

**Front-end Evaluation of**  
*Life's New Frontiers*

**Prepared for the Tech Museum of Innovation**

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## **DISCUSSION AND RECOMMENDATIONS**

Overall, this study indicated that visitors are intrinsically interested in genes, genetic diseases, and peoples' stories related to diagnosis, prevention, and treatment of those diseases. The evaluation activities and conversations encouraged visitors to explore the human perspective of genes, genetics, and genetic technology, which proved to be the most provocative aspect of the visitors' experience during the evaluation.

### *Visitor Concepts of Genes*

Visitors' understandings of genetic biology pose a challenge to interpreting the role of genetic technology in human health. This study indicates that visitors do not have an adequate understanding of genes and genetic technology, and they do not have an extensive understanding of health conditions related to genes, genes' affect on physical traits, or the safety and reliability of new genetic technologies. Additionally, interviewees were often unclear about how genes, the environment, and lifestyle affect health conditions.

Middle school students emphasized they did not yet know basic biological concepts related to genes beyond knowing genes are responsible for human traits. Additionally, the evaluation revealed that students needed to feel informed about the background science and relevant information to engage in debates.

Moreover, many interviewees assumed that researchers have more information about the links between genes and human characteristics, proclivities, and health than actually exist in current scientific cannons. Therefore, visitors are likely to think that with the genome project, publicized research, and discoveries about genes, scientists have "solved" many of the puzzles about human characteristics, how the body works, and health.

### *Visitors' Personal Connections to Genetically Related Diseases*

This study has shown that connecting with visitors on a personal level motivates them to delve deeper into science. When probed for personal connections to genetically related conditions, all visitors discussed at least one topic that touched them personally. Interviewees became emotionally and psychologically charged when discussing the degree of control that people have over genetic diseases, decisions related to genetics and health, and coping with genetically related diseases. Many felt fear and worry. However, students countered their anxiety with hope for new developments in treatments and prevention.

### *Visitors' Responses to Case Studies*

The case studies helped interviewees consider and understand genetically related health conditions, while sparking curiosity about diagnosis, treatment, or prevention. Interviewees empathized with and were concerned about the main characters while discussing the case studies, and wanted to know more about the science and procedures that would affect each character's life.

Responses to the case studies show that visitors are highly sensitive about the ethics of genetic technology. Often in interviews with groups, friends and family members debated differing opinions. Conversations and discussions encouraged visitors to challenge opposing responses, as well as to work together to find consensus. Additionally, controversies surrounding advances in genetic technologies have made many suspicious of genetics in medicine.

### *Visitor Reactions to Potential Exhibition Topics*

The most frequently selected exhibition topics related directly to the case studies, stressing the importance of fusing technological content with a human element. Additionally, many discussed preferences for interpretation and presentation, such as factual and unbiased information and presenting multiple perspectives.

### *Recommendations*

- Staff should consider that visitors might have a rudimentary knowledge of genetics, so consider providing essential information at each component that will help convey each component's primary message.
- Participants were as interested in finding out why they are the way they are, as they were in finding out about disease-related topics. The interpretation should address the role of inheritance, behaviors, and environment since interviewees asked about these topics.
- Use the case studies to introduce visitors to the technology used in genetic research, as they piqued visitors' personal interest.
- Prepare strategies to help visitors deal with their emotional responses, fears, and worries. Set aside programming space and collaborate with counselors to help visitors cope with and make informed decisions about genetic health matters. Produce resources for parents to help them talk to their children about genetically inherited diseases and related subjects.
- Provide unbiased interpretation that explores all perspectives of genetic research to encourage discussion and orchestrate debates. The exhibition should include multiple opinions, as well as scientific facts concerning underlying issues.
- A small sample of middle school students participated in the evaluation. After the exhibition's messages, conceptual design, and interpretive techniques are further developed, planners may want to conduct additional studies with middle school students to determine how best to communicate with them.

## INTRODUCTION

This report presents the findings from a front-end evaluation for an exhibition being developed by The Tech Museum of Innovation about genetics, health, and technology. Front-end evaluation is conducted to help planners understand visitors' thoughts and reactions to key themes, ideas, concepts, and activities being developed for an exhibition. Since front-end evaluation highlights both common ground and gaps between visitors and the exhibition's concept, the evaluation findings may inform the team's decisions as exhibition development progresses.

