

Background and objectives

We decided to conduct 2 surveys this year covering 2 different themes:

1. Understanding the general needs and sentiments of Public towards synthetic biology.
2. Doing market research for spider silk.

Survey method:

We used non-profit platform of google docs for creating our surveys, distributing it and collecting responses. Most questions were multiple choice and are presented with pie-chart distribution for responses. For certain questions, bar graphs were employed as necessary to provide conclusive and meaningful results. The language of both surveys was English.

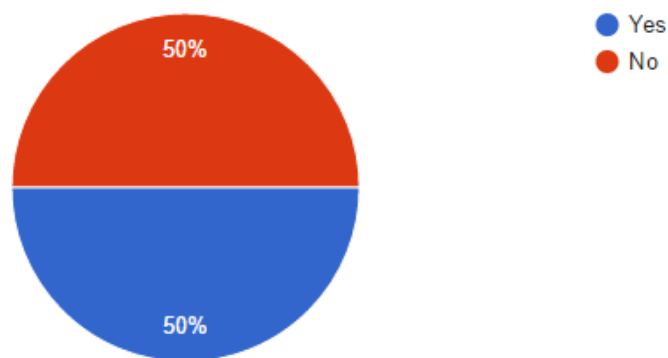
The target respondents in first survey were mainly members of community not having biological sciences background. Our respondents comprised heavily of undergraduates (56%) and post-graduates (29%) students but there was a nice mix of professionals including doctors, consultants, psychiatrists, architecture, etc.

Our second survey was designed to conduct market research for existing silk and our recombinant spider silk. Most respondents in survey 2 were young adults (~67%) around 18-25 years in age. Most respondents (~83.6%) were educated upto undergraduate levels with diverse group of chemists, biotechnologists, electrical engineers, architecture etc.

Survey results

Survey 1

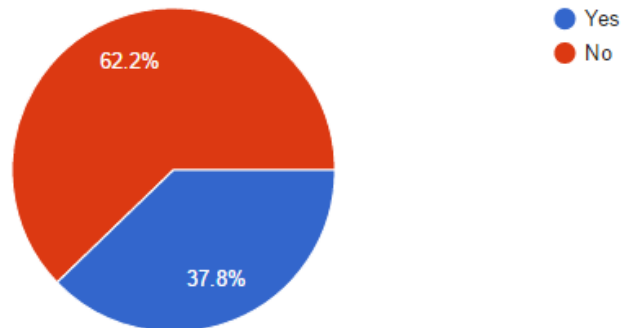
Have you ever heard the term "Synthetic Biology"? (206 responses)



We inquired the respondents if they have ever heard about "Synthetic Biology" and promisingly about 50 % respondents were aware of synthetic biology.

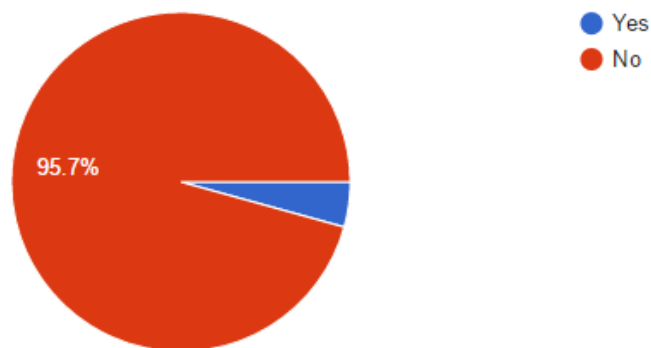
Have you heard about iGEM (International Genetic Engineering Machines)?

(209 responses)



Though surprisingly a majority, i.e. 62% of survey respondents, acknowledged they are informed about iGEM.

Are you a part of an iGEM team? (210 responses)



Since we felt that members of iGEM community will heavily bias our responses we aimed to achieve maximum respondents from non-biological sciences background. 95.7% were not part of any iGEM teams.

