Survey: Understanding Public Opinion

There has never been a large-scale survey in Israel about synthetic biology and genetic engineering. Therefore, our first step was to undertake a massive public opinion survey to learn about the current state of public opinion, and hopefully understand the roots of opposition to synthetic biology.

In the past few years, a number of public opinion surveys have been undertaken in various countries regarding new biological technologies, including synthetic biology. We based our survey on the strong, high-quality foundations of past efforts from across the world, including studies done in the United States[i], the United Kingdom[ii], Japan[iii], and New Zealand[iv].

Two questions must be asked before presenting the questionnaire and the results: Why bother conducting such a survey? And what did we intend to learn from it?

We wanted to canvass Israeli public opinion about synthetic biology because first of all, we couldn't find any similar survey done in the past in Israel, and secondly, scientific progress tends to outpace public perception. We believe synthetic biology holds great potential for ecological, medical, and other projects, but nothing can be implemented without public support. For that to happen, we first need to understand how much people know about genetic engineering and synthetic biology, and what their concerns and thoughts are.

**Note: as the term "synthetic biology" is not very common, we used the term "genetic engineering" which is much more familiar, even though they are not completely equivalent.*

The Questionnaire:

Ten questions were translated to Hebrew from the surveys mentioned above, some slightly modified to be more comprehensive and generic. In addition, one question was added that relates to our project specifically.

The personal details asked were minimal, to make survey as convenient and fluent as possible, and included: age, gender, religion & education.

The full survey in English is attached at the end.

Methods of distribution

The questionnaire was distributed from September 8th to September 24th, 2013, in the following ways:

- Link in an article about our team, posted on the Israeli news website "Ynet". => 120 responses.
- Hard copy surveys handed out in the "Science Night Festival" in Beer Sheva. => 50 responses.
- Science forums. => 234 responses.
- Facebook link, distributed by team members and posted on several Israeli forums. => 711 responses. 13 out of them belong to "green" forums and are marked separately.

Altogether we collected 1115 responses for our survey, from a variety of age groups and backgrounds, 77 of which were excluded due to many missing answers.

Do the responders accurately represent Israeli society? Unfortunately, no. We tried to reach a diverse sample of Israelis but as seen above, most responders were ones that reached the link via Facebook, which is skewed to be a younger and more technologically savvy population. Also, because we are all students and because we used science forums to promote the survey, the percentage of people with an academic background or advanced degrees that answered our survey is higher than in general population.

Because the results of this survey are not necessarily representative, we focused on directed analysis of the groups that we do feel that our results represent, rather than generalizations about all of Israeli society. We also excluded the responses from the science forum links for some of the analyses. For a fuller picture, we recommend generating an even larger survey using survey companies that have better access to a more representative sample of the public.

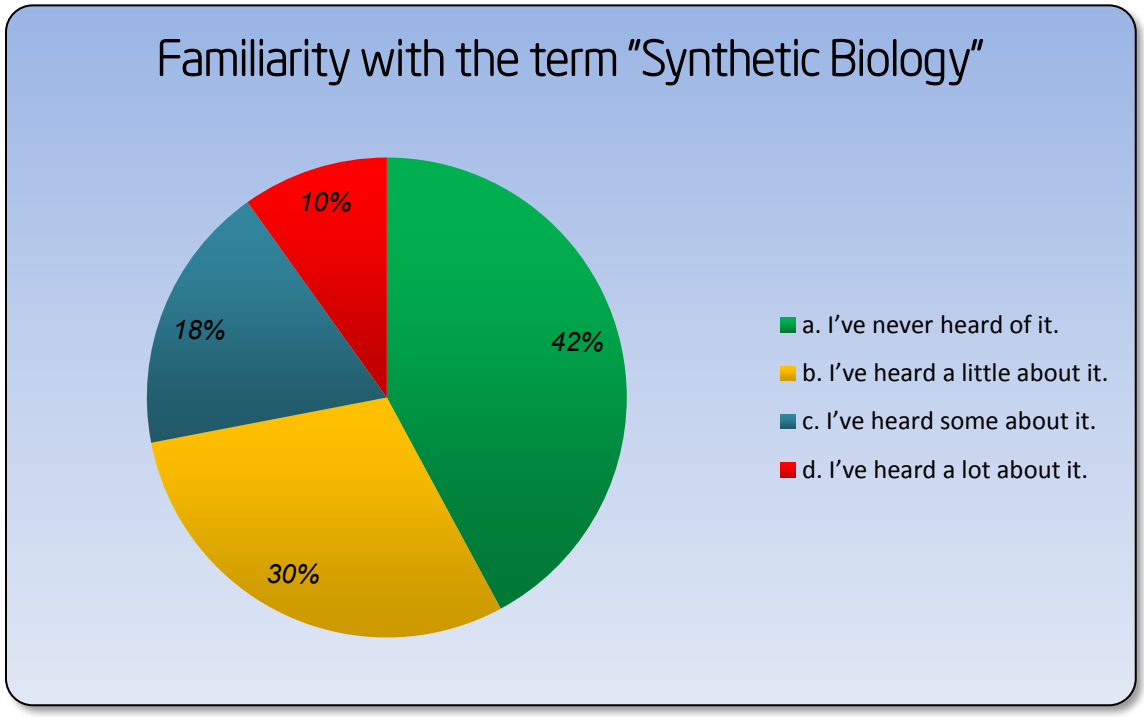
Results & Analyses:

Our hypothesis is that the more people hear and learn about the world of genetic engineering and synthetic biology, the less they are concerned about it. The encounters with this field could be through an article in a newspaper, studying about it in school, talking about it with friends, watching a video on YouTube, etc. In our eyes, the negative public perception and uncertainty about biological developments has a lot to do with a lack of familiarity with the subject and a lack of participation in public discourse about it.

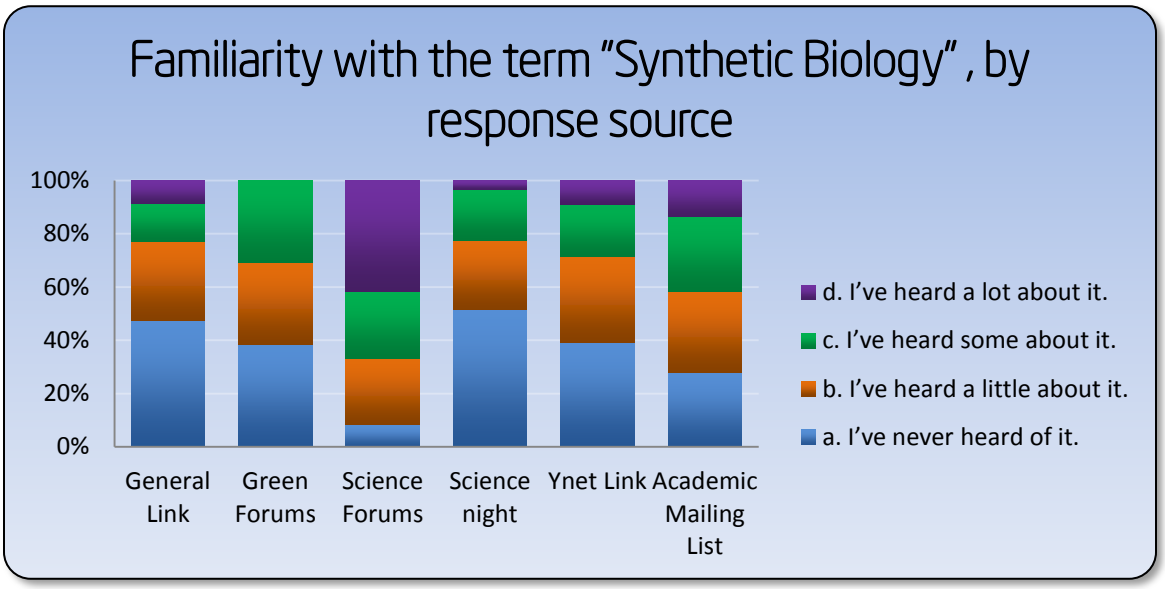
We present below many results we got, not only those relevant to our hypothesis, but also graphs that demonstrate differences between our religious responders to our secular ones, gender differences in attitudes, and more.

1. Have you ever heard of synthetic biology?

(Graph 1)

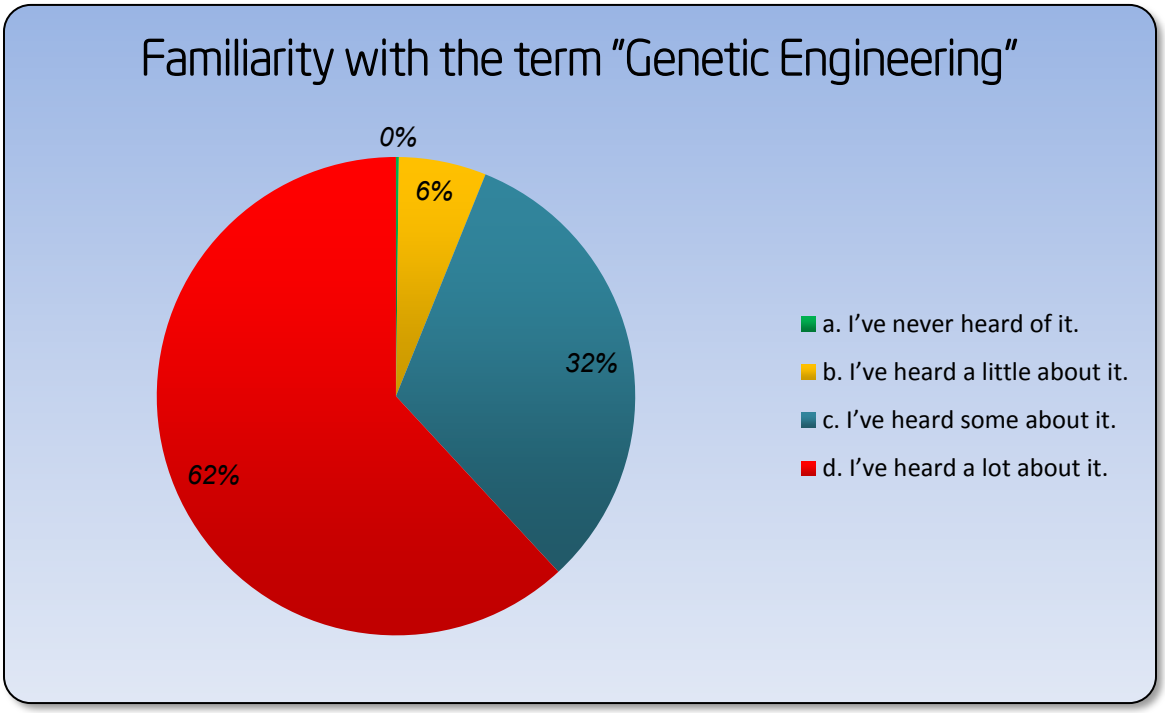


(Graph 2)



2. Have you ever heard of genetic engineering?

(Graph 3)



Unlike the term "synthetic biology," "genetic engineering" is relatively well-known: this is not surprising considering that the field of genetic engineering has been around decades longer than synthetic biology. This could actually be an advantage, because it indicates that there is still potential to shape people's perceptions of synthetic biology, whereas this may be more challenging for genetic engineering.