The evaluation objectives were to:

- Determine how visitors think genes relate to human health and disease.
- Determine how visitors personally connect to genetically related diseases.
- Determine how visitors respond to case studies that involve diagnosis, treatment, and prevention of genetic diseases.
- Find out which exhibition topics interest potential visitors.

## METHODOLOGY

Data were collected using in-depth interviews with a card sort, sample case studies, and a list of potential exhibition topics. In the card sort, participants organized a list of twelve topics into the following categories: determined by genes; determined by genes, lifestyle and environment; determined by lifestyle and/or environment; or not sure. Participants also read and discussed one of two case studies—one about genetic testing used to diagnose colon cancer, or one about genetic technology used to treat a condition affecting a child's growth.

### *Interviews*

In-depth interviews produce rich data and are useful for understanding ideas and concepts from the visitors' point of view. The purpose of conducting in-depth interviews is to encourage and motivate interviewees to describe their experiences, express their opinions and feelings, and share the meaning they construct about ideas and experiences that the evaluator presents to them.

An interview guide was developed, and interviews were conducted in April 2002 with two different audiences: middle school students and museum visitors.

Following a random sampling method, the interviewer asked museum visitors ages 12 years and older to participate in the study. Individuals, pairs, or casual groups of up to four visitors participated.

Middle school students from an after school program in San Jose also participated in the evaluation. For the interviews, school instructors selected students whose parents completed a permission form. Pairs of students were interviewed.

Each interview lasted 15 to 30 minutes. Most questions on the interview guide were open-ended to allow interviewees the freedom to discuss what they felt was meaningful. Two questions on the interview guide involved categorizations and selections of exhibition topics from lists, which combined closed-ended and open-ended approaches. All interviews were tape-recorded (with participants' consent) and transcribed to facilitate analysis.

## DATA ANALYSIS AND METHOD OF REPORTING

In-depth interviews yield descriptive results. To analyze the data, the evaluator studied the transcripts and identified meaningful patterns and trends. Interviewees' categorizations and selections from the list of exhibition topics were also tabulated.

The data presented in this report are qualitative. Trends and themes are presented from most frequently to least frequently occurring. Verbatim quotations from the interviews are edited for clarity and illustrate respondents' thoughts and ideas, and convey the essence of visitors' experiences. Within quotations, the interviewer's questions appear in parentheses, and an asterisk (\*) signifies a change in speaker.

## PRINCIPAL FINDINGS

### DEMOGRAPHICS

Interviews were conducted with two audiences: museum visitors and middle school students in an after school program.

Twenty-four interviews were conducted with a total of 48 museum visitors. The majority of participants were adults over 19 years ( $n=38$ ), while 10 participants were visitors under 15 years. Of the data collected with young people in the museum, two interview groups were middle schoolers (ages 12, 13, and 14 years). Eight interview groups included adults with children between the ages of 11 and 15 years. There were slightly more males than females.

Due to constraints with the after school program, fewer interviews were conducted than planned. Data from the middle school includes four interviews with seven students between the ages of 12 and 14 years. Four females and three males participated in those interviews.

As the exhibition will target middle school students, findings from all interviews with middle schoolers (children who were visiting the museum with their families and those interviewed in their middle school;  $n=12$ ) are presented separately from interviews with adult-only or adult-child groups.

### CONCEPTS OF GENES

**Museum visitors and middle school students could define genes. However, they were unsure how children inherited genes from their parents, as well as the degree that genes affect health conditions. Both groups believed that genes, lifestyle, and environment influence breast cancer and one's ability to memorize. Additionally, both groups felt that lifestyle and/or the environment influence food preferences and having the flu.**

#### *Museum Visitors*

##### General Perceptions of Genes

First interviewees were asked to define genes. Frequently, museum interviewees were unsure how to describe genes as well as what they determine. Most associated genes with “inherited” traits or visible characteristics received from parents. Nearly one-third of interviewees immediately associated genes with issues such as cloning or other topics featured in the media or politics. Almost one-quarter said genes are “what makes us *us*,” and an equal portion of interviewees mentioned DNA in their responses. The few interviewees who had a background in science mentioned chromosomes or scientific terms associated with genes. Almost every interviewee showed an interest in genes and scientists’ new discoveries about them. Many interviewees were confused about the degree that genes, lifestyle, and environment affect diseases such as breast cancer, allergies, and asthma.

Interviewees often contradicted themselves and said they knew little about how genes are inherited. Most interviewees were confused about the relationship between genes and traits or disease, as well as the relationship between lifestyle and environment, and traits or disease.

