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Gene Editors of the Future: A Unique Model for CRISPR in Research-Engaged Education at the University of Westminster

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Jolina Viessmann [1], Nadezda Zelve [1], Aya Hijazi [1], Aabha Khaparde [1], Daniela Rojano [1], Paalvi Nemade [1], Ioanna Bojinova [1], Afsaneh V.M. Masouleh [2], Shally Choudhury [2], John J Murphy and Kalpana Surendranath
Gene Editors of the Future, School of Life Sciences, University of Westminster, London United Kingdom
k.surendranath1@westminster.ac.uk
[1] BSc Biomedical Sciences [2] MSc Biomedical Sciences

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ABSTRACT:
CRISPR-Cas-based technologies have revolutionised molecular biology, becoming a pioneering tool with unparalleled precision and versatility in genome editing. This has led to widespread interest among students in exploring the potential of CRISPR technology. The global gene editing market is projected to exceed USD 29.93 billion by 2032, with an anticipated compound annual growth rate of 15.73% during the forecast. As the applications of gene editing expand, so does the need for skilled professionals capable of harnessing its capabilities for various beneficial purposes. Committed to United Nations Sustainability Development Goal 4, the Gene Editors of the Future program was launched in 2020 with the primary objective of enriching research-engaged students' experience and employment opportunities. The dynamically evolving program operates with the following at its core: Phase I, conducted entirely online, focuses on the fundamentals of CRISPR technology, Phase II involves a lab-based approach, and Phase III offers research internships for selected students. The poster will discuss student engagement, impact, and experience learning cutting-edge research techniques in a UG-PG-PHD pipeline. In addition, student voices about the initiative's impact which extends beyond technical proficiency, incorporating skill development in interdisciplinary linking and community engagement will be discussed. As students navigate the ever-expanding horizons of science, this program underscores the importance of nurturing a generation of informed student researchers committed to knowledge sharing and responsible application of genome editing tools.