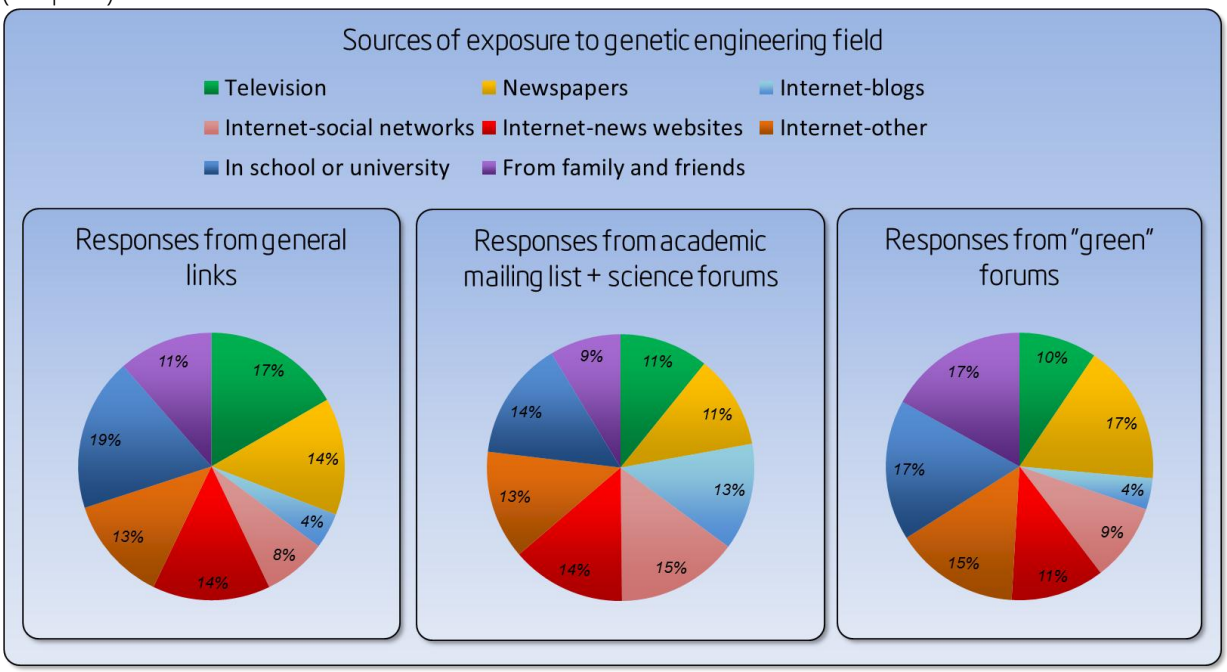
3. What are the first things that come to mind when you hear the term "genetic engineering"? (Graph 5)

(Graph 6)

This question was a free response section, and we created a world cloud with the responses (the largest words appeared most often). From the results, it is obvious that out of all of the applications and projects in genetic engineering, what most captured the public imagination is cloning and Dolly the sheep. If this result repeats itself in a larger-scale survey, it would be interesting to attempt to analyze what it is about the Dolly story that resonated with people, and whether it hurt or helped opinions about genetic engineering.

4. Assuming that you have heard of synthetic biology or genetic engineering, where did you hear about it?

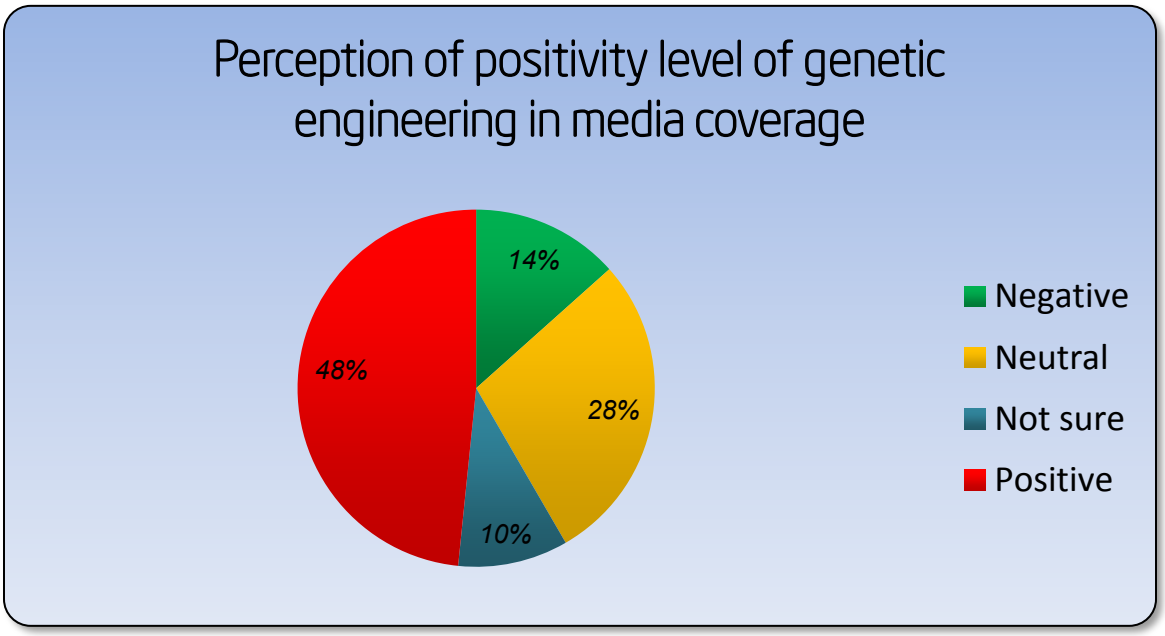
(Graph 7)



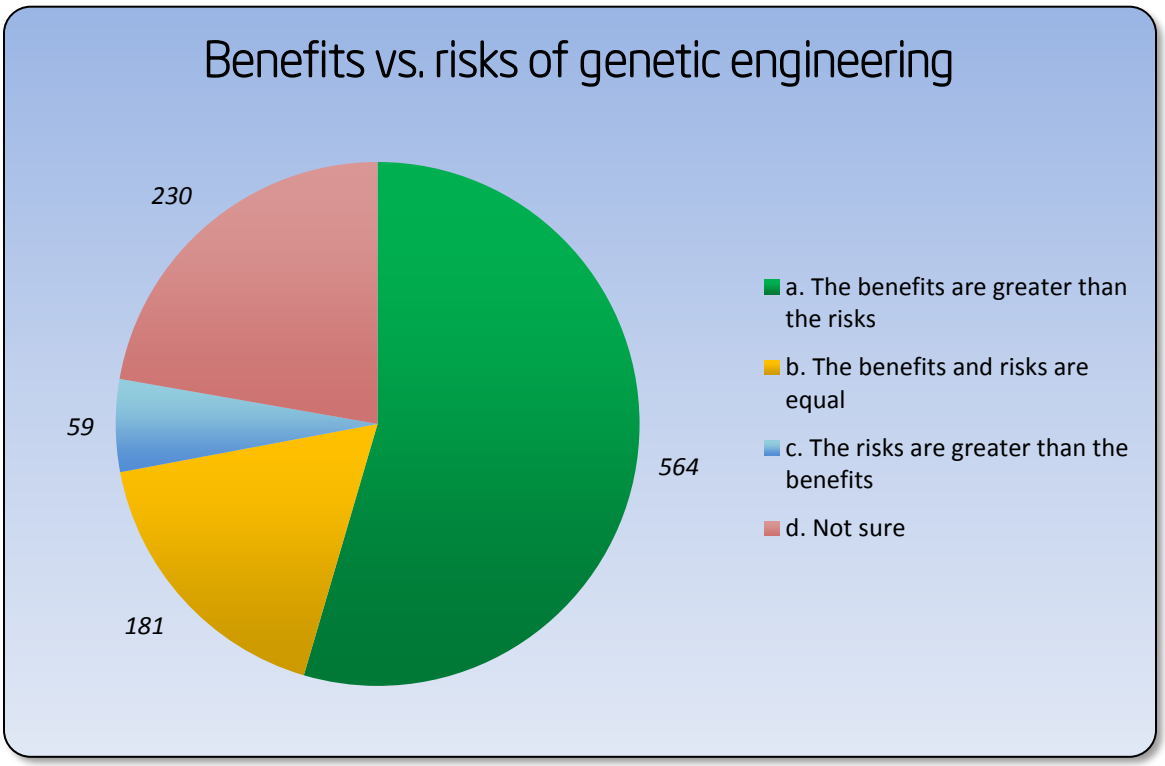
All groups encountered the topic of "genetic engineering" in a wide variety of contexts. Nevertheless, small differences can be seen: responders from the science forums are much more active in science blogs online, while responders from the general links heard the term more on television than others.

5. In the sources you were exposed to, do you feel that the subject was covered in a positive or negative manner?

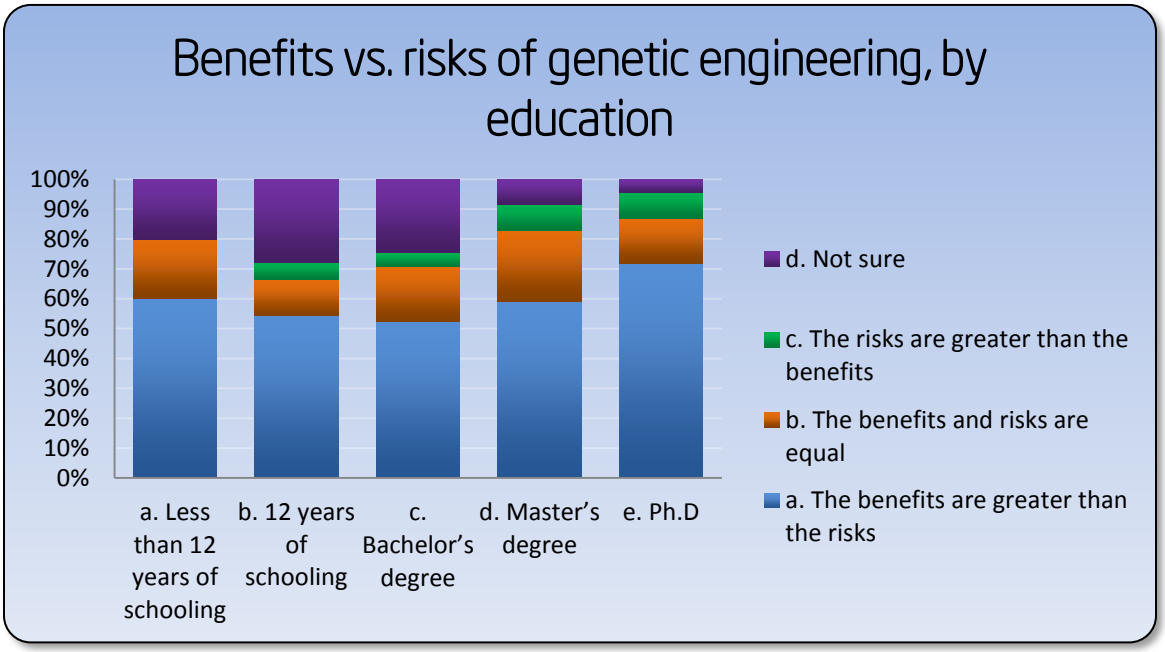
(Graph 8)



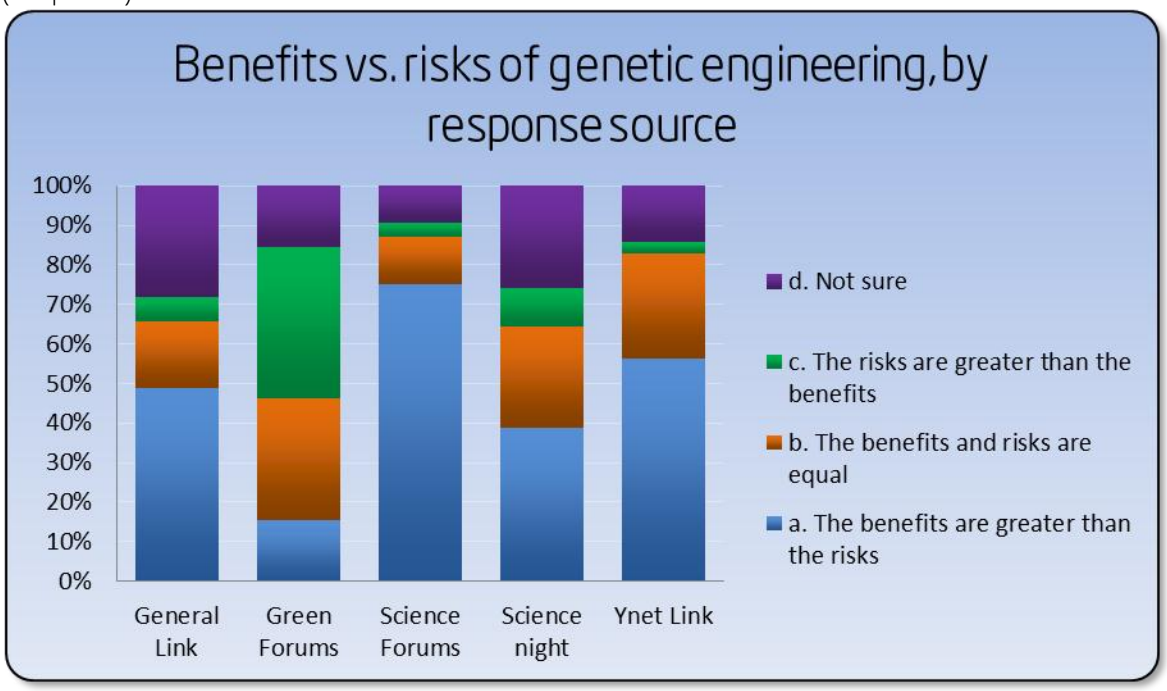
6. In your opinion, do the benefits and usefulness of genetic engineering outweigh the risks? (Graph 9)



(Graph 10)

