Genetics: Technology with a Twist
Summative Evaluation

Prepared for The Tech Museum of Innovation

March 2005

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TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

EXECUTIVE SUMMARY

This report presents the findings of a summative evaluation of *Genetics: Technology with a Twist* conducted by Randi Korn & Associates, Inc. (RK&A), for The Tech Museum of Innovation (The Tech) in San Jose, California. *Genetics* was developed by The Tech staff in collaboration with Stanford University and was funded by the National Institutes of Health Science Education Partnership Award (SEPA) program.

Data collection took place in June and July 2004. The evaluation documents the impact and effectiveness of the exhibition using timing and tracking observations and exit interviews. It also examines the partnership between The Tech and Stanford University through interviews with graduate students, who conduct programs in the exhibition, and their supervisor.

Selected highlights of the study are included in this summary. Please consult the body of the report for a detailed account of the findings.

I. PRINCIPAL FINDINGS: TIMING AND TRACKING OBSERVATIONS

RK&A collected data in the *Genetics* over eight days in June and July 2004. Evaluators observed 121 walk-in visitors, ages nine years and older. Visitors encountered few broken exhibits in *Genetics*.

Visitor Demographics

- 65 percent of observed visitors were adults and 35 percent were children.
- 60 percent were visiting in groups of both adults and children (i.e., "family" groups).
- 51 percent were females and 49 percent were males.

Overall Visitation Patterns

- Visitors spent a median time of 7 minutes in *Genetics*.
- Visitors spent considerably more time in *Genetics* than in *Life's New Frontier*, The Tech's previous genetics exhibition, which had a median time of 5 minutes.
- Visitors stopped at a median of 5 exhibits (12 percent of available exhibits).[1]
- Visitors stopped at the same number of exhibits in *Genetics* as in *Life's New Frontier,* in which visitors also made a median of 5 stops.

Visitation to Each Exhibition Section

- Visitors stopped in a median of two sections while in *Genetics*.[2]

[1] *Genetics* included 41 exhibits at which visitors could stop. For this evaluation, a "stop" was defined as a visitor standing for three seconds or longer in front of a component.

[2] *Genetics* included five sections: Introduction Area, Genetic Medicine: Scientists' Lab, Genetic Policy: Policy Maker's Office, Genetic Counselor's Office, and the Alternative Entrance/Curiosity Counter.

- Two most-visited sections: 83 percent stopped in the Introduction and 62 percent in Genetic Medicine: Scientists' Lab.
- Least-visited section: 35 percent stopped in the Genetic Counselor's Office.
- Section with the longest dwell time: Genetic Medicine: Scientists' Lab (median time of 6 minutes).
- Section with the shortest dwell time: Genetic Policy: Policy Maker's Office and Introduction sections (median times of 49 seconds and 39 seconds, respectively).

Visitation to Individual Exhibits

- Exhibit with longest dwell time: Wet Lab: Experiment Station (median time of 10 minutes).
- Three exhibits with shortest dwell times: Genetic Technologies Suggest the Need for New Laws and Policies panel, Patients Can Turn to Experts for Guidance panel, and Genetics and Ethics panel (median times each of 7 seconds).
- Two most visited exhibits: Genetic Portraits video and Genes, like Family Recipes, Pass from Ancestors to Parents to You panel (50 percent and 41 percent, respectively).
- Two least visited exhibits: Demonstration Bench and Who Should Receive Human Growth Hormone? (Pros and Cons) panel (each 2 percent).

Behaviors[3]

- Most common behaviors: noticing artifacts (74 percent), watching videos (69 percent), and doing activities (49 percent).
- Least common behaviors: interacting with staff (38 percent), using GeneKid cards (38 percent), and misusing exhibits (37 percent).

II. PRINCIPAL FINDINGS: EXIT INTERVIEWS

RK&A evaluators conducted 50 open-ended interviews—25 in English and 25 in Spanish—with visitors as they exited *Genetics*. The majority of interviewees were adult females. Slightly more than one-half of interviewees were visiting The Tech for the first time.

Opinions about Genetics

All interviewees said they had positive experiences in *Genetics*, praising the exhibition for its educational and interesting content, hands-on activities, and authenticity. All of the Spanish-speaking interviewees appreciated the bilingual exhibition text for its educational value, while some English-speaking interviewees commended The Tech for being responsive to the needs of the San Jose community. For the majority of interviewees, the most interesting exhibits were

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[3] Data collectors noted several behaviors: misusing exhibits, interacting with staff at exhibits, reading aloud/talking about exhibit content, noticing artifacts, using GeneKid cards, watching video, doing activities, and watching other do activities.

those focusing on personal stories. They noted that the stories' voices and content resonated with them. Some interviewees also described the Wet Lab as their peak experience.

Responses to Personal Stories and Multiple Perspectives

Of the one-half of interviewees who visited Genetic Portraits, most said the exhibit content was personally relevant. While fewer interviewees used Address the Senate, they, too, appreciated expressing their opinion and thinking about different points of view.

Visitors who bypassed Genetic Portraits and Address the Senate did so for logistical reasons or because the exhibits' medium did not appeal to them. For example, many interviewees were unaware of Address the Senate, while others mentioned that both exhibits were already occupied by other visitors. Others were not interested in watching videos or in public speaking, so they did not use these exhibits.

Understanding of Exhibition Content

When asked what ideas or information they took away from the exhibition, most interviewees said the exhibition made them more aware of how genetics is interfacing with medicine. Many interviewees also grasped the idea that genetic testing can assess the likelihood of developing a particular disease, but also acknowledged that environmental factors impact risk.

Nearly all the interviewees who had visited the Wet Lab understood that they had taken genes from one animal and placed them in another. Most also readily saw a connection between the Lab and genetic medicine, noting that genetic engineering is used to make human proteins and other medicines.

Interestingly, other than identifying one area of the exhibition as a "lab," no one could explain the themes of other sections. In fact, data collectors noted that during the conversations, interviewees often discussed other Life Tech exhibits, suggesting that the organization and boundaries of *Genetics* were unclear to visitors.

III. PRINCIPAL FINDINGS: INTERVIEWS WITH STANFORD PARTNERS

RK&A interviewed The Tech Museum-Stanford University partnership's primary liaison, Dr. Starr. RK&A also conducted telephone interviews with seven Stanford graduate students who either were previously or are currently working in the exhibition.

Motivation for and Experiences while Working at The Tech

Stanford participants had both personal and professional motivations for working at The Tech, which included taking a break from the daily routine of doing research, gaining teaching skills, and exploring unconventional science career opportunities.

Dr. Starr and the students said they enjoyed the enriching work experiences The Tech afforded them. Dr. Starr liked that his students were learning how to communicate with the public, and the students found interacting with visitors rewarding. Students said the time commitment was reasonable and praised Dr. Starr for being responsive to their needs.

Perceived Benefits of the Partnership

Dr. Starr said he felt that his participation on the exhibition development team helped the Museum create an accurate and innovative exhibition. He and the students also noted that having real scientists work in the exhibition benefits the Museum, because they provide critical assistance with the ongoing operation of the Wet Lab and keep the exhibits and associated Web site current. Additionally, students said they felt they add scientific expertise to the exhibition and demystify what being a geneticist is like.

Dr. Starr and the students agreed that the partnership has also benefited Stanford University by broadening students' perspectives, providing them with valuable teaching skills, enhancing their writing ability, and serving a community outreach function.

Suggestions for Improving the Partnership

While Dr. Starr and the students made overwhelmingly positive comments about their experiences with the partnership, they also offered suggestions for improving future projects. They would have liked to have learned some techniques for working with visitors from the Museum's education staff. They also suggested that The Tech provide students with an orientation to the Museum. In terms of the development of the exhibition, Dr. Starr and two students suggested bringing scientists into the process earlier and clearly defining their roles .

DISCUSSION AND RECOMMENDATIONS

THE EXHIBITION

Genetics: Technology with a Twist is extremely successful in providing a high quality, enjoyable, thought-provoking, and educational experience for visitors. Few exhibits were broken during the evaluation and little misuse of the exhibits was observed, both suggesting that the exhibits are well conceived, designed, and fabricated. Visitors spent more time in *Genetics* than they did in The Tech's previous genetics exhibition (RK&A, 2000). Furthermore, they were highly engaged with *Genetics*—more than one-half noticed artifacts, watched videos, and did activities—suggesting that the variety of experiences works well for visitors. The exhibition appeals to both adults and children, as there were no age-related statistically significant differences in time spent, stops made, or use of particular exhibits in *Genetics.* Similarly, adults and children who were interviewed praised the exhibition equally, with some parents commending the Museum for creating an exhibition with multi-generation appeal.

