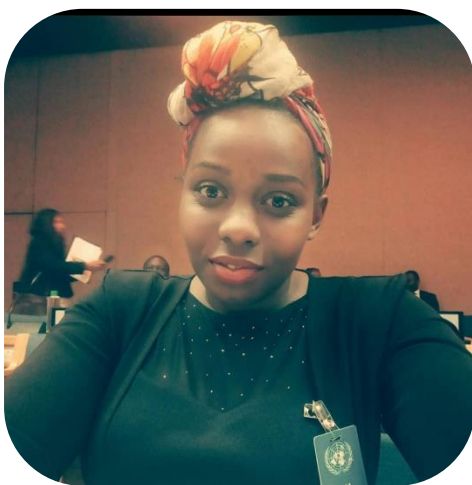


*Student
reflection*



My journey in the gene editors of the future program has been quite an interesting one. Just a few weeks ago, when I enrolled in this program, I had no idea about how this would impact my learning and thought process. I had the opportunity to learn quite a lot of new things. The first week kickstarted from an amazing introduction to the journey by Dr. Kalpana Surendranath, who is leading this program and I am so thankful to her for giving me a chance this program. We started learning from basics of human genome, introduced to the CRISPR tool to edit genes which can help in preventing/ managing/ and giving a better quality of life to patients suffering from life- threatening diseases. I also had the chance to locate a particular chromosome on the human genome using various genome browsers and designing the RNA guides for the targeted gene. I was also very inspired after listening to some of the amazing stories of people who have already undertaken this program and how successful they are in their careers as gene editors. This has given me an opportunity to understand the CRISPR technology in much detail and I am looking forward to make the most of it.

[Zinneerah Yusuf Khan]



I'm very excited to be part of Gene Editors of the Future 2.0. I am optimistic about the potential of CRISPR technology to revolutionize the way we approach healthcare, agriculture, and many other fields. As a scientist, I am drawn to the precision and versatility of CRISPR, which allows us to make precise changes to the genome with unprecedented speed and accuracy. I believe that this technology has the potential to not only advance our understanding of biology, but also to improve the lives of people around the world by enabling us to develop new treatments for diseases, create more sustainable and efficient food production systems, and much more.

[Eddith Agoroh]

My name is Dina Ahmed, second year doctoral researcher at the University of Westminster. Back in 2017, I was among the first batch of master students, in the world I believe, who were taught about CRISPR, a brand-new tool by then, by Dr. Kalpana. Ever since, I have been overwhelmed by the topic and couldn't wait to find any opportunity to study CRISPR. Nevertheless, all workshops and courses were so disappointing and never satisfied my deep will to learn as they were either very short-timed or providing merely a very shallow overview as if it's impossible to implement this promising technology.



I was thus eager to join this training with Dr. Kalpana and unsurprisingly, the very first phase of the training, which was entirely online, provided us with massive knowledge and the impossible has become reachable. I was finally able to understand what practically CRIPSR is and how to design a guide RNA with more than 3 databases and different options whilst one day before the training I thought this was magical. In this training, we were able to design primers in a couple of minutes, access a wide range of databases which state the gene localization and expression along with different protein interactions, disease associations and all available gene transcripts which reflect its exact and various potentials.

Most importantly, I was super proud to be able to apply this knowledge through the end of basic training assignment and mostly excited to learn more and proceed further with such an outstanding professor and an overwhelming technology that can change the road map of scientific research in future.

[Dina Ahmed]



First and foremost, I want to say thank you to Dr. Surendranath and everyone who helped make this experience so interesting and exciting. When I first heard about the gene editor of the future program, I knew I had to join. The chance to learn amazing and new things about CRISPR and how it is used in modern-day science is something I could not pass up. During the training program, I have been able to learn and use multiple gene tools such as Ensembl, human protein atlas and USCS genome browser which helped me gain a better understanding of genes and CRISPR itself. I am so thankful to Dr. Surendranath for this great opportunity to see and learn amazing new things about CRISPR. This has sparked an interest in learning even more and perhaps becoming a gene editor or a scientist involving the usage of CRISPR in the future. Thank you once again for everything!

[Danny Duong]

In my academic experience, the Genes Editors of the Future 2.0 programme has a special place. I have always wanted to broaden my knowledge, experiment with new things, and explore more related to my degree, but I never had enough chances to do so. Being an MSc student and working on top of it made it difficult to find free time, so when I applied for this programme, I was unsure of what I would get from it and whether investing my time would be worthwhile. However, I can say with pride that I gave my time to a programme that deserved it very much. I had the feeling that I had accomplished something for myself when the program's leader, Dr Kalpana Surendranath, presented a compelling introduction to the programme during the first week. The training has been fantastic thus far; I got the opportunity to start out by learning the fundamentals of the human genome before gradually moving on to other levels where I was given a much more thorough



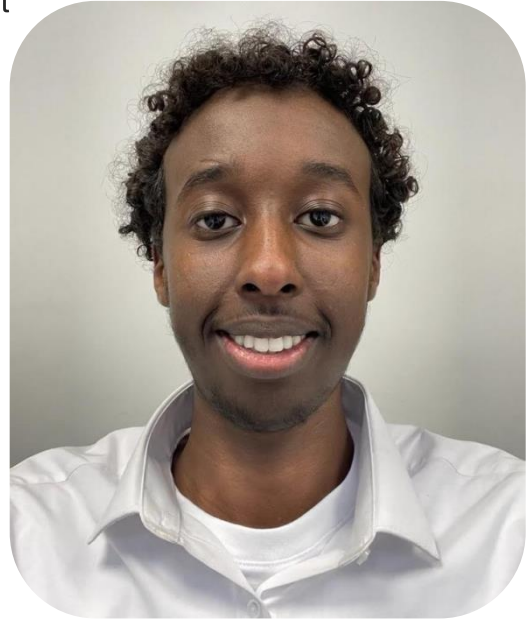
introduction to the CRISPR tool. I had the chance to use genome browsers like NCBI, Blast, and Ensemble effectively before getting a thorough rundown of the various CRISPR workflow steps. Also, from Synthego, Benchling, Horizon Discovery, and many others, I had the chance to design RNA guides for the targeted gene. Every session opened with a shining example of a former student who described how CRISPR technology aided them in advancing their educational career. Every talk was genuinely motivational and inspiring. In addition to these meetings, every one of us was given homework so that we could independently use what we had learned in the meetings and understand more about CRISPR. I am eager to continue with this programme since it has given me the chance to thoroughly understand CRISPR technology and explore my interests. Many thanks to Dr Kalpana for providing us with this excellent opportunity and guiding us all through every stage of the programme so that we could all benefit and no one was left behind.

[Farah Ibrar]

I really enjoyed the Gene Editors programme. I always had an interest in genetics/bioinformatics and the programme gave me an opportunity to build on those foundation skills. It was amazing how interactive the course was, especially how Dr Kalpana was available every step of the way to provide guidance, support and motivation. Having the opportunity to work with likeminded individuals was really motivating, also learning from other academics was a unique opportunity. I really enjoyed the motivational speech given by Munuse and in times of lacked belief in myself, I turn back to my notes on her recording, and it motivates me. Finally, I really enjoyed the ability to learn how to use bioinformatic websites like Synthego and Ensemble, I believe that these are skills that will greatly benefit me in the next step of my career.

[Jasmine Mahgerefteh]

I first heard about genetic editors of the future last year and the cancellation of the programme. It was an opportunity I couldn't pass up from the moment I found out it was back on. CRISPR was introduced to me during my undergraduate studies as part of a bioinformatics module. This module covered the basics of analyzing CRISPR using bioinformatic tools and abundantly I fell upon genetic editing and genomes. That piqued my interest, and the opportunity to participate in this extracurricular curriculum event was one I couldn't pass up. Being chosen to participate in a curriculum with limited



space was also a personal accomplishment for me. Through the journey of gene editors, I was able to gain many perspectives on accomplices and experience alumni, and how, despite their difficulties, they were able to achieve their goals. This was honestly truly inspiring and filled my tank of inspiration. Through the first fact of how each DNA strand is 2m in length is stretched end-to-end I was both amazed in disbelief and intrigued. As part of this course, I learned how to use other websites such as Benchling, Protein Atlas, Ensemble, and Synthego to collect information that will not only help later in upcoming modules but has also been added to a list of experience websites. Attending these segments opened my eyes to the possibilities of genetic editing, and I hope to continue my studies in the programme for future gene editors. I would like to thank Dr Kalpana Surendranath and her team, and I hope to continue this aspect in the upcoming gene editing and genomics.

[Abdullahi Ibrahim]

Molecular biology, Genetics and the tools used in it has always fascinated me. It was a lengthy dream for me to work on it to know more about them. Now, I feel really blessed to be a part of such a wonderful initiative taken by the University of Westminster and professor Dr. Kalpana. Each and every day it is getting better and exciting to learn and acquire deep knowledge on CRISPR. I also got to learn about various bioinformatic databases and a manual to operate them. It has been more than four sessions now, but every session provides the participants with



variety of technical skills and an opportunity to know a wide range of topics and tools used in CRISPR. I believe that by enrolling further in this workshop, I would really be benefitted as it could increase my potential both theoretically and practically.