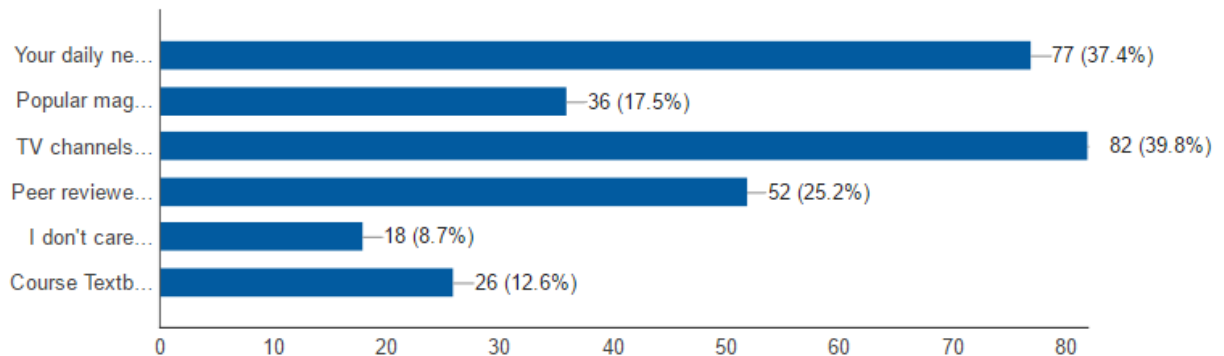
Do you think it is important have a good knowledge of the basic concepts of biology?

(209 responses)



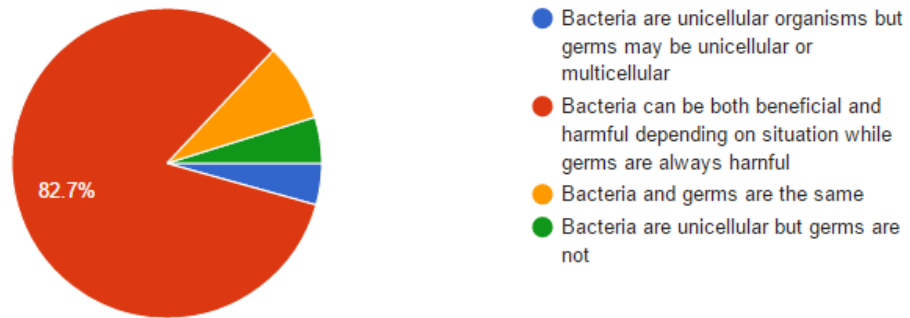
59.3% of the respondents conceded to the notion that knowledge in biological sciences is as important as other fields like physics, math, and language. 27.8% of additional respondents additionally noted that they appreciate the idea of learning about biology but are apprehensive when they face concepts they find too advanced for them. The remaining 12.9% suggested that learning biology is either too difficult due to difficult nomenclature and complex diagrams or only useful for professionals like doctors, zoologists, ecologists etc.

What is the source of your scientific information? (206 responses)



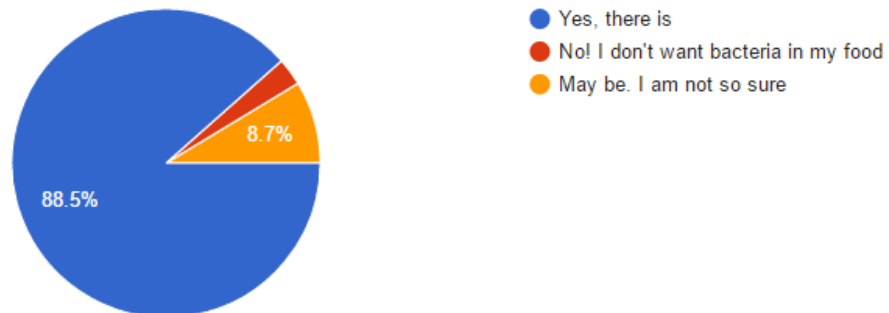
37.4% of the respondents cited their daily newspaper and 39.8% of respondents cited as their source of scientific information. However, 25.2% of the respondents also cited most-reliable peer-reviewed journals and 12.6% responded that they use course textbooks as their source for scientific information.

How would you distinguish between a bacteria and a germ? (208 responses)



82.7% of the respondents correctly identified that all bacteria are not harmful and should be categorized as germs. However a minority 8.2% were not aware of this distinction.