Genetics is also effective in conveying its main messages: genetic technologies are changing the field of medicine; and genes, the environment, and lifestyle choices play a role in determining one's health. Two aspects of the exhibition convey those ideas: exhibits that feature personal stories (e.g., the Genetic Portraits) and the Wet Lab. Interviewees readily connected with the stories, finding them personally meaningful. The authenticity of the Wet Lab experience, the information displayed on the computers at each bench, and its staff helped visitors understand that they were doing real genetic engineering and that this technology is being used now to produce medicines.

In spite of the overwhelmingly positive response to the exhibition, a few aspects could be improved. Visitors had difficulty understanding the organization and boundaries of *Genetics*. While interviewees understood that the Introduction and Genetic Medicine: Scientists' Lab sections were part of the exhibition, they could not describe the other two sections: the Genetic Policy Maker's Office and the Genetic Counselors' Office. Additionally, of all the topics discussed in the exhibition, policy and the ethical issues were the least understood. The observations corroborate the interview findings: the Introduction and Genetic Medicine: Scientists' Lab were used by more visitors for longer periods of time than were the Genetic Policy Maker's Office or the Genetic Counselors' Office. One reason for this behavior may be the exhibition's layout and design. As visitors exited the Genetic Medicine section, they could see the rest of the Life Tech Gallery. Classic evaluation studies document a phenomenon known as the "exit gradient effect"—that is, an exit has a powerful attraction for visitors and draws visitors away from the exhibition (Melton, 1935; Miles and Tout, 1994). It may be that visitors are naturally drawn out of *Genetics* and do not visit the genetic policy and counseling sections at all or do so later in their visit and do not realize their connection with the other *Genetics* sections. Furthermore, the wooden frame structure that bounds the exhibition may exacerbate the issue. None of the interviewees were aware of the structure until it was pointed out by the data collectors. In other words, they did not perceive the open walls as boundaries. While the wooden framework provides nice visual access to the whole *Genetics* exhibition and creates an open feeling, The Tech may want to consider closing a few of the walls at key entry/exit points so the transitions to each section are more obvious to visitors.

Another element that could be more successful is the GeneKid Card. Slightly more than one-third of visitors observed used the Card and a few interviewees referenced it. The Card offers such a unique addition to the Museum experience that increasing its use should be a primary goal of The Tech. The Museum may simply need to do a better job demonstrating how to use the Tech Tag and explaining what it offers visitors—customized experiences both on-site and off-site through the Internet. For example, during the interviews, the data collectors were often asked what was the purpose of the Tech Tags and how to use them. Visitors will become more accustomed to the Tech Tag once more exhibitions incorporate it—but promoting it will benefit the institution in the meantime.

Finally, there are a few specific exhibits that could be improved. While misuse in *Genetics* was generally low, the Ashanthi video and the Gene Array Simulator mechanical interactive were misused by both adults and children. This suggests that these exhibits' instructions and design were confusing to a range of visitors. Additionally, the Who Should Receive Human Growth Hormone? voting interactive was the least used interactive exhibit. It may be that visitors did not realize it was an interactive or that from a quick glance the activity did not seem compelling. The low attraction power of Who Should Receive Human Growth Hormone? voting interactive should be remedied, as it provides an important piece of the genetic policy story.

THE PARTNERSHIP

The Tech Museum-Stanford University partnership was also beneficial to the two institutions and visitors. Including a scientist on the exhibition development team and having scientists conduct programs helped ensure the scientific integrity of *Genetics*. Additionally, the genetics graduate students are learning first-hand the value of communicating science to the general public. Certain aspects of the partnership (the main liaison for the partnership was a scientist who worked at the Museum, and the program was flexible and responsive to students' needs) should be modeled in similar partnerships.

The Stanford partners offered helpful suggestions for improving the partnership. For example, students would like to receive a Museum orientation and have opportunities to work with the Museum's education staff. They also suggested bringing scientists on board in the early stages of exhibition development and clearly outlining their roles. While the grant for this partnership is coming to a close, The Tech should take advantage of its unique location by seeking additional ways to collaborate with Stanford University.

RECOMMENDATIONS

- Consider providing additional visual clues to help distinguish *Genetics* from the rest of the Life Tech Gallery.

- Consider including discussion of genetic policy and counseling issues in the Introduction Area, for example in the Genetic Portraits video.

- Consider remediating the instructions and design of the Ashanthi video and the Gene Array Simulator mechanical interactive to reduce visitors' confusion about how to operate these exhibits.

- Develop a more compelling interactive experience at the Who Should Receive Human Growth Hormone? voting interactive to increase this exhibit's attraction power.

- Educate visitors about how to use the Tech Tags both onsite at the Museum and at home through the Internet.

REFERENCES

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INTRODUCTION

This report presents the findings of a summative evaluation of *Genetics: Technology with a Twist* (*Genetics*) conducted by Randi Korn & Associates, Inc. (RK&A), for The Tech Museum of Innovation (The Tech) in San Jose, California. *Genetics* was developed by The Tech staff in collaboration with Stanford University and was funded by the National Science Foundation.

Data collection took place in June and July 2004. The evaluation documents the exhibition's impact and effectiveness and the partnership between The Tech and Stanford University. The evaluation's specific objectives were to determine:

- How visitors used the exhibition,
- The meaning visitors constructed from their exhibition experiences,
- Visitor's affective and cognitive experiences in the exhibition,
- A Stanford University advisor's experience assisting the exhibition's development,
- Stanford University student experiences working in the exhibition, and
- The benefits and challenges of museum-university partnerships.

METHODOLOGY

RK&A used two data collection strategies to assess visitors' experiences in *Genetics*: timing and tracking observations and uncued exit interviews. Additionally, RK&A conducted telephone interviews with Stanford University students and their supervisor.

Timing and Tracking Observations

Visitor observations provide an objective and quantitative account of how visitors behave and react to exhibition components. Observational data indicate how much time visitors spend within an exhibition and suggest the range of visitor behaviors.

All visitors nine years of age and older were eligible to be unobtrusively observed in the exhibition. The evaluator selected visitors to observe using a continuous random sampling method. In accordance with this method, the observer stationed herself at the exhibition's entrance, and observed the first eligible visitor to enter. The observer followed the selected visitor through the exhibition, recording the exhibits used, select behaviors, and total time spent in the exhibition (see Appendix A for the observation form and Appendix B for the Master Exhibit List with Tech Identification Numbers). When the visitor completed his or her visit, the observer returned to the entrance to await the next eligible visitor to enter the exhibition.

In addition to recording stops made and time spent at each exhibit, the data collector also noted specific behaviors listed on the observation form. One behavior was misusing an exhibit—using an exhibit in ways not intended by the developers. Appendix C describes the intended use and misuse of exhibits.

Exit Interviews

Open-ended interviews encourage and motivate interviewees to describe their experiences, express their opinions and feelings, and share with the interviewer the meaning they constructed from an experience. Open-ended interviews produce data rich in information because interviewees talk about their personal experiences.

Upon exiting the exhibition, visitors nine years old and older were eligible to be selected (following a continuous random sampling method, as described above) to answer several questions about their experiences (see Appendix D for the exit interview guide). The interview guide was intentionally open-ended to allow interviewees the freedom to discuss what they felt was meaningful. All interviews were tape-recorded with participants' permission and transcribed to facilitate analysis.

Partnership Telephone Interviews

RK&A also conducted open-ended telephone interviews with Stanford University students and their supervisor, Barry Starr (see Appendix E for the partnership interview guide). Dr. Starr provided RK&A with contact information for graduate students who had previously worked or currently work in *Genetics*. Again, all interviews were tape-recorded with participants' permission and transcribed to facilitate analysis.