[Kevin Roshan Amalanathan]



The CRISPR programme has been quite remarkable and allowed me to learn and gain new insight into the efficacy and efficiency of utilizing the CRISPR Tool. There were indeed moments where I felt the weight of just how generous of a topic it truly is, but that's what makes it so beautiful. It has been an incredible journey, from utilizing different gene access tools such as Synthego, addgene, and Ensembl, to being engaged with senior gene editors. Dr Kalpana has sparked an interest in me to progress further within this multifaceted and exciting field. I will keep the momentum going as I am interested in learning even more, specifically about the use of CRISPR in immunotherapy. Thank you again, Dr Kalpana and Team, for such an excellent opportunity.

[Andre' Gordon]

My month-long journey into gene editing framework and groundbreaking applications of the novel CRISPR Cas-9 in cancer immunotherapy, such as in CAR T-cell therapy, cancer cell fitness genes, and cancer vulnerabilities identification, as well as in therapeutic renovations of hereditary diseases has grown quite a devotion of mine to the overarching domain of the 2020 Nobel Prize-winning invention, namely a tool that rewrites the code of life. The robust content delivered through our virtual workshops held every Friday has imprinted the way I perceive biotechnology-facilitated advances in genomics, as per first having learned how to analyze target gene sequences that are to be edited by inducing genomic and proteomic data, and further having grasped how to search for high-scoring guide RNAs and target sequences for a specific gene and lastly implementing all that knowledge when designing genomic



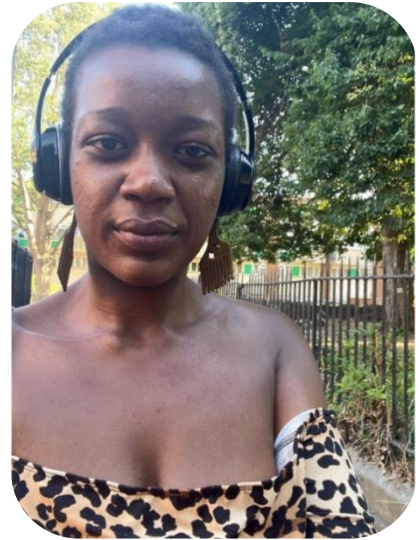
PCR schemes for its genotyping, both on-target and off-target in the concluding laboratory session held online. I, therefore, thank the incredible mastermind behind this extremely innovative project scheme, Dr. Kalpana Surendranath for teaching me how to deploy various analyses of complex bioinformatic tools, those of Benchling, Synthego, NCBI BLAST and etc, for giving me an opportunity to connect with fellow gene editors and lastly for taking me on board of this genome editing training scheme in the first place that I will now surely brag about in my curriculum vitae.

[Assem Ubigaliyeva]

Whilst studying my undergraduate degree at university, I have briefly come across the role of CRISPR in diagnostics and how it is one of the best technologies we have to date. So, when I first heard about the opportunity to be part of the gene editors of the future program, I knew I had to sign up and try my best to get in because it was a once-in-a-lifetime opportunity. I have learned so many different skills and knowledge whilst being in this program through the weekly talks from previous alumni and knowledgeable professors. I have learned many things about CRISPR that I never knew existed, such as the tools for locating the target site, and the use of transcript tables. I have also learned about the use of CRISPR to locate and manipulate genes that cause specific illnesses and diseases. So, I am grateful to Dr Kalpana for organizing this program which gave me an insight into CRISPR, and for this wonderful opportunity.

[Camnay Vanessa Duong]

CRISPR/Cas 9 Gene engineering program is a highly informative and insightful module that allowed me to expand upon my current knowledge of genetics and genomics. Many of the modules that I wanted to take at the beginning of the semester were centered around genes and were unfortunately full, however, with the CRISPR program I have been able to quench my thirst for knowledge. The module is intense and requires a lot of proactivity, but it is worth it as it provides knowledge and understanding given that you manage your time appropriately. I highly recommend this module and encourage students at any level of education to embrace this extracurricular activity, as it offers so much to one's personal and professional development.



[Candace Clarke]



The Gene Editors of the Future program has opened my eyes and shown me the power of gene editing. As a Ph.D. researcher, at the University of Westminster, my research is primarily focused on thrombocytes and their prothrombotic properties with the use of flow cytometry analysis. However, now a new frontier has been shown to me by Dr. Surendranath, that frontier is gene editing and its powerful capabilities. Throughout the course I was fortunate to listen to fellow colleagues and their experiences with gene editing, thus I was able to learn the importance of change and an organism's DNA. A variety of bioinformatic databases such as benchling, ensembl, the human protein atlas, horizon discovery, and bio grid, were shown to me which will be utilized in my future work in gene editing. Upon reflecting on the past month, this program has given me an immense understanding of how a naturally occurring genome editing system by a bacteria can be adapted through CRISPR-Cas9, which makes me extremely excited to take advantage of and use it in my Ph.D. research.

[Aleksandar Dishkelov]

I have always been fascinated by the CRISPR technique, not because it was the first ever woman awarded Nobel prize in 119 years but also because of the potential it could have over various disciplines. This left a profound impression on me during the early days of my research career. By joining the Gene Editors of the Future 2.0 program, I was constantly surrounded by experts in the field of gene editing, right from



my fellow batchmates, Ph.D. fellows, and scientists to Professors. Ever since then, I

would eagerly wait for Friday evenings, to learn the wonders of gene editing. Due to the zeal and consistent motivation of Dr. Kalpana, the program leader, I was able to learn the basic CRISPR techniques such as target site analysis, determination of a number of exons and the CCDS sequence, designing potential guides, cloning of guides in plasmids, protein analysis and expression in different tissues by using different bioinformatic tools. This program has truly helped me convert my passion to learn CRISPR into practical knowledge and

expertise.

[Darcia Savina D Mello]

I am a master's degree student of biomedical science at the University of Westminster, London. I have always been fascinated by the genome. The extent of the complexity associated with the genome and how it is compacted in something so small as the nucleus of mammalian cells has always intrigued me.

I first came across CRISPR when it was advertised for the gene editors' program at the start of my master's program, and I promptly registered for it. As I started researching it, I realized that it encompasses everything I have deemed fascinating with regard to the mammalian genome. Moreover, it is also a pioneering approach inherently associated with the field of my profession. CRISPR technique is so endearing as it unveils a potentially novel approach using gene editing technique (CRISPR/Cas9) for therapeutic application to various diseases and cancer, diagnostic application, and drug discovery for cancer and other infectious diseases.

The gene Editors program has acquainted me with far-reaching knowledge of CRISPR/Cas9, guided design techniques, and generating a workflow for CRISPR/Cas9 application in gene editing.

I am grateful and privileged to be given this opportunity. I cannot wait to improve further my knowledge, skill, and competency in applying the CRISPR/Cas9 technique towards gene editing to provide therapeutic solutions, drug discovery, and treatment for various cancer cell lines and infectious.

[Edward Obioha]

I came across the term CRISPR in my undergraduate, where it was introduced to me as an emerging technology to edit genes. After that, I learned in detail about CRISPR in one of my modules in my Master, and it was the time when I started developing an interest in this. I just wanted to grab an opportunity to dive deep into this new world of playing with genes and editing them to resolve the unsolved mysteries of genetics. Soon after, Dr Kalpana introduced us to this golden chance to be a part of this wonderful journey “gene editors’ program”. At this point, I know that I had to jump into this deep ocean of learning and grab as much as I can. When the journey began, I was a little nervous and excited at the same time. Slowly, the nervousness was taken over by the ever-increasing excitement to play around with the techniques which we learned. Undoubtedly, learning how to analyze the target sites of a gene and design the guides fascinates me the most. And how could I forget the live lab session which was a great experience? I am eagerly waiting to move on to the next stage to have first-hand experience of wet lab experience to learn more about CRISPR. Drug discovery is the area where I see myself since it will allow me to answer the queries of how a disease can be treated by targeting a specific gene sequence and designing a drug. This training will allow me to uplift my career and enrich my skills in gene therapy by designing drugs using a magical wand called CRISPR.

[Ekam Deep Kour]



I developed a keen interest in genome engineering after attending a related talk before starting my university studies. However, I was left unsure of how to deepen my understanding and gain practical experience. When the Gene Editors of the Future program became available, I knew it was the perfect opportunity for me to gain hands-



on knowledge and skills. Through this program, I have gained a comprehensive understanding of the uses of CRISPR technology, the necessary tools, and websites, as well as the ground-breaking clinical applications gene editing research offers. This experience has further piqued my interest in the field of CRISPR, as I am eager to participate in the advanced sessions and contribute to such innovative research.

[Fajar Masood]

I have been interested in CRISPR and its use in genetics research for a while now so when I found out about this opportunity, I knew I had to be a part of it. Over the course of the workshop, I have learned several new things about what it's like being a gene editor. I found it very engaging and helpful that several previous alumni were brought in and spoke to us, which inspired me, even more, to see how much their experiences on the gene editors' program have helped them find many careers and job opportunities. It was remarkably interesting to learn about the process of using CRISPR, especially the process of guide design which we were lucky enough to see demonstrated on Livestream. I am looking forward to progressing to the next level of gene editors of the future so that I can get some experience in the lab, working more hands-on with CRISPR.