After defining genes, visitors participated in the card sort exercise to assess the degree that visitors think genes determine specific conditions. Table 1 shows how interviewees categorized the card-sort topics.

**Table 1**  
**How Museum Visitors Categorize Topics Related to Genes**  
*n* = 24 groups

Topics	Determined by Genes <i>n</i>	Determined by Genes, Lifestyle, and Environment <i>n</i>	Determined by Lifestyle and /or Environment <i>n</i>	Not Sure <i>n</i>
Blood type	23	-	-	1
Height	17	7	-	-
Huntington’s disease	12	-	-	12
Breast cancer	-	21	2	1
Life span	1	19	3	1
Heart disease	1	18	5	-
Allergies	3	18	2	1
Asthma	4	15	3	2
Ability to memorize	2	13	6	3
Flu	1	4	18	1
Food preferences	2	5	15	2
Pain reliever preferences <sup>1</sup>	3	3	13	5

<sup>1</sup> Card read: “Preference for either aspirin, or ibuprofen, or Tylenol.”

### Blood Type

The majority of interviewees associated blood type with “determined by genes.” Interviewees noted that people are born with a specific blood type and did not think external factors could affect it.



## Height

The majority of interviewees responded that genes determine height. However, several interviewees felt that genes and lifestyle/environment determine height, as one responded, “I’ve heard smoking and caffeine will stunt your growth.”

## Huntington’s Disease

About one-half of interviewees, including those with a science background, said they knew of Huntington’s disease as one of the first diseases to be genetically linked. Others said they had never heard of the disease and put it into “not sure.”

## Breast Cancer

The majority of interviewees said that genes and lifestyle and/or environment causes breast cancer (see the two quotations below). A couple of interviewees mentioned genetic tests that identify the presence of the breast cancer gene.

\*I think it’s hereditary—but if you work with radiation, that could cause cancer. \*\*Or if you smoke, can you get breast cancer? Or if you ate bad things, couldn’t you get cancer? \*But they say if you breast feed, then it lowers your chance of breast cancer. \*\*So you choose that. That’s a lifestyle. \*\*But if your mother had it, you might have it. [Female, 28, and Male, 30]

For breast cancer—I’m sure, at least from what I read, that there are genetic predispositions for cancers. But . . . I think there is definitely something in the environment. I think there’s a combination of both genetic predisposition and environmental factors. [Male, 62]

## Life Span and Heart Disease

The majority of interviewees said that genes and lifestyle and/or environment affected life span and heart disease.

## Allergies and Asthma

Some interviewees were unclear if genes, environmental factors, or a combination of the two cause allergies and asthma (see the quotation below). Several interviewees speculated whether they could have once had a gene for allergies, but did not anymore. Additionally, they wondered if they carried a gene for allergies and asthma even if they did not have the symptoms of the condition.

Allergies are both genes and lifestyle and environment. There is a genetic component to it. There is a predisposition to it, and it’s also about your environment. You go out into a field and you know, you get hay fever. [Male, 21]

### Ability to Memorize

Most interviewees related ability to memorize with genes as well as lifestyle and/or environment (see the quotation below).

Some people are born with a higher capacity to memorize stuff, but it's also determined by lifestyle because memory is something you can train. Some people have a higher capacity to memorize things—it just comes naturally to them. Some people can just learn to memorize by rote training. [Male, 28]

### Food and Pain Reliever Preferences

Most interviewees associated food and pain reliever preferences with lifestyle and/or the environment (see the first two quotations below). When prompted to consider what could link food and pain reliever preferences to a biological dimension, a few interviewees remarked that taste buds, the nervous system, and brain chemistry are influenced by genetics and therefore might play a role in determining preferences (see the third quotation).

Preference for aspirin, ibuprofen, or Tylenol—most of that's marketing. I know that there's the placebo effect: someone will feel more healed when they get a brand name. The bigger the pill, the better they're going to feel. [Female, 25]

I think food preference is lifestyle and environment. I think a lot of people learn to eat food when they are young—whatever their parents and their immediate community around them teach them. That is what they learn is the “preferred” food. [Male, 21]

With taste buds, there are some things that you can taste, and some things you can't taste, and I remember that's inherited. I learned that in science class. [Female, 11]

### Flu

Most interviewees said that lifestyle and/or environment affect getting the flu.