DATA ANALYSIS

Quantitative Analysis

The quantitative observational data were entered into a computer and analyzed statistically using SPSS/PC+, a statistical package for personal computers. Frequency distributions were calculated for all categorical variables (e.g., gender, age group). To examine the relationship between two categorical variables (e.g., use of an exhibit and age group), cross-tabulation tables were computed to show the joint frequency distribution of the two variables, and the chi-square statistic (X^2) was used to test the significance of the relationship.

Summary statistics, including the mean (average), median (data point at which half the responses fall above and half fall below), and standard deviation (spread of scores: "±" in tables), were calculated for the time data.[4] To compare the means of two or more groups, an analysis of variance (ANOVA) was performed. The level of significance was set at 0.05 because of the moderate sample size. When the level of significance is set to $p = 0.05$, any relationship that exists at a probability (p-value) of ≤ 0.05 is termed "significant." When a relationship has a p-

[4] For the most part, medians rather than means are reported in this document because, as is typical, the number of components used and the time spent by visitors were distributed unevenly across the range. For example, whereas most visitors spent a relatively brief time with exhibition components, a few spent an unusually long time. When the distribution of scores is extremely asymmetrical (i.e., "lopsided"), the mean is strongly affected by the extreme scores and, consequently, falls further away from the distribution's central area. In such cases, the median is the preferred measurement because it is not sensitive to the values of scores above and below it—only to the number of such scores.

value of 0.05, there is a 95 percent probability that the relationship being explored truly exists; that is, in 95 out of 100 cases, there really would be a relationship between the two variables (e.g., gender and preferences for visiting). Conversely, there is a 5 percent probability that the relationship does not really exist; in other words, in 5 out of 100 cases, a relationship would appear purely by chance. Within the body of the report, only statistically significant results are discussed.

Qualitative Analysis

The interview data are qualitative, meaning that results are descriptive, following from the conversational nature of the interviews. In analyzing the data, the evaluator studied responses for meaningful patterns, and as patterns and trends emerged, grouped together similar responses. To illustrate interviewees' thoughts and ideas as fully as possible, this report includes verbatim quotations (edited for clarity).

REPORTING METHOD

The data in this report are both quantitative and qualitative. For the quantitative data, tables and graphs display the information. Percentages within tables may not always equal 100 owing to rounding. The findings within each topic are presented in descending order, starting with the most frequently occurring.

The interview data are presented in narrative. The interviewer's remarks appear in parentheses, and, for visitors, an asterisk (*) signifies the start of a different speaker's comments. Trends and themes in the interview data are also presented from most- to least-frequently occurring.

Findings in each report are presented in three main sections:

I. Timing and Tracking Observations
II. Exit Interviews
III. Partnership Interviews

I. PRINCIPAL FINDINGS: TIMING AND TRACKING OBSERVATIONS

RK&A collected data in the *Genetics: Technology with a Twist* exhibition at The Tech over eight days in June and July 2004. The evaluators observed 121 walk-in visitors, ages nine years and older.

DATA COLLECTION CONDITIONS

Evaluators conducted the majority of observations on weekend afternoons during low visitation conditions with few broken exhibits (see Table 1).

Table 1
Data Collection Conditions
(*n* = 121)

Condition	%
Day	
Weekend day	59.5
Weekday	40.5
Time of Day	
AM	28.9
PM	71.1
Crowding Level	
Few	62.0
Moderate	25.6
Crowded	12.4
Broken Exhibits	
No broken exhibits encountered	77.7
One broken exhibit encountered	21.5
Two broken exhibits encountered	0.8

VISITOR DEMOGRAPHICS

As shown in Table 2, the total sample of visitors observed included slightly more females than males (51 percent and 49 percent, respectively). About two-thirds of visitors (65 percent) were adults (19 years of age and older) and one-third were children (35 percent).

Table 2
Visitor Demographics
(*n* = 121)

Characteristic	%
Gender	
Female	51.2
Male	48.8
Age Group (in years)	
9 to 10	10.7
11 to 12	8.3
13 to 15	9.1
16 to 18	6.6
19 to 24	7.4
25 to 34	14.0
35 to 44	27.3
45 to 54	9.1
55 to 64	4.1
65 and older	3.3

As presented in Table 3, the majority of visitors in the sample were in groups of both adults and children (60 percent).

Table 3
Group Composition
(*n* = 121)

Group Composition	%
Adults and children	59.5
Adults only	19.8
Alone	15.7
Children only	5.0

OVERALL VISITATION PATTERNS

Total Time Spent in the Exhibition

Genetics included one area—the Wet Lab—that was designed to be used by visitors for an extended period of time. To understand how much time visitors spent in the exhibition, the evaluator calculated the total times both including and excluding the Wet Lab. When the Wet Lab is included in the data, visitors spent a median time of about 7 minutes in *Genetics* (see Table 4). For this data set, the shortest time a visitor spent in the exhibition was 24 seconds and the longest time was 44 minutes (see Graph 1 in Appendix F for the frequency distribution).

When the Wet Lab is excluded from the data, visitors spent a median time of about 5 minutes in *Genetics* (also see Table 4). For this data set, the shortest time a visitor spent in the exhibition was 23 seconds and the longest time was 40 minutes (see Graph 2 in Appendix F for the frequency distribution).

Visitors spent more time in *Genetics* than in *Life's New Frontier*, the previous genetics exhibition at The Tech, which had a median time of 4 minutes, 58 seconds.

Table 4
Time Spent in *Genetics*
(*n* = 121)

Total Time (Including Wet Lab)				
Median	**Minimum**	**Maximum**	**Mean**	**±**
7 minutes, 11 seconds	24 seconds	44 minutes, 21 seconds	10 minutes, 42 seconds	10 minutes, 16 seconds
Total Time (Not Including Wet Lab)				
Median	**Minimum**	**Maximum**	**Mean**	**±**
5 minutes, 21 seconds	23 seconds	40 minutes, 19 seconds	7 minutes, 39 seconds	7 minutes, 13 seconds

Total Number of Exhibits Stopped At

Genetics included 41 exhibits at which visitors could stop. **For this evaluation, a "stop" was defined as a visitor standing for three seconds or longer in front of a component. If a visitor returned to a component at which s/he had previously stopped, this return was not counted as an additional stop, but the amount of time spent was included in the total time spent at the component.**

Visitors stopped at between 1 and 23 exhibits in *Genetics* (see Table 5). Visitors stopped at a median of 5 exhibits (12 percent of available exhibits) in *Genetics*—the same number as they stopped at in *Life's New Frontier*.

Table 5
Total Number of Exhibits Stopped at in *Genetics*
(*n* = 121)

Median	Minimum	Maximum	Mean	±
5.0	1.0	23.0	6.2	4.7

VISITATION TO EACH EXHIBITION SECTION

Genetics included five sections: Introduction Area, Genetic Medicine: Scientists' Lab, Genetic Policy: Policy Maker's Office, Genetic Counselor's Office, and the Alternative Entrance/Curiosity Counter. To understand the relative use of each section, the evaluator calculated the total time spent and total number of stops in each section.

Total Number of Sections Visited

Visitors stopped in a median of two sections while in *Genetics* (see Table 6). One-half of visitors stopped at three or more exhibition sections (50 percent; not shown in table).

Table 6
Total Number of Sections Visited in *Genetics*
(*n* = 121)

Median	Minimum	Maximum	Mean	±
2.0	1.0	5.0	2.5	1.0

Time Spent and Stops Made in Each Section

More than one-half of visitors stopped in the Introduction and Genetic Medicine: Scientists' Lab sections (83 percent and 62 percent, respectively) (see Table 7). The fewest number of visitors stopped in the Genetic Counselor's Office and the Alternative Entrance/Curiosity Counter sections (35 percent and 32 percent, respectively). The relative visitation of each section provides a glimpse of the path that visitors took through the exhibition. In general, visitors stopped in the Introduction, followed by Genetic Medicine, then Genetic Policy.[5] Fewer visitors turned right and visited the Genetic Counselor's Office, suggesting that many visitors continued straight, leaving *Genetics* and entering the Imaging or Beyond Our Limits sections of Life Tech Gallery.

Visitors spent the most time in the Genetic Medicine: Scientists' Lab (median time of about 6 minutes), followed by the Alternative Entrance/Curiosity Counter (median time of about 2 minutes). Visitors spent the least time in the Genetic Counselor's Office and Introduction sections (median times of 49 seconds and 39 seconds, respectively).