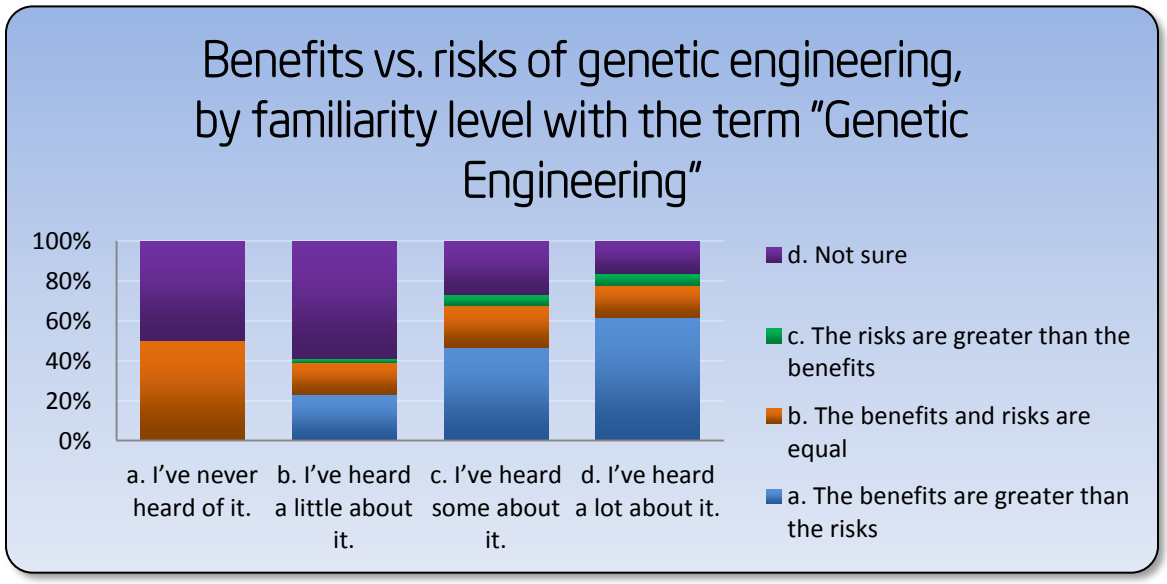


(Graph 11)



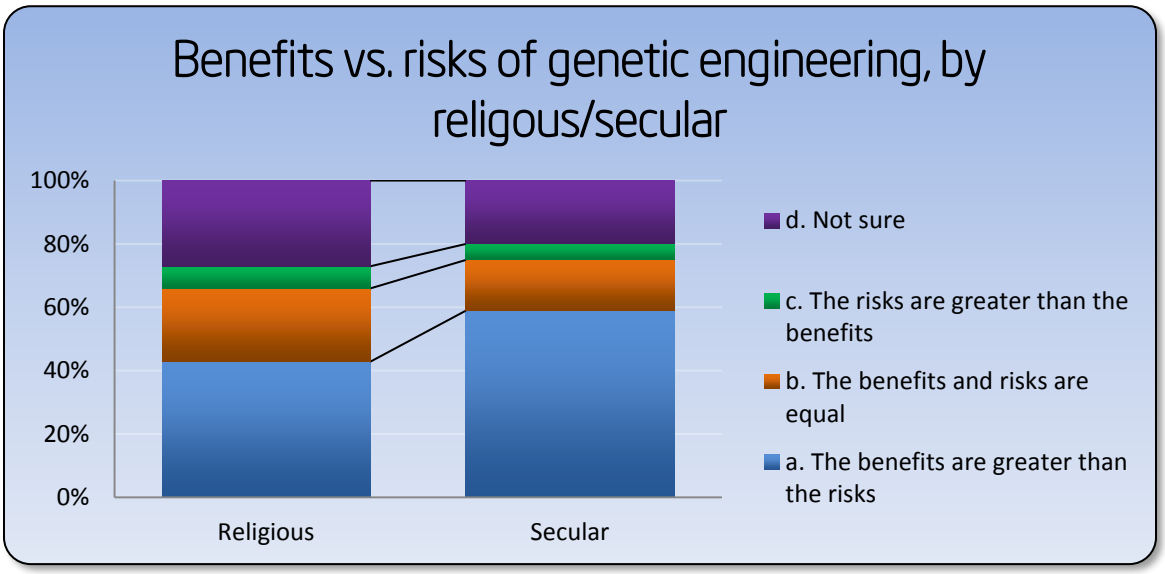
As expected, responders active in "green" forums are more concerned about the risks of genetic engineering than other groups. Also, it is clear that people with scientific background are prone to be more supportive. Generally speaking, ~50% of the population believes benefits outweigh risks.

(Graph 13)



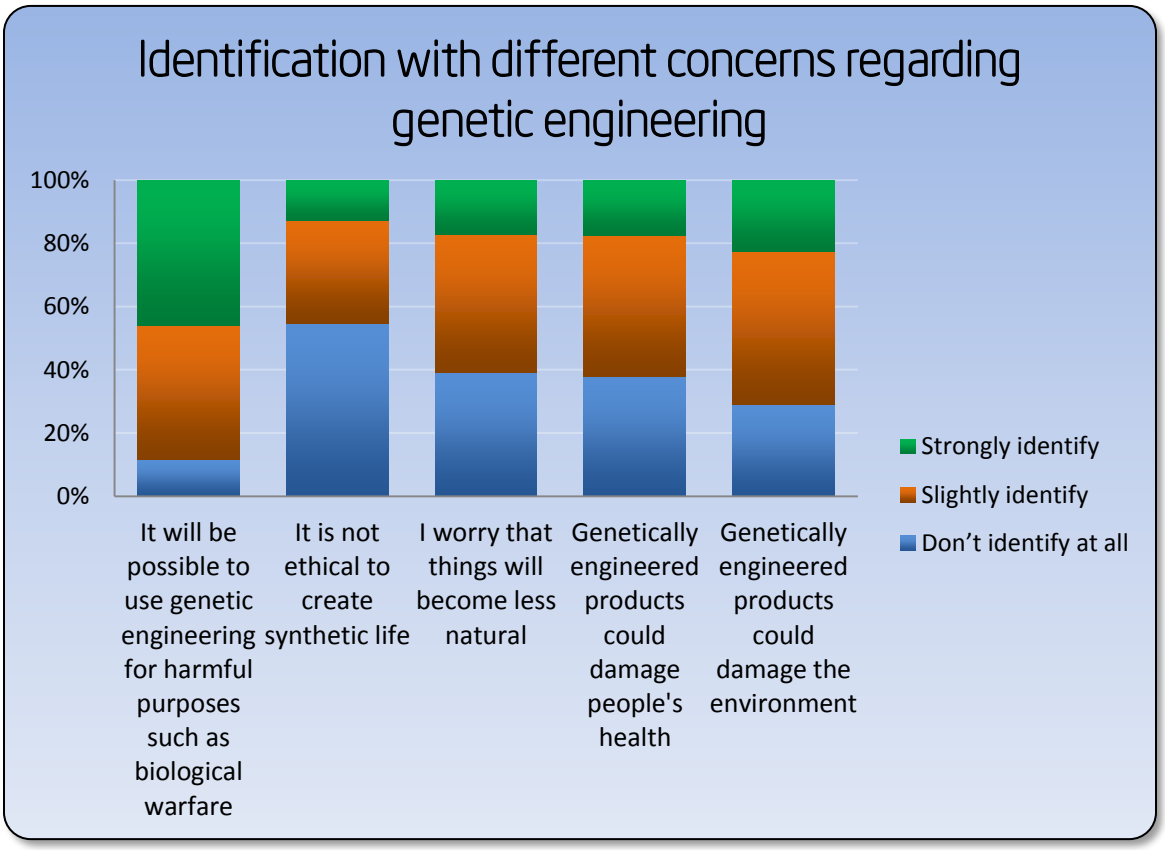
This graph strengthens our hypothesis: the more people are informed about GE, the less they are concerned about risks. This might mean that the actual risks are less significant than what people who are not informed imagine. Or, it may be that perception of the risks stays the same, but when people are more informed about the benefits of GE, they feel that overall the benefits outweigh the risks.

(Graph 14)



7. How much do you identify with each of the following concerns?

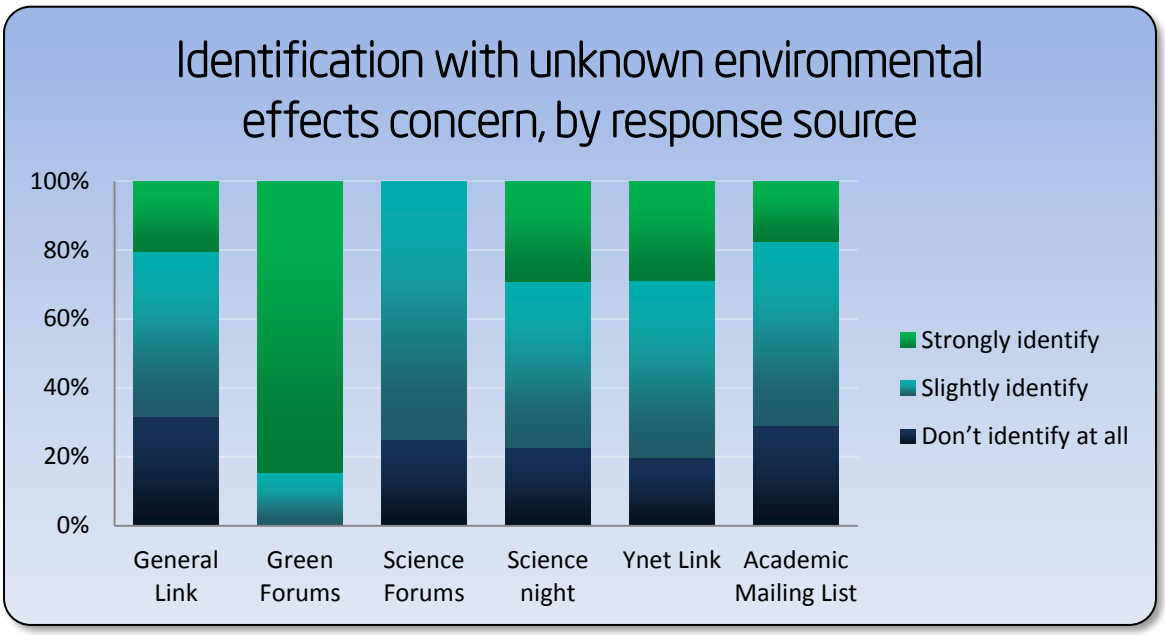
(Graph 17)



*note: we excluded the responses of the academic mailing list here to get a picture that is closer to the general public perception in israel.

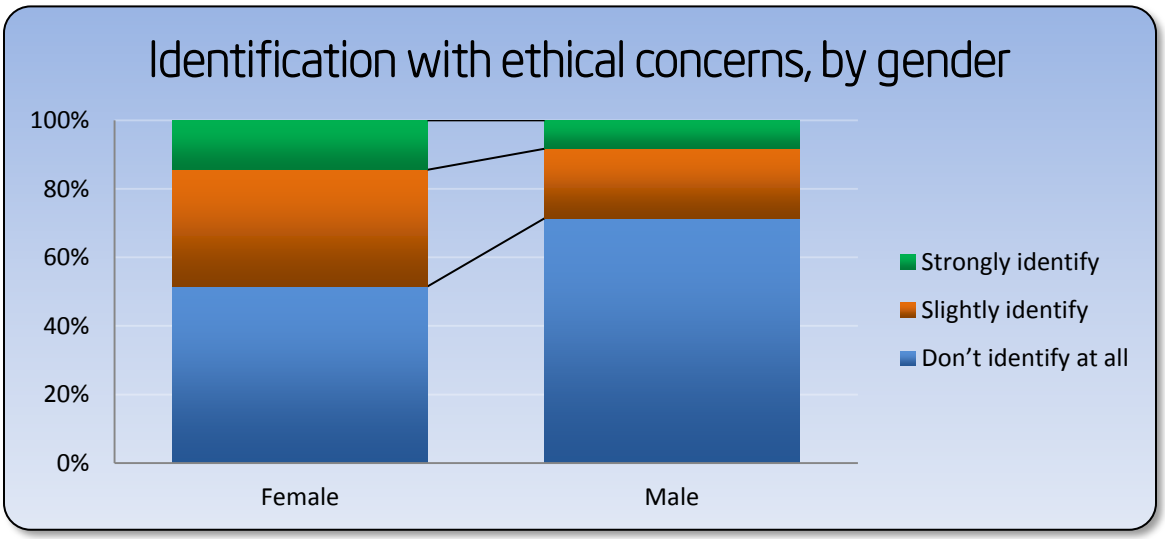
a. It will be possible to use genetic engineering for harmful purposes such as biological warfare.

