify myeloid and lymphoid cell populations, focussing on changes in CLEC5A+ neutrophil populations. Both projects helped me to improve my mouse handling and dissection skills, in a biosafety level 2 (BL2) laboratory environment.

After dissecting the mice, we would also process the relevant tissue samples to stain and view under the microscope. I learnt how to use cryostat to section samples, where the dissected tissue is sliced into thin (10-40 μm) sections at a very low temperature. After mounting these sections onto slides and appropriately staining them, we used a confocal microscope to view cellular structures. The image below shows a cross-section of the mouse colon; the pockets of green fluorescence show crypts, where intestinal stem cells reside at the base of each crypt.



For cell image quantification and analysis, we used Fiji Image J – allowing us to compare the normal mouse colon with the colon of a mouse that has been chronically stressed. During the experiment, we stressed this group of mice by putting them into a test tube for 6 hours a day, so they were unable to move. I also learnt a lot about breeding mice, as every week I would genotype the new pups and run PCR to determine which offspring carried the desired genes and which would be sacrificed. This opportunity helped me to learn and understand an array of laboratory techniques that will benefit me during my integrated master's. This internship also strengthened my transferrable skills; I particularly learnt the importance of precision and patience in this environment, whilst thinking creatively to problem solve. The lab also helped me to appreciate the value of teamwork and communication when regularly troubleshooting and adjusting the experiments.

Outside of the time spent in the lab, I enjoyed exploring Boston and Cambridge. I spent a lot of time at the different Harvard University libraries and around the campus. I enjoyed visiting the Isabella Stewart Gardner Museum and the Museum of Fine Art; the Boston

freedom trails were a great way of seeing the city and understanding its history. I would often go on a run to the beach and liked to swim there on weekends. I was also able to keep up my rowing and coxing with the Massachusetts Institute of Technology rowing club, where twice a week we would row for about 2 hours on the River Charles (which I found a lot bigger than the Isis River in Oxford). Rowing in the US uses quite different coxing calls compared to the UK, so when I was coxing with MIT, I had to relearn all of the terminology needed to instruct the rowers, which was a tricky but engaging task.

Some weekends, I had to come into the lab each day to weigh and monitor the mice; however, on the free weekends I tried to travel outside of Boston. I went to Cape Cod for one weekend, which was very beautiful, with an amazingly long and sandy coastline. I also went to Maine to visit a friend who lives on Cliff Island (just off Portland); I saw lots of wildlife and had fun wakeboarding and fishing. My favourite trip was to New York City with a friend, where we managed to pack a lot into one weekend – we explored Manhattan, Brooklyn, and Queens; I particularly enjoyed visiting Central Park, the Metropolitan Museum of Art, the Museum of Modern Art, and seeing sites like Times Square and the Statue of Liberty. It was interesting to visit these three places outside of Boston, which, despite not being far away in distance, were all culturally very different.

My internship at the Chiu Lab was fascinating as well as very beneficial; my supervisor was an excellent teacher and gave me the opportunity to learn many new laboratory techniques. I am incredibly grateful to have received the Career Development Fund from Corpus Christi College, as it enabled me to acquire a range of new skills that will be valuable for both my degree and career.

Imogen Haydon

This summer I undertook an internship in the Materials Division at the UK Atomic Energy Authority (UKAEA). UKAEA is an executive non-departmental public body, sponsored by the Department for Energy Security and Net Zero, receiving both governmental funding and funding from industry and research organisations. They focus on research for nuclear fusion, with the Materials Division based in the Materials Research Facility (MRF) on the Culham campus.

My project was focussed on the oxidation of tungsten, characterising what oxides form under different conditions, in order to inform procedure for maintenance and provide data in the case of an accident for STEP (Spherical Tokamak for Energy Production), which is planned to be built in North Nottinghamshire in the 2040s, although a 'concept design' is expected to be completed next year. I used multiple techniques to do this, including Raman Spectroscopy, Scanning Electron Microscopy with EDX, and XRD, all of which I was trained on and then able to use independently. As part of my time there, I also visited Imperial College London to see the oxidation rig that my samples had come from, enabling me to better understand the research process and collaboration that occurs between organisations. As a cohort, we were also offered tours of various departments at UKAEA, as well as Student Engagement talks from each division on what they do, and how this factors into the wider research at UKAEA. I was very interested to learn about H3AT, the division who deal with and research the effects of the radioactive isotope of Hydrogen called

Tritium, which forms part of the fuel mixture for fusion reactions, as they also deal with materials based problems, with both experimental and modelling research occurring.