Visitors stopped at the most exhibits in the Genetic Policy: Policy Maker's Office section (median of 3 exhibits), followed by the Genetic Medicine: Scientists' Lab (median of 2 exhibits). Visitors stopped at one exhibit in each of the following sections: Introduction, Genetic Counselor's Office, and Alternative Entrance/Curiosity Counter.

Table 7
Time Spent and Stops Made in Each Section
(*n* = 121)

Section	% of Visitors Stopping	Median Time (Seconds)	Median Number of Stops
Introduction	82.6	39.0	1.0
Genetic Medicine: Scientists' Lab	62.0	380.0	2.0
Genetic Policy: Policy Maker's Office	41.3	121.5	3.0
Genetic Counselor's Office	34.7	49.0	1.0
Alternative Entrance/Curiosity Counter	32.2	137.0	1.0

[5] RK&A designated the Introduction Area as the exhibition entrance, because it was more heavily used than the alternative entrance near the Curiosity Counter. Data collectors began all observations from this entrance.

When visitation to the sections was examined by demographic characteristics and data collection conditions, four statistically significant relationships emerged (see Tables 8 -10). Adults stopped at more exhibits in the Introduction than did children. Weekday visitors spent more time in the Genetic Medicine: Scientists' Lab than did weekend visitors. Children and weekday visitors spent more time in the Genetic Policy: Policy Maker's Office than did adults and weekend visitors.

Table 8
Differences in Stops Made in the Introduction by Age
(*n* = 100)

Age Group*	Mean Stops	±
Adult	1.6	1.2
Child	1.1	1.0

*$F = 4.611$; $df = 1, 99$; $p = 0.03$

Table 9
Differences in Time Spent in Genetic Medicine by Day
(*n* = 75)

Day*	Mean Time (Seconds)	±
Weekday	627.7	538.8
Weekend day	378.2	362.3

*$F = 5.392$; $df = 1, 74$; $p = 0.02$

Table 10
Differences in Time Spent in Genetic Policy by Age and Day
(*n* = 50)

Age Group[1]	Mean Time (Seconds)	±
Child	274.3	265.2
Adult	145.6	118.1
Day[2]	**Mean Time (Seconds)**	**±**
Weekday	277.9	196.6
Weekend day	108.0	112.1

[1]$F = 5.622$; $df = 1, 49$; $p = 0.02$ [2]$F = 14.974$; $df = 1, 49$; $p = 0.00$

VISITATION OF INDIVIDUAL EXHIBITS

Time Spent at Each Exhibit

Tables 11 and 12 (below and next page) show the median time visitors spent at each exhibit. Table 11 shows the 20 exhibits at which visitors spent the longest time (i.e., exhibits that had the longest dwell times). Visitors spent the longest time in the Wet Lab: Experiment Station (median time of 10 minutes). The Demonstration Bench held visitors' attention for nearly 8 minutes; however, only two visitors stopped at this exhibit.

Table 11
Median Time Spent at Each Exhibit: Highest Dwell Times

Exhibit	*n*	Median Time (Seconds)
Wet Lab: Experiment Station	38	624.5
Demonstration Bench	2	458.5
Curiosity Counter	38	137.0
Gene Sequencer computer interactive/artifact	25	132.0
Gene Array Scanner computer interactive/artifact	16	76.5
Pigs-to-People Activist photo interactive	34	72.0
Ashanthi video	18	71.0
Genetic Portraits video	61	58.0
Address the Senate: video recording interactive	33	58.0
Calling all GeneKids computer kiosks	32	48.0
Explore Genetic Tests computer interactive	18	43.5
Meet a Genetic Counselor video (4)	30	37.5
Who Should Receive Human Growth Hormone? (Pros and Cons) panel	2	36.0
Treatments Offer Hope for Curing Genetic Disease panel	4	32.0
Who Should Receive Human Growth Hormone? voting interactive	14	32.0
Address the Senate: playback station	19	31.0
Technology Tailors Drugs and Doses to Suit Your Genetic Profile panel	4	28.0
Bacteria Plus Human Genes Equals Better Medicine panel/artifact	24	27.0
Newborn Screening: Each State Screens for Genetic Disorders panel	24	27.0
Calling all GeneKids: View Your GeneKid Cards Here panel	5	26.0

As shown in Table 12, the exhibits at which visitors spent the least time were Genetic Technologies Suggest the Need for New Laws and Policies panel, Patients Can Turn to Experts for Guidance panel, and Genetics and Ethics panel (median times each of 7 seconds).

Table 12
Median Time Spent at Each Exhibit: Lowest Dwell Times

Exhibit	*n*	Median Time (Seconds)
Zoom in on a Gene: You'll Find Genes in Almost Every Cell panel/looping video	15	25.0
Baker/Scientist video	25	23.0
How Should New Genetic Technology be Used? Panel	4	22.0
How Does a Gene Array Work? Panel	4	21.5
Gene Array Simulator mechanical interactive	19	21.0
Profiling Breast-Cancer Genes Help Guide Treatment panel	3	20.0
Ashanthi's Story: Severe Combined Immune Deficiency case study panel	3	19.0
Technology Helps Scientists Look for Gene Mutations panel	7	18.0
Randy's Story: Hemochromatosis case study panel	13	18.0
Pigs-to-People Transplants: Life Saving Treatment or Serious Threat? panel	12	17.0
It Takes More than Genes to Make You panel	7	14.0
High-tech Biology Can Help Improve Human Health panel*/looping video	19	13.0
Wet Lab: Be a Geneticist: Grow Jellyfish Protein in Bacteria panel	3	12.0
Like Recipes, Genes Contain Instructions panel	16	11.0
Genetic Testing and You talk-back board	11	11.0
Emily's Story: Phenylketonuria case study panel	5	9.0
Genes, like Family Recipes, Pass from Ancestors to Parents to You panel	50	8.5
Genes Help Diagnose Disease and Predict Future Health Risks panel	3	8.0
Genetic Technologies Suggest the Need for New Laws and Policies panel	3	7.0
Patients Can Turn to Experts for Guidance panel	4	7.0
Genetics and Ethics panel*	4	6.5

*These exhibits were repeated twice in the exhibition. The data for each set of panels was combined.

Stops Made at Each Exhibit

Tables 13 and 14 (below and next page) show the percentage of visitors that stopped at each exhibit. Overall, interactive exhibits were visited by a range of ages; whereas, panels were almost exclusively visited by adults (see Appendix G for the stops made at each exhibit by age group).[6]

Table 13 shows the 20 exhibits at which the most visitors stopped (i.e., exhibits that had the strongest attraction power). The most visitors stopped at Genetic Portraits video and Genes, like Family Recipes, Pass from Ancestors to Parents to You panel (50 percent and 41 percent, respectively).

Table 13
Percentage of Visitors Stopping At Each Exhibit: Most Visited Exhibits

Exhibit	% Stopping
Genetic Portraits video	50.4
Genes, like Family Recipes, Pass from Ancestors to Parents to You panel	41.3
Wet Lab: Experiment Station	31.4
Curiosity Counter	31.4
Pigs-to-People Activist photo interactive	28.1
Address the Senate: video recording interactive	27.3
Calling all GeneKids computer kiosks	26.4
Meet a Genetic Counselor video (4)	24.8
Baker/Scientist video	20.7
Gene Sequencer computer interactive/artifact	20.7
Bacteria Plus Human Genes Equals Better Medicine panel/artifact	19.8
Newborn Screening: Each State Screens for Genetic Disorders panel	19.8
High-tech Biology Can Help Improve Human Health panel/looping video	15.7
Gene Array Simulator mechanical interactive	15.7
Address the Senate: playback station	15.7
Ashanthi video	14.9
Explore Genetic Tests computer interactive	14.9
Like Recipes, Genes Contain Instructions panel	13.2
Gene Array Scanner computer interactive/artifact	13.2
Zoom in on a Gene: You'll Find Genes in Almost Every Cell panel/looping video	12.4

[6] Because of the moderate sample size, the evaluator was not able to determine whether the differences among age groups and visitation to specific exhibits were statistically significant. As such, the data presented in Appendix G are intended to be descriptive and do not show statistically significant differences.

