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# Awareness & Impressions of Synthetic Biology

Key findings from a survey among 804 adults nationwide  
Conducted January 2013

*for*

**Synthetic Biology Project**  
**The Woodrow Wilson International Center for Scholars**

Margin of error =  $\pm 3.5$  percentage points among all adults



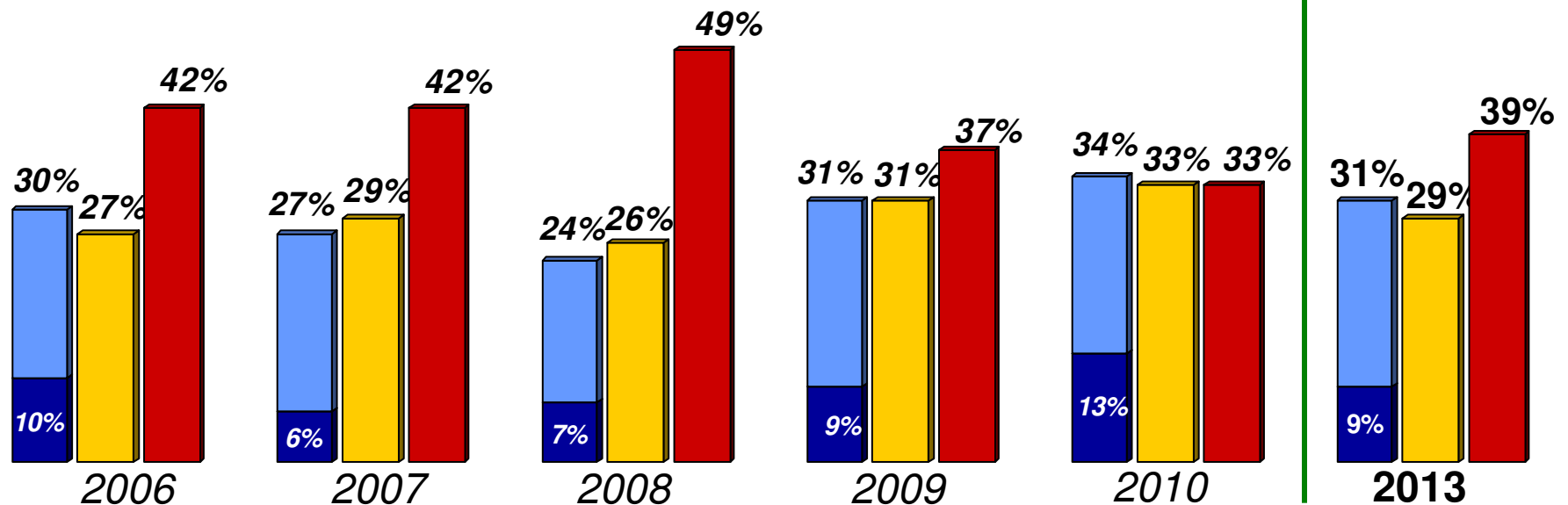
## Methodology

- ◆ Telephone survey among nationally representative sample of 804 adults, including 561 landline and 243 cell-only interviews conducted January 10 – 14, 2013
- ◆ Margin of error =  $\pm 3.5$  percentage points among all adults, higher among subgroups
- ◆ Trend data from similar surveys conducted August 2006, August 2007, August 2008, September 2009, and August 2010

# There has been only a minor shift in public awareness of nanotechnology.

*How much have you heard about nanotechnology?*

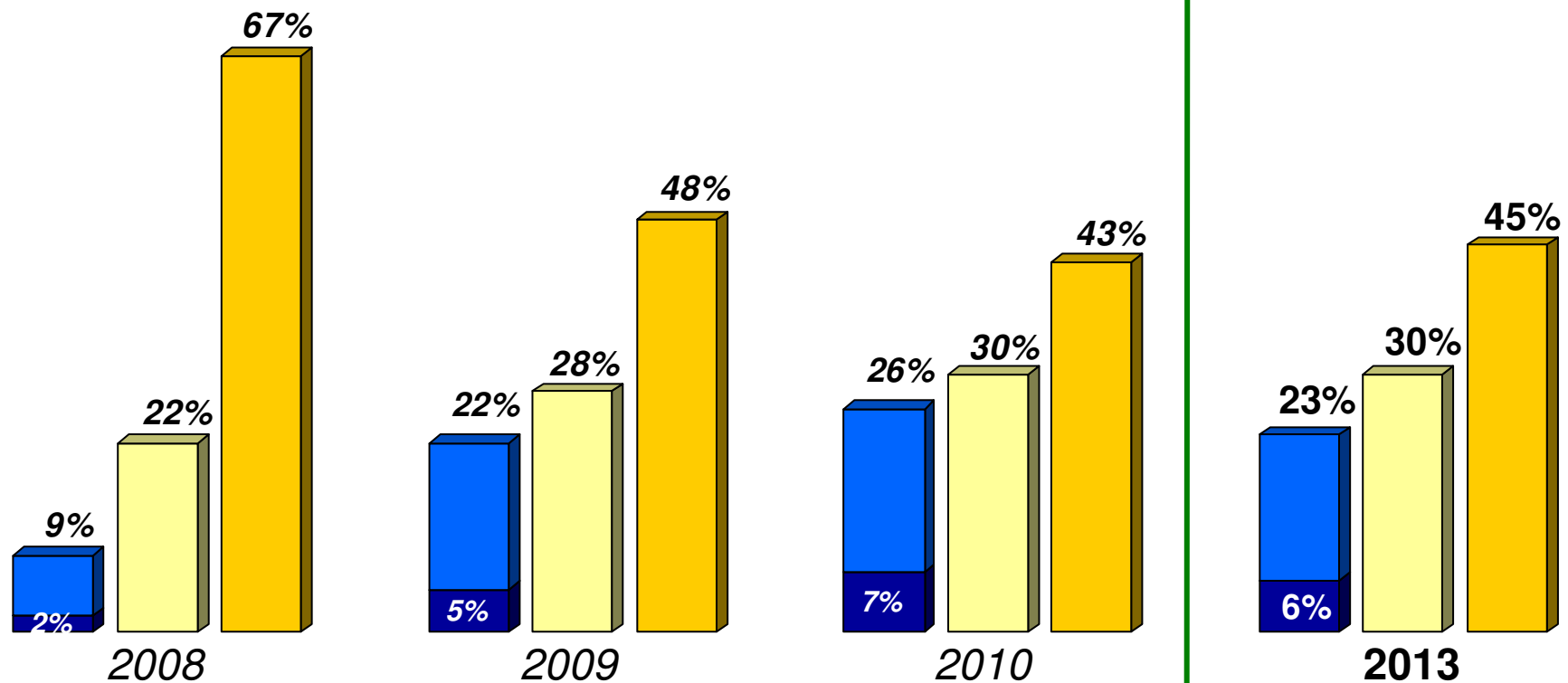
■ Heard a lot   ■ Heard some   ■ Heard just a little   ■ Heard nothing at all