(Graph 18)

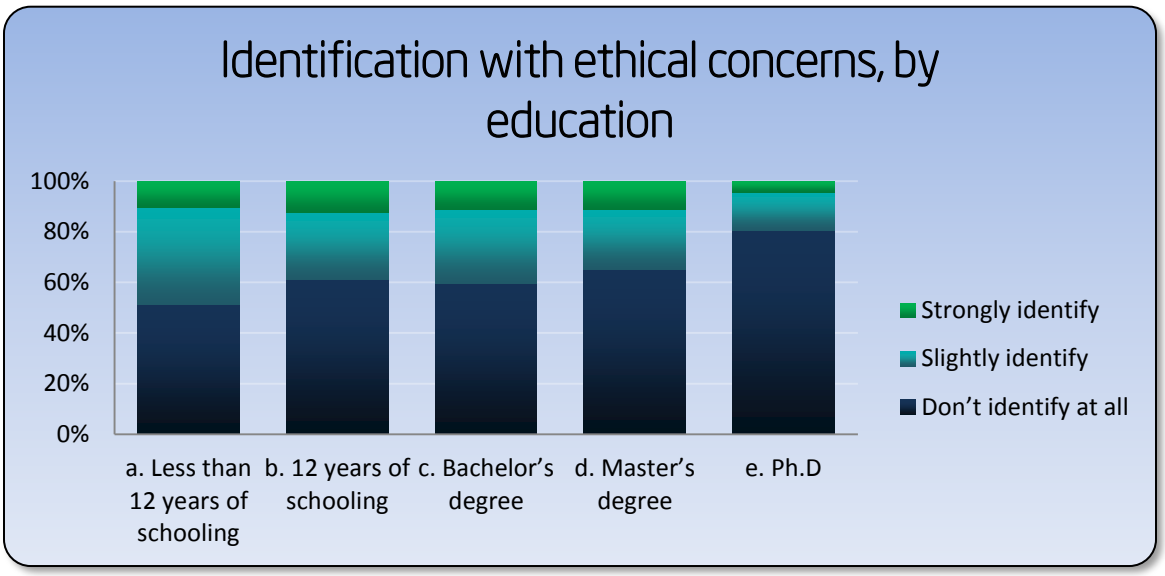


b. It is not ethical to create synthetic life.

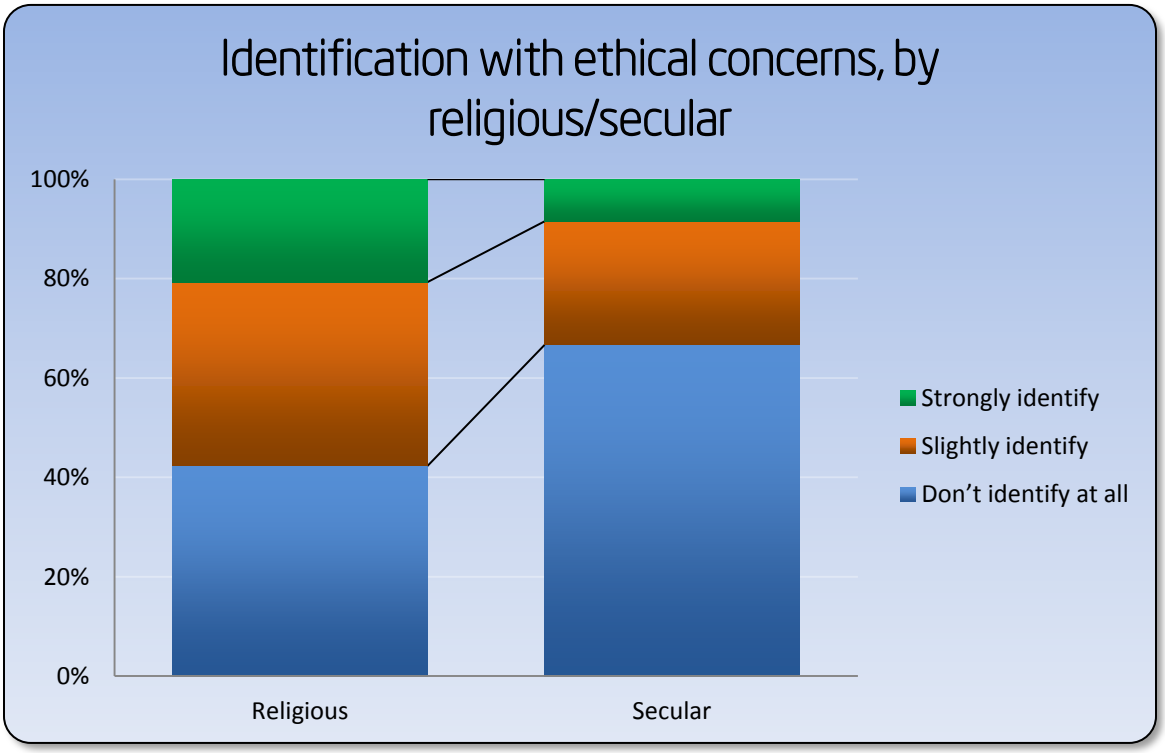
(Graph 19)



Taking a closer look at one specific concern mentioned in question, we can see in graph below that higher education level correlates with fewer ethical concerns.
(Graph 20)

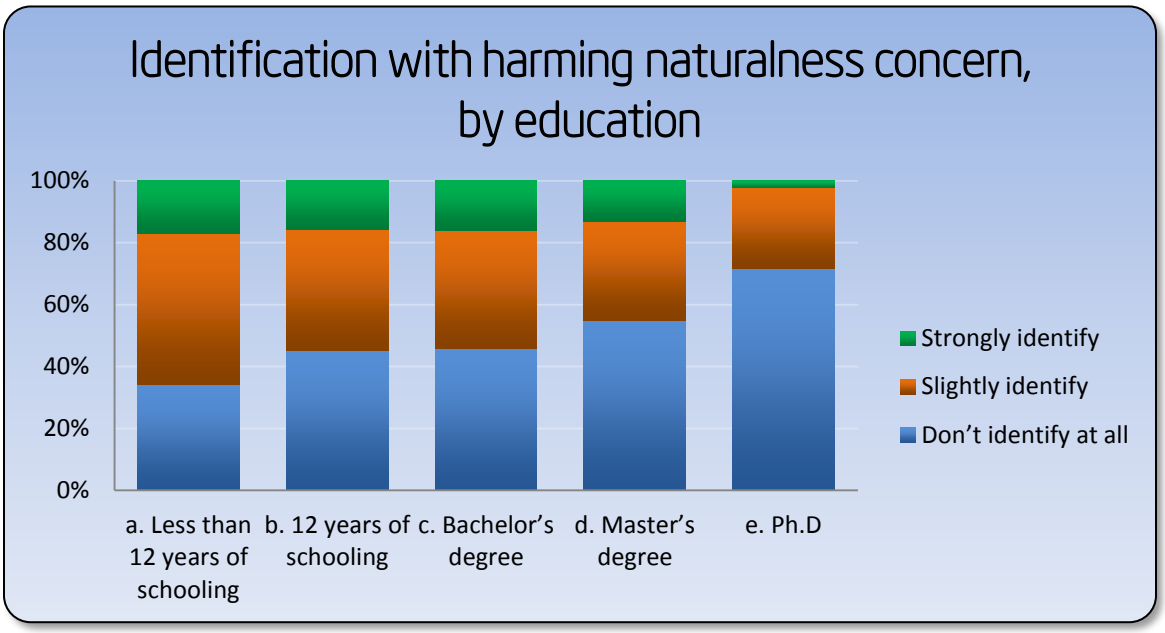


(Graph 21)

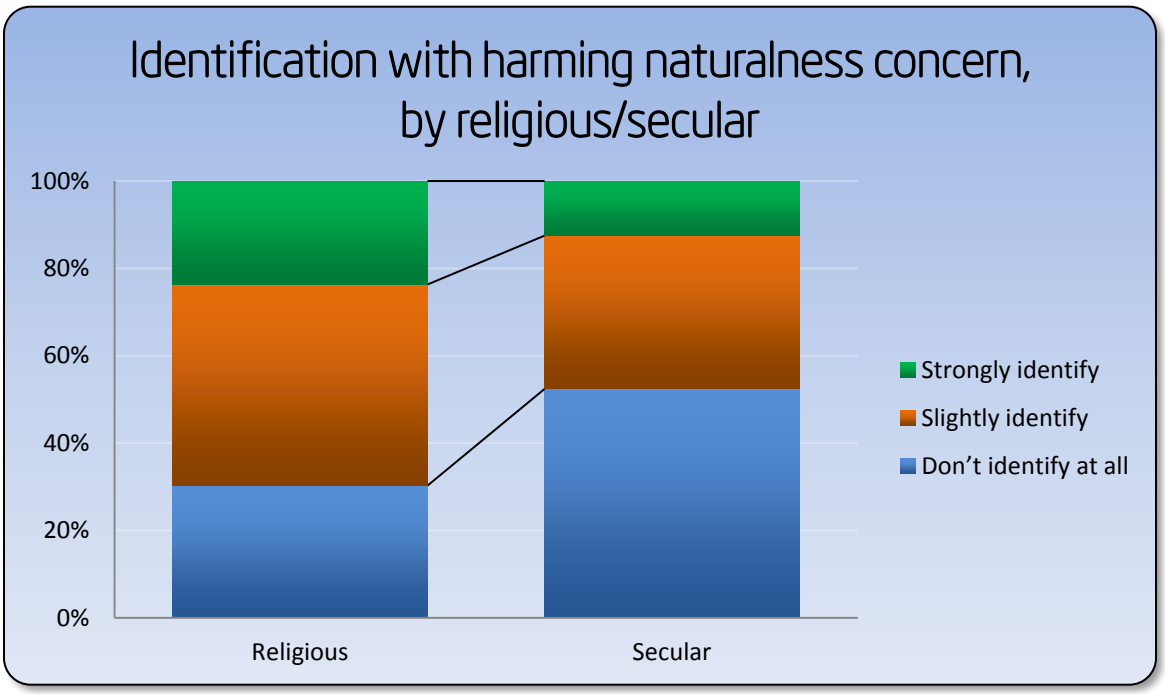


c. I worry that things will become less natural and prefer not to mess with nature.

(Graph 22)

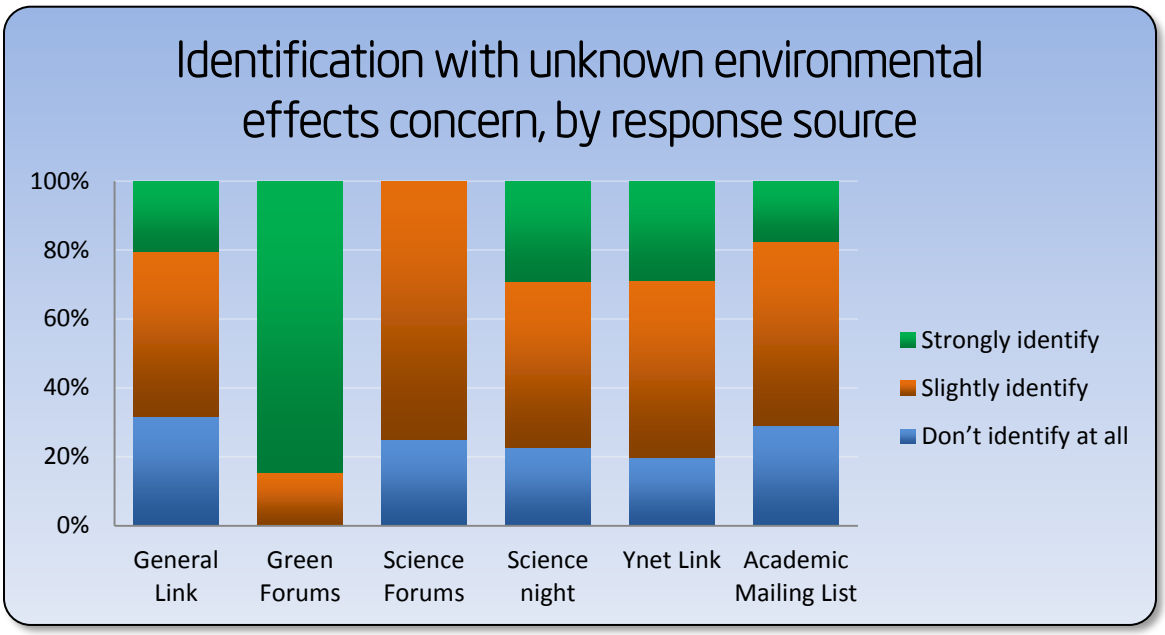


(Graph 23)