As shown in Table 14, the fewest visitors stopped at the Demonstration Bench and Who Should Receive Human Growth Hormone? (Pros and Cons) panel (each 2 percent).

Table 14
Percentage of Visitors Stopping At Each Exhibit: Least Visited Exhibits

Exhibit	% Stopping
Who Should Receive Human Growth Hormone? voting interactive	11.6
Randy's Story: Hemochromatosis case study panel	10.7
Pigs-to-People Transplants: Life Saving Treatment or Serious Threat? panel	9.9
Genetic Testing and You talk-back board	9.1
Ashanthi's Story: Severe Combined Immune Deficiency case study panel	6.6
It Takes More than Genes to Make You panel	5.8
Technology Helps Scientists Look for Gene Mutations panel	5.8
Calling all GeneKids: View Your GeneKid Cards Here panel	4.1
Emily's Story: Phenylketonuria case study panel	4.1
Genetics and Ethics panel	3.3
Treatments Offer Hope for Curing Genetic Disease panel	3.3
Technology Tailors Drugs and Doses to Suit Your Genetic Profile panel	3.3
How Does a Gene Array Work? panel	3.3
How Should New Genetic Technology be Used? panel	3.3
Patients Can Turn to Experts for Guidance panel	3.3
Wet Lab: Be a Geneticist: Grow Jellyfish Protein in Bacteria panel	2.5
Profiling Breast-Cancer Genes Help Guide Treatment panel	2.5
Genetic Technologies Suggest the Need for New Laws and Policies panel	2.5
Genes Help Diagnose Disease and Predict Future Health Risks panel	2.5
Demonstration bench	1.7
Who Should Receive Human Growth Hormone? (Pros and Cons) panel	1.7

BEHAVIORS

In addition to noting the time spent and stops made, data collectors noted several behaviors: misusing exhibits,[7] interacting with staff at exhibits, reading aloud/talking about exhibit content, noticing artifacts, using GeneKid cards, watching videos, doing activities, and watching others do activities.

Summary of Behaviors

As shown in Table 15, visitors most often noticed artifacts and watched videos (74 percent and 69 percent, respectively). The least common behavior was misusing exhibits (37 percent).

Behaviors at each exhibit are presented in tables in Appendix G.

Table 15
Summary of Behaviors
(*n* = 121)

Behavior	%
Noticed artifacts	73.6
Watched videos	68.6
Did activity	47.9
Read aloud or talked about exhibit content	43.0
Watched others do activity	39.7
Interacted with staff	38.0
Used GeneKid cards	38.0
Misused exhibit	37.2

[7] Misuse—when visitors used interactive exhibits in ways the developers did not intend—was defined for each applicable exhibit (see Appendix C for definitions of exhibit misuse).

When the evaluator compared behaviors among demographic characteristics and data collection conditions, she found four statistically significant differences (see Table 16). Weekday visitors were more likely to do activities, read aloud or talk about exhibit content, and use GeneKid Cards than were weekend visitors. Additionally, children were more likely to misuse exhibits than were adults (see Table 19 in Appendix G for detailed analysis of misuse by age).

Table 16
Differences in Behaviors

Did activity[1]	**Weekday %**	**Weekend %**
Did one or more activities	63.3	37.5
Read/Talked about Content[2]	**Weekday %**	**Weekend %**
Read aloud or talked about exhibit content at one or more exhibits	59.2	31.9
Used GeneKid Card[3]	**Weekday %**	**Weekend %**
Used one or more GeneKid Cards	53.1	27.8
Misuse of Exhibits[4]	**Children %**	**Adults %**
Misused one or more exhibits	61.8	27.6

[1] x^2=7.756; df=1; p=0.005 [2] x^2=8.828; df=1; p=0.003 [3] x^2=7/910; df=1; p=0.005 [4] x^2=12.225; df=1; p=0.000

II. PRINCIPAL FINDINGS: EXIT INTERVIEWS

RK&A evaluators conducted open-ended interviews with visitors immediately after their visit to *Genetics* to gather information about their perceptions, opinions, and understanding of the exhibition. Evaluators conducted 50 interviews—25 in English and 25 in Spanish—with 56 visitors. Of 96 visitors approached, 40 refused to participate, making the refusal rate 42 percent, similar to other studies conducted by RK&A at The Tech.

The sample was comprised of 45 adults and 11 children. Two-thirds of interviewees were female and one-third were male. Adults ranged in age from 18 to 64 years, with an average age of 36 years. Children ranged in age from 7 to 16 years, with an average age of 12 years. Slightly more than one-half of interviewees were visiting The Tech for the first time, while less than one-half were repeat visitors.

OPINIONS ABOUT *GENETICS: TECHNOLOGY WITH A TWIST*

Overall Reaction to the Exhibition

All of the interviewees said they had positive experiences in *Genetics*. Many praised *Genetics* for its educational and interesting content (see the first quotation below). Some were pleased to find so many hands-on activities in the exhibition, noting that the exhibition appealed to both children and adults (see the second quotation). A few were impressed by the authenticity of the exhibition experiences (see the third quotation).

> My overall opinion was that it was very interesting—something that you don't see every day. . . . I've always liked science, but now [that] I've been out of school, it [the exhibition] makes me want to go back to school to be more familiar with all of this new stuff that's happening with genetics and medicine. [Male, 25 years]

> It's very good and very specific. It touches on many specific points that are necessary for the children and adults [to know]. It's fun, so that they understand. When children are bored they don't want to learn, so this is fantastic. (Was there anything is particular that worked well for you as an adult?) The information is really current and relevant. It's interesting, too, since you hear about genetic testing . . . on the news. (And what did your children like?) They like anything manual—things they can touch and activities they can do—so this [exhibition] was great for them. . . . As a parent you want your children to be happy but you also want to learn something yourself so this [exhibition] did both. [Female, 30 years; translated from Spanish]

> That [exhibition] is really cool. (What did you like about it?) It's not like . . . genetics in school where they just explain it to you—you're actually doing it. It's not all fake. It's more than just displays, it's the real thing. (How so?) In the [Wet] Lab, I got to work with bacteria and stuff from jellyfish. So I was doing the real science. [Female, 12 years]

Peak Exhibit Experiences

When asked what they found most interesting in *Genetics,* two-thirds of interviewees named exhibits related to personal stories. Some expressed surprise at the extent to which genetic disorders impact families (see the first quotation below). Several others found the information in the case studies personally relevant (see the second quotation). A few noted that the human-interest stories made them aware of the field of genetic medicine (see the third quotation).

> The one about genetic testing—whether or not to have it—was really interesting. The story about the woman with the Alzheimer's genes was pretty heart-wrenching. As a parent, I'm not sure if I want to know about a disease that I might have given to my children. [Female, 45 years]

> I really found that first one [Genetic Portraits] interesting. (Why is that?) It's easier for people to accept and understand, because this conversation [is] carried by normal people—it's happening everyday in their lives. It catches people's attention, because they're one of us. It's not a scientist trying to teach us something or make me read something—it's real people. . . . I know a lot of people [who] have problems with drinking milk. . . . I also was really interested in the growth hormones because my daughter is really short for her age. You really have to weigh the benefits and the drawbacks. So that was really interesting to see information about that. [Female, 49 years]

> I really liked that story of the little girl [Ashanti's Story] who was able to get the first genetic treatment. (What about that story interested you?) Because it was about a little girl who was sick and was kind of cured from that treatment. I never knew that they [scientists] were already doing things like this with genetics. I liked it a lot—to hear about how these genetic treatments are helping people. [Male, 35 years; translated from Spanish]

Nearly one-third of interviewees said the Wet Lab was their favorite experience. They enjoyed using the real tools and interacting with Lab staff and praised the well-written instructions (see the first quotation below). Some of the teens and adults were also amazed at doing genetic engineering (see second quotation).

> I liked the jellyfish genes experiment the most. (What was interesting about that?) I liked doing the testing, pouring things, and following the directions—actually doing the experiment myself. I thought that was pretty fun. *And the person back there helping us was really great. He told us some additional information and it was nice to have someone back there to help me. The Lab felt safe and organized. . . . I was very impressed with the directions, because he was able to follow them. . . . To the program writer it really is easy to follow. I think that's great that kids can do it on their own. [Female, 11 years; Male, 43 years]

> I liked the laboratory section best, since we could really feel like real scientists. (How so?) I think we were doing the same thing that that scientists do to get the bacteria to make human medicines. [Female, 25 years; translated from Spanish]

A few interviewees had idiosyncratic preferences. One child liked collecting the GeneKid cards. One adult employed in the biotechnology field was particularly impressed with the real equipment and Wet Lab setup. A third said the DNA cookbook helix was "clever," noting that it helped her understand DNA's structure.