[Jake Gayle]

My enthusiasm for CRISPR started very early in my studies, and since I am only a level 5 biological science student, I wanted to get to know many different areas of research; therefore joined the Genome Editors of the Future program to learn more about the exact steps of the CRISPR workflow. Through the weekly workshops with Dr. Surendranath, visualizing the function and the application of CRISPR in research has become much easier.



During the sessions, I had the chance to learn how to design RNA guides for a target gene and how to modify them for cloning. Furthermore, I learned about former students and their journey with CRISPR at the beginning of the sessions, which motivated and inspired me immensely. Reflecting on the last weeks, I am beyond grateful for this opportunity, as the students' engagement during the workshop was incredibly motivating. Furthermore, Dr. K Surendranath's devotion to answering specific questions and aiding students in their CRISPR journey helped clarify some topics.

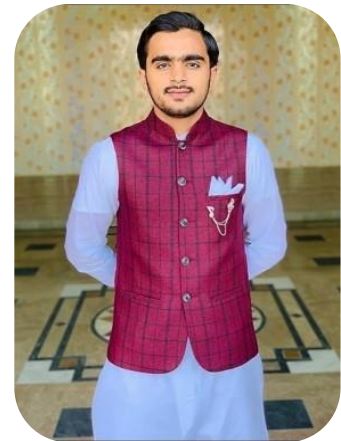
[Jolina Viessman]

The Genes Editors of the Future 2.0 program holds a special place in my endeavor to broaden my scholarly and professional knowledge. I've always wanted to learn more about interesting concepts and explore techniques briefly that are more directly relevant to cellular and molecular biology. Being an international student and working part-time made it challenging to find spare time, but I knew I'd sign up for this course because CRISPR has always piqued my curiosity. I can, however, proudly state that I contributed my time to a project that richly merited it. Dr. Kalpana Surendranath, the program leader, delivered a persuasive introduction to the program during the first week, and I had the feeling that I would be learning more about gene editing, which I could subsequently use in my studies and become a competent gene editor myself. I had the chance to start off by studying the principles of the human genome before progressively moving to a more complete introduction to the CRISPR tool. So far, the training has been excellent. Before receiving a full explanation of the different CRISPR workflow phases, I had the opportunity to use genome browsers like NCBI, Blast,

Ensemble, and human Protein Atlas efficiently as well as Synthego, Benchling, and Horizon Discovery for designing RNA guides for the targeted gene. Every class began with a glaring example of a former student who discussed how CRISPR technology helped them advance their academic careers. Each presentation was inspiring and motivating. The great part about this session was that we had to take careful notes and finish a brief assignment on our own, which can help us feel confident about the knowledge we gained at the workshop. I am eager to get accepted into the second level and receive hands-on experience with this incredible technology. My sincere gratitude goes out to Dr. Kalpana for giving us all this wonderful opportunity and leading us through every step of the program.

[Kajal Madhawani]

To describe it mildly, my experience as a member of the Gene Editors of the Future 2.0 has been fascinating. I first learned about CRISPR a few years ago, and I've been fascinated by it ever since. I was finally able to learn more about the CRISPR technology through this workshop, while also being inspired by Dr. Ahmad, Munuse and Dr. Kalpana herself as they shared their incredible findings and success stories. I had some difficulty attending the online session because it conflicted with my work schedule, but I was able to make up for it by listening to the recordings. As a student and aspiring scientist, this program informed me and assisted me in determining the most likely scientific field that I want to pursue.



[Khuzima Tawab]

As a part of one of my first-year assignments, I wrote thoroughly about how CRISPR works and how it could solve global health issues. The assignment I wrote got an 86% grade and is what got me interested in gene editing in general. I had always been fascinated by the potential of science to change the world, but it was not until I learned about CRISPR that I truly understood the enormity of that potential. I read about the many potential applications of CRISPR, from treating genetic diseases to increasing crop yields, and I knew that I wanted to be a part of the effort to harness this powerful technology.

When I saw the Gene Editors of the Future program posted in one of my module announcement pages, I was instantly intrigued and applied. I knew that this program would be the perfect opportunity for me to gain the knowledge and skills I needed to pursue a career in gene editing. I was not disappointed. The program was nothing short of incredible. I learned so much about the science behind CRISPR and the many ways in which it can be used.

I got the chance to learn many vital skills for the gene editing landscape. The program included experience with designing and creating guide RNAs, and I was able to practice using CRISPR to edit genes in an assignment. This experience was invaluable, and I now feel confident in my ability to use CRISPR in real-world applications.

In the future, I hope to use all the knowledge and skills I have gained in the Gene Editors of the Future program in practice. The large scope of CRISPR technology still fascinates me, and I have Dr Kalpana to thank for that knowledge. She was an excellent teacher, who shared her passion for the subject with us and showed us the potential of CRISPR. The program has inspired me to pursue a career in gene editing and to work towards using this technology to make a positive impact on the world.

[Hugo Katerbau]

As a level 6 student, I found the experiences of the alumni gene editors extremely beneficial in helping me pursue and apply for future careers. The most difficult yet valuable learning experience of the program entailed the application of knowledge to produce a guide design. Despite having taken notes on benching, whilst doing the task, I had many questions related to the why and how. Nonetheless, whilst preparing my gene guide design, I was excited to finally apply the theory into practice. As such, I can't wait to both apply my current knowledge as well as build it further. During the program, I came to realize the impact CRISPR technology will have on medical therapeutics, which pumped me further in wanting to acquire more knowledge on this amazing tool. Overall, this program was extremely insightful, interesting, and informative.

[Kamnoor Begum]

My experience with gene editing has been very intriguing, before getting into the training, I had some clues as to what I was getting into. Previously I was studying a module called bioinformatics, in which we looked at phylogenetic trees and sequence alignment. Therefore, my experience so far has been remarkably interesting so far. From the first day when I was added to the group chat with several other students who share the same interests as me, I was feeling really motivated to work harder. I especially became a fan of Dr Kalpana Surendranath who unlocks new potential in people. Hearing motivational speeches from her past students made me especially excited to become her student in this marvelous journey. To say a little about myself, I am a pharmacology and physiology student, I am also currently working in a pharmacy, and I previously worked with blood. So, to say my passion for science is quite diligent. I have always enjoyed learning specifically about genes and how they work. From every task given to the meetings we have every Friday; I work harder to stay on top and work my way through every session.

[Laiba Sheikh]



My name is Jacqueline Leon Ribas and I am a final-year Ph.D. student. I initially joined the CRISPR course because genetics has never been my strength and I wanted to learn more about gene editing which I could then apply to my research and become a proper gene editor myself. So far, the course has been incredibly helpful and fulfilled all my expectations. I have learned how to use different software and websites such as Benchling, synthetic, RefSeq, UCSC, the human protein atlas, etc. Not only this but it has helped me understand the basics of how CRISPR is performed and what it can be used for. I am truly looking forward to hopefully being accepted onto the second stage and being able to gain hands-on experience with this incredible technique.

[Jacqueline Leon Ribas]

Part I of the Gene Editors of the Future 2.0 program has been a valuable opportunity that introduced CRISPR technology and showed its potential applications. The two sessions that I found exceptional were when hearing other students' stories and watching a live stream from the lab. I had an incredible time talking about the first steps involved in the CRISPR workflow in one of the sessions and was extremely happy with the word cloud made on Padlet. Looking forward to the coming parts of the program!



Thanks, Dr. Kalpana for the continuous support.

[Lina El Badaoui]

The journey as a member of the Gene Editors of the Future 2.0 has been mesmerizing, to say the least. I heard about CRISPR a few years ago and have been obsessed with this technology ever since. This programme finally gave me a chance to get a deeper understanding of the CRISPR technology, all the while getting motivated by listening to the success stories and amazing discoveries of current gene editors, including Dr Ahmad, Munuse and Dr Kalpana herself. Despite having some trouble attending the online workshop as it coincided with my work, I managed to catch up by listening to the online recordings. This program enlightened me as a student and a future scientist and helped me identify the likely scientific field that I want to pursue.

[Maha Shakil]



At the beginning of this programme, I knew rough details about the concept of CRISPR, mainly from lectures in class. However, as each session progressed, my understanding of CRISPR genetic editing technology began to expand. It is so interesting, the idea that we can modify a given genetic sequence with this tool. I find each session incredibly engaging but what I find best are the special guest talks given by people that are involved in the field; they are so inspiring

and motivate me to achieve just as highly. I thank Dr Surendranath who was the one had offered me a place in this programme; it is truly a unique opportunity, and she has organized each event to be stimulating. I hope to see what else the Gene Editors of the Future programme has in store for me.

[Tasnia Masud]



I am very excited to be part of this project. I believe that this is a great opportunity for students like me, who are passionate about CRISPR, but cannot afford to pay for training. So far, I have been inspired by seeing all the people that participated in the Gene Editors of the Future in the past years and talked about how much this specific programme has helped them in their careers and job opportunities. I understand that lab work is not available at this stage of the training yet, so I intend to progress as far as I can in order to gain some experience in that sense. I am grateful to the University, the Genome Engineering Laboratory and all the academics involved, especially to Dr. Kalpana for providing us with insights, experience, networking and important information regarding CRISPR tools.

