Survey on Genetically Modified Organisms (GMOs) and Synthetic Biology

Conducted by Team-**IISER Mohali**, India, in collaboration with Team-**Patras**, Greece, Team-**IISER TVM**, India Team-**AFCM**, Egypt.

Our team is conducting this survey in collaboration with Team-**Patras**, Team - **IISER TVM,** and Team- **AFCM**, Egypt, to understand the public's perception of genetic engineering and synthetic biology's applications worldwide.

We will ensure that the participants give us **informed consent** for this survey:

1. The participants will be informed that the survey is conducted by Team-**IISER Mohali**, Team-**IISER TVM**, Team- **AFCM,** Egypt, and Team-**Patras**, as a part of iGEM 2022.

2. The participants will know the survey and why it is being done.

3. The participation will be voluntary and can be terminated at any point in time before the submission.

4. The participants will be informed that their email ID is NOT collected in the process and thatthe data collected will be anonymous.

5. The participants will be informed that their responses are solely for research purposes used by Team-IISER Mohali, Team-IISER Thiruvananthapuram, Team-Patras, Greece, and Team- AFCM Egypt.

6. The participants who cannot access the survey due to a lack of internet connection will be approached locally.

7. Parents or guardians can fill out the survey on behalf of minors.

We have obtained approval from a Bio-Ethics committee member who is also a Social Science Researcher from the Institute concerning the informed consent used. The R&D Department from the Institute has also approved the informed consent to be used.

Since India doesn't have any formal rules concerning the survey, we are adhering to the WMA's Declaration of Helsinki and WHO's Ethical Standard and Procedures for Research with Human Beings.

The **objective** of the survey:

1. Understand the perception of Genetically Modified Organisms (GMOs) andSynthetic Biology among people.

2. Understand if the difference in perception towards Genetically Modified Organisms (GMOs) and Synthetic Biology is affected by geographical boundaries.

3. Understand if the difference in educational qualification affects people's perception ofthe various applications of GMOs and Synthetic Biology.

4. Understand the difference in perception towards GMOs in a cohort.

5. Understand the concerns towards usage of genetic engineering in Synthetic Biology andGMOs.

6. Understand whether the perception of people changes toward GMOs and Synthetic Biology based on its field of application.

7. Understand what kind of Science Communication and Education events we can organize to help people enhance their knowledge regarding Synthetic Biology &GMOs.

About Participants in the Survey

The survey received a total of 136 responses, out of which 73.5% of the participants were from India, 19.1% were from Greece, and 7.3% were from other countries, including Canada, England, the USA, Brazil, Finland, and Dubai.

The majority of the participants, about 65.4%, were from the age group of 18 to 25 years, 16.2% were from 15 to 18 years, 8.1% from 12 to 15 years, 5.1% from 25 to 35 years, 4.5% from 35 and above years of age.

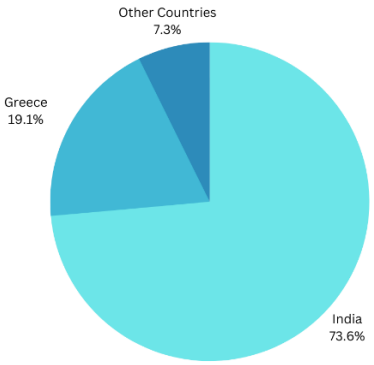

Fig 1: Demographics of the survey sample

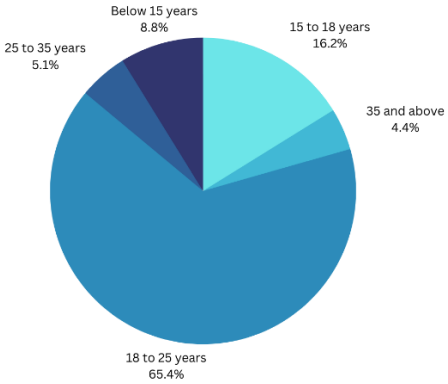

Fig 2: Age group of the participants in the survey

Out of all the participants, the majority of them were high school graduates, about 55.8% and about 26.7% were school students. Graduates with Diplomas, bachelor's, master's, and Ph.D. formed 1.7%, 5%, 10%, and 0.8% of the survey, respectively.