# Public awareness of synthetic biology has held steady.

*How much have you heard about synthetic biology?*

■ Heard a lot   ■ Heard some   ■ Heard just a little   ■ Heard nothing at all



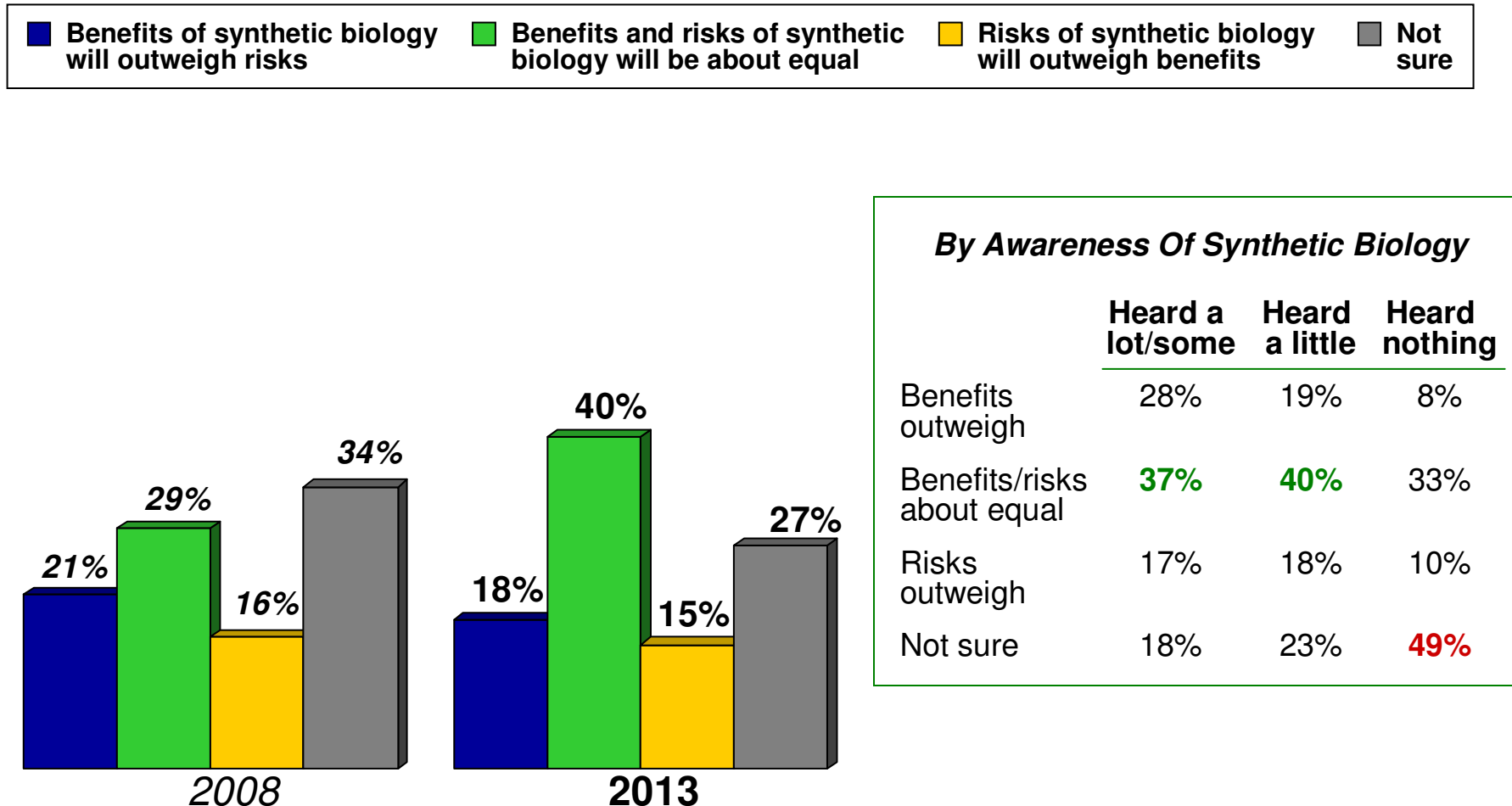


## The public tends to associate synthetic biology with something man-made and artificial.

### *What do you think synthetic biology is?* (Volunteered Comments)

|  |     |
|--|-----|
| Unnatural, man-made, something that isn't real, artificial     | 32% |
| Reproducing/recreating life, cloning, genetic/DNA manipulation | 15% |
| Prosthetics, artificial limbs/organs/tissues                   | 10% |
| Synthetic oils/composites/materials                            | 9%  |
| Development of medicines/treatments for diseases               | 6%  |
| Agricultural applications, weather-resistant plants/crops      | 6%  |
| Based in science/scientific experimentation/research           | 5%  |
| Don't know; no response  | 24% |