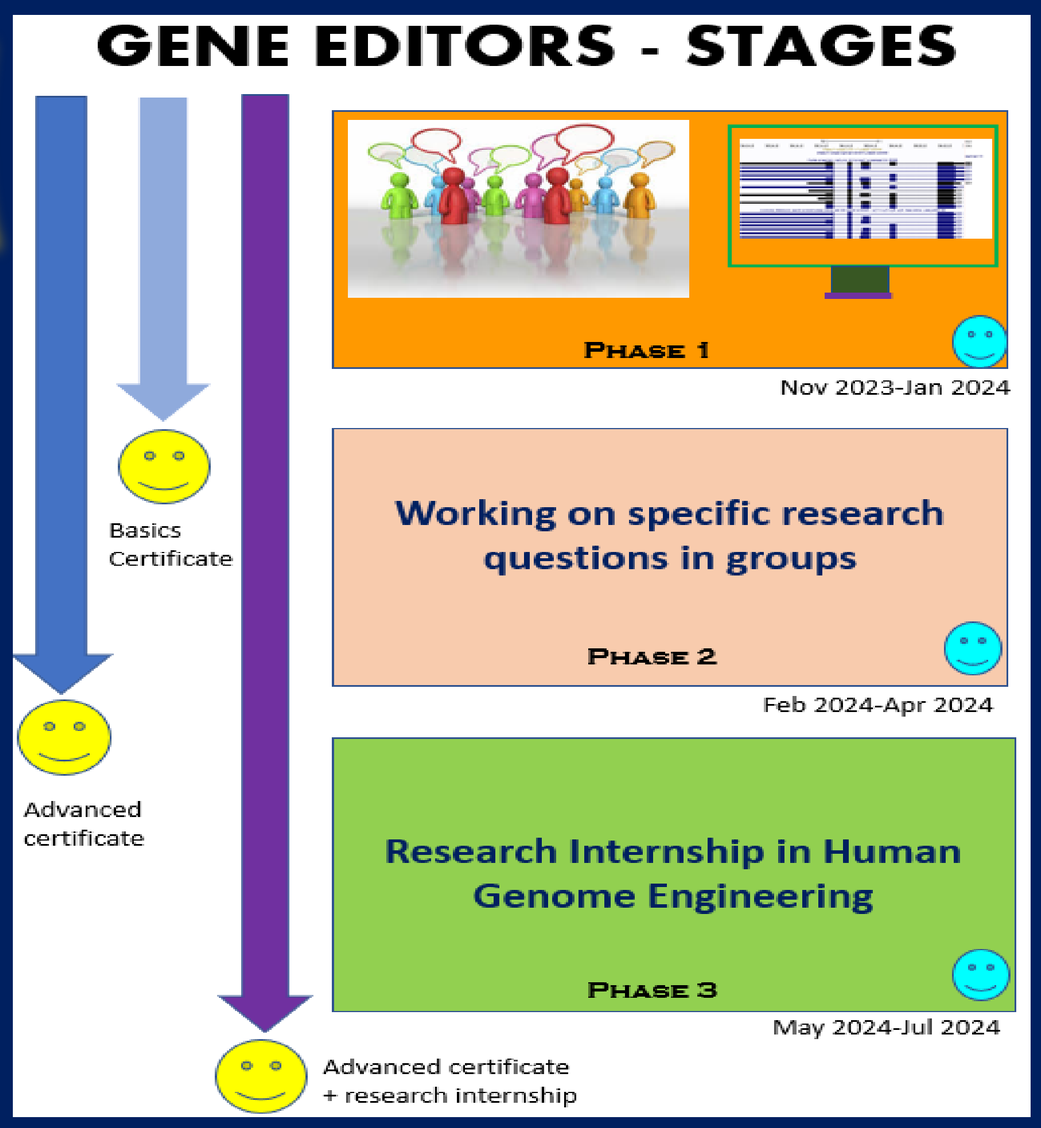


Figure 1 The program consists of three phases, students can opt to participate in one or more of the following phases: For instance, in the current run, the current scheme is followed: November - December 2023: CRISPR basics training, an online course requiring 2 hours per week on Fridays from 5 to 7 pm. January 2024 - March 2024: Independent, interdisciplinary research work offered to around 50 students, which dynamically evolves depending on the students' interests and opportunities. June-August 2024: Research internship shadowing opportunity for selected students. Sessions are scheduled to avoid overlap with regular learning commitments. While formal assessments are not included, participation in at least 70% of sessions and completion of assigned activities are necessary to receive the training certificate and progress to stages 2 and 3.

3 Iterations and 500 students: an extracurricular activity closely tied with the curriculum

Student participation

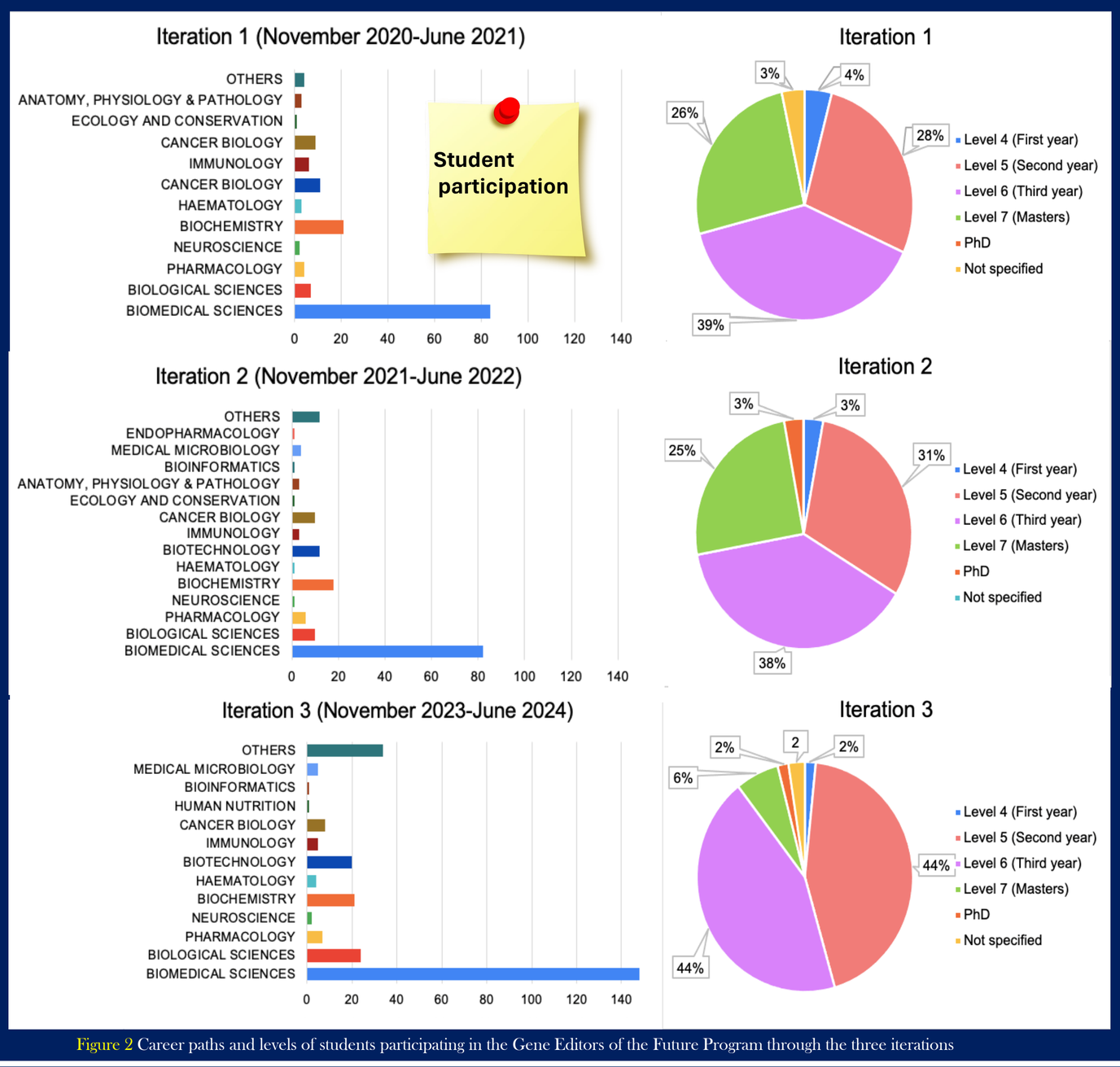


Figure 2 Career paths and levels of students participating in the Gene Editors of the Future Program through the three iterations