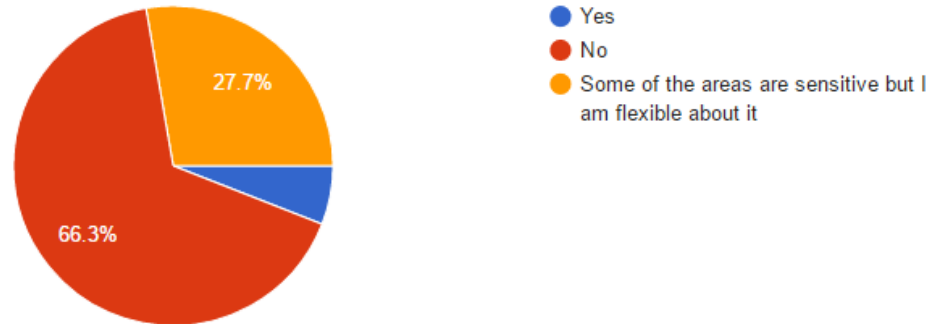
Are you aware of any food product which requires bacteria for it's formation?
(208 responses)



88.5 % of the survey respondents conceded to the knowledge that certain food items require bacterial biochemical transformation to be completed as food products.

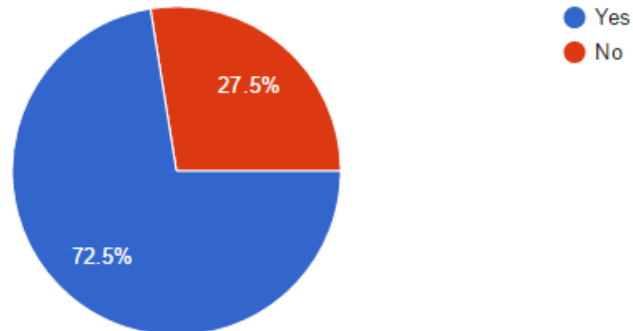
Are few of the current discoveries in biotechnology against your religious beliefs?

(202 responses)



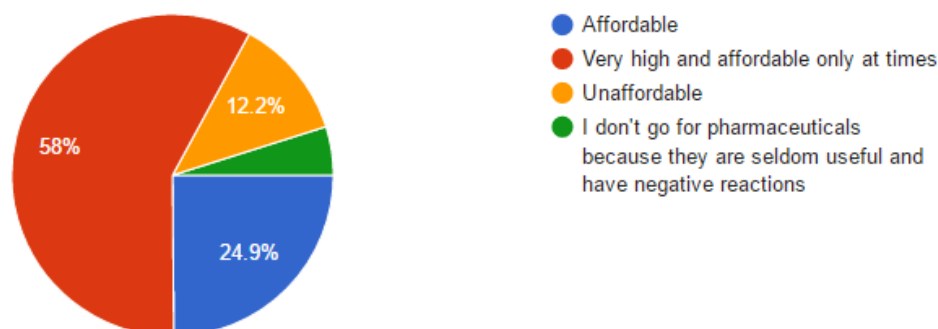
66.3% of our respondents accepted that their religious beliefs do not find inconsistency with current discoveries in biotechnology. 27.7% responded that they find some areas controversial but in general are flexible about this.

Have you ever heard about the term "Biological warfare"? (207 responses)



72.5% of the survey respondents were aware of biological warfare.

You think current prices of pharmaceuticals are (205 responses)



58 % of the respondents claimed that they found the current price of pharmaceuticals as very high and affordable only at times. While 24.9 % of them say they find the prices to be affordable while 12.2 % consider them unaffordable always. Around 5 % claimed that they do not prefer pharmaceuticals as they doubt its value as their efficacy is not high.