Responses to Spanish Text

All Spanish-speaking interviewees appreciated that the Museum's had information in English and Spanish. Many of these interviewees spoke English, but noted that others in their group did not, so the Spanish text made the exhibition more accessible to their group as a whole. Additionally, they said the information was often easier to understand in Spanish than in English.

Some non-Spanish speaking interviewees also praised the idea of having bilingual text, because they felt the Museum was being responsive to the San Jose community. In contrast, one English-speaking interviewee complained that the Spanish text was "distracting."

Suggestions for Changes

When asked whether any exhibits were confusing to understand or difficult to use, few interviewees offered comments. Two noted that Genetic Portraits was frustrating to use because other visitors kept pushing buttons, making it impossible to hear any of the stories in their entirety. One visitor who had limited time to see the entire Museum complained that the videos were too long and that the exhibition, as a whole, had too many in-depth experiences. Another interviewee said there should be a Web site or informational brochures for visitors who want to know more information about health topics discussed in the exhibition.

RESPONSES TO PERSONAL STORIES AND MULTIPLE PERSPECTIVES

Reactions to Genetic Portraits

About one-half of interviewees visited the Genetic Portraits. Most of these interviewees said they found the exhibit content personally relevant (see the two quotations below). Even those who did not make a personal connection said they appreciated that the exhibit had "real people talking about real diseases." A few were intrigued by the presentation method—how the characters on the video screens "seemed to talk to each other."

> It [Genetic Portraits] was very engaging, because it was [about] real people. The one I watched was talking about Fragile X Syndrome and she said she had to go years before the doctors diagnosed it. . . . That's too bad for that child. . . . I have a granddaughter who is autistic, which is a little bit related to Fragile X Syndrome. Once you do know

> what's causing it, you can do better at intelligently designing a program that will help them learn, because you know what their deficiencies are. [Female, 64 years]

> I saw one of the stories—the one about lactose intolerance. It [might] be genetically linked and it [might] not. One of my friends is lactose intolerant—more Hispanics than you think are lactose intolerant. I'll have to suggest to him that stuff you can take to eat ice cream. [Female, 20 years; translated from Spanish]

The other one-half of interviewees did not visit the Genetic Portraits. Some said other visitors were using the exhibit and so they bypassed it. Others said they were not interested in watching videos, but preferred to do hands-on activities. Six interviewees could not use the exhibit because it was broken.

Reactions to Address the Senate

Three-quarters of interviewees did not visit Address the Senate. Most said they were unaware of the exhibit because they had not visited that section of the exhibition. Several adult interviewees said they thought Address the Senate was intended for children. A few said they do not enjoy public speaking so they had no interest in using the exhibit, while a few others said the exhibit was already occupied by other visitors.

The one-quarter of interviewees who visited Address the Senate said they enjoyed using it. Most said they felt strongly about the opinion they selected, but they also appreciated having the opportunity to think about different points of view (see the quotation below). A few could not recall which opinion they selected.

> I chose the option in which people have the right to decide whether they want a [pig] heart transplant. People should be able to choose. . . . There was also a petition for the Senate's approval of this legislation. . . . It was interesting, and it shows the different opinions there are about this issue. . . . Trying to convince other people is really hard since everybody has a different point of view. The policies of genetics can help people to cope with genetic diseases but some may be only creating some new scientific concerns. [Female, 27 years; translated from Spanish]

UNDERSTANDING EXHIBITION CONTENT

Ideas and Information Gleaned from the Exhibition

When asked what ideas or information they took away from the exhibition, most interviewees said the exhibition made them more aware of how genetics is interfacing with medicine (see the first two quotations below). Several interviewees said they learned about genes (see the third quotation). A few said they did not take away any ideas from the exhibition.

> It [the exhibition] made me realize that a lot of the medicines people take every day were made through genetic research—that's how they [scientists] invented all this stuff. . . . Scientists are doing a lot of research that's going to help medicine. [Female, 49 years]
>
> Genetics is going to become revolutionary in the near future, and genetic[ists] are already doing research that can help sick people. [Female, 24 years; translated from Spanish]
>
> For me, everything that I've seen here is very interesting, because I didn't [know] the human body was like this. We were surprised, [the exhibition] left us thinking, 'Wow, this is how our bodies are—our genes—we never really thought that this is how we look inside. . . . All this stuff was new to me—that each parent gives one-half of their genes to the children. We didn't know that in reality it was like that. [Female, 36 years; translated from Spanish]

In another question designed to gauge visitor understanding, the evaluator asked interviewees to describe the exhibition's three sections. Many identified one area of the exhibition as "a lab;" however, none could explain the themes of other sections. In fact, data collectors noted that during the conversations, interviewees often discussed other *Life Tech* exhibits, suggesting that the boundaries of *Genetics* were unclear to visitors.

Understanding the Wet Lab

Interviewees who had visited the Wet Lab were asked to describe their experiment. Nearly all grasped that they had taken genes from one animal and placed them in another (see the first quotation below). Several added that the bacteria would glow because of the jellyfish genes but were unsure how this happens (see the second quotation). A few completed the message—they understood that by placing the jellyfish genes into bacteria enabled the bacteria to make jellyfish proteins (see the third quotation). In contrast, a few other interviewees who used the Web Lab enjoyed using it but could not explain their experiment.

> (Can you talk about what you did in the Lab?) You're taking all the different genes and putting them into a different living thing. (Why might you want to do that?) It has something to do with medicine and research. [Female, 12 years]
>
> My daughter she . . . put the jellyfish stuff in germs. We did this activity before and the last time we checked on the Internet the next day—it was really, really interesting to see the germs glow. (Why do you think the germs glow?) I don't know, but it was cool to see them glow. [Female, 40 years]
>
> I fed jellyfish gene into the bacteria and then the bacteria made these green dots. The bacteria make stuff the jellyfish used to make. It's like how they can get bacteria to make insulin. [Female, 49 years]

When Wet Lab participants were specifically asked how what they did in the Lab was connected to genetic medicine, most understood that genetic engineering is used to make human proteins

and other medicines (see the quotation below). Others simply said "medical [researchers] do "similar experiments in their labs."

> (In what ways, if any, is what you did in the Lab related to genetic medicine?) Because this is how they make medicines that can treat diseases. . . . Like with the story about the boy who needs growth hormone. They use procedures like this to make the growth hormone. [Male, 35 years; translated from Spanish]

Genetic Testing Scenario

The evaluator presented interviewees with the following scenario and question: "If someone in your family was diagnosed with Alzheimer's disease, breast cancer, or another disease known to be related to one's genes, what are some things you might do to determine your own risk?" Many interviewees said they would want to have a genetic test—either to simply know if they also had the genes associated with a particular disease or to inform them about treatment options (see the two quotations below). Several others were unsure how to proceed in determining their risk. A few said they were unsure whether they would want to have genetic tests because currently there is little doctors can do with the information (see the third quotation).

> (What are some steps you might take to assess your own risk?) You can be tested for that? (Yes.) I'd like to see how they look at different genes and see what causes disease in certain people, and why some people get cancer or why people get certain things and other people don't. (Would you be tested?) Yes. (Why is that?) I think I'd like to know. (Even if they couldn't do anything about it?) That's right. I'd like to know. [Female, 41 years]

> [I would] research the disease and then go to the doctor and have him check to see if I had those same genes. (You would want to know?) Yes. (Why is that?) Because if you don't check, it could affect your life. Because it could kill you, or Alzheimer's—it can make your life very hard. *Exactly. So it's better to find out sooner than later. (Even if doctors can't do anything about Alzheimer's right now?) Well, there might be some experimental drugs you could try or at least you'd be aware of warning signs and try to get help early on. [Female, 14 years; Male, 15 years]

> (What are some steps you might take to assess your own risk?) You mean as to whether or not to have the genetic test done? (Sure, that could be something you could do.) I don't know. I'm fortunate enough that, so far in my family, we don't have that type of a genetic history that would make the genetic testing a potential issue to have to deal with. I think it would be a really hard decision. Again, as a parent, one of the things that it [the exhibition] brought up was . . . your children—would you want to know whether or not you are pre-Alzheimer's and thinking about that, would you treat your children differently if you did know that—that you might be passing it on to them? [Female, 42 years]

Interviewees were asked what factors, in addition to genes, might contribute to someone developing Alzheimer's disease or breast cancer. Nearly all interviewees mentioned

environmental factors—from diet to exercise to pollutants (see the quotations below). Three interviewees said they thought genes were the sole determinant of these diseases.