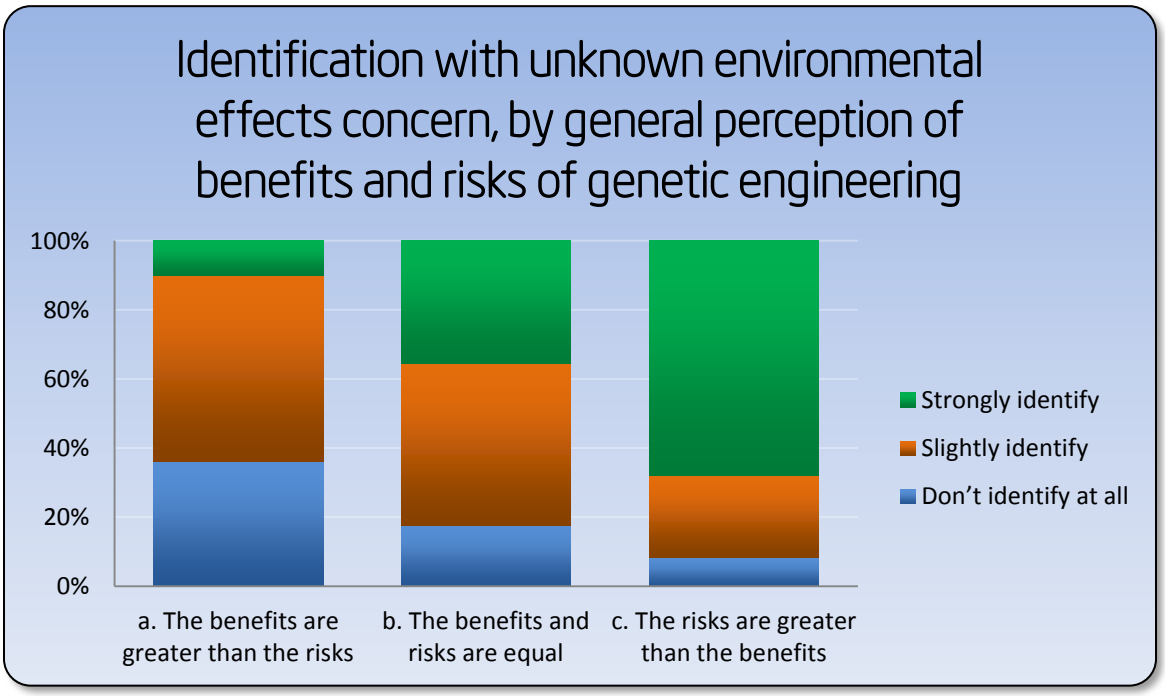


d. Genetically engineered products could damage the environment and ecology; we still don't know enough to rule that possibility out completely.

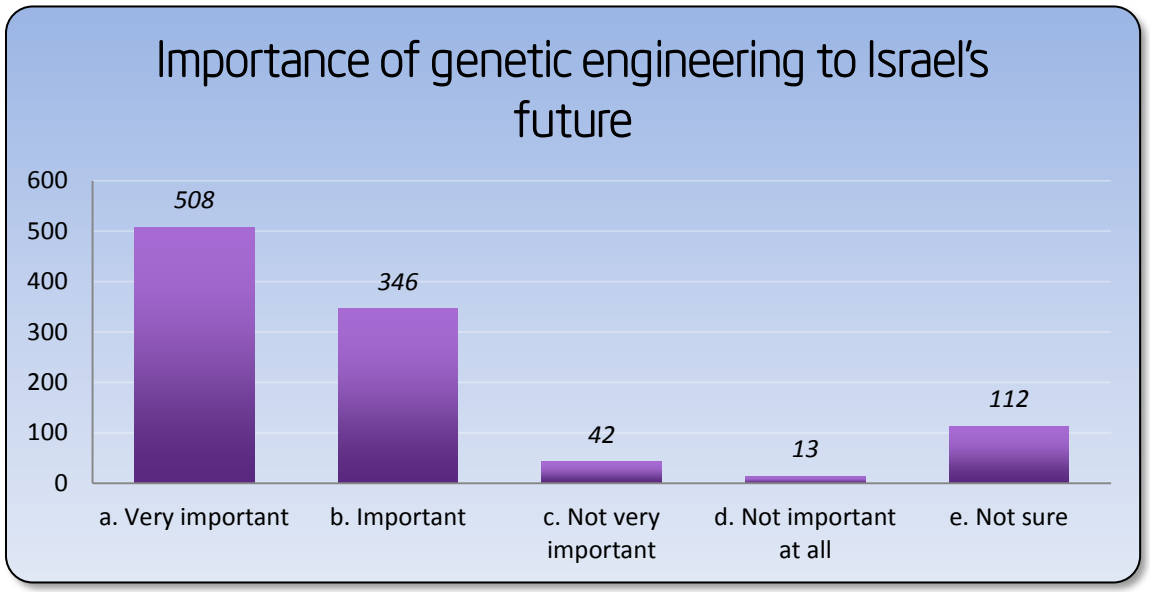
(Graph 24)



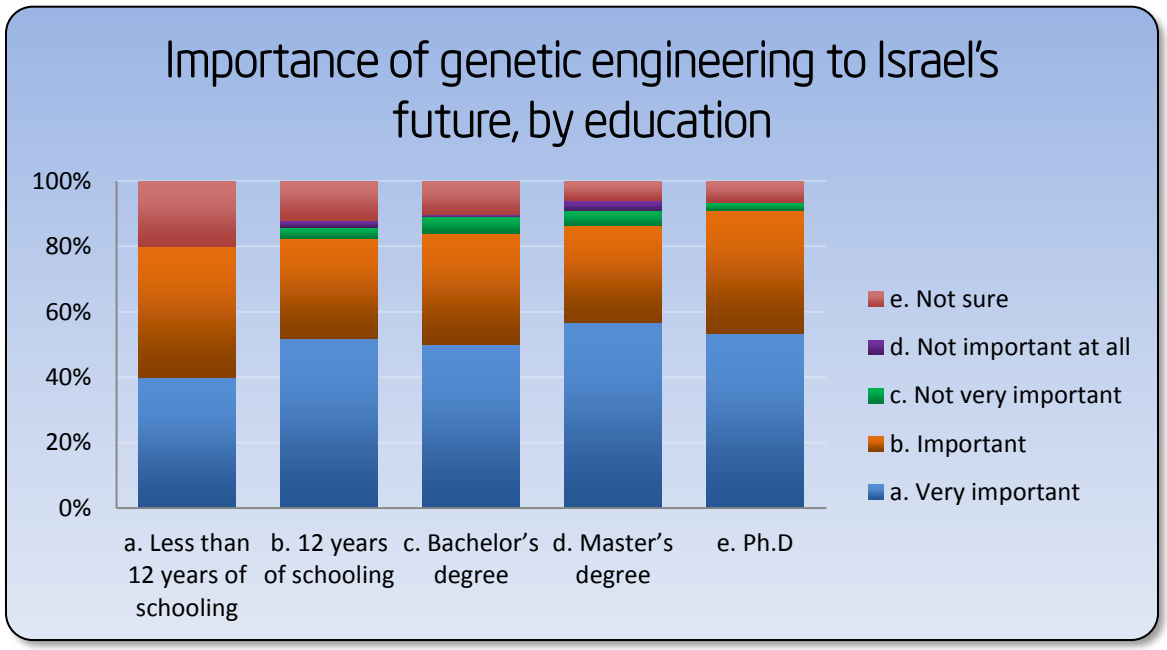
(Graph 25)



8. How important is the use of genetic engineering for the future of Israel? (Graph 26)

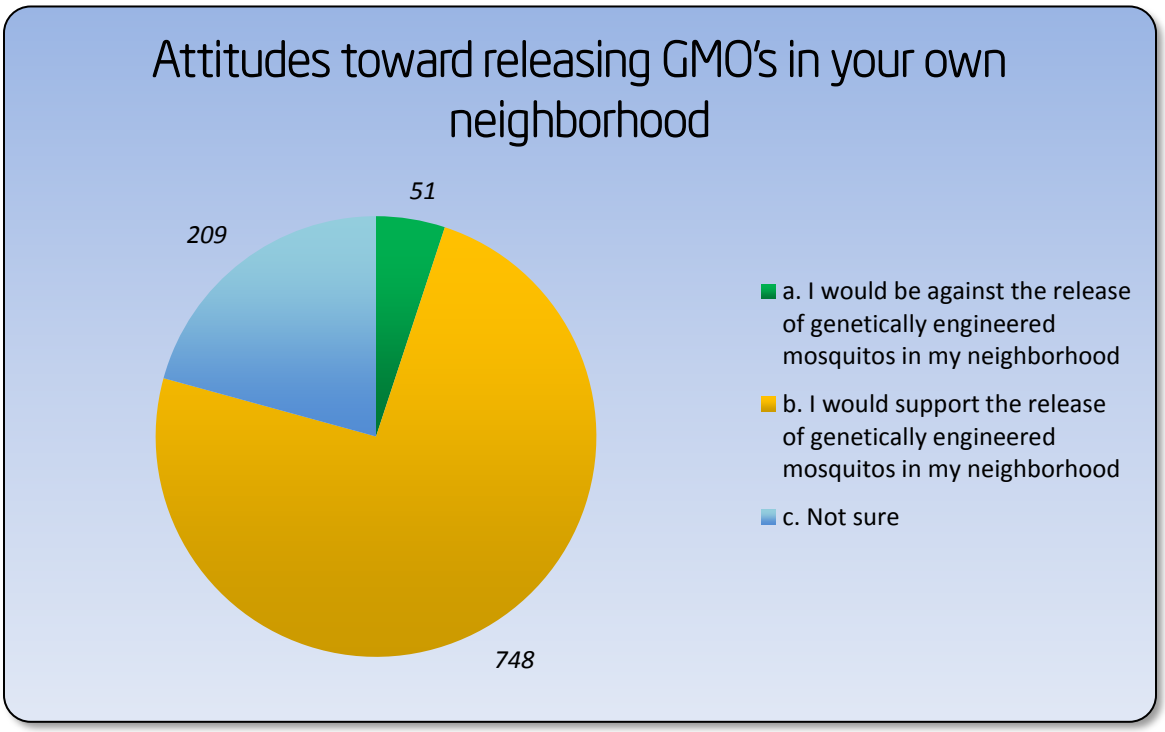


(Graph 27)

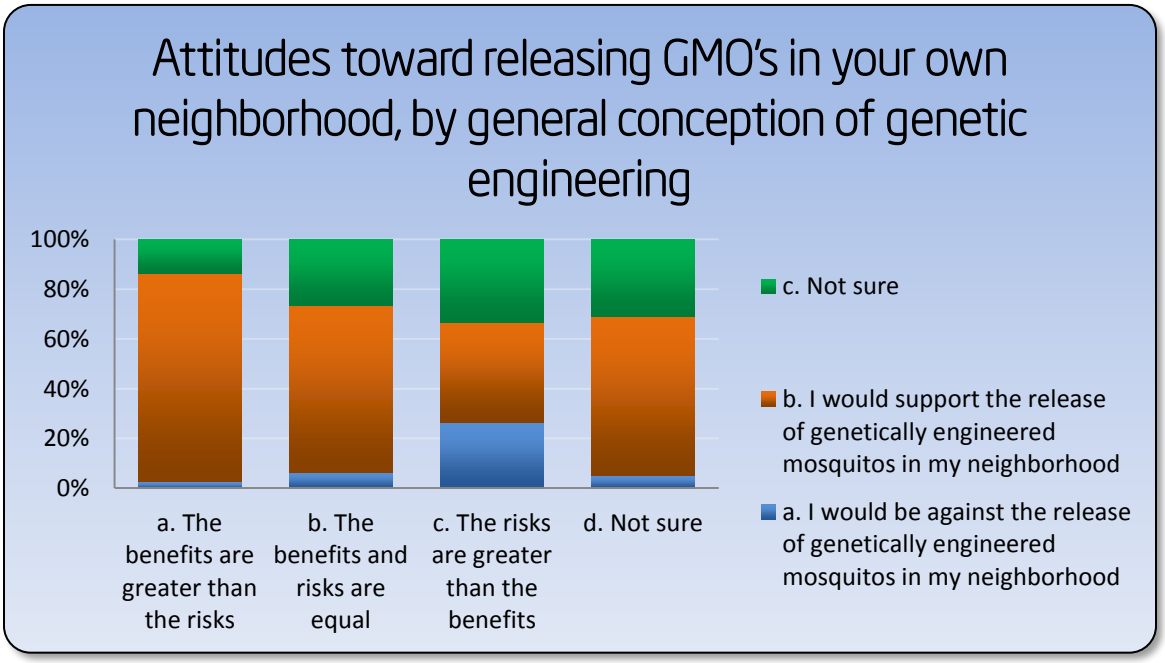


9. One of the uses of genetic engineering is engineering new types of insects, such as mosquitos, in order to help prevent outbreaks of disease like the West Nile Virus. The mosquitos are engineered so that the males of the new kind will be sterile, and thus the general number of mosquitos in the area falls. Since the disease is transmitted to humans via mosquito bites, the fewer mosquitos, the lower the chance of infection. This new type of mosquito has already been released in Brazil and the Caiman Islands. Assuming that a disease like the West Nile Virus became a problem in your neighborhood... (Complete the sentence that best describes your feelings)