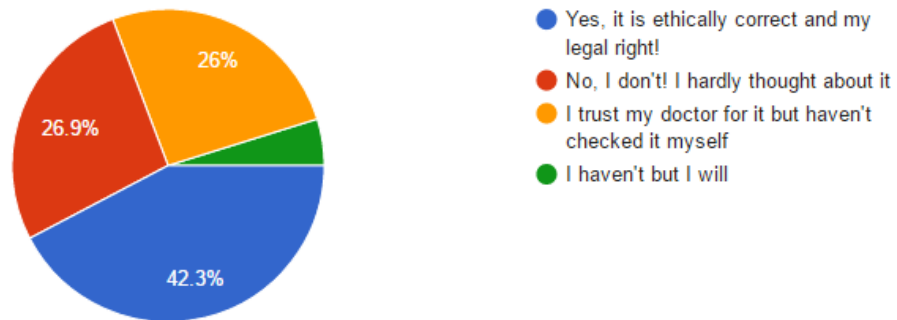
Biological science is one of the largest recipient of government funding! Do you think is it justified?

(206 responses)



53.4% of our respondents acknowledged that investment in biological sciences is a worthwhile investment because they can boost agriculture and healthcare sector. 32.5% of respondents agreed to government funding but did not associated it with any particular sector in general.

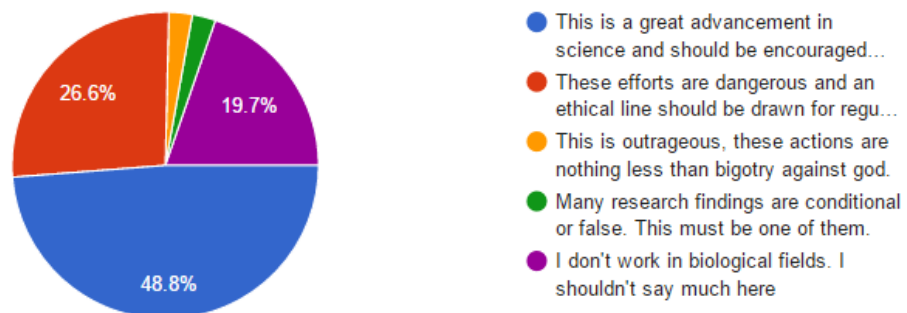
Do you ensure that your medical information is kept private? (208 responses)



On questioning about medical privacy, 42.3 % of the respondents claimed that they ensure that their medical data remains private. 26.9% responded that they were completely ignorant about the fact

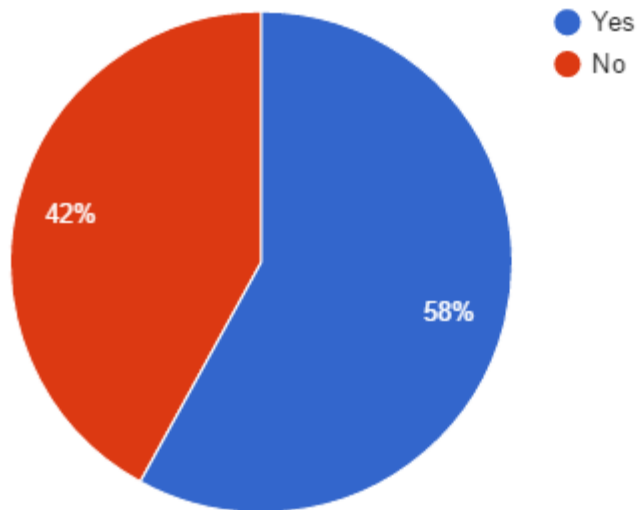
Recently a Chinese research team has modified human embryo in lab before birth. Your take

(203 responses)



On the recent news about Chinese team about gene editing unborn human embryo, 48.8 % acknowledged it as a great advancement in science. 26.6% responded that an ethical line should be drawn in controversial and dangerous areas. 19.7 % of the respondents stated that matter was beyond their expertise because they do not work in biological sciences.

Would you prefer to consume genetically modified crops?



58 % of the survey respondents were open to consuming genetically modified crops while 42 % disagreed for the same citing lack of information, lack of field trials and expense as their reasons.

If you come to know that your neighbour is experimenting with a bacteria or a virus at his home, you will

(207 responses)



56.5 % of respondents said that in case they found their neighbor is experimenting with bacteria in their homes they will be calm and have objective conversations with them. While 11.1 % claimed that they would alert the police and other neighbors. 22.2 % of the respondents claimed that they are ignorant to what they can do.