### *Middle School Students*

#### Overall Perceptions of Genes

Most middle school students said they had heard of genes or DNA and a few had studied DNA or inherited traits in school. Most associated genes with “parents,” and often explained genes in terms of visible traits, such as height and eye color or “looking alike.” Most students' knowledge of genetics was reportedly influenced by conversations with family members, peers, or teachers. Additionally, students were unclear about how genes passed between the generations (see the quotation below).

My teacher said that mostly whatever you get comes from your family, or over time, from the next person who had it, but not everybody. Sometimes it [breast cancer] skips a generation or something like that. [Female, 14]

Students who had not studied genes responded vaguely to questions, though they did acknowledge that they share some health conditions, physical traits, or other similarities with family members.

Table 2 shows how student interviewees categorized topics related to genes in the card sort exercise.

**Table 2**  
**How Middle School Students Categorize Topics Related to Genes**  
*n*=6 pairs

Topics <sup>1</sup>	Determined by Genes <i>n</i>	Determined by Genes, Lifestyle, and Environment <i>n</i>	Determined by Lifestyle and /or Environment <i>n</i>	Not Sure <i>n</i>
Life span	-	3	-	3
Heart disease	-	3	2	1
Allergies	-	3	2	1
Asthma	-	2	2	2
Height	2	3	-	1
Ability to memorize	2	1	-	3
Breast cancer	2	1	2	1
Flu	-	1	3	2
Food preferences	1	1	2	2

<sup>1</sup>Note: For the middle school interviews in the after school program, the following topics were eliminated: Huntington’s disease, blood type, and preference for aspirin, ibuprofen or Tylenol.

### Life Span

One-half of students believed that genes and lifestyle and/or environment determined life span. Many highlighted specific behaviors that affect longevity (see the quotation below).

Life span cannot be determined by genes [alone] because your lifestyle can interfere with that. You’re around a lot of smokers—it kills you and we all know smoking is not [determined] by genes. [Female, 12]

### Heart Disease

The majority of students believed that genes and lifestyle and/or environment caused heart disease. However, a few felt that lifestyle and/or environment were the exclusive causes of the condition.

### Allergies

The majority of students believed that genes as well as lifestyle and/or environment caused allergies (see the quotation below). Two other students responded that lifestyle and/or environment only affected allergies.

The environment causes allergies. Mostly everyone in my family has allergies because of the dust and pollen and all that stuff. (And what do you think your genes have to do with it?) \*Maybe her mother gave her all her genes? [Female, 12; Male, 12]

### Asthma

Students were unclear about the affect of genes on asthma. An equal number of students believed that asthma is determined by genes, lifestyle, and environment; determined exclusively by lifestyle and/or environment; and not sure. Many interviewees were confused about what causes asthma, for example saying it could either be something they are born with or something that is caused by exposure to smokers or other environmental factors like pollen and pets (see the quotation below).

If you're in a smoke-filled house, then you might get asthma, because you have the genes for asthma. But, if you smoke, then you could also get it, even if you didn't have the genes. That's a lifestyle. [Male, 14]

### Height

Student interviewees usually chose to discuss height first, and they often compared their own height to that of their peers and family members. Most students believed that genes, lifestyle, and environment affect height (see the quotation below). However, some felt that genes are the only contributing factor to height.

If your parents are tall, then you're probably going to be tall. But if you don't eat right, then you'll be short. [Male, 14]

### Ability to memorize

Most students were unclear about the roles of genes, lifestyle, and environment as they affect one's ability to memorize. Of those who did make a choice, most believed that genes play an important role in memory.

## Breast Cancer

Most students said that breast cancer was either genetically determined or determined by lifestyle and/or environment.

## Flu

The majority of students responded that the flu is determined by lifestyle and/or environment.

## Food Preferences

Many students believed that lifestyle and/or environment affected food preference. However, an equal amount of students were unsure how to categorize food preferences.

## PERSONAL CONNECTIONS TO GENETICALLY RELATED CONDITIONS

**Interviewees often became emotional when confronted with topics that touched them personally. Museum visitors and students closely identified with breast cancer and allergies. Additionally, museum visitors often spoke about heart disease, and students often discussed height.**

### *Museum Visitors*

Every interviewee cited at least one personal connection to an item on the card-sort list of topics. Museum visitors most frequently felt personally connected to exhibitions about breast cancer and allergies, followed closely by life span and heart disease. More than one-half of interviewees either had breast cancer in their families or knew someone who had breast cancer in their family. Furthermore, many interviewees mentioned feeling emotional distress when pondering the relationship between genes and serious health conditions such as cancer. Additionally, most interviewees have allergies or knew someone who has allergies, however, very few knew about the development of the condition. Interviewees felt least engaged by blood type.