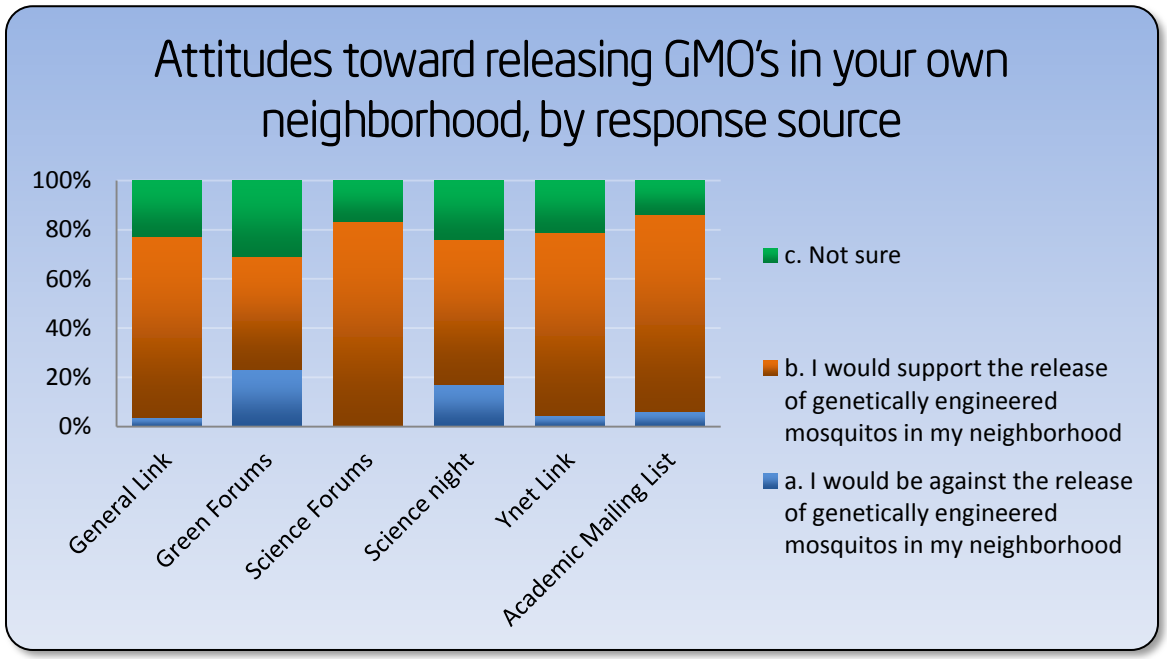
(Graph 28)



(Graph 29)

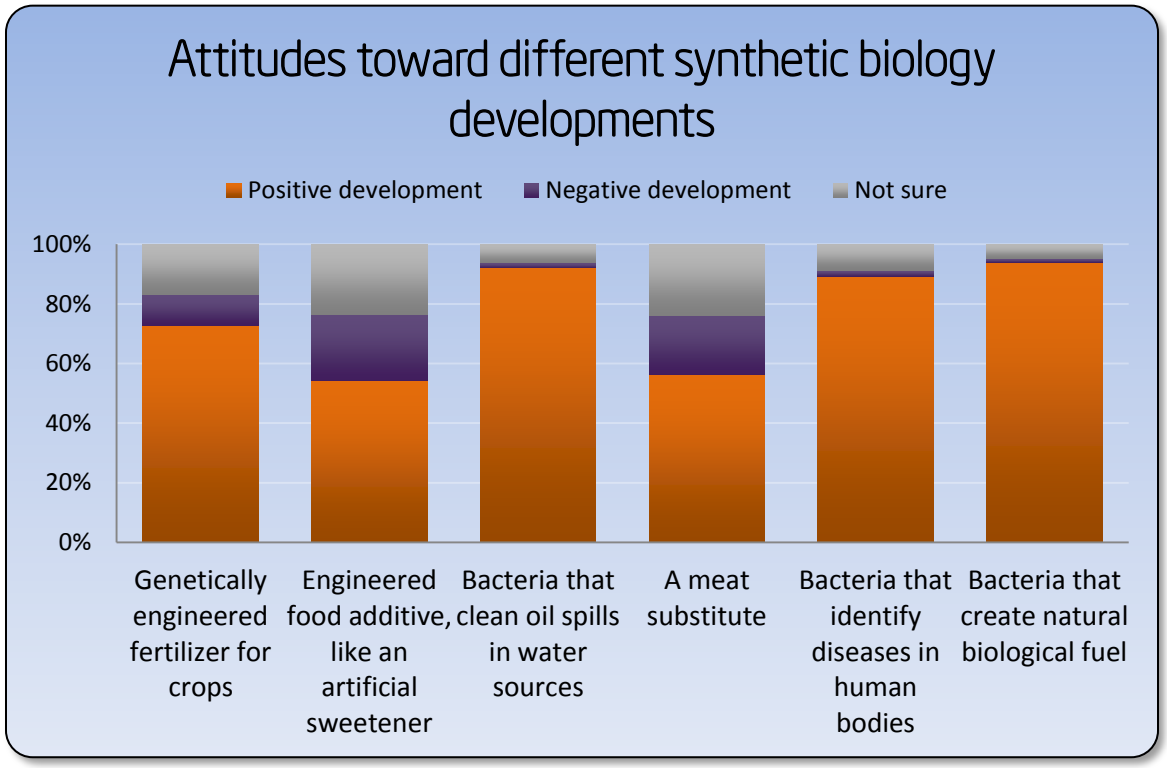


(Graph 30)



10. For each of the following uses of genetic engineering: in your opinion, is it a positive development that makes you optimistic, or a negative development that makes you concerned?

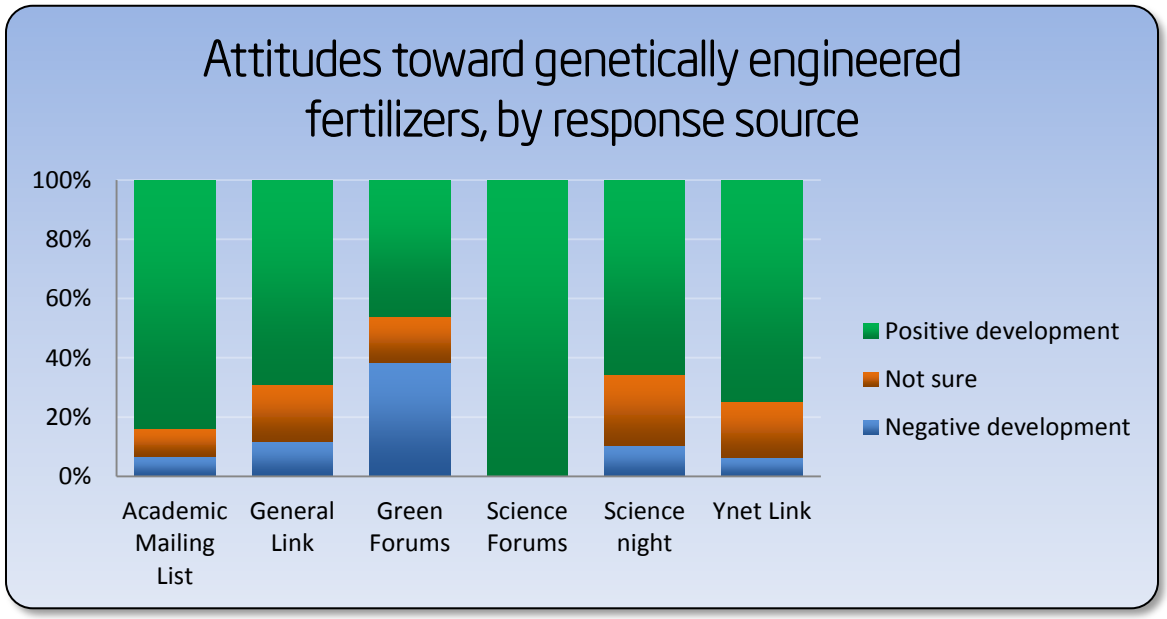
(Graph 31)



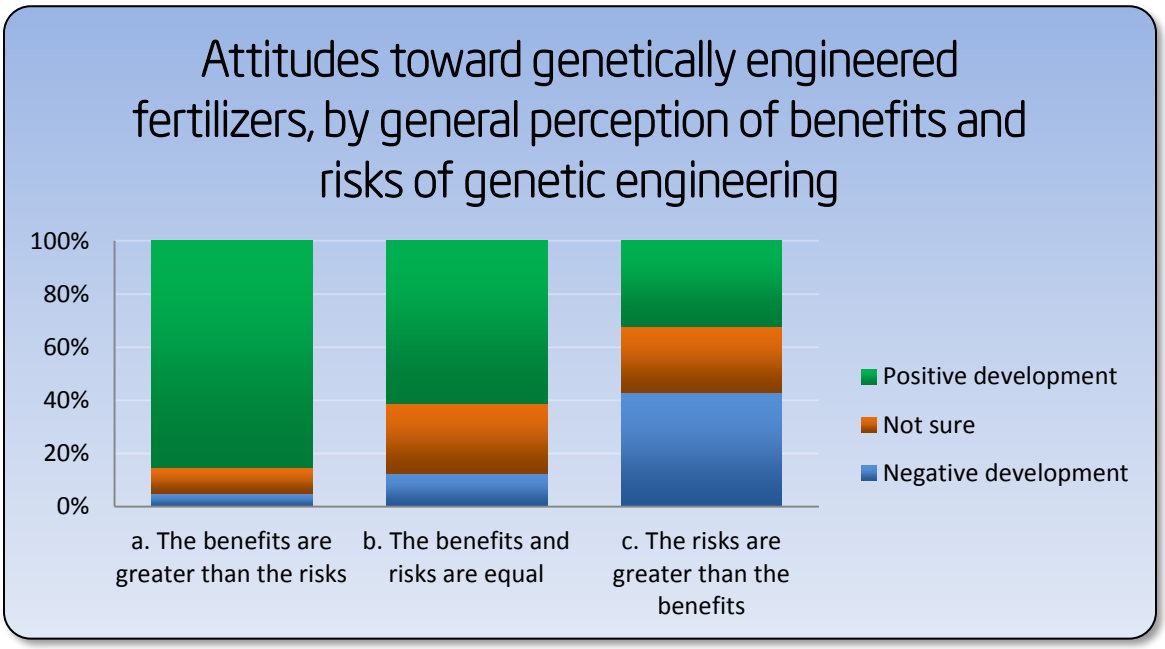
So far we discussed the field of synthetic biology in general, but perhaps people feel differently about different applications? Indeed, support is much higher for environmental applications such as biological fuel or the cleaning of oil spills, and significantly lower for engineered food products. To determine why will require follow-up research, but it seems that one obvious factor is that people are more concerned about things that will affect them on a personal level. Interestingly, for the medical application of disease identification, this did not hold true: most saw this as a positive development. Perhaps people are willing to accept scientific developments for the sake of health; or they are more used to "non-natural" treatments; or trust the medical industry more than the food industry. In any case, it seems that perhaps for now, the public is not ready for the use of synthetic biology in the food industry.