Connecting the dots:

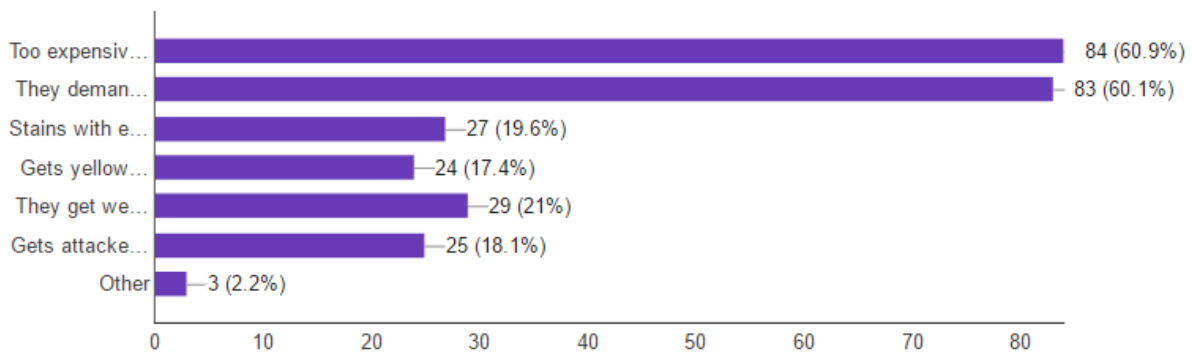
Since the majority of respondents were undergraduates and post-graduates there has been a progressive stance taken up by respondents on many issues despite not being well versed with synthetic biology or iGEM. There has been general acceptance on topics of importance of biology and rationale funding provided to it. Moreover, the majority of respondents displayed command over primary knowledge on biology topics, gauged by their awareness of importance of microorganisms in food

production, bio-warfare and distinguishing bacteria from germs. However, there was little minority which failed at this test and on studying the individual background they were discovered to be either high school students or people practicing non-science profession. This stresses the important fact that the acceptance of forthcoming biological frontiers may not be uniform. Therefore, areas of public education in areas bringing up complex bio-ethical challenges should be emphasized. Deriving from these results we conducted workshops in high schools and university campuses, introducing them to the field of synthetic biology. To be scientifically aware it is important to rely on right sources. However, from our results we discovered that most of our respondents relied upon TV channels like national geographic and newspapers for their information. More reliable resources like coursebooks and peer reviewed journals were not ranked much behind though. This behavior needs a shift considering that primary sources of information should be credible, which have been reviewed in public, to have a more educated society. On controversial issues of GMOs, human gene editing and backyard biohacking the stand is more equitably distributed on for and against the notions. Though the scales do tip in favor of biologists this may well be because the survey sample did not included non-scientific background people in large number. The reason as pointed out by a respondent was the technical nature of few questions, despite they being of trivial origin. We tried to overcome that in next survey.

Survey 2

Is there any particular issue you face with using silk? (Please tick no more than three options!)

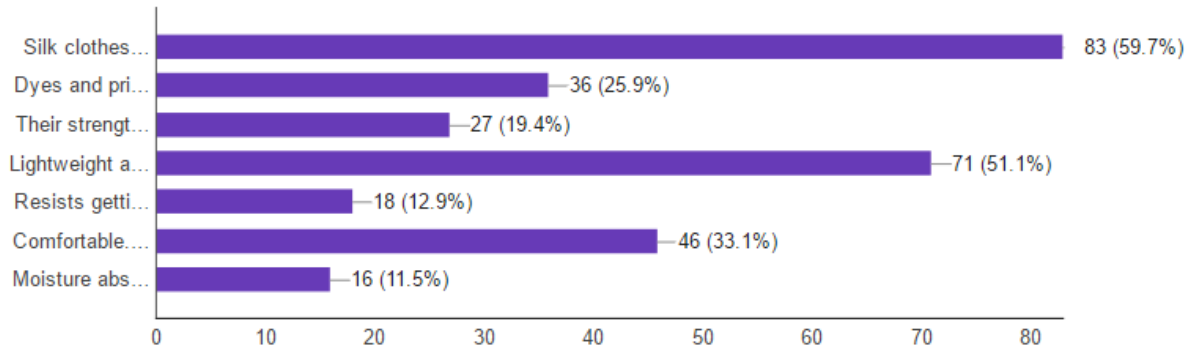
(138 responses)



Expense (60.9%), extra care (60.1%) and weakening of silk by perspiration (21%) were the top 3 issues faced in using silk.