The Career Development Fund allowed me to stay in Oxford and then commute to the Culham campus of UKAEA, as well as supplementing my income to be closer to Oxford Living Wage levels. I am grateful to the college for providing me this opportunity to spend a summer researching at an organisation that I have aspired to be part of since I was in sixth form, and hopefully helping to launch my career looking at materials for nuclear fusion. I am pleased to announce that since my internship, I was shortlisted for UKAEA's Graduate Scheme and attended an assessment centre day. I am waiting to hear if my application was successful.

Sebastian Kenny

In Trinity term of last year, just before my final exams were due to begin and my classical undergraduate degree to end, I applied for a place at the Leiden Summer School in Languages and Linguistics. Among the summer school's many classes, four classes struck me as essential to my future master's work. For me the school was a way to bridge the gap between undergraduate and post-graduate studies and it also offered a return to studying for love of my subject rather than for fear of exams. Unfortunately, when I saw the bill I realised that I simply didn't have the money to stay in the Netherlands for the course. As I was panicking I received an email announcing the new Career Development Fund. So, I pinned my hopes on the application and submitted. Without the money granted by the fund I would not have been able to stay in Leiden for the duration of the summer school and so of the four courses I attended I would have only been able to join one. Over two weeks I attended classes in two languages—Lycian and Phrygian—as well as three in papyrology. Another bonus of staying in Leiden was that I could attend a series of evening lectures, some in areas of linguistics I'd never previously encountered, such as 'associated motion' in East Asian languages, and others that have proved essential to my current thesis work, including a talk on language contact.

In the summer school I spent an hour and a half every day developing the skills necessary to read Greek papyri from a period of roughly a thousand years, between the fourth century BCE and the sixth CE. Then, after my lunchbreak, an hour and a half of each day would pass while I applied what I had just learnt to a papyrus fragment assigned to me from the Leiden Papyrological Institute's collection, a papyrus at the time unpublished. In the mornings I'd learn letter forms that would offer a relatively secure date for a text and then in the afternoon I'd have to fight to find these same forms in my own papyrus. By the end of the course I prepared a scholarly edition of this text, including a transcription of its contents, a translation and even a commentary. Each of us on the course then presented our individual findings in front of the rest of the class. We all worked on different texts, taken from a range of periods. I had worked on a Byzantine period papyrus, a financial note written by Egyptian Christians, while others in the class worked on Roman period literary texts. But, as is often the case in a small class, I didn't focus exclusively on my own work, and like everyone else I ended up helping and being helped by others, giving me additional experience working with other papyri. This year, I've taken a papyrology option so I can apply what I learned over the summer and continue growing academically.

As much as I enjoyed learning this practical skill, I also needed some historical and cultural background to accompany it. Luckily, the Leiden summer school was also running an 'Introduction to Papyrology' class, covering both the ancient world context of the papyri found in Egypt as well as the history of the field itself. The class was taught by a series of experts in different fields of papyrology, whether we were learning about legal papyri written in abnormal hieratic or about Aramaic wisdom literature we always had specialised instruction. The sheer range of this class was really special, we began by examining hieroglyphic and hieratic texts from about four thousand years ago and concluded with Christian, Coptic papyri of the fifth century CE. In one class we studied the ancient culture of Egypt that shaped and moulded Hellenism in the Ptolemaic kingdom, but we also got to see the impact of Greek culture on Egyptian language and philosophy long after the Ptolemaic rulers had disappeared. Even though this class was less hands-on than the other papyrology course, it also relied on me being physically in the city of Leiden, as we were shown the wonders of the papyrological collections of both the Leiden Museum of Antiquities and the Leiden Papyrological Institute.