> (Besides genes, what are some other factors that might contribute to someone developing these diseases?) Oh, lots of things—diet, exercise, stress. The genes are just part of why you might get a disease. [Female, 41 years]

> (Besides genes, what are some other factors that might contribute to someone developing these diseases?) Nutrition, exercise, how one takes care of their health. *The environment. We're so contaminated that all of us get illnesses. [Female, 49 years; Male, 49 years; translated from Spanish]

III. PRINCIPAL FINDINGS: INTERVIEWS WITH STANFORD PARTNERS

As part of the NIH SEPA grant, The Tech Museum formed a partnership with the Genetics Department of Stanford University. To documents the effectiveness of this partnership, RK&A conducted interviews with the partnership's primary liaison and seven Stanford graduate students who were either previously involved with *Genetics* or who are currently working in the exhibition.

The partnership's primary liaison, Dr. Barry Starr, is employed by Stanford University but works on-site at the Museum. He provided scientific expertise to the team during the development of *Genetics* and continues to be a science resource for the ongoing operation of the Wet Lab. He also trains and manages the Stanford students who work at the Museum as part of the partnership. During their internship, students spend one morning a week for two academic quarters giving presentations at the Museum, maintaining cultures and solutions for the Wet Lab, and answering visitors' questions in the "Ask a Geneticist" section of the *Genetics* Web site. Early in the partnership, students also prototyped exhibits. On their own time, students complete a final project related to their work at The Tech. For example, students might develop a new demonstration or write articles for the "Current News in Genetics" section of the Web site. For their participation, students receive teaching assistant credit and are paid a stipend.

MOTIVATION FOR WORKING AT THE TECH

Overall, Stanford participants offered both personal and professional motivations for working at The Tech. All of the students said working at the Museum appealed to them because they thought it would be a pleasant break from their daily research routine. In terms of professional interests, most students wanted to diversify their skills by gaining teaching and other non-laboratory-related work experience (see the first quotation below). Conversely, Dr. Starr and a few students were looking for unconventional science career opportunities—other than the typical genetics professions in industry or academia—and said they felt the Museum would allow them to explore other options (see the second quotation).

> I didn't have any teaching experience—I didn't have an opportunity to TA [to be a teaching assistant]. So I wanted . . . take advantage of the opportunity. I just wanted to broaden my horizons I guess, and get some experience—not direct teaching experience but it's certainly out of the lab experience anyway. (So would you say your motivation was more personal or professional?) Both. I don't know that it will directly help [me], but it's always good to have new experiences. I think I learned more during [my time at The Tech] than the people I'm supposed to be teaching. . . . Conveying science to young kids and keeping them interested—it's a challenge.
>
> I'm interested in alternative careers in science. I'm not sure that I want to do the academic thing. I'm really not sure exactly what I do want to do, so I'm just trying to explore as many options as possible. I enjoyed teaching—mostly in the past it's been in the form of tutoring one-on-one. . . . It's something that I've enjoyed, so I thought it

> [working at The Tech] would be a good experience for me. (So were your motivations more personal or professional?) I guess probably more professional than personal but there's certainly a component of both. I figured it would be useful for me to figure out if it's something I want to do and at the same time it would probably [look] good on my resume. I thought it would be something I would actually enjoy in the process, a nice change of pace from the daily grind of lab work.

EXPERIENCES WORKING AT THE TECH

Dr. Starr says he is proud of having shaped a current, accurate genetics exhibition and of updating the exhibition with the work of the Stanford students. He enjoys seeing the students progress in their ability to communicate with the public both in person and in print.

Overall, students have had pleasant work experiences at The Tech. They find interacting with visitors and answering visitors' questions rewarding. They also enjoy working with each other and learning new content as they write articles for the Web site. They said they feel the time commitment is reasonable and praise Dr. Starr for being understanding of their workload and working around their school commitments. They also appreciate that Dr. Starr varies their tasks to give them a range of experiences but also allows them to pursue their interests. Two quotations below exemplify students' responses.

> (Can you talk a little bit about your experiences at The Tech?) It's been a lot of fun. . . . I think it's something that people really enjoy. I think all of the activities definitely give people good insight into what we do in the lab. It's fun when they [visitors] get so excited about something that I take for granted—like when I do the Tool Time demonstration and let visitors use standard lab equipment, they get really excited. . . . (What about any negative experiences?) None really. My main concern originally was time, because my lab work takes incredible amounts of time. The time I have to spend at The Tech turns out it's a really manageable amount. [Dr. Starr], is a Ph.D. himself, so went through the same training that I'm going through right now. He has a really good appreciation for how much time I can be allowed to be away from lab. He's really great about being flexible.

> (Can you talk a little bit about your experiences at The Tech?) It's really great when people are really engaged with the demonstration or whatever you're doing. You can see that they understand—that you've helped them understand something that maybe they didn't know before. . . . (What about any negative experiences?) I don't think there [have] been any negative experiences. Each experience is different, but the good thing is [Dr. Starr] mixes it up so you don't always do the same thing. If you always had to do the same thing that would get a little old after a while. . . . But if you wanted to focus on a particular thing—like one person really wanted to spend her time writing so that's mostly what she did—[Dr. Starr] will let you tailor your experiences to what you're interested in exploring. It's a good mix.

A few students acknowledged that there were aspects of their work at The Tech that were trying. Two students said they became frustrated with children who did not pay attention when they tried to explain the content of the activity (see the first quotation below). Two others mentioned that having the prepare materials for the Web Lab was tedious (see the second quotation).

> I actually found teaching to be less enjoyable than I thought it would be. It's a balance of frustration versus pleasure and [my experiences] were often more toward frustration. . . . So many of the kids were . . . only interested in the end goal and not in the process or they just wanted to play with goo and [did] not really care what DNA was or anything like that. Of course I did my best not to act impatient with them, but I sort of felt like, 'How helpful is this to them versus playing in a sandbox when a lot of them weren't interested in learning . . . about the DNA, but they just wanted to go through the motions of grinding up the stuff?' Of course there were a select few kids that seemed to be really excited and were telling you they wanted to be a scientist themselves and that was really neat, but I think on the whole, I don't know if I have the patience for it.

> There were minor frustrations with being required to do sort of monkey work sometimes—in terms of preparing set up for the labs and stuff—when we feel our time is so valuable. It's frustrating to be asked to do things that you think are better off with someone else doing [them], and you spending your time answering questions about genetics. So sometimes it felt like I was doing something that was not that useful, and not a good use of my time. I understand that [the Museum] needs us to do those things, but they are sort of mundane chores that you have to do, not something I really looked forward to doing.

PERCEIVED BENEFITS OF THE PARTNERSHIP

Benefits for Museum Visitors

Dr. Starr said he felt that his participation, as a content expert, on the exhibition development team helped the Museum create an accurate and innovative exhibition. By having him in-house at the Museum, he could review text and provide suggestions for exhibits in a more timely manner than an outside consultant or advisor would have able to do. He could also coordinate the review of the text by other scientists; for example, he knew a Spanish-speaking geneticist and had the Spanish translations reviewed for accuracy. Dr. Starr was most proud of his contribution to the Wet Lab experiments, noting that his professional lab experience enabled him to find ways to make the experiments easier for visitors to successfully conduct and troubleshoot problems with the experiment. His connections with the biotechnology industry also proved helpful, as he was able to secure some artifacts for the exhibition. Dr. Starr noted that his inexperience in the exhibition development process and in writing for a general audience may have slowed the process somewhat, but he enjoyed working with The Tech staff and believes that the exhibition is stronger because of the collaboration.