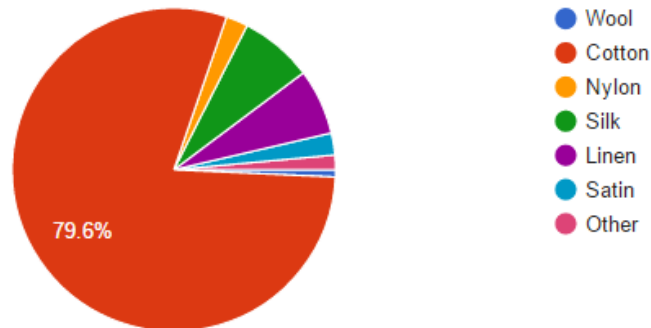
What qualities of silk makes them preferable to use? (Please tick no more than three options!)

(139 responses)



Softness (59.7%), lightweight nature (51.1%), and innate comfortability (33.1%) of silk clothes were top 3 reasons among respondents for using silk clothes.

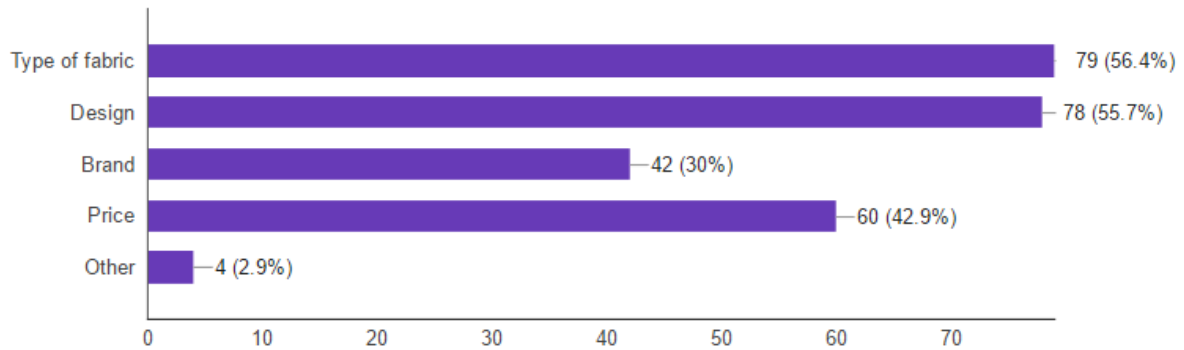
Which of the following fabrics do you prefer to wear the most? (137 responses)



79.6% of the respondents cited cotton as their most used fabric.

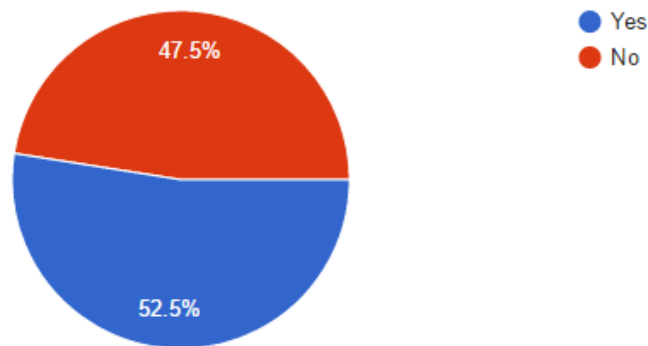
Which of the following are your top 2 criteria while buying clothes?