[Martina Minea]

Being part of gene editors of the future2.0 has been an important and exciting opportunity for me. I came in without knowing too much of the programme and unfamiliar with certain criteria, but the staff were all aware of the fact that the students were at different learning levels which was evident throughout the course by giving background information and dedicating time outside the scheduled hours to offer more support. I personally have always been intrigued by genetics and the aspects of genetic engineering which encouraged to participate in this programme. Immediately, I was appreciative as it turned out to be a valuable and essential learning experience, moreover for me since I plan to continue onto postgraduate hopefully specializing in genetics. On a final note, Dr Kalpana was a superstar and supportive throughout!

[Maimun Nur]

CRISPR technology is a promising technology that allows scientists to edit the genome. I was always so fascinated by this technology and want to learn how it beautifully holds promise to prevent and cure complex diseases. Fortunately, I got a chance to join the workshop on "Gene editors of the future: 2.0" at the University of Westminster under the supervision of Dr. Kalpana Surendranath. I am so blessed to be a part of the workshop. Through this, I came to know about CRISPR technology and how it implements in editing the genome. The beauty of the workshop was the enthusiastic talks given by masters, doctorates, post-doctorates, Professors, and different experts having a hand on experience in CRISPR technology. Moreover, Dr. Kalpana's motivational speeches and way of explaining every bit of CRISPR from small needle to big frame were excellent. I knew many of the molecular biology techniques, but now I become more confident by learning the software and bioinformatic tools used to design guide RNA and how it targets the desired genes. I am sure, in the future, I will use the CRISPR technique in fishing out the disastrous genes. I am looking forward to being a part of the advanced training program of the CRISPR workshop.



[Pratibha]



I am Premicca Rakulan MSC Biomedical (Medical Microbiology) student. I have gained my undergraduate degree in Veterinary Medicine and Animal Science. I am a clinical person and always interest in research and scientific base approaches. I have carried out my postgraduate research project in 'Identification of Antibody Targets using Photo activated Cross-linkers Located in the Binding Site.' So, I have learned about molecular biology tools, techniques, and recombinant DNA technology. So, I am always fascinated about CRISPR techniques and its concepts. The Genes Editors of the Future 2.0 program gave me a new opportunity to discover more about concepts of gene editing and explore techniques of recombinant

DNA technology. I really enjoyed every session and had a hands-on experience with different genome browsers. I had an opportunity to discover more about genome browsers like NCBI, Blast, Ensemble, and human protein Atlas, Synthego, Benchling, and Horizon Discovery for designing RNA guides for the targeted gene. It gave me the confidence to do the task in each session and acquired the knowledge towards the next level of my studies. I wish to express my sincere gratitude and appreciation to Dr. Kalpana Surendranath (Program leader) for giving us this wonderful opportunity and her guidance through every step of this program.

[Premicca Rakulan]



Learning a new amazing super tool that is CRISPR, it's like helping insert a missing piece of a puzzle that are filling the gaps of knowledge in the human evolution of science and improve new and emerging therapies to tackle many disorders. It's exciting to know that genome editing resources are increasing every day and it's becoming easier to understand molecular mechanisms now days compared to 20 years ago, when the first human genome was sequenced. Not to forget the amazing and the wise people that has dedicated their lives to contribute to a great cause and specially to pass on this wonderful knowledge to young and passionate scientists and that is Dr Kalpana, and all the beautiful people that has contributed to this amazing journey. I want to thank you all for this wonderful journey and for inspiring me further and dream about doing great things in the future. Oh, and this will look excellent in my CV!. Many thanks

[Diego Reyes]

It was one of my best journeys in life, throughout the CRISPR program, I received lots of knowledge and after attaining this program now I can indeed say that gene editing for revolution in the drug and diagnostic industry is my passion, and presently I feel that journey has started and there is a lot more to learn about CRISPR and gene editing. Dr. Kalpana is a great tutor, she is a fun loving and calm person, but she also teaches us to stay focused at the same time and I love this quality of hers. I wanted to work hard for the advanced program and wanted to do something great for humanity with the help of this CRISPR technology. I wanted to thank our most honorable mentor Dr. Kalpana and team for arranging this program. It has been a great opportunity for me to learn from all of you and to join this program. Thank you so much.



[Rushikbhai Manojkumar Barot]

Gene editors' program has so far been the highlight of my degree at the University. In the second year of my UG degree, Dr. Kalpana gave a lecture on CRISPR technology and its application. At the time I was fascinated but, in my mind, I thought it was impossible because it seemed like an easy answer to all the complicated questions. When the gene editors of the future 2.0 was initiated, I felt this eagerness to be convinced by this amazing idea. I felt like a mesmerized kid at an aquarium as phase 1 of Gene editors began. Gaining skills using bioinformatic databases to accumulate as much information as possible about a gene to form the foundation of mechanism of function has been exhilarating. The complex nature of genetic diversity is intriguing as there is always something new to discover. Being able to understand one of the most promising breakthroughs in science is an awarding feeling and I am incredibly grateful to be on such a program.

[Sana Khan]

Joining the Gene Editors of the Future 2.0 Programme has broadened my perspective of what CRISPR really is. Aside from the basic knowledge I acquired over the years, attending these sessions has opened my eyes towards what great potential CRISPR

has. From using CRISPR Cas9 as a therapeutic and diagnostic tool in cancer research, to discovering transcripts each gene has, I learn something new from each session. I have also been able to apply this knowledge to my current modules and my literature review for my second year on this topic. Thank you to the Genome Engineering team and Dr Kalpana Surendranath for putting together such an innovative programme!

[Sara Ahmed]



When I was in sixth form applying to universities to study biomedical science, I mentioned CRISPR in my personal statement. I found it amazing how we discovered something to edit and change the genetic material of organisms. I always thought that the genetic material and DNA of somebody is set in stone, so a tool like CRISPR really intrigued me. As soon as I heard about opportunities to learn more about CRISPR I took them. I am very glad I was chosen for the CRISPR gene editing programme; the programme so far has been amazing allowing me to learn more and exposing me to different programs where

I can synthesize my own guide RNAs. I always knew I wanted to get into the gene editing field and assumed it would be possible for me to do that in postgraduate studies. To be able as a second-year undergraduate to learn so much about CRISPR has been a wonderful opportunity.

[Sara Karaoui]

I want to begin by thanking Dr. Kalpana Surendranath for spending her Friday afternoons providing interesting information to us! Seeing and hearing doctors and PhD students involved in gene editing and the career path they took was really inspiring, as I had very little knowledge on CRISPR to begin with, let alone potential careers and further education. Now that I understand more about the field, I am excited to explore more on gene editing as this whole training influenced me to further expand my knowledge in it.



[Savini Nanayakkar]



CRISPR is something new to me when I first joined this opportunity-giving gene editors' program, but now after understanding its ability and potential to solve the millions of questions that arise in the field of gene editing for drug discovery, diagnostics, and treatment I have started to get acquainted with its process and protocol. I am in the initial phase of designing the correct RNA guides and locating the site of interest. My interests in CRISPR are growing more than ever and I want to go all the way to utilize this skill in my career as this training will enrich my knowledge

in gene therapy as drug discovery is where I see myself having an impact in the biomedical science world.

[Schnieder Fernandes]

I am a master's student of Biomedical Science at the University of Westminster. I came to the UK to broaden my knowledge and improve my skills in certain areas of my field. I never expected that I would be involved in the Gene Editors of The Future 2.0. I had come across CRISPR on YouTube and discovered I had a passion for gene editing and gene therapy and treatment. I thought it was just a phase of something I would just read about in my leisure time and not



necessarily indulge in. I got an email from the university one day, I read it and it was about the gene editors' program. I applied for it, but I honestly did not think I would get it because I know extraordinarily little about genes because I was coming from an Anatomy background. The professors and people I have met in this program have been so accommodating, encouraging and helpful. They go back to the basics so everyone can be carried along and no one gets left behind. The sessions are so lively and entertaining that you would not feel like you are working or doing anything hard. I never saw myself wanting to work with CRISPR but being a part of this program has

opened my eyes to many opportunities, and I know we are just scraping the surface. I am really looking forward to future sessions and cannot wait to apply my acquired knowledge in my career.

[Usiju Shaldas]

Week 1 (4th Nov 2022)

We had our inaugural session of the Gene Editors 2.0 workshop. “Before joining, I had limited understanding of gene editing and did not have any expectation of coming in contact with CRISPR tools because of the assumption that the content was too advanced for an undergraduate student like me.” However, I was excited by the prospect of learning something novel in the workshop organized by Dr. Kalpana Surendranath, who also leads the genome engineering laboratory.

My assumptions were overturned on the very first day when Professor Ollie Haworth drove home the idea that “CRISPR is not particularly difficult to understand and scientists from all levels within the field of life sciences can easily make use of it, not just a select few.”