The following graphs focus on three specific applications, and once again show that knowledge and familiarity correspond to a more favorable perception of various synthetic biology applications.

a. Genetically engineered fertilizer that increases the growth rate of crops. (Graph 32)

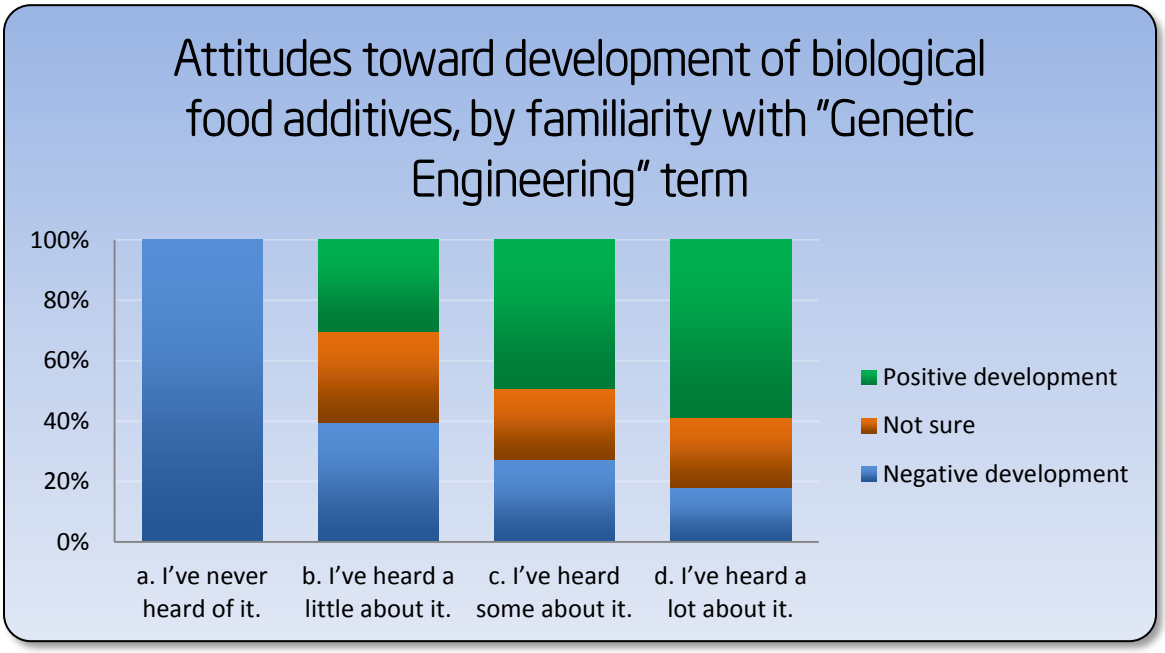


(Graph 33)



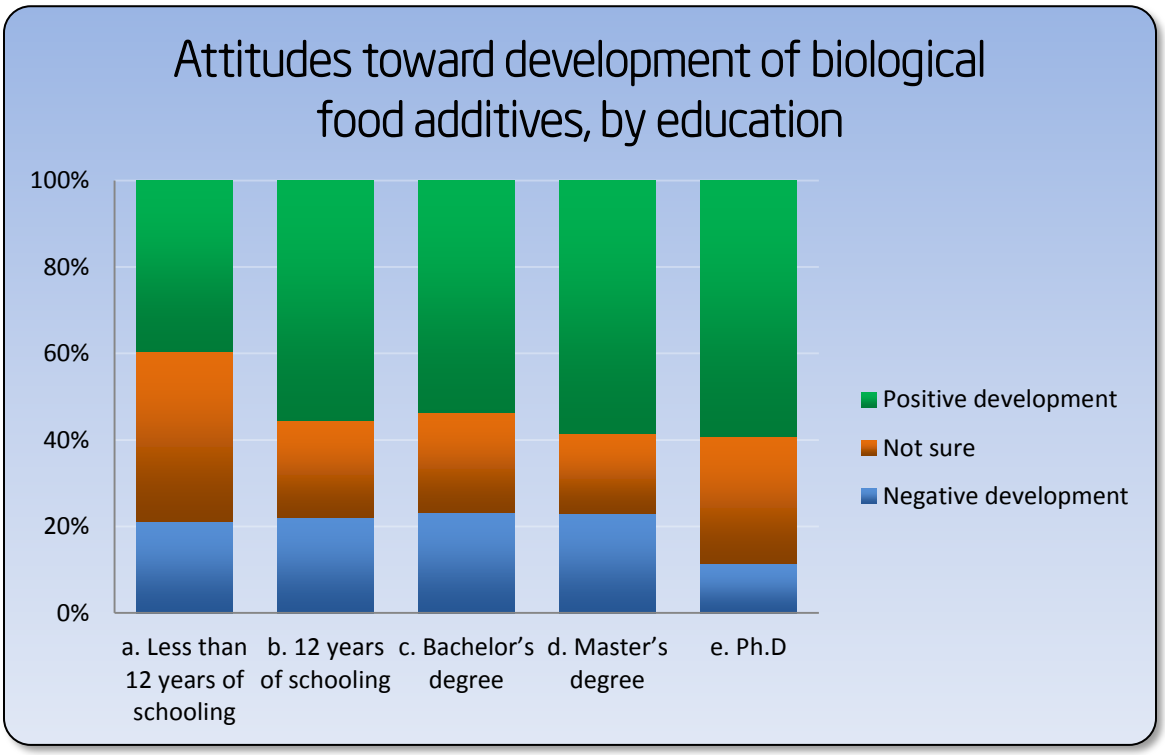
b. An engineered food additive, like an artificial sweetener, that reduces the use of natural resources.

(Graph 34)



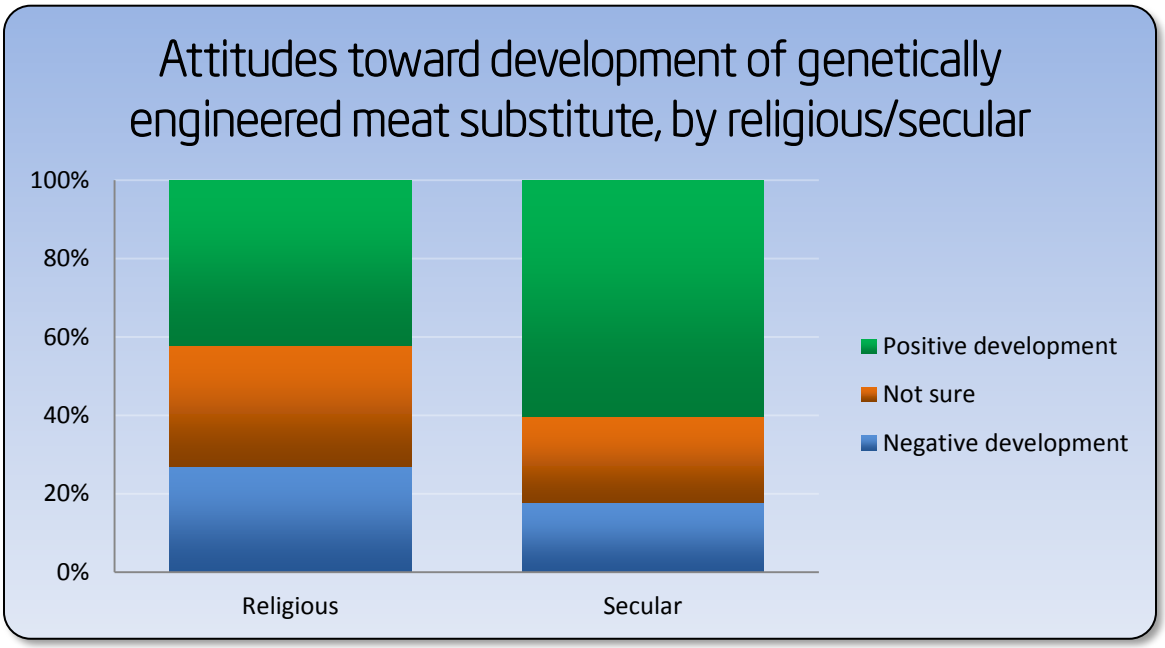
Again we can clearly see the relation between how much a person has heard about a subject and how positive his feelings are about it.

(Graph 35)



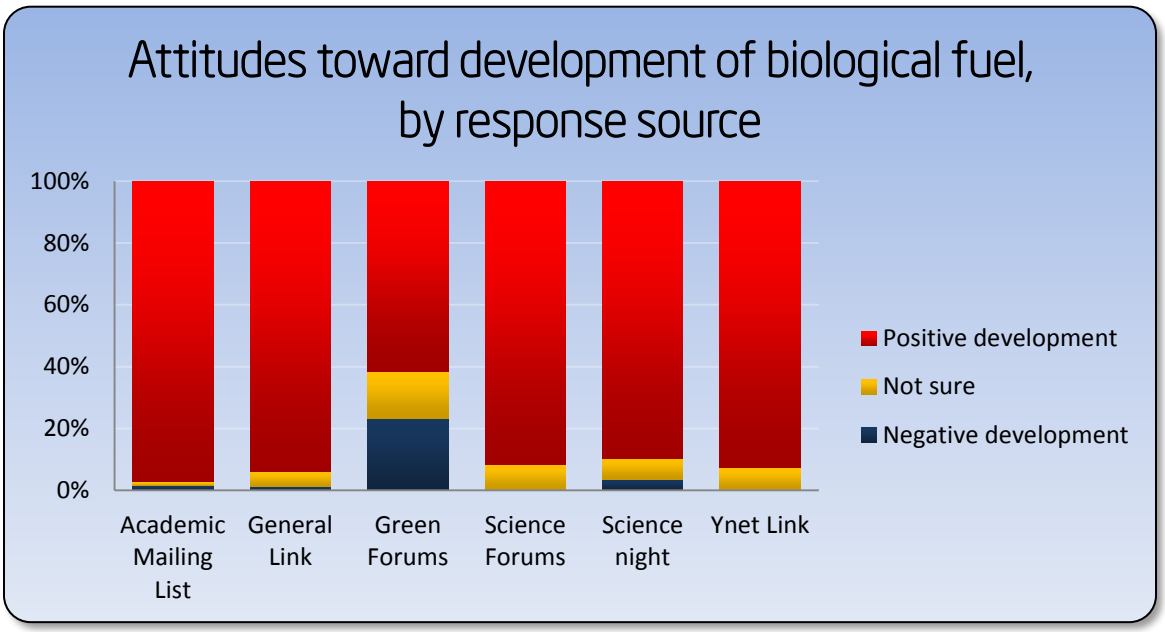
c. A meat substitute.

(Graph 36)



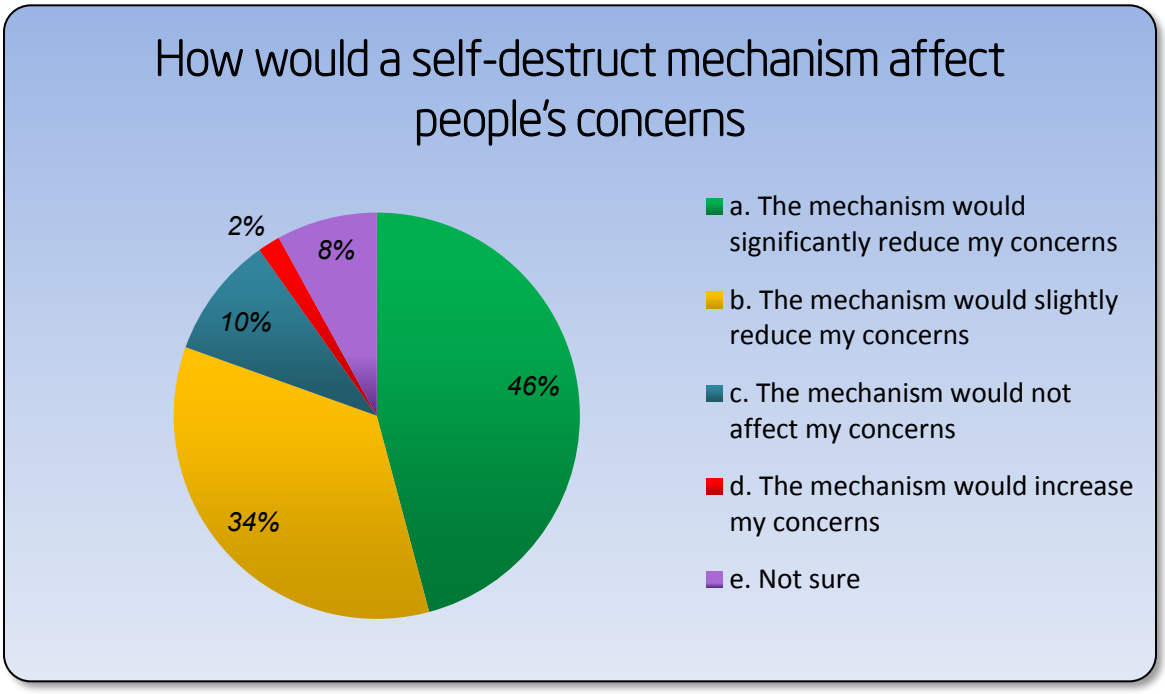
d. Bacteria that are engineered to create natural biological fuel, that will make it possible to reduce the use of oil.