My last class every afternoon was called 'Minor Anatolian Languages' and it involved learning two separate ancient languages, both of which would have been spoken in the first millennium BCE in the area now called Turkey. Phrygian was an Indo-European language, quite closely related to Greek, but in the modern day it is perhaps most famous as the language of the King Midas from myth. In fact, one of the texts we read mentioned a King Midas, although it's unlikely he had either a golden touch or donkey's ears. Learning Phrygian allowed me to deepen my understanding of comparative linguistics, I often use it now when I am trying to understand the origin of an ancient Greek word or a peculiar grammatical structure, or when I study the Greek language's reconstructed past. The other language I learned on the course was Lycian, unfortunately it's only fragmentarily attested but it is closely related to Hittite, which I learnt during my degree, and to Luwian, which I am studying this year. Lycian may not be a language of many literary texts, but it allows me to improve my knowledge of the Anatolian language family and to build a better picture of the linguistic environment of the first millennium. My time learning Lycian focused on the translation of tomb inscriptions, a strangely personal experience, connecting me with the names of men and women long since dead. The inscriptions themselves also had a certain drama to them. Each contained a curse formula, calling down the vengeance of the Lycian gods on whoever disturbed the tomb. Perhaps it was best that this was the only part of the Leiden courses that did not involve a hands-on approach to text.

William McEwen-Benatar

Thanks to the funding from Corpus Christi's Career Development Fund, I spent six weeks this summer working as a teacher and ambassador for the NGO 'Akshar Foundation' in Guwahati, India. The grant of £1000 was indispensable to my ability to go, paying for almost the entirety of the flights.

Akshar Foundation is an NGO based in Assam which focuses on improving education in the North-East. Many students in the area drop out of school in order to get jobs and help provide for their families, so one of the ways Akshar incentivises staying in education is by paying the older students to teach the younger ones. Though the school charges no fees, it does instead require the students to bring in a substantial amount of plastic waste each

week, helping combat another problem in the area – pollution. The students then use this plastic to create ‘ecobricks’ which are used for creating paths and things of the sort around the school. The organisation started with just one school, Akshar Forum in Pamohi, but has since expanded to many other schools in the North-East, where they push their teaching model which is based on Gandhi’s ‘Nai Talim’.

The majority of our weekdays were spent teaching in their original school, the Forum. The school was English medium, though levels of fluency varied dramatically. Also important to note is that the classes are based on ability as opposed to age, due to the differing amounts of education each student has had prior to joining the school. The teaching consisted largely of worksheets, though this method of teaching left much to be desired as the sheets would be incessantly repeated, causing the students to simply memorise the answers without necessarily understanding them. As a result, the other interns and I would often try and come up with our own activities to do instead. An hour a day was also set aside for the interns’ individual projects – these were classes where we would choose what to teach, and the students would choose which project they wanted to attend. Mine was on coding and robotics. The students were all a pleasure to teach, and it was saddening to have to leave them on the last day. There were never any issues, and they all seemed to get along well with each other – even when there were large age differences.

As well as teaching, we would occasionally visit other schools in more rural areas, where we would act as ambassadors for the organisation – a way for Akshar Foundation to promote and attempt to expand their teaching model. These would generally just be daytrips to a single school, however during the last week, I and three of the other interns had the opportunity to travel about five hours away to a rural village, which we stayed in for several days. It was a very action-packed trip, visiting I believe twelve schools in three days. At every school we visited we received such an unbelievably warm welcome. Most schools would perform some sort of dance or song for us, sometimes inviting us to join in, and every school without fail presented us with a local ceremonial scarf – a sign of respect in the region. All of the children were so excited to see us, and these few days ended up being quite possibly the highlight of the trip. Our brief tour even landed us a spot in the local news!

Since most days we only taught from 9am to 12pm or 2pm, this left afternoons free for activities in the city. One of the eleven interns actually being from Guwahati herself, we had a plethora of suggestions for activities, and ended up experiencing a lot of what the city had to offer by the end of the six weeks. The real tourism occurred at the weekends however. Thanks to the most organised in the group, elaborate trips were planned for almost every weekend. Usually we would set off immediately after lunch on the Friday, and return early in the morning on Monday in order to maximise the time we had. Akshar Foundation also kindly gave us a Monday off on one of the weeks, allowing us to extend a trip. Our first excursion was to Dibrugarh, located in upper Assam. We took a sleeper train on Friday night, which in itself was an experience, and arrived in Dibrugarh early Saturday morning. The area is known for its tea, so points of interest here involved visiting tea plantations, as well as a multitude of temples. Our next trip was to Shillong in the neighbouring state of Meghalaya. We had hired a minivan for the weekend, and spent the weekend being driven around to various noticeable sites. The landscape here was breathtaking, with huge forested valleys, lakes, and many tall waterfalls. We even managed to see Bangladesh off in the distance (though entering was unfortunately not an option with our visas!). The