# Initially, a plurality thinks that the risks and benefits of synthetic biology are about equal.





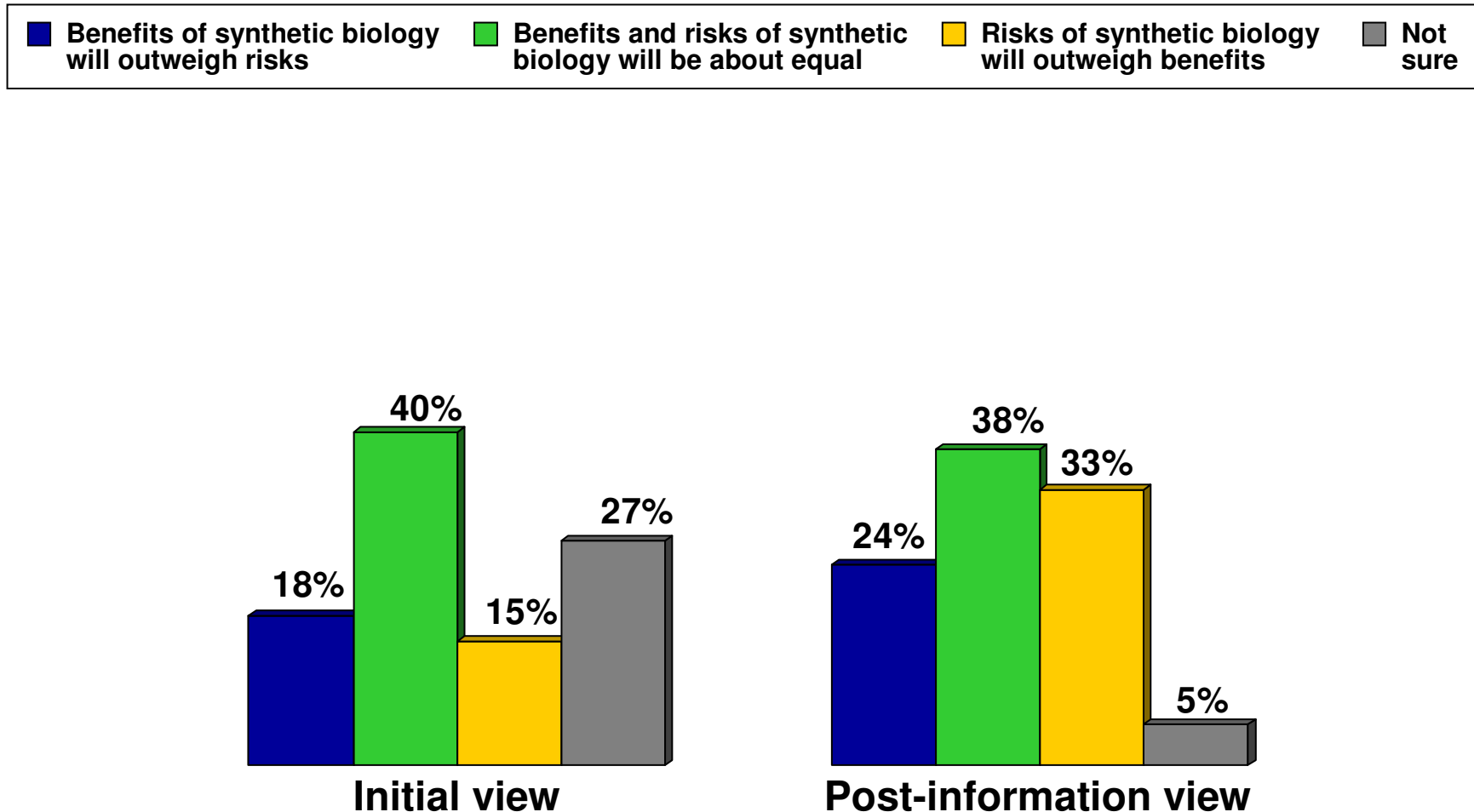
## Description Of Synthetic Biology Given To Respondents

Synthetic biology is the use of advanced science and engineering to make or re-design living organisms, such as bacteria, so that they can carry out specific functions. Synthetic biology involves making new genetic code, also known as DNA, that does not already exist in nature.

The potential **BENEFITS** of synthetic biology include developing new micro-organisms to treat disease, including cancer, more effectively and to create new and less expensive medications. It also could be used to make new organisms that could provide cheaper and cleaner sources of energy than today's oil-based fuels, and to detect and break down environmental pollutants in the soil, air, and water.

While the potential **RISKS** of synthetic biology are not known, there are concerns that man-made organisms might behave in unexpected and possibly harmful ways and that they could cause harm to the environment. There also are concerns that, if these organisms fall into the wrong hands, they could be used as weapons. Additionally, the ability to create artificial life has raised moral and ethical questions about how life is defined.