Dr John Murphy gave a brilliant explanation of PhD student’s work on RNA binding protein ZFP36L1, and how CRISPR/Cas9 was used to generate cancer disease models and ZFP36L1 knockouts for testing. Dr Anjali Ghosh gave an interesting example of the uses of CRISPR in the medical field, such as for tuberculosis screening. “These real-world examples play a vital role in informing students about possible future aspirations and career pathways that can be unlocked by learning highly in-demand skills such as CRISPR gene editing”.



Week 2 (11th Nov 2022)

Dr Ollie returned with an amazing talk on ‘genetic diversity as a result of migration by ancient humans. “I was particularly impressed by the idea of evolutionary trade-offs and adaptations. The hypothesis suggests that certain detrimental genes such as those for mental illness or autism, may have been advantageous in the past and hence persisted through

natural selection over long period of evolution.” For example, Schizophrenia probably exists because the ability to speak outweighed the risks of malfunctioning language genes and auditory hallucinations. Similarly, depression could be a mechanism to limit energy exertion by making people feel unmotivated, which conserved energy and maintained our ability to hunt or gather in the past.

Finally, Dr Kalpana gave us an introductory tour of creating a benchling profile to keep a record of our workflow during the programme. “I deeply understood the importance of following laboratory good practices and note taking as a useful skill for any academic.” This also allowed me to check back on my notes any time I needed to refresh my knowledge.

Week 3 (18th Nov 2022)

We learnt about the uses and differences between different genome browsers such as UCSC, Ensembl and RefSeq. Dr Kalpana explained how to navigate genome browsers in order to extract information about a particular gene such as its chromosomal location, transcripts, number of exons and other details.

One detail which awed me was her fervent description of the Human Genome Project which took 13 years and 3 billion dollars to complete. “The sheer amount of time, effort and money it took to sequence the entire human genome of 3 billion base pairs, enlightened me about the true nature of work that researchers undertake, which often spans generations.”

Week 4 (25th Nov 2022)

We demonstrated our ability to extract the details of a gene by navigating genome browsers and answered questions about sickle cell anaemia, a genetic disorder, with the help of a fun interactive activity called ‘CRISPR Café’.

“The most important learning I gathered was that CRISPR can be used as a tool to alleviate symptoms of sickle cell anaemia, through specific gene therapies such as LentiGlobin, where defective genes are edited to produce deletions.” There are some concerns of off-target effects and autoimmune response against lentiviral delivery.

Week 5 (2nd Dec 2022)

Such a fantastic conversation on taking unconventional pathways to achieve your goal by Munuse Ceyda Savash BSc, MSc. Her personal journey studying MSc

clinical embryology (genetics) at Oxford, all without an A-level, leaving her first undergraduate degree and doing a bachelor's which had little relevance to her interests, was so inspiring and relatable.

Some important messages I gathered from her talk were:

“Feel confident walking the untrodden path.”

“Do what your heart suggests and where your interests lie.”

“Be eager about creating a positive impact on society.”

Dr Kalpana walked us through the 9 stages of CRISPR workflow and started us off with a discussion on plasmid vectors, which are used for delivering the CRISPR/Cas9 systems. We practiced how to use Addgene website to select our plasmid, in addition to learning how guides are integrated into the plasmids for cloning and transfection into eukaryotic cells (transformation for prokaryotic cells). There was a short introduction on PAM motif (NGG) and single guide RNA as well. Finally, we practiced using Synthego to search for target sequences which can be used in guide design.

Two important metrics I found useful throughout the workshop for selecting guides were Specificity, which is how specific is gRNA to our target sequence, and Efficiency or Functionality, which is how well the CRISPR-Cas9 cuts the target site.

Week 6 (9th Dec 2022)

Lina El-Badaoui kindly took charge of 200 strong audience and walked us through the first 5 steps of the CRISPR workflow which can be performed within a week and include in-silico work. She explained how to design guides after selecting them, in a simple and concise manner as well as the lab techniques used for preparation of guide duplex, cloning using plasmid vector after insertion of guide and sequencing to check for presence of guide within the plasmid.

Our main focus was to learn how to use CRISPR design tools like Benchling, Synthego and Horizon Discovery as well as how to modify recommended target sequences by creating complementary sequences, adding overhangs and flipping orientation to 5' à 3'. Finally, we discovered how to add our desired vector to the Benchling profile from addgene as well as the importance of BBSI restriction enzyme for cutting BBSI target site and cloning the guides

“This was by far the most demanding among all the sessions in the workshop but also filled me with a sense of accomplishment because of how far I have come since I started the programme. One benefit of such a large group of Gene Editors was

that most questions I had were often cleared by helpful peers, such as when I was curious about why an extra G nucleotide was added to the overhangs in some cases.”

Week 7 (16th Dec 2022)

The workshop finally came full circle when Dr John Murphy once again shared the glowing success of PhD students who used CRISPR to uncover the molecular function of ZFP36L1 by creating cancer cell knockout models. It was observed that ZFP36L1 serves as an RNA binding protein mediating mRNA decay, therefore, its deletion can be used to study genome stability, susceptibility to drugs and tumour survival. He also gave a motivating talk on the bright future of CRISPR tools, citing many of its uses such as CAR T cell therapy and tumour infiltrating lymphocytes against various cancers.

“We ended our final workshop with a live lab session on the first 5 steps of CRISPR workflow by Dr Kalpana and her seasoned team. Note taking was emphasized once again which demonstrates the importance of the skill, and would be of great help during my final year project as well. The meticulousness, precision and discipline demonstrated by the researchers in the laboratory, also infected us with the will to strive in their footsteps and work in a laboratory one day.”

Final thoughts

Participating in the first phase of Gene editors 2.0 was the best decision I ever made, because it allowed me to interact with a large network of like-minded and driven peers, as well as senior experts in the field who encouraged me to actively participate. “The success of past graduates also urges me to put my best foot forward!”

I truly feel that my employability has increased by a large margin after learning in-silico techniques used in the first 5 steps of the CRISPR workflow. “These transferable soft skills and enhanced digital competency will allow me to flourish in any setting whether in industry or academia.” I will definitely apply for the next phase of Gene Editors 2.0 because it is a once-in-a-lifetime experience for getting exposed to gene editing techniques and should not be missed!

[Shashwat Guha]



This program has helped me to develop my knowledge about CRISPR and genomics, I'm grateful that I got the chance to be a part of this training program. I have always enjoyed learning specifically about genes and how they work I really enjoyed every session, and each task were given I tried hard and searched about it, I gained so much knowledge in this program, I would like to thank everyone involved in this program especially Dr. Kalpana for her dedication and for facilitating such a positive learning environment.

[Shna Amin]



I am Sirisha Yerramalli, a final year PhD student at the University of Westminster, UK. I was looking for an opportunity to get experience with gene knockouts, especially using CRISPR technology as it is one of the most prestigious molecular biological techniques. Therefore, I was highly intrigued and excited to learn about the course: Gene Editors of the future 2.0 and could not wait to apply for it. I am ever so grateful to Dr. Kalpana Surendranath and team for accepting my application and giving me this wonderful opportunity to learn CRISPR. This course is everything I was looking for, especially in terms of the depth of knowledge transfer. Since so far, I only had experience working with bacterial and fungal cells/genes; therefore, I wanted an opportunity to explore mammalian cells/genes. This course has provided me with an added advantage of working with mammalian genes. Every session has been extremely informative, engaging, and interactive, and each session began with a success story of an ex-student highlighting how CRISPR technology helped them to build their career. Learning about their journey is truly inspiring and motivates me even further. Dr. Surendranath also made sure that every student's voice is heard, and all the doubts were cleared in each session. Apart from the online sessions, the CRISPR coursework gave us the added benefit to work independently on each topic; thus, enhancing our understanding of CRISPR. Moreover, the extracurricular activities such as CRISPR Café, LinkedIn and Twitter posts have helped me to get noticed by several professional bodies even

before acquiring the training certificate. I cannot wait to progress further in this course as I am extremely passionate and enthusiastic to learn every bit of CRISPR technology. It is absolutely a dream come true for me!

[Sirisha Yerramalli]



Deciding to apply and take part in the Gene Editors of the Future 2.0, a wonderful initiative by the Genome Engineering Laboratory, University of Westminster, is by far the best decision I have made ever since commencement of my master's at the university.

I got to know more about genes, identifying target site, various components of CRISPR and much more from sessions so far.

With the "knock-in" of both genetics, laying the foundation for better understanding of CRISPR and inspiring yet necessary discussions with genome engineering lab alumni has not only made the Fridays interesting but also keeps me motivated to do better in life. Eagerly looking forward to the upcoming sessions which have exceeded my expectations time and again.

Grateful to Dr. Kalpana Surendranath for giving me this opportunity to learn the highly sought-after CRISPR and needless to mention the achievement of hosting such a training at this scale with 100 plus students.