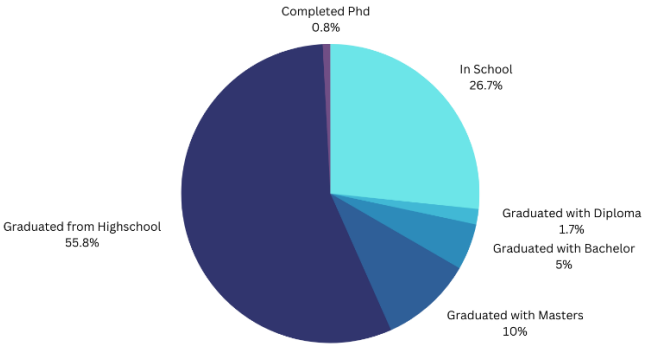

Fig 3: Educational Qualification of the participants in the survey

About 28.6% of participants of the survey agreed to have studied biology in their higher education, and another 28.6% agreed to have taken some courses related to biology out of interest in the field.

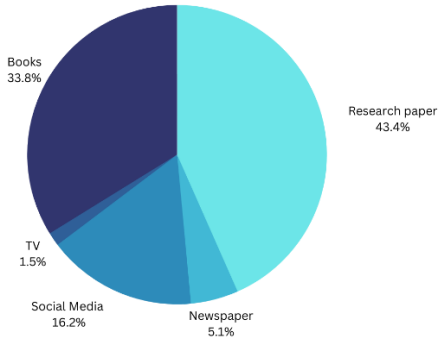

Fig 4: Preferred source of scientific information

With respect to getting their scientific information, about 43.4% of the participants preferred research papers, and 33.8% of the participants preferred books. The percentage of people getting their scientific information from social media, TV, and newspaper was 16.2%, 1.5%, and 5.1%, respectively.

The general opinion of people on GMO and Synthetic bio

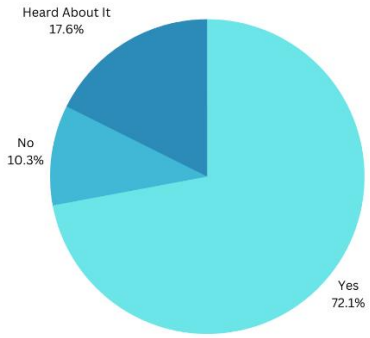

Fig 5: Distribution of participants who know about GMO

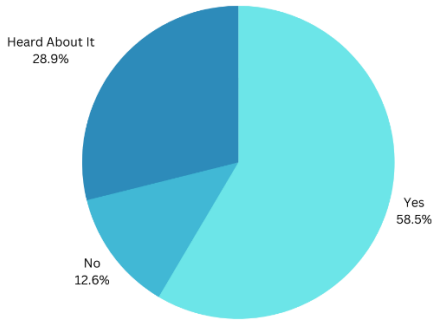

Fig 6: Distribution of participants who know about Synthetic Biology

A huge majority, about 89.7% of the participants, had at least heard about GMOs, and 72.1% knew what it is. A similar trend was observed for Synthetic biology, such that about 87.4% of the participants had at least heard about synthetic Biology, and 58.5 knew what it is.

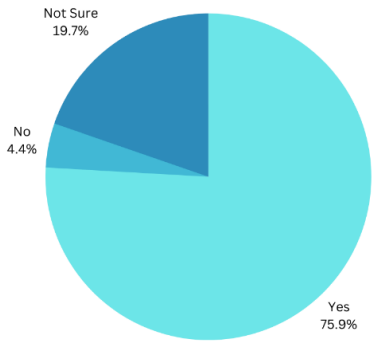

Fig 7: Distribution of participants who think GMOs are beneficial to the society

While 19.7% of people were unsure if GMOs could be harmful or beneficiary to society, 15.4% and 6.6% of people were concerned that GMOs are harmful to society because of their being unnatural and their association with genetic engineering, respectively. Still, the majority of 75.9% of the participants held a positive opinion of GMOs.