# After learning about synthetic biology, more move toward concern about risks than toward optimism about benefits.





# Initial/Informed Impressions Of Risks/Benefits Of Synthetic Biology, *Among Key Subgroups*

|                        | Initial Impression |            |                | Informed Impression |            |                |
|------------------------|--------------------|------------|----------------|---------------------|------------|----------------|
|                        | Benefits outweigh  | Equal      | Risks outweigh | Benefits outweigh   | Equal      | Risks outweigh |
| <b>All adults</b>      | <b>18%</b>         | <b>40%</b> | <b>15%</b>     | <b>24%</b>          | <b>38%</b> | <b>33%</b>     |
| Men                    | 26%                | 36%        | 13%            | 31%                 | 35%        | 30%            |
| Women                  | 11%                | 43%        | 18%            | 18%                 | 41%        | 35%            |
| Age: 18 to 34          | 19%                | 45%        | 13%            | 26%                 | 44%        | 27%            |
| Age: 35 to 49          | 18%                | 39%        | 16%            | 28%                 | 36%        | 32%            |
| Age: 50 to 64          | 18%                | 35%        | 23%            | 21%                 | 36%        | 38%            |
| Age: 65 and over       | 14%                | 37%        | 10%            | 23%                 | 38%        | <b>30%</b>     |
| High school/less ed    | 11%                | 49%        | 13%            | 18%                 | 35%        | <b>38%</b>     |
| Some college/tech ed   | 16%                | 39%        | 18%            | 21%                 | 42%        | 34%            |
| College graduate/more  | 24%                | 33%        | 16%            | 32%                 | 38%        | 27%            |
| Income: under \$30K    | 11%                | 45%        | 13%            | 18%                 | 43%        | <b>33%</b>     |
| Income: \$30K to \$50K | 16%                | 45%        | 18%            | 20%                 | 43%        | 30%            |
| Income: \$50K to \$75K | 24%                | 41%        | 19%            | 35%                 | 31%        | 32%            |
| Income: over \$75K     | 28%                | 35%        | 15%            | 32%                 | 35%        | 32%            |

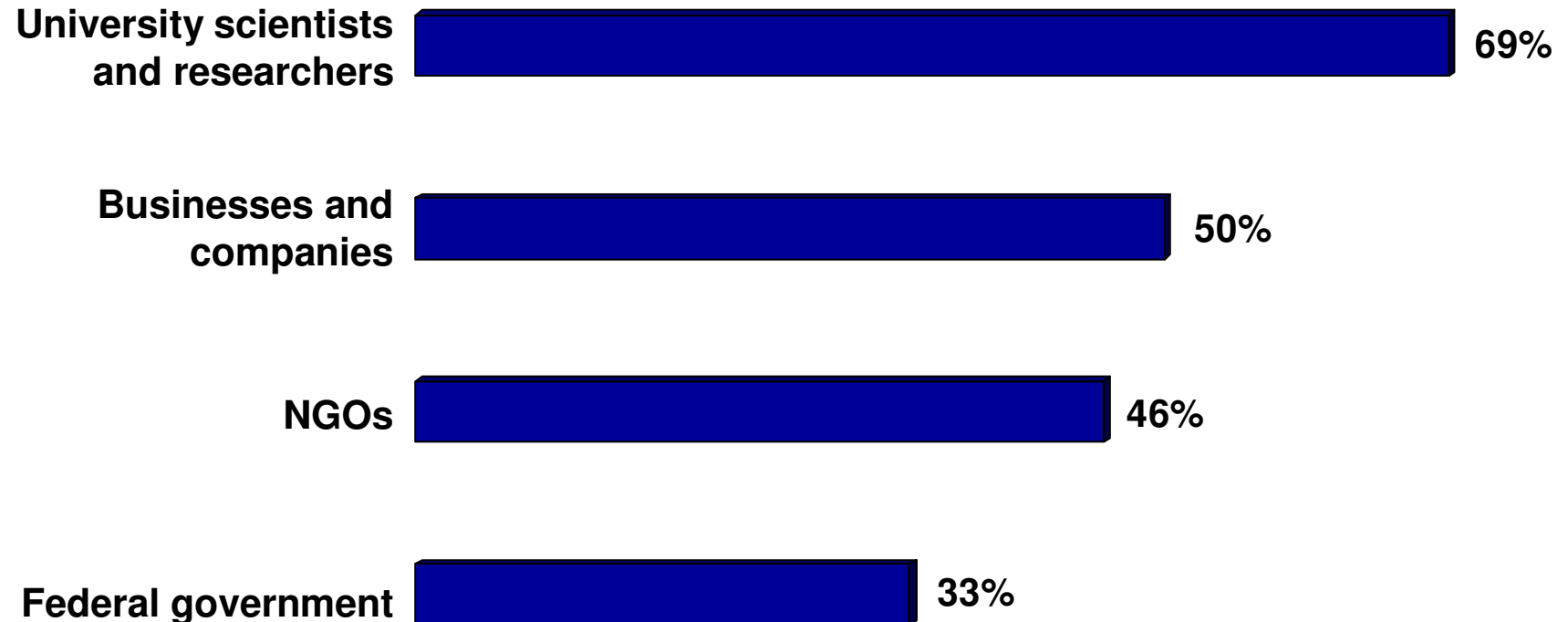
# Initial/Informed Impressions Of Risks/Benefits Of Synthetic Biology, *Among Key Subgroups*