(140 responses)



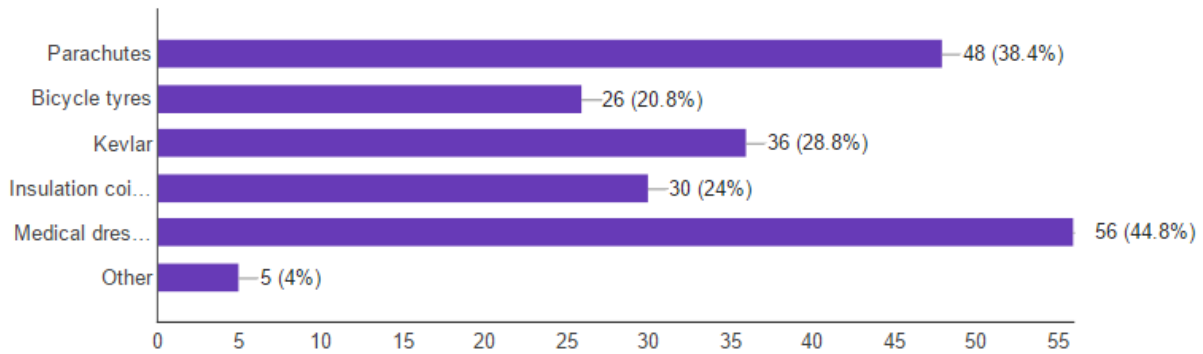
Type of fabric (56.4%) and design (55.7%) were unanimously the top 2 criteria among respondents for selecting the clothes.

Would you prefer silk over cotton, if silk was cheaper? (141 responses)



52.5% of the respondents agreed to shift towards using silk from cotton if its prices went down.

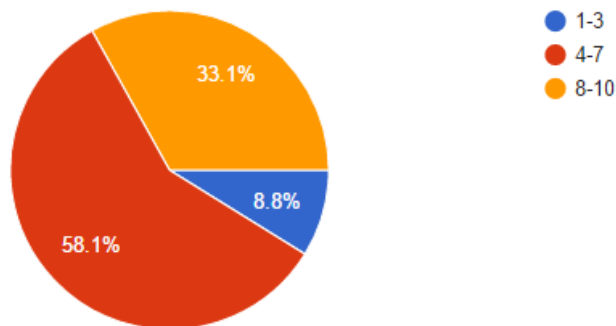
Are you aware of any of these alternative uses of silk? (125 responses)



The respondents were highly aware about usage of silk in parachutes and medical dressings, while lesser so in bicycle tyres, Kevlar and insulation coil.

Given the above applications, how impactful do you think an economical process of silk production would be? (on a scale of 1-10, 10 being most impactful)

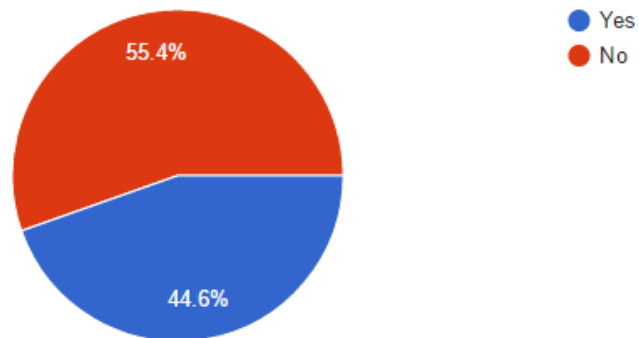
(136 responses)



On a scale of 1-10, 58.1% rated impact of economical silk production process to be between 4 and 7 while 33.1% rated it between 8 to 10.

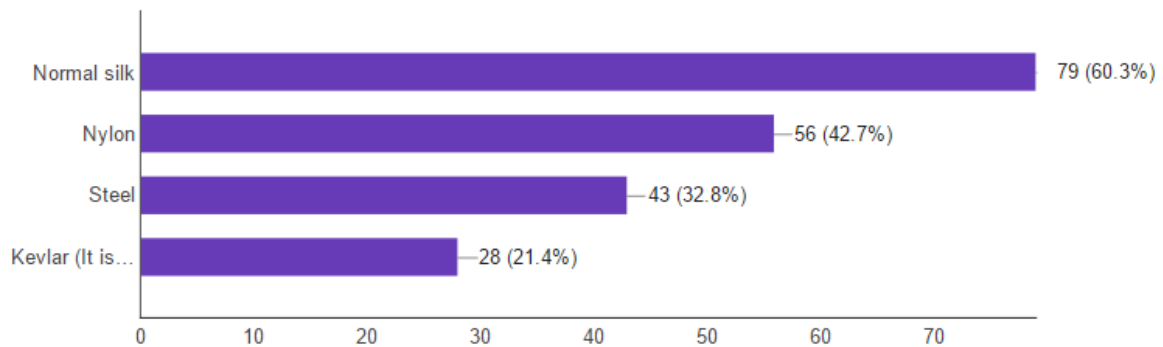
Are you aware of the fact that spider silk is also commercially used?

