NEWNHAM COLLEGE
CAMBRIDGE CB3 9DF

The Newnham Engineering Prize 2020-21

The Newnham Engineering Prize is open to all **girls currently in Year 12** (Lower Sixth) at a UK school. The prize may be of particular interest to those studying Physics, Mathematics, Further Mathematics, Chemistry, Biology, Design and Technology or Economics, but we welcome entries from interested students studying any combination of subjects.

Entrants are invited to submit an essay on **one** of the topics overleaf. You can write broadly about the topic, or you can choose to go into greater detail on a specific aspect. Some ideas are given under each topic area to help you to start thinking, but feel free to explore the topics and choose your own examples to discuss.

The essay should be 2000-2500 words in length including footnotes and figure captions, but lists of references and bibliography can be additional to this. All sources must be appropriately acknowledged and cited and the bibliography should include websites that you have consulted. Up to **five** entries may be submitted per school.

There is no rigid requirement for the structure and format of the essays, but good submissions will present clear arguments, include illustrations (which might be graphs, plots and diagrams as well as pictures), and where possible provide some specific examples or cases. A good level of technical content is expected, but you should aim to make the essay interesting and accessible to an intelligent non-specialist audience.

Each of the Newnham Essay Prizes has a first prize of £400, a second prize of £200, and third prize of £100.

Entrants should upload their submissions to the webform, found here: https://cambridge.eu.qualtrics.com/jfe/form/SV_d0jlQUfoNT1f7g1

The **cover sheet** should also be uploaded to this webform. Please ensure that a school/college representative has completed the appropriate section. Entries will not be valid without this information.

The deadline for receipt is **12pm on Wednesday 10th March 2021**. For any queries not answered here, please contact Lucy Rogers (Schools Liaison & Outreach Officer) by email at slo@newn.cam.ac.uk or by telephone on 01223 330471.

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The Engineering Prize Questions: 2020-21

1) Biomimicry in engineering

The natural world has evolved to operate efficiently, and can provide many sources of inspiration to engineers as they design new materials, structures and processes. This is biomimicry. Examples from different engineering disciplines include:

- the design of naturally ventilated buildings taking lessons from termite mounds;
- the silent flight of owls giving clues as to how noise can be reduced in mechanical flight;
- investigating how geckos can walk upside down on the ceiling opens up the possibility of humans following suit;
- coral reefs make a cement-like material without emitting carbon dioxide; can we imitate this?

Choose one or more examples of how biomimicry has been used in engineering, explaining how the applications benefit from what is found in nature. Some of these applications are completely new and wouldn't be possible without the new ideas; in other cases, natural materials and processes enable real improvements over what we do now – in terms of efficiency, environmental impact, and even cost. It's an exciting field which is constantly developing!

Suggested background reading:
Biomimicry : Innovation Inspired by Nature by Janine M. Benyus, Sept. 1, 1997, (ISBN 0-06-053322-6)

2) Engineering for the COVID-19 pandemic

The year 2020 has been defined by the COVID-19 pandemic. The COVID-19 virus has been found to spread primarily through droplets or aerosols carrying the disease. Engineers have a key role to play in limiting the spread.
Write an essay on how engineers have supported the fight against the COVID-19 pandemic.

Some ideas on what you could consider:

- Increasing evidence suggests that understanding airflows is important for estimation of the risk of contracting the disease. What can engineers do with air flow study and ventilation study?
- What devices can engineers develop to support rapid testing and detection?

- What are some of the benefits and risks of using data-driven approaches to model and understand the spread of the disease?

3) How can engineers benefit society?

Engineers are people who apply science and maths to real-world problems to make things happen. They find ingenious solutions, invent machines and devices, and they have the power to make the world a better place. Find one or more examples of how engineering advances have helped people to lead better lives, and explore the technologies that have enabled change. Some ideas of topic areas are suggested, but do use examples from your own areas of interest.

What is the role of engineers in the developing world? Common areas of interest include providing safe water supplies, generating electricity and building houses, and achieving all these in ways that are appropriate to the area and to the community.

What is the role of engineers in the post-COVID world? So much has changed in the last year, and the world won't go back to how it was before the pandemic. Can we make public transport safe? How should schools and work places be adapted to enable safe working?

What is the role of engineers in limiting the consequences of global warming? Climate change is impacting the whole world, resulting in extreme weather events and sea level rises. How can technological solutions help? How can the danger of flooding be reduced? Can housing be designed to cope better with heat and cold without excessive use of power?