|                                  | Initial Impression |            |                | Informed Impression |            |                |
|----------------------------------|--------------------|------------|----------------|---------------------|------------|----------------|
|                                  | Benefits outweigh  | Equal      | Risks outweigh | Benefits outweigh   | Equal      | Risks outweigh |
| <b>All adults</b>                | <b>18%</b>         | <b>40%</b> | <b>15%</b>     | <b>24%</b>          | <b>38%</b> | <b>33%</b>     |
| Whites                           | 19%                | 36%        | 17%            | 27%                 | 36%        | 33%            |
| African Americans                | 15%                | 45%        | 12%            | 19%                 | 47%        | 30%            |
| Hispanics                        | 13%                | 51%        | 8%             | 17%                 | 47%        | <b>30%</b>     |
| Attend religious services:       |                    |            |                |                     |            |                |
| Weekly                           | 14%                | 40%        | 20%            | 19%                 | 34%        | <b>42%</b>     |
| Occasionally                     | 21%                | 43%        | 12%            | 28%                 | 44%        | 26%            |
| Rarely/never                     | 19%                | 37%        | 16%            | 29%                 | 38%        | 26%            |
| Evangelicals                     | 17%                | 41%        | 16%            | 19%                 | 34%        | <b>43%</b>     |
| Initial familiarity with synbio: |                    |            |                |                     |            |                |
| Heard a lot/some                 | 28%                | 40%        | 19%            | 34%                 | 37%        | 27%            |
| Heard just a little              | 19%                | 44%        | 19%            | 29%                 | 33%        | 34%            |
| Heard nothing                    | 11%                | 37%        | 12%            | 18%                 | 42%        | <b>34%</b>     |



## The public has varied levels of confidence in several groups to maximize benefits and minimize risks of synthetic biology.

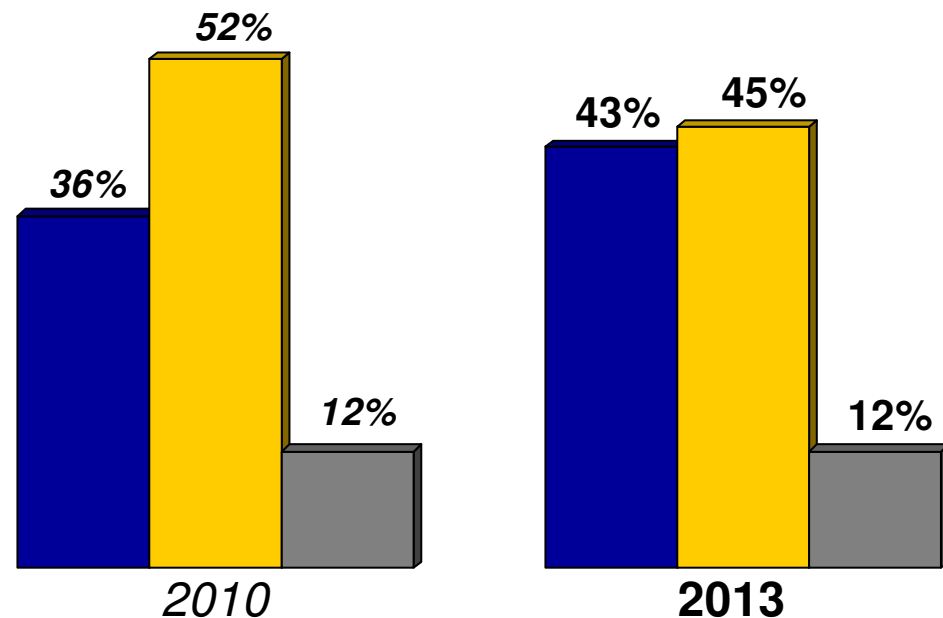
*I have a great deal/fair amount of confidence in this group to maximize benefits and minimize risks associated with scientific and technological advancement:*



# The public today is divided over voluntary guidelines versus government regulation of synthetic biology.

*Which best describes your point of view on voluntary research guidelines for synthetic biology research?*

- Voluntary research guidelines developed jointly by industry and government can provide adequate oversight of synthetic biology research.
- Synthetic biology research should be regulated by the federal government because voluntary research guidelines developed jointly by industry and government cannot provide adequate oversight of synthetic biology research.
- Not sure



# Voluntary Guidelines Vs. Government Regulation, Among Key Subgroups

*Which comes closer to your point of view  
on regulation of synthetic biology research?*

|                        | Voluntary<br>guidelines | Gov't<br>regulation |   | Voluntary<br>guidelines | Gov't<br>regulation |
|------------------------|-------------------------|---------------------|---|-------------------------|---------------------|
| <b>All adults</b>      | <b>43%</b>              | <b>45%</b>          | Democrats   | 31%                     | <b>60%</b>          |
| Men                    | <b>48%</b>              | 41%                 | Republicans   | <b>56%</b>              | 32%                 |
| Women                  | 37%                     | 49%                 | Independents  | 45%                     | 39%                 |
| High school/less ed    | 38%                     | 49%                 | Confidence in <b>federal government</b><br>to maximize benefits/minimize risks: |                         |                     |
| Some college/tech ed   | 44%                     | 46%                 | Great deal/fair amt   | 33%                     | <b>59%</b>          |
| College graduates      | 45%                     | 41%                 | Just some/little  | <b>49%</b>              | 38%                 |
| Whites                 | 47%                     | 41%                 | Confidence in <b>business</b> to maximize<br>benefits/minimize risks:           |                         |                     |
| African Americans      | 32%                     | <b>58%</b>          | Great deal/fair amt   | 47%                     | 43%                 |
| Hispanics              | 30%                     | <b>57%</b>          | Just some/little  | 39%                     | 48%                 |
| Income: under \$30K    | 35%                     | <b>55%</b>          |   |                         |                     |
| Income: \$30K to \$50K | 46%                     | 42%                 |   |                         |                     |
| Income: \$50K to \$75K | 44%                     | 42%                 |   |                         |                     |
| Income: over \$75K     | <b>48%</b>              | 41%                 |   |                         |                     |