Research and Knowledge Exchange

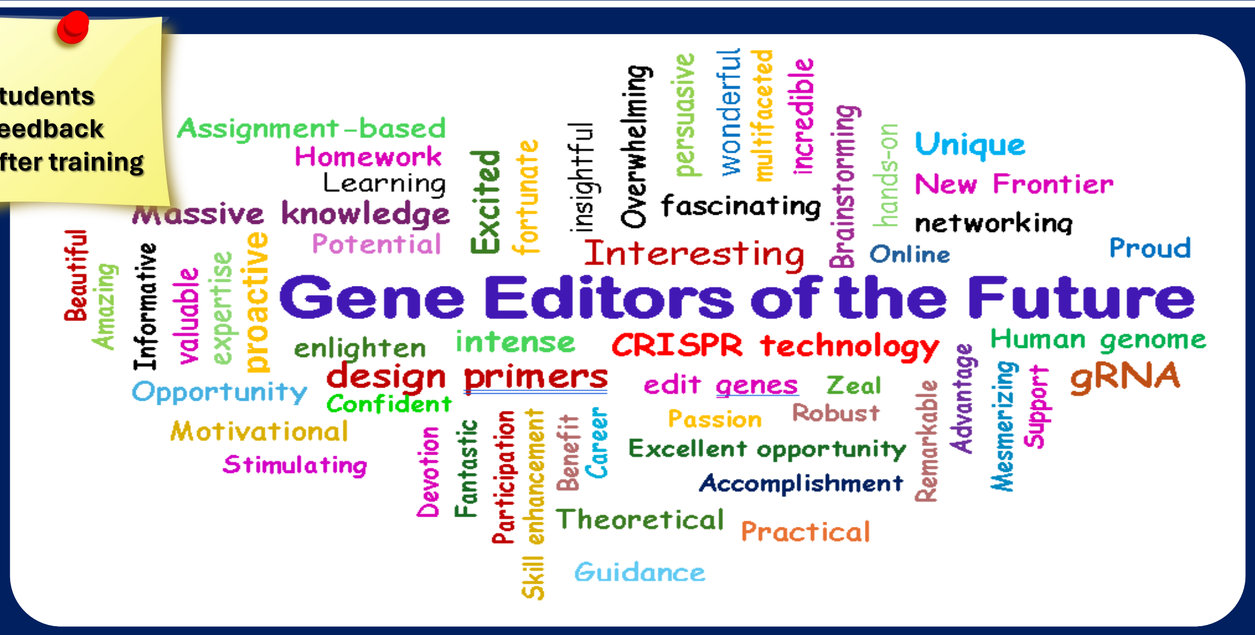
Table 1 Motivation behind the growth of Gene Editors Superstars

	ITERATION YEAR					
	2020	% of all	2022	% of all	2023	% of all
Student motivation						
Potential	29	20.42	46	26.59	105	45.85
Knowledge	75	52.82	124	71.68	129	56.33
Passion	19	13.38	24	13.87	64	27.95
Practice	29	20.42	24	13.87	30	13.10
Dedication	5	3.52	3	1.73	33	14.41
Challenge	9	6.34	9	5.20	26	11.35
Student expectation						
Lab work	30	21.13	52	30.06		
Learning	34	23.94	88	50.87		
Understanding	87	61.27	62	35.84		
Teamwork	18	12.68	10	5.78		
TOTAL number of responses	**142**		**173**		**229**	

Students are the drivers of the program

NOTE: In 2023 question about expectation was not included in application form

Students Feedback After training



Reflections

Life sciences in the UK currently employ over 250,000 people and have the potential to create more than 130,000 jobs in the next 10 years. This highlights the demand for transformative and experiential learning for students to gain an upper hand in holistic career development. "Gene Editors of the Future" is a research-engaged extracurricular initiative of the School of Life Sciences, University of Westminster, built around CRISPR, the 2020 Nobel Prize-winning technology in Chemistry. The program launched a week after the announcement of the Nobel Prize to CRISPR vertically integrated cutting-edge CRISPR-based research, for students of all levels and international researchers. In three years, it has successfully fostered co-creation, reflection, and appreciation of taught subjects, as well as providing opportunities to succeed and innovate in an ever-changing and demanding world.

References

1) Rowe, L. (2020). Ethics and systems thinking in biochemistry: A CRISPR-based activity for undergraduate students. Journal of Chemical Education, 97(7), 1944-1950.
2) Wang MT, Degol J. Staying Engaged: Knowledge and Research Needs in Student Engagement. Child Dev Perspect. 2014 Sep;8(3):137-143.