[Sneha Latha Rangan]

I am so grateful to Doctor Kalpana Surendranath that I was given the chance to attend and take part of Gene Editors of the Future course and allowing me to gain new knowledge on a topic which I had almost no knowledge and no experience about it. This course made me realize of how important gene editing is and will be in the future too, as it has great potential of curing diseases that many people suffer and die and are incurable. Moreover, being taught about multiple scientific platforms that scientists, researchers, and gene editors use to find information about the gene of interest and designing guides was very interesting. Finally, there was a laboratory session which was very interesting, worth watching and experiencing!



I would recommend and advice people to take part in this course if it happens again even if you are not familiar with CRISPR, not only because it is an interesting topic, but also because you expand on your knowledge about science and because gene editing is one of the most important inventions in science and it will change the future science and therapeutic approaches of many diseases.

[Sokratis Bezanis]



I am Soumya Sharma pursuing Ms applied biotechnology. Gene editors of the future 2.0 have been brainstorming for me. I studied Genetics during the under graduation, but I never expected I would be fortunate enough to get hands on training on CRISPR genetic editing. I am thankful to Dr. Kalpana for bringing us this amazing opportunity to learn and explore.

After the basic training, I am happy to share that I know how to find information about gene, design guides, find disease associated and much more. I am looking forward to proceeding to advance level of the training.

Once again, I would like to extend my gratitude towards University of Westminster, Dr Kalpana and other team members for bringing such an amazing opportunity.

[Soumya Sharma]

As a beginner in genetics and CRISPR, the gene editors of the future 2.0 programme were very interesting for me. It was great to hear from a variety of experts in this field, and to gain deeper insight into the topics through their perspectives. The interactive activities and demonstrations were also very helpful in understanding the concepts more clearly and motivating for all upcoming researchers. Overall, this programme was a great way to stay up to date with the latest science advancements in CRISPR Technology and to explore interesting topics in gene editing more depth. I was particularly impressed by the way the programme was structured, with different hands-on activities and demonstrations that allowed me to gain a deeper understanding of the gene knockouts. Professors were knowledgeable and passionate about the topics,



and I was able to ask questions and get detailed answers. Overall, I enjoyed the programme, and it has certainly increased my knowledge and interest hope more activities and sections in upcoming days. Thank you for Dr Kalpana Surendranath for giving wonderful Fridays, evenings for better future.

[Subaiba Shafi Kadakkadan]



The Gene Editors course came as a boon in my life, just as I was beginning to wonder if I had made a good decision pausing my medical residency preparations, to ride the Crispr wave, hoping to find a more fulfilling life working on finding new cures to as-yet incurable disorders.

Dr Kalpana who leads this programme was kind enough to get in touch with me to personally explain to me the real-world applications of the skills that a research newbie like me should expect to gain from this course. I also received very patient orientation from Khalid, her PhD student, and some alumni from the previous year- the pilot edition of the course.

Every session on this course is different, with a new meritorious graduate piling heaps of inspiration onto us while clearing many core concepts and handing us some useful tips. I think the part I like best about Gene Editors is the way the course is structured, as it allows us plenty of time & opportunity to practise a new skill we learn on each session. I think its valid to say I 'lucked out' by getting to be a part of this utterly selfless and extremely valuable initiative on the part of the professor. Crispr, here we come!

[Sush Deshmukh]

The Gene Editors of the Future 2.0 student training program provided me with the opportunity to develop my interest in CRISPR gene editing further. I was first introduced to CRISPR technology in my foundation year at University of Westminster, however, I was unaware of the possibilities of this extraordinary CRISPR-Cas9 tool until I joined Gene Editors of the Future 2.0. Since taking part in this enlightening program, I have developed a keen interest in genetic engineering and its various applications, particularly how CRISPR might assist in treating cancer. I have also been introduced to many interesting websites such as Ensembl Gene Browsers and Benchling.



This Gene Editors of the Future 2.0 training has equipped me with valuable newfound information and transferable skills, which I aspire to apply in future jobs after graduation. It has also been a good opportunity for me to gain insight into the industry, as we were able to hear talks from previous alumni who worked with Dr. Kalpana and how they navigated through this research sector.

I am grateful to have been a part of this amazing program and I am extremely appreciative to Dr. Kalpana for putting together Gene Editors of the Future 2.0 to give students the opportunity to learn about CRISPR-Cas9.

[Taniya Ahmed]



Taking part in this programme was truly a great experience. I am grateful for the fact that this programme did not just teach us about CRISPR, but also provided talks by guest speakers which gave a better insight into the world of gene editing and their own experiences which was very inspiring. Dr Surendranath did a great job organizing this, her passion for this really radiated in every session. It was very clear through online chats that this passion spread to her students-me included! I now have a better understanding of the processes underlying gene editing and the potential it has especially in cancer research.

It has motivated me to embrace new challenges as before taking part in this programme, I only had known of CRISPR genome editing but did not know about the workflow needed to actually carry it out. So I felt quite overwhelmed as I was completely new to this, however I felt more at ease once the programme started. The online sessions and the live laboratory session was incredibly informative, well

explained and easy to follow. I am glad I took part as it helped me gain valuable skills, I look forward to testing my knowledge and expanding it further if I progress to the next stage.

[Tanzila

Harun]



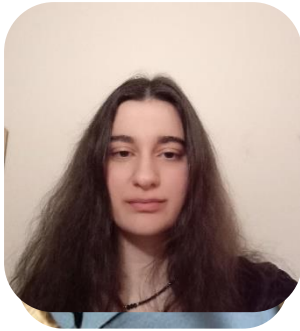
I am satisfied and happy to be a part of the CRISPR Gene Editor Team. I thank the University and the Genome Engineering Laboratory for providing an excellent training program for the students. This training definitely upgrades the scientific knowledge of bioscience. The topic is very new to me and have started to gain more information. I have seen the online websites for genome sequences, but never understood how to use it. Now, with this training, I am learning it step-by-step. I am glad that with this training I will be updated to the current biotechnology techniques. This would help me for my future research. There will be lots of techniques and mechanisms that I should learn with this training, and I believe I would successfully pass this training.

[Pheba Thomas]



Beginning the programme with little to no knowledge of CRISPR, I was eager to learn more. With every session I have been able to expand my understanding of exactly what CRISPR gene editing technology is and how it can be used to support all areas of science and medicine. With different guest speakers guiding us through their journeys, I was inspired to look into different career pathways that I had previously not considered. To be able to use CRISPR in the future in research or work with biotechnology interests me greatly. Throughout the programme I learnt to use genome browsers like Blast and Ensemble that provided me with vast knowledge on different genes and has given me the ability to further my research. I am thankful for the opportunity to experience such cutting-edge technology that represents the future of science technology.

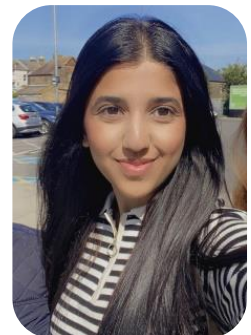
[Safaa Shaikh]



Being part in Gene Editors was one of the best choices I made in my life, I usually don't apply for any programs but I'm glad that I did for this one. I had the opportunity to learn so many new things and be able to understand in certain level how to use different platforms on the internet to gather information and developing my skills using benchling. Not only that every single session was extremely interesting and not even once I got bored of listening such fascinating information, I was introduced to CRISPR-Cas 9 tool which was also an amazing experience and I think that this technology will change a lot of things in the future and even had a live session in the lab. Overall, all the people that took part in this program and the amazing Dr Kalpana, PhD students and master students which took part in helping and teaching in this program was just simple amazing and I'm very thankful.

[Andriana Avramiduo]

My name is Warda Khan, and currently, I am a final-year pharmacology and physiology student. I was very briefly introduced to CRISPR during my second year, and immediately I knew I had to go down the CRISPR pathway and learn more about it. I conducted my own research last year and managed to get a CRISPR-related article published in the leading news (which is definitely one of my biggest achievements!). When I saw the Gene Editors 2.0 programme, I instantly knew I had to be a part of it. I decided to apply and now here I am, looking forward to the CRISPR sessions every Friday! I feel extremely grateful to be a part of this programme, a special thank you to Dr. Kalpana Surendranath, as I am learning so much about genes – in particular, gene sequencing and learning how to identify locations of these genes using various software. I cannot wait to see where this programme takes me next!



[Warda Khan]

As a level 6 student, I had been worried about career aspirations. I had no idea on what route to take and had doubts about staying in the STEM field. At the beginning of the academic year, I was completely lost and lacked motivation. I have heard briefly

about the advancements of CRISPR from college but did not comprehend how complex the tool was until joining in this program.

Learning about the 'diagnostic of the future' the CRISPR-Cas9 tool has opened endless possibilities as a form of treatment. The tool is not only limited to cancer therapy but has also made advancements in genetic conditions such as, Sickle Cell Anaemia. As a result, I have become confident in using platforms such as, Synthego and Benchling in creating a guide RNA.

After completing phase 1, It helped regain my interest in life sciences, particularly in genetics and cancer genomics. I have Dr Kalpana Surendranath and all the lovely and inspiring speakers to thank. This whole experience has truly inspired me, and I hope to use these lessons in the future.

Thank you for all the encouraging words, Dr Kalpana Surendranath. I hope you continue with this program to inspire many more students.