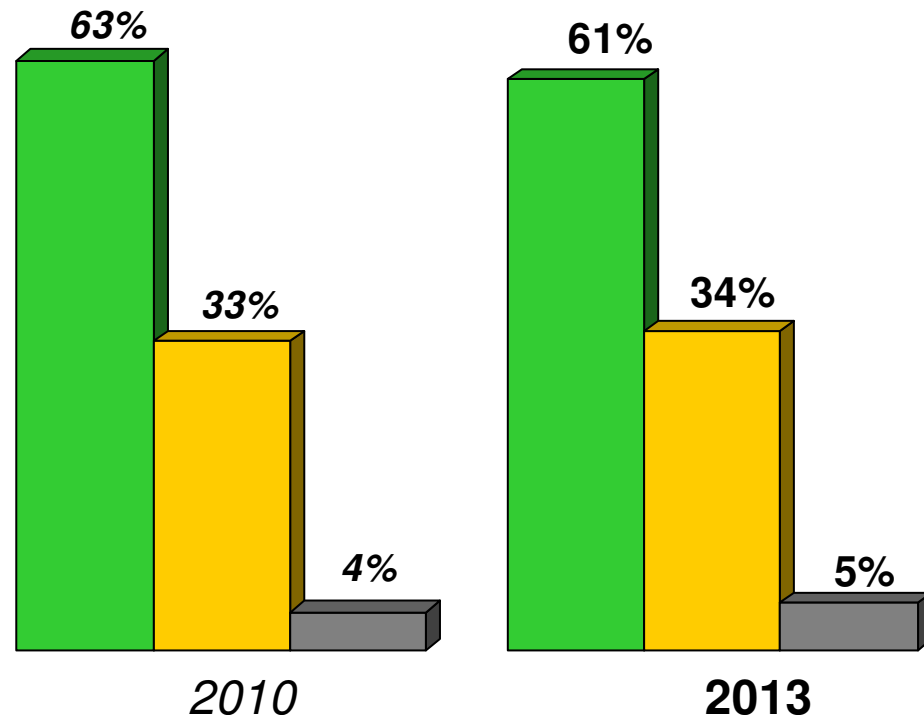
# A majority expresses support for continuing work in synbio rather than banning it.

*Which best describes your point of view on synthetic biology research?*

■ Synthetic biology should move forward, but more research must be done to study its possible effects on humans and the environment.

■ A ban should be placed on synthetic biology research until we better understand its implications and risks.

■ Not sure



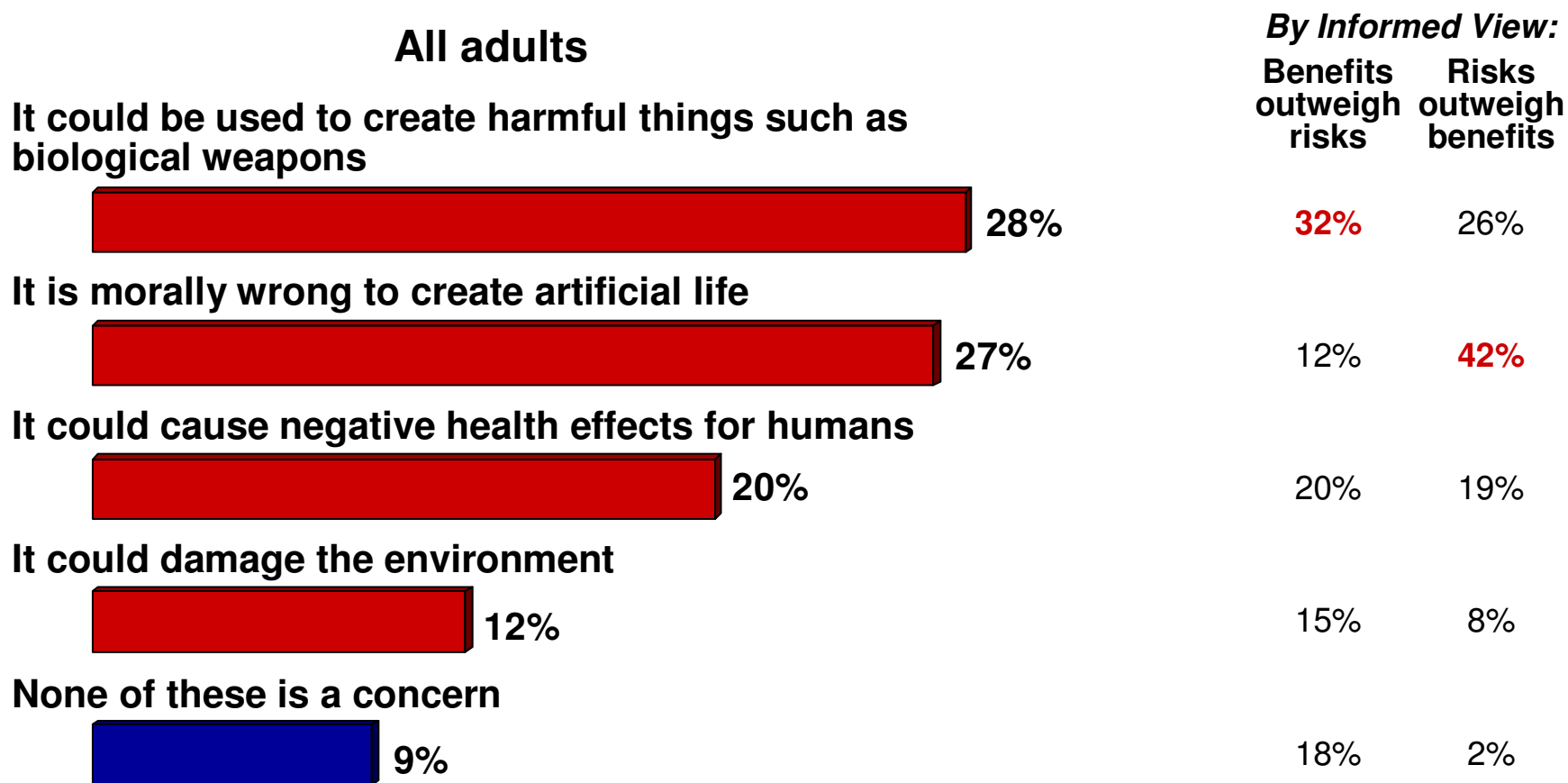
# Moving Forward Vs. Banning Synbio Research, Among Key Subgroups