### *Middle School Students*

Several students had difficulty articulating any personal connection to genes. Those who did feel a personal connection often mentioned family histories of disease, people who have allergies and asthma, or general comments about height. The most frequently mentioned genetically related disease was breast cancer, of which several female interviewees expressed fear. Most students also either have allergies and asthma or have a friend with one of the conditions. A couple of young interviewees seemed attuned to the difference between genetic and lifestyle/environmental factors, or a combination of these factors, noting that their parents taught them to take preventative steps to avoid diseases that ran in their families (see the quotation below).

My grandma and my grandpa are mentally ill. Everybody in my family is mentally ill except for my mom and me, so that's kind of scary. . . . So my mom has told me why I shouldn't do drugs or drink—because of addiction and mental illness. [Male, 14]

## RESPONSES TO CASE STUDIES

**Nearly all interviewees expressed interest in the case studies, and some commented that the presentation helped them understand genetically related health conditions. Most interviewees responded positively to the interpretive information, and did not feel that the case studies were too negative or depressing. However, nearly all interviewees commented they would want to know what happened to the main characters “in the end.” Museum visitors and students often discussed feelings of anxiety about finding themselves in a situation similar to the character in the Digestive Tract Cancer case study. In both groups, the Growth Hormone case study elicited debates about ethics.**

### *Museum Visitors*

#### Digestive Tract Cancer Case Study Reactions

Many interviewees did not know about digestive tract cancer and were surprised by the high degree of genetic predisposition of the disease. Most interviewees' initial responses focused on the diagnosis or discovery of a digestive tract cancer gene (see the first quotation below). All interviewees said that if they were in the main character's situation, they would be worried and fearful, but they understood having the gene does not ensure the growth of cancerous cells. Additionally, most interviewees commented that they would get the genetic test if in a similar circumstance. However, almost one-third of all interviewees added they would have a hard time deciding whether to get the genetic testing if there were no known preventative steps or cures for the disease (see the second quotation). Interviewees wondered about the prospects of avoiding the cancer by taking preventative steps (see the third quotation).

I think it [finding out she has the cancer gene] means a full array of emotions for her, involved with whether she can do anything about it or not, whether she is going to have her children tested as well, how to prepare for that. (Female, 41)

I think [genetic testing is] a good thing, because then you would know what to expect, but it would be a bad thing because you could get worried about what's going to happen to you, how fast it [the cancer] could come on, things like that. [Female, 12]

I think we are learning more about the foods we eat, and I think there are some of those kinds of problems that [the character in the case study] could work on: diet and lifestyle, getting frequent check-ups by doctors, catching it early and treating it early. [Male, 62]

## Growth Hormone Case Study Reactions

Adult interviewees who read the growth case study often immediately brought up ethical issues about hormone treatment (see the first quotation below). Many interviewees questioned other uses of genetic treatments, for example, discussing genetic engineering to produce a favorable offspring. However, all interviewees thought the growth hormone should be given to the child in the case study.

Almost every group wanted to know about possible side effects and long-term testing that had been done on gene therapy patients (see the second quotation). Additionally, many did note their curiosity about production of the growth hormone in bacteria.

We should avoid using it simply because someone wants to be taller. . . . Designer genes is the term I've heard before, where it goes beyond [addressing a medical condition]. The promise of the future is being able to manipulate genes in the human egg cells. [Male, 21]

What kinds of risks are associated with the drug? How long have [scientists] been testing it before they actually administer it to humans? Would there be side effects? If I take the drug, is it 100% certain that I am going to grow taller? [Female, 27]

## Overall Responses to Presenting Case Studies in an Exhibition

Most interviewees responded favorably to exhibiting applications of genetic engineering by using case studies. However, most interviewees worried about how the case studies would be presented. Many wanted truthful stories, however others wanted a more sensitive interpretation (see the quotation below). A couple of parents said they would have trouble talking to their kids about the topics featured in the sample case studies. A majority of interviewees added that they would not want to read stories in the exhibition, but would prefer a video or first person interpretation. Adults with and without children preferred an interactive approach appropriate for all ages.