Opinion of people on the specific use of GMO and Synthetic bio

To get more insights into the participant's perceptions, we collected their opinion on the use of GMOs in different contexts like purification of contaminated water, Agriculture, Drug development and Therapeutics, Increasing Biofuel efficiency, Bioremediation of polluted sites, Reduction of CO_2 emissions, Development of Diagnostic kits, and Biocomputing.

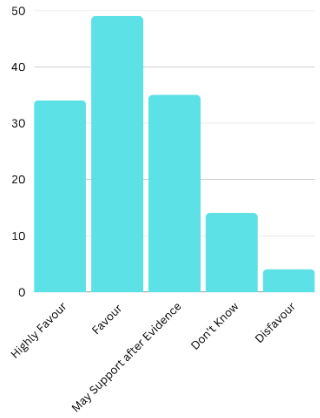

Fig 8: Distribution of the population on their opinion on use of GMO and the application of synthetic biology in purifying Contaminated water

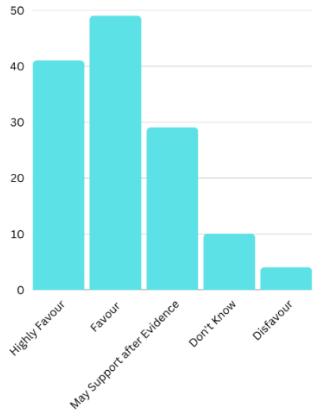

Fig 9: Distribution of the population on their opinion use of GMO and the application of Synthetic Biology in Agriculture

About 61% of participants held a favorable opinion on the use of GMOs and synthetic biology in purifying contaminated water, while 25.5% agreed to support it based on some evidence. Similar trends were observed in the Opinion of people on the use of GMO and synthetic biology in Agriculture, Drug Development and Therapeutics, Development of Diagnostic kits, and Biocomputing, and the numbers were 66%, 63.9%,64.7%, and 63.9% of participants in support, and 21.3%, 21.5%, 21.3%, and 14.7% agreed to support it based on evidence in both areas, respectively.

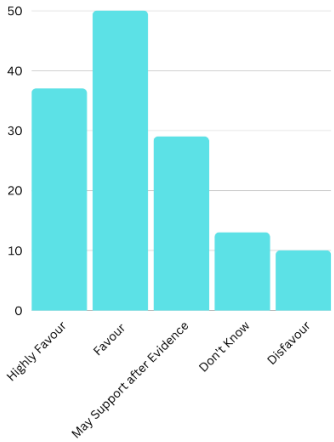

Fig 10: Distribution of the population on their opinion on use of GMO and the application of synthetic biology in Drug development Biofuel and Therapeutics

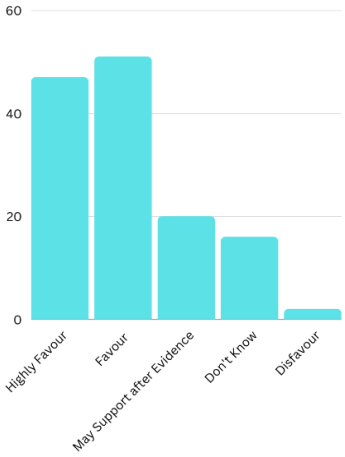

Fig 11: Distribution of the population on their opinion use of GMO and the application of Synthetic Biology in increasing efficiency

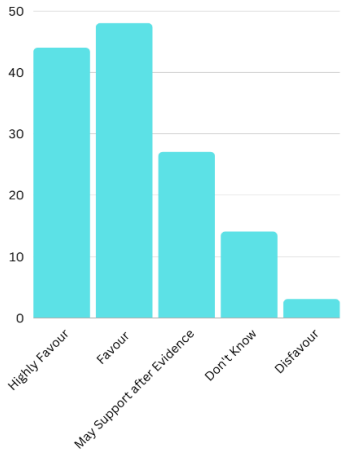

Fig 12: Distribution of the population on their opinion on use of GMO and the application of synthetic biology in the Bioremediation of polluted sites