*Which best describes your point of view on synthetic biology research?*

|                        | Move<br>forward | Ban<br>research |  | Move<br>forward | Ban<br>research |
|------------------------|-----------------|-----------------|--|-----------------|-----------------|
| <b>All adults</b>      | <b>61%</b>      | <b>34%</b>      | Churchgoing/religion:                      |                 |                 |
| Men                    | 65%             | 30%             | Attend svcs weekly                         | 54%             | 40%             |
| Women                  | 57%             | 38%             | Evangelicals                               | 49%             | <b>47%</b>      |
| High school/less ed    | 48%             | <b>47%</b>      | Informed support<br>for synthetic biology: |                 |                 |
| Some college/tech ed   | 60%             | 33%             | Benefits outweigh                          | <b>88%</b>      | 12%             |
| College graduates      | <b>72%</b>      | 24%             | Risks/benefits equal                       | <b>68%</b>      | 26%             |
| Whites                 | <b>66%</b>      | 30%             | Risks outweigh                             | 34%             | <b>61%</b>      |
| African Americans      | 46%             | <b>48%</b>      |  |                 |                 |
| Hispanics              | 46%             | <b>47%</b>      |  |                 |                 |
| Income: under \$30K    | 50%             | <b>46%</b>      |  |                 |                 |
| Income: \$30K to \$50K | 62%             | 34%             |  |                 |                 |
| Income: \$50K to \$75K | <b>73%</b>      | 25%             |  |                 |                 |
| Income: over \$75K     | <b>70%</b>      | 26%             |  |                 |                 |

# Top Concerns About Synthetic Biology

*Which ONE of these concerns you most about synthetic biology?*





## Reminder of Varied Reactions To Applications In 2010 Survey

■ Positive development/I would be hopeful ■ Negative development/concerns me

**Synthetic Flu Vaccine:** Current flu vaccine manufacturing requires the replication of the flu virus in chicken eggs. This is a lengthy and time-consuming process often taking four to five months to make vaccines available for use. Using synthetic biology, an influenza vaccine could be designed in a few hours on a computer and biologically manufactured in weeks instead of months.

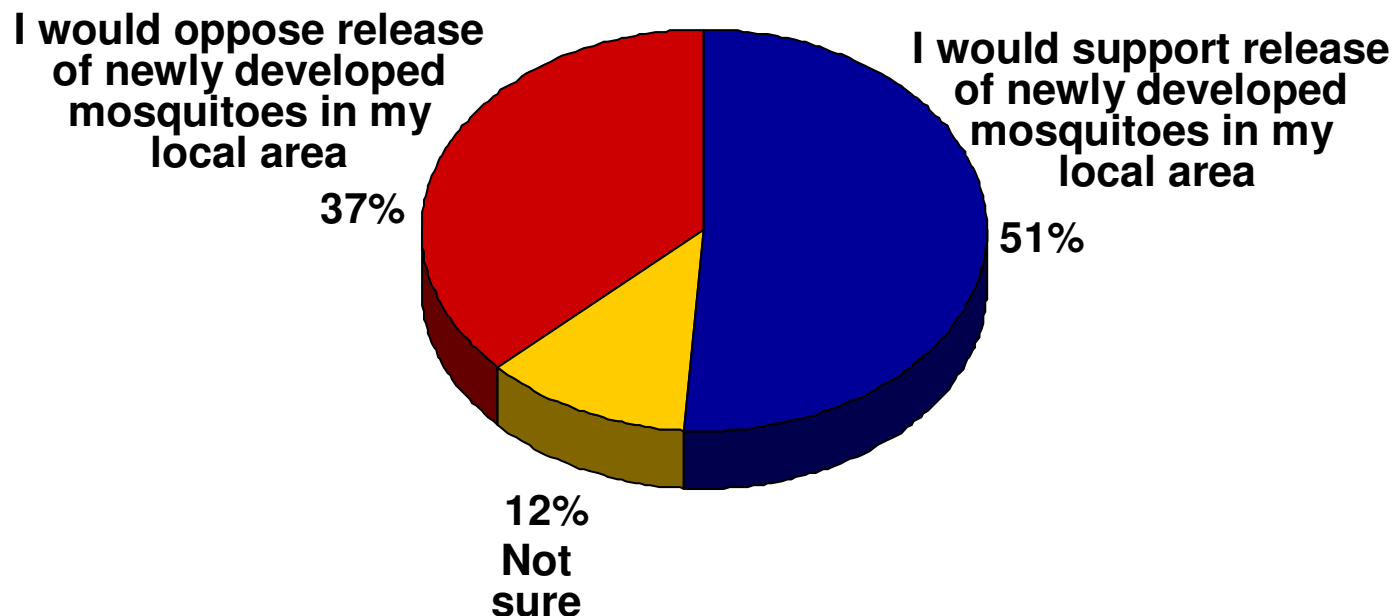


**Animal Growth Acceleration:** Using synthetic biology, researchers could insert a synthetic chromosome designed on a computer into cows or pigs that would allow the animals to mature in four months instead of eight months. Other than the acceleration of growth, the animals would look and act exactly like regular pigs and cows, but it would mean that farmers could produce meat for consumers more quickly.