[Shamina Akther]

Till recent times hereditarily inherited or mutated complex genetic morsels were considered incurable. This putative conviction rendered the medical professionals in a state of helplessness, or to be precise, capitulate to the fate. Modifying or editing genes to imbibe genetic adaptation or manipulation has been unthinkable. However, the magical wand arrived in the form of genome sequencing, wherein the once 'unthinkable' became 'practicably feasible.' CRISPR technology, the precious golden feather in the crown of genome engineering has now been widely used in treating deficiencies in genes. 'An Unexpected Delight' arrived with the announcement of "Gene Editors of the Future 2.0" steered by one of the pioneers in the field, Dr. Kalpana Surendranath. Understanding the essentials of CRISPR directly from the pioneer in the field gave a new direction to my dream. Never a second thought was required for me to express my willingness to be part of the team to learn CRISPR. Then, it was frequent (then more frequent) checking of emails to know the results of selection. My anxious prayers were answered when I received the message of being selected to learn the technical version of CRISPR.

The inaugural ceremony itself was thrilling and informative leaving me wait for Friday evenings. The voyage since then to know the basic methods and theoretical



knowledge into complex molecular and cellular biology problems has been increasingly captivating. Provided hands-on training and the basic CRISPR techniques like target site analysis, gene modification, CCDS sequence, plasmid guide cloning, protein analysis and expression in tissues, etc using various bioinformatic tools were quite enthusiastic increasing my thirst for the technique. Dr. J Murphy's session on CRISPR Era in cancer research accorded yet another magnificent panorama into the prospects of technology.

'A Mind Stimulating and Vibrant Session' - Discussion forum with eminent and emulative Dr. Kalpana Surendranath, Dr. J Murphy, Dr. O. Haworth, and fellow researchers. The sharing of knowledge and experience during this interaction has been priceless.

The basic program, the dream come true "Live Genome Lab Session" and Dr. Kalpana's promising availability in clarifying queries round the clock has fascinatingly made me curious in knowing the subject in depth. It was initially fascination for the topic and then followed by incredible guidance that increased the thirst to know the subject. The well conducted program immensely impacted me giving the confidence in getting expertise in CRISPR technology and genome engineering. Kudos to the team behind "Gene Editors of the Future 2.0 - higher education student training and development program for life sciences." This team has for sure rightly guided me into a technology that requires 'vibrant thinking', 'creative mind' and 'innovative technique.'

[Merin Thyagu Pereira]



My experience with the Gene Editors of the Future 2.0- CRISPR Workshop was an interesting journey. The boring Friday evenings were filled with excitement as I was looking forward to the workshop. The talks from guest speakers were truly motivating and informative. The workshop was interesting and very easy to follow, all thanks to the professors and students involved in the programme. And I am really thankful to Dr. Kalpana Surendranath for giving us the opportunity to learn these skills, who was always available to answer any queries from students. Her passion for CRISPR was truly radiating throughout the sessions. I now have better understanding of the CRISPR technology, and I am very glad that I decided to join the workshop due to which I have gained valuable skills.

[Andrea Donna Pereira]

The gene editors of the future programme have been the silver lining in a stressful final year at the University of Westminster. My first introduction to CRISPR was in my second year, facilitated by Dr. Kalpana during an extremely interesting lecture. Since then, my intrigue regarding this technology has increased. The idea that DNA could be altered to achieve such drastic changes with such a seemingly simple technology was fascinating to me. When I was first told about the Gene Editors programme, I immediately wrote my proposal to join the basics training. Having the ability to use and familiarize myself with bioinformatics programme such as Benchling and learn the ins and outs of CRISPR technology has been a truly fascinating experience.

Every session was extensively planned to be both educational and genuinely enjoyable. In six short meetings, I learned more about gene editing than I ever thought possible, and I left every session feeling accomplished that I was able to complete the given tasks. I am extremely grateful for the opportunity and ability to have first-hand experience working with this ground-breaking technology, and I hope that this is just the beginning of my gene editing journey.

[Iffat Hussain]



Attending the gene editing program is the best decision I've ever made. I'm incredibly grateful to the university for conducting such a program for future scientists and doctors. Dr. Kalpana has really inspired and motivated me to listen to the program with how interestingly she took the lecture on CRISPR. I was able to understand a lot about the CRISPR program and I'm assured to know that it's going to be an enormous success in

the future of science and technology. I've never attended a class that had everyone's attention throughout the session, all enraptured about the wonders of the gene and CRISPR technology.

[Sreelekshmi Kanisseri]

Before starting the gene editors of the future, I knew what CRISPR was from lectures. I knew that CRISPR is a new technique that is revolutionising biology. On placement,

I learnt that as a scientist, you constantly need to adapt and be proactive. I joined this program with an open mind and I am glad I did its been truly inspiring. The talks that have been given by alumni of the program, hearing about their career progression and the opportunities that they have had because of the gene editors program have all been motivating. I am also creative so I really loved hearing about their interests, their creativity and how they integrated into their research and its impacting their field. This program has allowed me to further my knowledge of CRISPR with the guidance of Dr Kalpana Surendranath who is always helpful and the sessions are engaging. I learn best when I can apply the theory, in the program I have been given activities to complete during the session that aid with my learning. Looking forward to learning more and enhancing my CRISPR skills to become part of the few.



[Basma Idle Suudi]



I have always wanted to explore genetics, specifically CRISPR, since it fascinates me. My experience as a member of the Gene Editors of the Future 2.0 has been intriguing. I learned about CRISPR a few years ago and was astonished by it. This programme offered me the opportunity to gain a better knowledge of CRISPR technology while also being inspired by the success stories and astonishing findings of existing gene editors. I am grateful to Dr Kalpana Surendranath for giving me this chance to learn the highly sought-after CRISPR and the accomplishment of holding such a programme. I'm privileged to be part of this programme, inspiring me to be part of something that allows me to broaden my knowledge; this change motivates me and permits me to attend this programme.

[Riekesh Thabesh]

After briefly learning about CRISPR during my undergraduate degree, I knew that I had to jump on the opportunity to be a part of gene editors of the future and it has not disappointed. I have learnt so much in this journey of gene editors, from hearing about previous alumni experiences with gene editors and how it opened so many doors for them and allowed them to see things about genetics from a unique perspective that they were not previously aware of prior to learning about CRISPR. Something that

really stood out to me was when we were learning how to analyze gene sequences and identify which specific regions need to be targeted within the sequence. It was interesting because we identified the genes that caused a specific disease and using CRISPR lets us manipulate this gene and identify the drug targets. The vast applications of CRISPR are so fascinating and I am so grateful to Dr Kalpana for setting this up and allowing me to be a part of this gene editors journey because I have learnt so much about CRISPR that I never knew I would be able to in any other learning environment.

[Aamnah Nawaz-Khan]



Taking part in the 'Gene editors of the future 2.0' programme at the University of Westminster has been an invaluable and insightful experience. I have thoroughly enjoyed learning about the different aspects of the CRISPR toolkit and listening to gifted alumni share their work and academic journeys.

I am so thrilled to have received training in this highly sought-after skill and very grateful to Dr Kalpana Surendranath for providing me with this amazing opportunity. Each session has been exciting, informative and intellectually stimulating, and I look forward to future sessions. Dr Surendranath's passion for gene engineering is so infectious and inspiring, and her influence, as well as the endless support given to the many talented alumni speakers is very clear during their presentations, as well as in our own sessions. This programme not only gives you technical skills, but also encourages you to take leadership of your own learning, to always be curious, and motivates you to challenge your abilities.

[Bushra Choudhary]



I am grateful to be part of the CRISPR gene editor's 2022 program. It was an amazing and inspiring experience as I met and heard about the journeys of some truly astounding people. I also had the opportunity to learn about their current research involving CRISPR technology and how it has truly revolutionized so many fields of modern science. To think that such a small tool like CRISPR could be of this mass significance and efficacy is what stunned me. After this program, I have learned so much more about CRISPR

and my interest in the topic has increased further. I hope to be able to take part in the advanced stage to further enhance my knowledge and hopefully contribute to it.

[Nawshin Nawal Aritry]

I would like to thank Dr Kalpana Surendranath for this amazing experience and amazing insight into CRISPR. I am very grateful for this programme allowing individuals to have access to such as amazing tool with such a bright future. This experience has been surreal, and I would be looking forward to applying knowledge I have gained from this programme.

[Sahra Berkpinar]



Being a part of this wonderful opportunity has opened my eyes on the world of gene editing. It has always been a mystery to me, what does “gene editing” mean and how it is done. However, now I am fully aware of all the necessary procedures and preparations. CRISPR is an important tool in medicine currently. Learning about its applications and its role in the future of science inspired me to continue learning. Even though this time I chose not to proceed to the next stage of the training programme, I still believed that the knowledge gained so far is irreplaceable and I feel beyond grateful for such an opportunity.