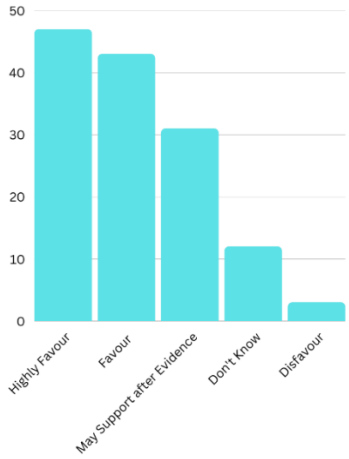

Fig 13: Distribution of the population on their opinion on use of GMO and the application of Synthetic Biology to reduce CO_2 emissions

A little larger fraction of favorable opinions of participants were observed for the use of GMOs and synthetic biology in increasing biofuel efficiency, Bioremedial of polluted sites, and to reduce CO_2 emissions, and the numbers were about 72%, 70.5%, 63.8% of participants in support, and 14%, 19.8%, and 20.5% required scientific evidence to support it.

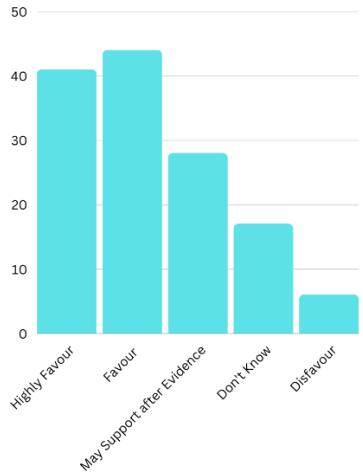

Fig 14: Distribution of the population on their opinion on use of GMO and the application of synthetic biology in the Development of Diagnostic kits

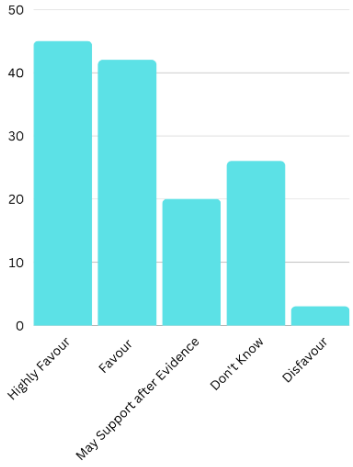

Fig 15: Distribution of the population on their opinion on use of GMO and the application of Synthetic Biology in Biocomputing

Overall, people held a positive attitude for the use of GMO and synthetic biology in different contexts of application.

About 85% of participants in the survey admitted that their opinion on the questions asked to them in the survey would have been more in support of Genetically Modified Organisms (GMOs) and the application of Synthetic Biology if they were told and shown that Biosafety measures were carried out in the processes.

Discussion

We clearly see that majority of participants of the survey have a positive outlook for GMOs and synthetic biology, but are worried if Biosafety measures can be properly ensured or not. They are also interested to know more about it.

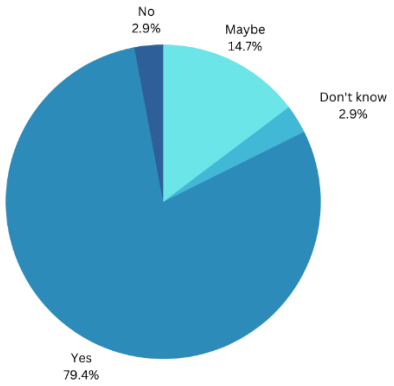

Fig 16: Distribution of participants interested in learning more about GMO and Synthetic Biology

A huge fraction of the participants, about 80%, showed interest to learn more about GMOs and synthetic biology.

For most of the applications of GMOs and synthetic biology discussed in the survey, participants supported the idea of introducing GMOs and synthetic biology, but there was a slight change in opinion in the case of Drug development and Therapeutics as there were relatively more people disapproving of the idea and more people wanted a supporting evidence for the same. In case of application of synthetic biology and GMOs in Biocomputing, relatively more percentage of people were unsure of approving or disapproving it.