(139 responses)



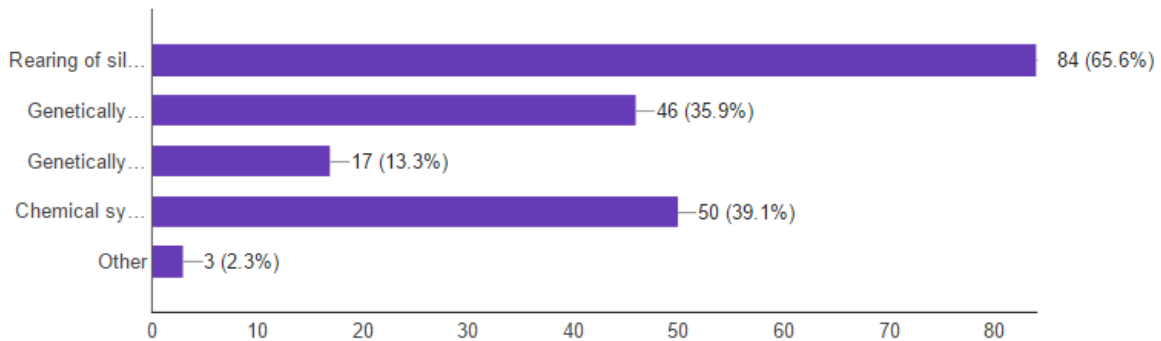
Around 44.6% of the respondents are aware of commercial usage of spider silk.

Do you think spider silk is stronger than any of the following? (131 responses)



Respondents considered spider silk to be stronger than normal silk and nylon but are less informed about its strength in comparison to steel and Kevlar.

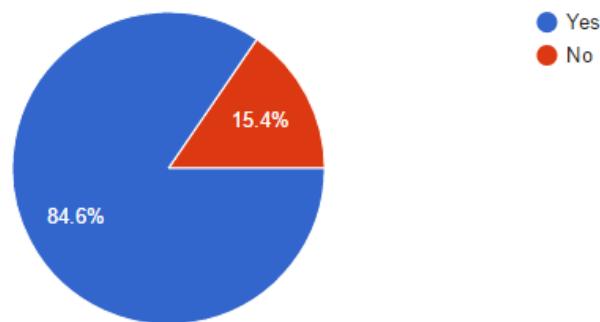
Are you aware of any of these silk production processes? (128 responses)



The respondents were more informed about rearing of silkworms (65.6%) and chemical synthesis (39.1%) when compared to genetically modified bacteria (35.9%) or goat (13.3%) to produce silk.

Would you be willing to use silk if it has been produced using recombinant DNA technology with genetically modified organisms?

(136 responses)



Overwhelmingly 84.6% of the respondents agreed to use silk if it has been produced by recombinant DNA technology with genetically modified organisms.

Connecting the Dots:

This survey was conducted primarily to do the market research for our product requirement and acceptance by potential consumers. Consumers have almost unanimously rated cotton as the most preferred fabric though about 52.5% of respondents agreed to move towards silk if the cost becomes cheaper. The consumers highly value silk for its comfort, softness and lightweight nature making it easier to carry around. However, due to high cost, requirement of extra care and damage to clothes tend to decrease its sell in market. Since spider silk overcomes these issues they will prove to be beneficial for the customers. However, convincing the community about new products can be difficult.

However on conducting survey it was discovered that there was awareness about properties of spider silk, notably its strength and medical uses. Also public were also informed about recombinant DNA technology method to produce silk. On further inquiry, around 84.6% respondents showed acceptance towards using silk made from recombinant DNA technology.