[Uljana Zvereva]



When I came across CRISPR which was still in its infancy 6 years ago – a genome editing technique which could edit genes with high precision and efficacy compared to traditional techniques available, it seemed like a ray of hope through dark misty clouds which held the potential to revolutionise the field of science. I wanted to get a hands-on experience and hone this technique to be able to make some contribution towards welfare of humanity and to the field, and Gene Editors of The Future 2.0 made it possible. Conscientious efforts made by Dr. Kalpana Surendranath PhD, SfHEA FRSB, made

this course very informative and easy to understand. The knowledge provided was robust, and stories of some current and former students during the sessions has given me a new purpose in life and pushed me towards working for a better future. My belief about myself as a learner is a positive one, and what I have discovered about myself over the Basics Training sessions is vast. After trying out different learning techniques I figured that I am more of a visual learner than an auditory learner. And Gene Editors of The Future 2.0 understood that. I am very grateful to Dr. Kalpana, alumni and current students and this course for such a wonderful experience.

[Abdul Hafeez Khan]

I started my journey with CRISPR technology during my summer break after the first year of my Biomedical Science degree. At that time, the whole idea was brilliant. However, I needed help with its in-depth understanding. I had never thought genome editing could be easily applied to laboratory practice and that even a complete newbie could introduce these precise changes into microscopical cells.



Derived by curiosity, I joined the Genome Editors of the Future programme to learn more about the strategies used in this groundbreaking technology and understand the biological and chemical pathways that facilitate the genome engineering process. I was highly intrigued from the beginning of this course, as I have learned how to create CRISPR tools using many different types of software. Additionally, I got familiar with rules that help us recruit single guides RNAs with the highest specificity and efficacy. This technology is one of this century's most powerful discoveries and can help increase the speed of many ongoing studies.

I dream of using CRISPR in my research to deliver significant findings that may yield progress in medicine and science. Hopefully, my research will be a part of the scientific revolution as prominent as CRISPR technology.

I want to thank all lecturers for their passion and devotion during the preparation and presentation of this programme. It was a precious time, and I hope to continue exploring this technology in the following stages.

[Julia Kijas]

My recent CRISPR/Cas9 training, delivered by a skilled researcher (Dr Kalpana Surendranath), was extremely beneficial and memorable. As an overseas student, I had heard of this gene-editing tool but had never had the opportunity to delve into the deeper intricacies of its potential until I became a gene editor of the future at the University of Westminster London. Being a gene editor of the future provided me with significant insights into the possible uses of CRISPR/Cas9 and its efficiency as a gene-editing tool. It also strengthened my motivation to do additional biological research using cutting-edge techniques like CRISPR/Cas9. The information I obtained will undoubtedly help me in any future work involving molecular biology and genetics. I am grateful for the opportunity to attend this course and obtain a better grasp of this fantastic technology.



[Oluigbo Nicholas Nwuihe]



Since hearing about the CRISPR Cas 9 tool for the first time during the medical genetics in practice lecture led by Dr. Kalpana, I have been captivated by the endless capabilities of this genetic tool and its revolutionary impact on healthcare. Further discussions with my dissertation supervisor, Dr. Haworth, about CRISPRs treatment for sickle anemia and various forms of cancers.

This has truly been an eye-opening program that has me considering a career based on CRISPR technology for cancer treatment and sickle cell disease.

Thank you for this wonderful opportunity DR Kalpana and co.

[Kweku Nkansah]



When reflecting on my time on the Gene Editors of the Future additional course I am very appreciative of Dr Kalpana for this amazing opportunity.

I especially enjoyed the joining of Westminster staff and their knowledge Dr Haworth's discussion of the possible origins of depression and schizophrenia and the in-depth Q&A sessions that further developed my understanding of genetic history, manifestation, and the development of genes.

To conclude I feel very privileged to have the opportunity to be on this additional course and it has supplied me with tools that I will use throughout my future working life, as well as giving me knowledge that pushes me into work and greatly interests me.

[Oliver Rowberry]

Taking part in the Crispr gene editing programme was a very educational and insightful experience. During my first year I took an application of biological sciences as my optional module, I was introduced to the human genome project and found it very fascinating and wanted to learn more. Being a part of this programme allowed me to understand what Crispr is and how different software like Synthego and benchling can be used to create and edit sequences.

In addition to this I also learned about how Crispr can be used to help manage diseases like breast cancer, sickle cell anaemia and Huntington's disease. This course consisted of many speakers who introduced the topic of Crispr and how it has evolved over the years and will continue to change gene editing. To wrap up this course I was given a specific gene to work on (MDM2) and conduct my research on. This was very interesting as I got to apply the information I had learned in the sessions. I was able to find background information on the gene, the gene location, the guide design and sequences for the guide.

[Numa Shah]



Being on this programme has solidified my interest in genomics. It has also allowed me to distinguish genomics between other scientific interests of mine. Therefore, I am very grateful to have come across such a surreal opportunity that had a significant impact on my desired career options. I would like to thank everyone involved in curating such a programme for undergraduates like me who needed extra guidance.

[Abdullah Rasheed Ismail Awad]

Since Jennifer Doudna and Emmanuelle Charpentier were awarded the ultimate science prize for their breakthrough research on CRISPR technology I have been completely fascinated by all the opportunities this technology has. Therefore, I am incredibly grateful for this wonderful and exciting opportunity of this project that enables me to further widen my knowledge in terms of future career prospects. I would like to thank Dr. Kalpana and her team for making this amazing opportunity possible and allowing me to be even more fascinated by this technology. Looking back at the past weeks I have learned many aspects of CRISPR in medicine and got to hear about some talented students that were part of it and how this technology is going to help many diseases.



[Rashani Galmangoda]

The gene editors of the future program at the University of Westminster Genome Engineering Laboratory have facilitated me to expand my knowledge of CRISPR technology and gain new interests within the field of molecular and cellular therapeutics. Not only is this course informative due to the engaging seminars held by the professors, but you are also provided with the opportunity to discuss with the University of Westminster Alumni.

To summarize, the gene editors of the program is not only interesting due to the seminar material but also interactive and engaging. Therefore, the gene editors of

the future program have allowed me to expand on possible opportunities/career paths that are available post-graduation and allow for discussions around completing a master's degree etc. I plan to form further connections from this program by talking with professors and students on this course to develop my communication skills as a scientist. To do so, I aim to enter the program's second stage and admit my project proposal by the 31st of January.

However, even just completing the primary stage of the program, I am so grateful to all the professors for taking the time to form the interactive sessions each week and also to have been allowed to be a part of this program in the first place; it has truly enriched my university experience, and I am thankful for the new skills that I have gained.

[Amelia Kitty Jesson]



The gene editing programme was a very enlightening experience for myself as I was able to gain experience and have knowledge that branched out of what I would learn in university with more detail, if I wanted to, I would be able to



get into a career within this subject. The sessions that I thoroughly enjoyed were when there were guest speakers, whether it was a student or if it was someone within the profession because they had some insightful advice which could help us in the future. As there was someone that was similar to my age, giving a talk was something that I could resonate with due to the fact that they could give advice on how to do something with more detail. During this programme I was taught how to navigate through a website called ensemble, which I would not have been able to use by myself otherwise, as it would be a bit confusing, however as we were going through the website together and answering questions in order to practice how to use it, it made it a lot easier and became a useful tool especially when I figured out how to find specific transcriptions and information. Being a part of the programme made me even more interested in the field of research because I could apply the knowledge and use

it for research whether it was for my personal gain or for university work which would increase my knowledge and improve my work. I would love to continue with this programme as I feel like I am using my time productively as it is something that is going towards my future.

[Maria Choudhary]

Gene editing is a hot topic and key players in the field are rapidly evolving. As someone with a keen interest in this topic, I jumped at the opportunity to join the 'Gene Editors of the Future 2.0 Programme'. This Programme has broadened my perspective of what CRISPR really is and its potential applications. Aside from the basic knowledge I acquired over the years, attending these sessions has opened my eyes towards what great potential CRISPR has. From using CRISPR Cas9 as a therapeutic and diagnostics tool in cancer research, to discovering transcripts each gene has, I learnt something new from each session. I am grateful to the Genome Engineering team and Dr Kalpana Surendranath for putting together such an innovative programme!

[Aisha Fadila Sadiq]

My interest for CRISPR started earlier in my studies, however I do not have the opportunity to study CRISPR in dept as I am studying now with this program the Genome Editors of the Future given by the University and directed by DR. Kalpana.



As a scientist and future researcher CRISPR will help me to conduct better research in my career later in future. This program helps me to understand more about DNA and Chromosomes. By listening to former student speech during the zoom lecture when they were talking about how their journey with CRISPR at the beginning was, this has motivated and inspired me a lot.

I am very grateful for this opportunity to be a part of Genome Editors of the Future program.

[Lariza Matcha]

The gene editors of the future sessions have reignited my passion for research and science itself in general. From listening to amazing speakers offer their invaluable

knowledge about CRISPR as well as how to progress in the industry, this program has helped me to reflect on my own personal development. This includes how significant it is to stay patient and resilient and to believe in yourself when conducting scientific research. The program has also made me realize how vast CRISPR is with its potential of application such as its use of helping individuals tackle infertility which amazes me how such a tool can cause a life changing impact to someone's life. I found that the training sessions were exciting due to learning new skills, for example, using websites like Synthego and ensemble for the first time to gather research information such as chromosome location, number of exons etc.

[Sara Emran]