I don't like to see anything that has to do with harming people. So if the story said, 'we did all this and there was no way to help her,' I wouldn't want to see that. [Female, 28]

## *Middle School Students*

### Digestive Tract Case Study Reactions

Many students first discussed the decision to get tested to determine the presence of the digestive tract cancer gene (see the first two quotations below). Primarily, interviewees talked about the psychological effects of knowing they carry the cancer gene. Students made hopeful remarks about avoiding the cancer, noting that if scientists could detect the genes and recommend preventative steps, then perhaps they would also one day discover a cure for the cancer (see the third quotation).

I would want to take the test [to find out if I have the gene]. If I didn't take the test [but was worried because it was in my family], and I didn't have it, then I'd be afraid for no reason. \*Plus, if you take the test and figure out that you have it, then you can do stuff to help get rid of it. But if you just wondered, you couldn't really do anything about it. [Male, 13; Male, 14]

If I had a risk for it, I would just go have the test and see first if I even had a chance of getting the disease. If you don't have the gene, then there was nothing to worry about, and if you do, then maybe you can do something about it. And if you wait all that time and you do have it, if you had taken the test at the beginning, then you might have been able to save yourself. [Female, 12]

Eventually, will there be a cure for everything? A while ago, we didn't have cures for anything. We've come a long way. [Male, 14]

### Growth Hormone Case Study Reactions

Students empathized with the child in the case study and expressed surprise that a genetic condition could make a person stop growing completely. All were in favor of allowing gene therapy for the child who stopped growing, and said they were opposed to the use of gene therapy just to make short children taller. Few students were familiar with the issues surrounding genetic research and technologies that are publicized in media.

### EXHIBITION TOPICS THAT INTEREST POTENTIAL VISITORS

**Both groups indicated that *how researchers identify a gene that is linked with a medical condition and uses of genetic technology to create medicines* were the most interesting topics to them. Additionally, many museum visitors remarked that the exhibition should include information about the ethical issues surrounding genetic technology. However, many students did not know the meaning of "ethics."**

#### *Museum Visitors*

#### Responses to Specific Exhibition Topics

Table 3 shows the tabulations for adult museum visitors' interest in exhibition topics. Most interviewees selected at least two or more topics from the list, and some said everything on the list could be interesting if presented in an interesting way. Interviewees most frequently selected *how researchers identify a gene that is linked with a medical condition and uses of genetic technology to create medicines* as the topics they would be interested in for the exhibition.

Interviewees had various opinions about exhibiting information about prevention. Some felt that a broad or preachy interpretation might mimic healthcare literature. Others preferred that the exhibition include preventative steps. Moreover, interviewees often did not understand that



prevention interpretation would include a display of genetic counseling or a new field of genetic research and diagnosis.

Adults in favor of presenting ethical issues believed that the museum should display a variety of perspectives to allow visitors to participate in debates and make informed decisions. Almost all interviewees who commented on ethical considerations said The Tech should take care to avoid advocating the use of genetic technologies. Rather, the museum should present information about the long-term effects of genetic technology, who controls the technology, the economics of who gets treatments, and which diseases receive attention.

**Table 3**  
**Museum Visitors’ Selections of Exhibition Topics**

Topics	<i>n</i>
How researchers identify a gene that is linked with a medical condition	17
Uses of genetic technology to create medicines	14
Experimental treatments for medical conditions	13
How powerful computers are used in genetic research	10
Robots used to speed up genetic research	9
Things people can do to prevent a disease after they find out they are at risk	9
Ethical considerations for genetic testing with individuals and families	8
Ethical considerations for deciding when new genetic treatments should be used	8
The procedures doctors use to test a person’s genes	4

*Middle School Students*

As shown in Table 4, students were most interested in *how researchers identify a gene that is linked with a medical condition, use of genetic technology to create medicines, robots used to speed up genetic research, and things people can do to prevent a disease after they find out they are at risk*. Most students said they did not understand the meaning of “ethics,” and therefore did not select that topic.

**Table 4**  
**Middle School Students' Selections of Exhibition Topics**

<b>Topics</b>	<b><i>n</i></b>
How researchers identify a gene that is linked with a medical condition	3
Uses of genetic technology to create medicines	3
Robots used to speed up genetic research	3
Things people can do to prevent a disease after they find out they are at risk	3
How powerful computers are used in genetic research	1
Ethical considerations for genetic testing with individuals and families	1
Ethical considerations for deciding when new genetic treatments should be used	1
Experimental treatments for medical conditions	1
The procedures doctors use to test a person's genes	-

Appendices removed for proprietary reasons.