penultimate, and possibly most exciting, trip was to Darjeeling. We took a train on Friday night to Siliguri at the base of the hills, where we stayed for the night. We then took a bus up the mountainous path the next morning, arriving in Darjeeling at around noon. Our accommodation had an amazing view, and on one morning we were all awoken at about 4am by one of the interns, so that we could catch a glimpse of the Himalayas before the fog settled, including Kangchenjunga, the third highest mountain in the world. We returned from Darjeeling on the UNESCO steam train, which despite taking around seven hours was still very enjoyable, followed by another sleeper train. The final weekend trip was to Kolkata, and it was very interesting to see how much it contrasted with the only other Indian city I had visited up until then – Guwahati. Points of note include the Victoria Memorial, the Great Banyan Tree (the largest tree in the world by area), and a massive communist rally which we stumbled into just across the road from the Victoria Memorial.

The internship was like nothing I had experienced before, and I am very thankful for having had the opportunity to do it.

Robert Pascalau

I am a fourth year MPhys Student with a solid knowledge and an extensive background in Astrophysics. First and foremost, I would like to express my deepest gratitude towards Corpus Christi College for providing me with the opportunity to take part in the Summer Internship Research Programme of the Astrophysics Sub-Department (via the Career Development Fund).

The first half of the Grant (£1000) was mainly used to pay for my flights from my home country (Romania) to London and vice-versa (on my return) as well as for the coaches between Oxford and the airports. The remaining amount was used to partly pay for my accommodation (iQ Alice House) where I stayed for 8 weeks (the full duration of my internship).

During this summer, I have worked on a self contained research project with Dr Arrykrishna Mootoovaloo. We have developed and implemented several algorithms that use Machine Learning techniques to study 740 type Ia Supernovae samples with the goal of quantitatively determining the current composition (which in turn gives the future subsequent evolution) of our Universe. Last but not least, I gave a talk of about 20 minutes in front of the Department members and other interns, outlining the process and highlighting the scientific results of the project. Therefore, I can say that my Presentation skills (such as creating the script, engaging with the public or illustrating difficult concepts using pictures) have seen a great improvement.

Furthermore, my supervisor was very kind to introduce me into the fields of Data Science, Advanced Statistics (Bayesian Methods, Gelman-Rubin convergence test procedure) and Machine Learning Techniques (Markov Chain Monte Carlo simulations, Gaussian Process methods, Data Compression algorithms). I am truly confident that this knowledge will further help me throughout my future planned Academia Career in Astrophysics. I have talked to my supervisor and he admitted that he has a great interest to expand this research based on the work I have done throughout the project. There is a high likelihood of him publishing a paper that I would be a co-author of. This will largely improve my CV and my chances to continue my study of Astrophysics at Oxford as a PhD student.

Besides the project related activities, I have also taken part in extra-curricular activities, such as Exoplanets and Cosmology Scientific Journal Clubs (organised by the Department) to name a few. Together with the other interns, I also had the opportunity to join the more experienced researchers for a coffee twice a week, thus socialising and obtaining valuable information about what they are studying (sometimes via attending informal Presentations).

All of these things considered, I can wholeheartedly affirm that my abilities and my understanding of how research is conducted were significantly enhanced as a result of participating in this internship. Again, I am very grateful to the College for allowing me to participate in the Summer Project, which I think is a great start of the long journey of becoming a successful Astrophysicist in the future. Please do not hesitate to contact me if you have any questions. Thank you very much for your time.

Emilia Schmid

Thank you again for the generous grant provided to me to aid my transition to life in London. I am now 2 months into my MSc in Novel Therapies (Genes, Drugs and Stem Cells) at Imperial College London and very much enjoying my postgraduate experience. The money provided as part of this grant has played a role in making this experience as enjoyable as it is – London is a very expensive place and especially the initial move into my new flat was extremely expensive. 6 months' rent in advance are required from landlords that allow students, in addition to one month's rent for a security deposit, not to mention all the costs associated with furniture purchases (even furnished flats do not provide desks, etc.) and making the flat a livable space. All these costs occurred in the same month as tuition fee payments. I used the money from the career development fund for the security deposit to limit this financial burden at least partially, enabling me to start my MSc in a better financial situation. This has enabled me to focus more on my postgraduate studies and make full use of the biomedical events and opportunities provided outside of the course curriculum.

Thank you for making this possible – I appreciate it!