# A bare majority supports using mosquitoes developed with synthetic biology to control disease in their neighborhoods.

Synthetic biology can be used to **engineer new versions of insects, such as mosquitoes, to help control diseases like West Nile virus.** The insects are modified using synthetic biology so that their offspring die or so that male insects are sterile, thus reducing insect populations that spread the disease. These new types of mosquitoes have already been released in Brazil and the Cayman Islands, and there is discussion of releasing them in Key West, Florida. If a mosquito-borne disease became an issue in my neighborhood:



# Majorities see other applications as negative developments.

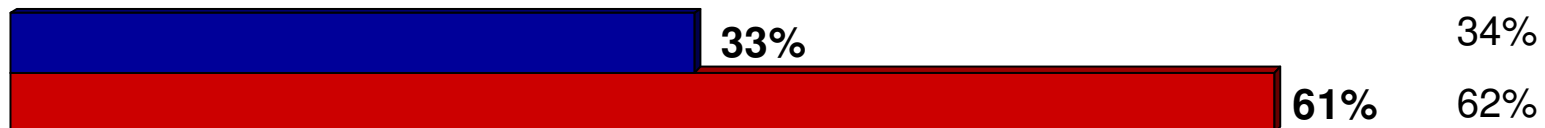
■ Positive development/I would be hopeful ■ Negative development/concerns me

**New fertilizer that speeds up root growth in crops:** Synthetic biology is used to change the genetic code of bacteria that occurs naturally in the soil so that it releases a growth hormone that is then absorbed by the plant, causing it to quickly grow stronger roots that help prevent soil erosion and protect the plant during a drought.

*By  
Informed View:  
Risks/benefits  
about equal*



**New food additives:** Including an artificial sweetener, a vanilla flavoring, and a citrus flavoring, rather than using crops or other natural resources to manufacture these food additives, they can be produced synthetically by bacteria.



# Impressions Of Potential Applications Of Synthetic Biology, *Among Key Subgroups*

|                       | Synbio in Fertilizer |                      | Synbio in Food Additives |                      |
|-----------------------|----------------------|----------------------|--------------------------|----------------------|
|                       | Positive development | Negative development | Positive development     | Negative development |
| <b>All adults</b>     | <b>41%</b>           | <b>52%</b>           | <b>33%</b>               | <b>61%</b>           |
| Men                   | <b>53%</b>           | 41%                  | <b>46%</b>               | 48%                  |
| Women                 | 30%                  | <b>62%</b>           | 22%                      | <b>73%</b>           |
| High school/less ed   | 38%                  | 55%                  | 26%                      | <b>70%</b>           |
| Some college/tech ed  | 39%                  | 56%                  | 35%                      | 59%                  |
| College graduate/more | 44%                  | 47%                  | 37%                      | 56%                  |
| Churchgoing/religion: |                      |                      |                          |                      |
| Attend weekly         | 33%                  | <b>62%</b>           | 25%                      | <b>68%</b>           |
| Attend occasionally   | 48%                  | 44%                  | 37%                      | 59%                  |
| Evangelicals          | 27%                  | <b>71%</b>           | 28%                      | <b>70%</b>           |
| Informed support:     |                      |                      |                          |                      |
| Benefits outweigh     | <b>62%</b>           | 34%                  | <b>68%</b>               | 27%                  |
| Risks/benefits equal  | 47%                  | 46%                  | 34%                      | 62%                  |
| Risks outweigh        | 17%                  | <b>77%</b>           | 13%                      | <b>83%</b>           |



# ***In Their Own Words: How The Public Thinks About The Benefits Of Synthetic Biology***

*From Focus Groups Conducted In 2011*

“I kind of agree with making sure you're doing a lot of regulation, checks and balances, and looking at the ethics behind it as well. But ultimately, I think it's for progress and for positive benefits.”

“I recognize that there's negatives. I recognize everything else, the concerns of it, but overwhelmingly I see the positive things that can come from it. And if there is that regulation like you talked about and there are safeguards taken, I think it's definitely going to be overwhelmingly positive, no doubt.”

“I think the application is the most important for me because I think finding a cure for cancer or helping us to be more conscious of our environment and recycling and things like that are all great causes and the end might justify the means, however, how do you control that? How do you make sure that once that technology is developed that somebody won't say, all right, well, now we can clone a human being, or where does it end? How do you regulate that?”

“I'm more positive than I've been with regards to this, and I think I look at it as almost levels of organisms that when you're talking about creation of microorganisms or bacteria or even plants, that doesn't seem as immediately concerning as more complex organisms such as animals or even humans.”

“I think it's very important that they continue it. I think it's necessary, and as long as there's research studies that continue to completely see how each drug, each thing that's modified along the way is done, that it should continue definitely.”



# ***In Their Own Words: How The Public Thinks About The Risks Of Synthetic Biology***

*From Focus Groups Conducted In 2011*

“We can sit and think about what sort of life form we'd like to make and design it like a car, we could alter nature and guide human evolution, we can put it in a microbe and two weeks later, out comes your product? Those are all very, very scary thoughts that somebody has that power.”

“I'd like to see more guarantees because, like I said before, you can't control nature. You know, it might be synthetic, but you're creating an organism, you know what I mean, it's going to do what it pleases.”

“I think that history's paved with the best intentions and that all of these arguably are phenomenal advancements, but there are no safeguards and there is no clean understanding as to what the negative repercussions are and I don't know if there ever would be. I don't think that there's ever going to be a failsafe mechanism to know what happens if this is given to the wrong people or with people who have solely profit in mind, and the ends justify the means in their world and to hell with anything else that comes along with it. It's concerning and I look at it with more of a critical eye.”

“I would say if there's not someone in their group that's constantly questioning ‘*Should we be doing this?*’ then they need to expand their group to include that person.”



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