(Graph 37)

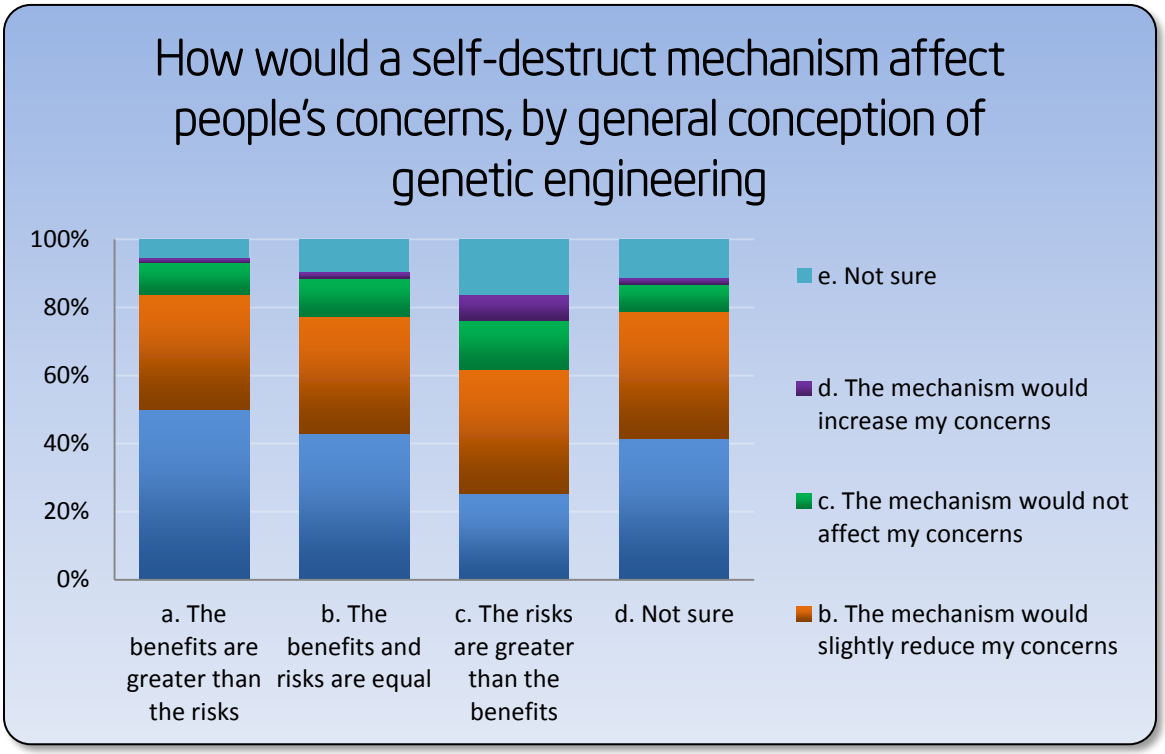


11. If it were possible to create a control mechanism for engineered bacteria, which would make sure that the bacteria destroyed themselves immediately after the completion of their intended purpose in nature, would the use of bacteria with this mechanism reduce your concerns?

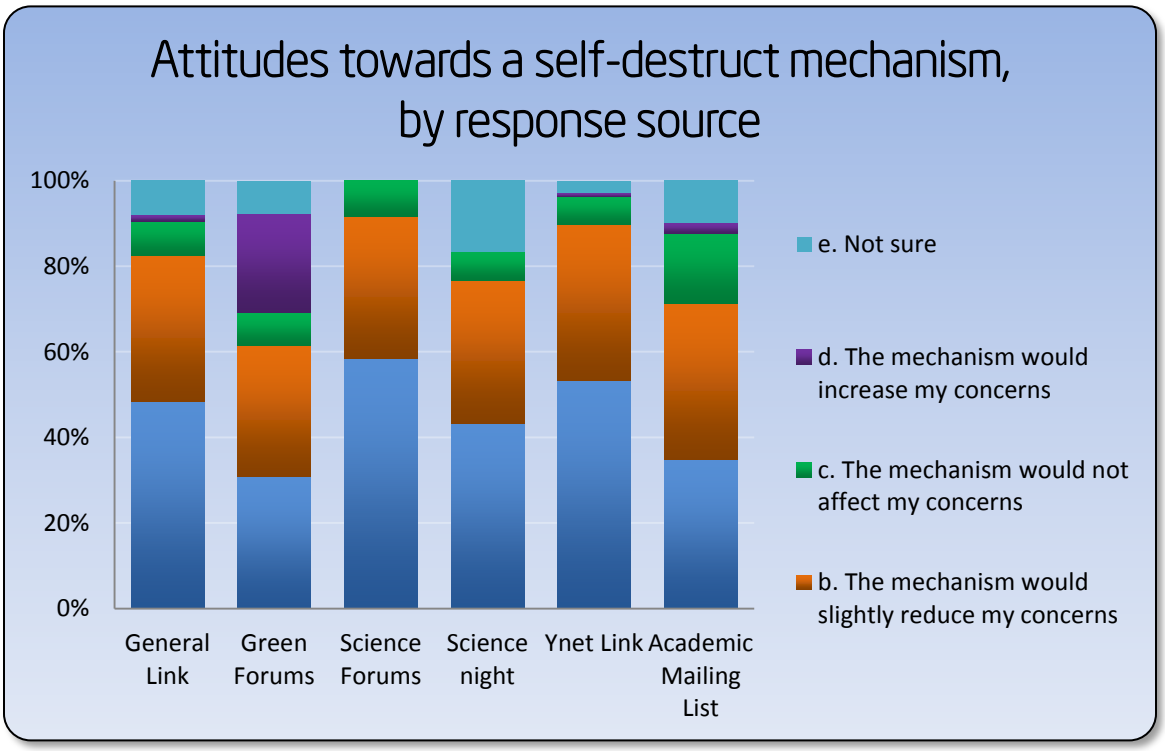
(Graph 38)



(Graph 39)



(Graph 40)



Conclusion

We have seen similar results in past surveys regarding synthetic biology in other countries, indicating a strong correlation between familiarity and knowledge and the degree of positive perception of the field. Using the conclusions from the survey, we directed our outreach efforts towards basic education about the field of synthetic biology to various populations, who might not be exposed to reliable information on the subject (see our Outreach section for details). We also attempted to address the concerns raised in the free-response sections from the survey in our Bioethics Q&A. In the future, a better sample of the population must be reached to increase data integrity and more importantly, efforts should be put in understanding not only *what* people feel, but also *why*.

In forming and analyzing this survey, we were greatly supported by Dr. Roey Tzezana from the Unit for Technology and Society Foresight at Tel Aviv University, who is currently planning a broader study about public perception of synthetic biology. We hope that our results will serve as a basis and proof of concept for further work, and look forward to hear and learn more about public opinion in Israel.

[i] Hart Research Associates. "Awareness & Impressions of Synthetic Biology– a Report of Findings". September, 2010. http://www.bio.org/sites/default/files/hart2010report_final_0.pdf (accessed August 2013)
[ii] Lock, Roger; Miles, Colin. "Biotechnology and Genetic Engineering: Students' Knowledge and Attitudes". 1993. http://www.rogerlock.novawebs.co.uk/files/Research%20in%20Science%20Education%20in%20Europe.pdf (accessed August 2013)
[iii] Macer, Darryl; Chen Ng; Mary Ann. "Changing Attitudes to Biotechnology in Japan". September, 2000. http://www.eubios.info/Papers/MacerNgNatBio.pdf (accessed August 2013)
[iv] Royal Commission on Genetic Modification, New Zealand . "Analysis of Public Opinion Survey". 2002. http://www.mfe.govt.nz/publications/organisms/royal-commission-gm/appendix3/section-6.pdf (accessed August 2013)

Welcome!

Thank you for taking the time to fill out our survey.
We are a group of students from Ben Gurion University participating in an international competition called iGEM for innovations in the field of synthetic biology.
As part of our project, we want to understand the opinions of the Israeli public about this field, and how much is known about it. Therefore, we created this questionnaire to learn more.

The questionnaire should take approximately five minutes to complete.
The questions are phrased in the masculine form but are directed towards men and women alike.
[Translator's note: Only relevant for the Hebrew version.]
Please answer all of the questions.

Statement of Consent

The answers will be used exclusively in order to survey public opinion about the fields of genetic engineering and synthetic biology, and will not be used for any other purpose.

1. Have you ever heard of synthetic biology?
    a. I've never heard of it.
    b. I've heard a little about it.
    c. I've heard some about it.
    d. I've heard a lot about it.

2. Have you ever heard of genetic engineering?
    a. I've never heard of it.
    b. I've heard a little about it.
    c. I've heard some about it.
    d. I've heard a lot about it.

3. What are the first things that come to mind when you hear "genetic engineering"?
   (Write each word/ phrase in a separate box. There is no need to fill out all of the boxes.)

a.	
b.	
c.	
d.	
e.	

4. Assuming that you have heard of synthetic biology or genetic engineering, where did you hear about them? (You can mark more than one answer.)

a. In school or university.
b. Newspapers.
c. Internet-other.
d. Internet-social networks.
e. Internet-news websites.
f. Internet-blogs.
g. Television.
h. From family and friends.
i. Other-please explain: _____

5. In the sources you were exposed to, do you feel that the subject was covered in a positive or negative manner?
    a. Positive.
    b. Negative.
    c. Neutral.
    d. Not sure.

6. In your opinion, do the benefits and usefulness of genetic engineering outweigh the risks?
    a. The benefits are greater than the risks.
    b. The benefits and risks are equal.
    c. The risks are greater than the benefits.
    d. Not sure.

7. How much do you identify with each of the following concerns? (Strongly identify, slightly identify, don't identify at all)
    a. It will be possible to use genetic engineering for harmful purposes such as biological warfare.

Strongly identify	Slightly identify	Don't identify at all

    b. It is not ethical to create synthetic life.

Strongly identify	Slightly identify	Don't identify at all

    c. I worry that things will become less natural and prefer not to mess with nature.

Strongly identify	Slightly identify	Don't identify at all

    d. Genetically engineered products could damage the health of Israeli citizens, we still don't know enough to rule that possibility out completely.

Strongly identify	Slightly identify	Don't identify at all

    e. Genetically engineered products could damage the environment and ecology, we still don't know enough to rule that possibility out completely.

Strongly identify	Slightly identify	Don't identify at all

    f. Other concerns that don't appear here: _____

8. Which of the following sentences best describes your attitude towards research of genetic engineering?
    a. Research needs to progress and develop, but efforts should be invested in understanding the effects of genetic engineering on the environment and humans.
    b. Research should be prohibited until we better understand the effects and dangers involved in releasing synthetic biology products to the environment or market.
    c. Not sure.

9. How important is the use of genetic engineering for the future of Israel ?
    a. Very important.
    b. Important.
    c. Not very important.
    d. Not important at all.
    e. Not sure.

10. One of the uses of genetic engineering is engineering new types of insects, such as mosquitos, in order to help prevent outbreaks of disease like the West Nile Virus. The mosquitos are engineered so that the males of the new kind will be sterile, and thus the general number of mosquitos in the area falls. Since the disease is transmitted to humans via mosquito bites, the fewer mosquitos, the lower the chance of infection. This new type of mosquito has already been released in Brazil and the Caiman Islands. Assuming that a disease like the West Nile Virus became a problem in your neighborhood... (Complete the sentence that best describes your feelings)
    a. I would be against the release of genetically engineered mosquitos in my neighborhood.
    b. I would support the release of genetically engineered mosquitos in my neighborhood.
    c. Not sure.

11. For each of the following uses of genetic engineering: in your opinion, is it a positive development that makes you optimistic, or a negative development that makes you concerned?
    a. Genetically engineered fertilizer that increases the growth rate of crops.

Positive development	Negative development	Not sure

    b. An engineered food additive, like an artificial sweetener, that reduces the use of natural resources.

Positive development	Negative development	Not sure

    c. Bacteria that clean oil spills in water sources.

Positive development	Negative development	Not sure

    d. A meat substitute.

Positive development	Negative development	Not sure

    e. Bacteria that identify diseases in humans, in the digestive system for example.

Positive development	Negative development	Not sure

f. Bacteria that are engineered to create natural biological fuel, that will make it possible to reduce the use of oil.

Positive development	Negative development	Not sure

12. If it were possible to create a control mechanism for engineered bacteria, which would make sure that the bacteria destroyed themselves immediately after the completion of their intended purpose in nature, would the use of bacteria with this mechanism reduce your concerns?
    a. The mechanism would significantly reduce my concerns.
    b. The mechanism would slightly reduce my concerns.
    c. The mechanism would not affect my concerns.
    d. The mechanism would increase my concerns.
    e. Not sure.

13. Optional: Please explain your above answer.
    _____

Personal Information

14. Sex:
    a. Male
    b. Female

15. Age: _____

16. Education:
    a. Less than 12 years of schooling
    b. 12 years of schooling
    c. Bachelor's degree
    d. Master's degree
    e. Ph.D.

17. Religion:
    a. Secular
    b. Jewish- Traditional
    c. Jewish- Religious
    d. Jewish- Modern Orthodox
    e. Jewish- Ultra-Orthodox
    f. Christian
    g. Muslim

h. Other: _____

The results of the survey will be published soon on the website of our project. Reminder: we are a group of 13 students from Ben Gurion University participating in an international competition called iGEM. In this competition, groups from universities all over the world present an innovative synthetic biology product that can have an impact on humanity or the environment.

In addition to working on the science, we also wanted to better understand the opinions of the Israeli public about these fields, and what are the main concerns. We hope that this survey will shed some light on the topic.

If you would like to receive the results of the survey when they are ready, please fill out your email below and we will be in touch soon. Also, you can visit our Facebook page and get updates there about our team and project: https://www.facebook.com/iGEMBGU

Email: _____