Dr. Starr and the students also noted that real scientists working in the exhibition also benefits Museum visitors. Dr. Starr emphasized that the students provide critical assistance with the on-

going operation of the Wet Lab and with keeping the exhibits and associated Web site current (see the first quotation below). Additionally, students said they feel they add a level of integrity to the exhibition by answering visitors' questions and talk about real laboratory experiences (see the second quotation). Finally, students also said they believe that they demystify what being a scientist is like and provide a positive association with science, in general, and genetics, specifically (see the third quotation).

> (In what ways, if any, do you think having geneticists at The Tech has benefited visitors?) I think accuracy. I read all the text to make sure it was scientifically accurate and if I said it wasn't, they changed it—so that was a big part of it. . . . It's hard because the [exhibit] developer might have old information—this field is changing all the time—and not know it. So it was good to have someone here to check all the information. And the Wet Lab—I don't think they could have done without scientists here. (Why is that?) For the technical in the sense of knowing that you can get away with these shortcuts—things that you can't learn in a book, things you can get through lab experience. . . . (What about the value the students bring to The Tech?) The Wet Lab couldn't happen without them, because they make all the bacteria and the DNA for it. . . . The Tech gets a cadre of really dedicated graduate students doing programs which I think are really important, as well as someone to make it an updatable exhibit. There wouldn't be any other way to do it otherwise because [staff have] gone on to other projects. For example, there are parts of the exhibit[ion] that are designed to be updated as well as the online exhibit with the 'Ask a Geneticist' and all of that. I don't think any of that would have been possible without a Stanford partnership

> (In what ways, if any, do you think having geneticists at The Tech has benefited visitors?) If somebody asks me a question, and they know that I'm from Stanford . . . and that I'm a scientist, it makes people maybe a little more interested in what I'm saying. I think it definitely lends a lot more credibility to what I'm telling them, and I think they appreciate that. (What value do you think there is in having real scientists at the Museum?) I think it's really good. From my experience, people are always really interested in what I do and what my opinions are about popular issues like controversies you hear about on the news. It's like you run into somebody and they turn out to be a doctor—just the fact that they are a professional lends them a lot of credibility to what they say.

> (In what ways, if any, do you think having geneticists at The Tech has benefited visitors?) We bring in expertise. I think we, as genetics graduate students, are a very specialized group of people—'experts' in our field as far as the Museum goes. They get to ask us technical questions that the regular full time museum staff can't really answer, so in that aspect I think that we benefit the Museum. (What value do you think there is in having real scientists at the Museum?) I hope they [visitors] learn more about genetics. I hope they come to appreciate genetics more. It's always been my perception [that] genetics is seen as a science to be feared, so I hope that by going to the Museum the public gets a better understanding of what genetics is all about, that it's a good science, and that there's nothing to be feared.

Benefits for Stanford Students

Dr. Starr and the students agreed that the partnership benefits the students and Stanford University. They believe working at The Tech broadened students' perspectives, provided valuable skills for explaining genetics to a general audience, enhanced their writing ability, and, in a few cases, refreshed their interest in lab work (see the first two quotations below). For one student, the experience enabled her to realize that writing for the general public is not a career that she wants to pursue—a valuable lesson in this stage of her professional development.

> (In what ways, if any, has your work at The Tech benefited you?) I think my writing got a lot better. I've given my technical pieces to a couple of people to read over, and they said that they were really surprised that they were so readable. I think a lot of that is due to the writing I had to do at The Tech. Plus I was getting pretty frustrated with grad[uate] school when I started there. Just moving clear liquids around between different tubes all day long for years on end—I think would frustrate anyone and just to see the excitement of visitors at The Tech [about] this stuff that I was kind of jaded about . . . refreshed my interest in basic bench work. But in addition to my writing, I think my overall communication skills about genetics got better. Now it's easier to explain what I'm doing to my parents, my grandparents, and my fiancée—none of whom are biologists.

> (In what ways, if any, has your work at The Tech benefited you?) I'm getting better at explaining the concepts in more approachable language. And my writing is definitely getting better. It was good to do something other than lab work—to see there are lots of interesting things out there besides what's going on in my lab. Just getting to meet other Stanford students was great. We don't mingle much outside our labs.

Benefits for Stanford University

In terms of the benefits for Stanford University, Dr. Starr emphasized that the partnership provided students with teaching experience—which is important to the Chair of the genetics department but is currently not offered through the University (see the first quotation below). Students thought working at The Tech served an outreach function for the University (see the second quotation).

> (What benefit is the partnership to Stanford University?) There are two things. One, I think in the long run they'd like to have a TA [teaching assistant] requirement for their graduate students and they don't have enough classes, so this provides an outlet for that. Part of your teaching requirement would be that you could come here and do this and it would count for your TA credit. I think it's a real deficiency in their training program that teaching isn't a required part of it. Some of them do it, but some don't and this way they would have an outlet for that. . . . In terms of the other goals, the . . . chair of the department is a strong believer in public education and scientists communicating their science to the public. So because of that . . . he wants graduate students to come out of there and educate the public.

(What benefit is the partnership to Stanford University?) I think that Stanford gets . . . another outlet for the science when we're here [at The Tech]. . . . We're giving something back to people—not just [publishing] in esoteric journals that most people are never going read and not just through advancing medicine . . . which are important, but in a very real way [making an] impact on the experiences of normal people. I think it's good for the university to be involved in that—to make it part of the larger community.

SUGGESTIONS FOR IMPROVING THE PARTNERSHIP

While Dr. Starr and the students offered overwhelmingly positive comments about their experiences with The Tech-Stanford University partnership, they also offered suggestions for future projects. Several of the comments related to how the partnership was organized and the role of The Tech. For example, Dr. Starr and students said they thought they could have learned some techniques for working with visitors from the Museum's education staff (see the first two quotations below). A few students also would have liked to have learned more about The Tech for their own education and to help them be better Tech ambassadors (see the third and fourth quotations).

I think more input maybe from the Tech side [about] the graduate student training. Maybe . . . it's not necessarily their responsibility, but I'm not an expert in communicating with the public and they are. So it would have been helpful to be able to work with their educators—to learn some techniques from their staff.

When the new [*Genetics*] exhibit[ion] opened, it was supposed to bring up more controversial issues, and so they expected . . . we would want to learn how to deal with [those controversial issues]. So I went to a training for all people working in that exhibit[ion] . . . [about how to] deal with ethical questions that could come up from visitors and that sort of thing and that was helpful. It was helpful to work with [Dr. Starr] but it would have been nice to learn from staff at The Tech, too.

There were a couple of days at the beginning of my stint there where I spent almost the whole day shadowing [Dr. Starr], sitting in one meeting after another, when the meeting didn't necessarily pertain to me that much. But that was really enlightening. It was still interesting to see how things operate—like . . . they have a certain budget for translating English to Spanish, and so the number of words you're allowed to have is so restricted. . . . These are not things I normally think about, so I realized the realities of writing with budget and timelines—the administrative stuff. You don't see that in your lab. . . . So I think it's useful to do things like sit in on meetings and just observe as many people as possible—to really learn about how the place works.

I think there [needs to] be more of an orientation [such as], 'Here's what you do when you're interacting with Museum visitors and here are some rules to follow.' There are real simple things like dress code, but at the same time there are more difficult things like if you start getting into an ethical discussion with a Museum visitor, what are you allowed to say? What kinds of disclaimers do you have to put on it—that this is not

> official museum policy—that it's your personal idea? That kind of rule-setting by the Museum would have been helpful.

The final suggestion concerned the exhibition. Dr. Starr and two students who started working at The Tech immediately before the exhibition's opening suggested bringing scientists into the process earlier and having their roles be clearly established (see the quotation below).

> (What advice would you give other museums looking to form partnerships with scientists?) It depends if it's a similar sort of structure [in which] someone is in-house. I think it's important to have them . . . involved in the initial stages of designing the exhibit[ion] as well. I think that would give them—the scientists—more ownership over the exhibit[ion] itself. (So have them come into the process a little bit earlier?) A little bit earlier which this [partnership] was designed to do. I was supposed to be hired a year earlier. So I think that would work better. . . . I would also say give the person more defined goals about what you want from them. It was hard at first because I wasn't sure what they wanted, and they weren't particularly good at communicating what they wanted and so I can remember sitting around in the first few months. There were times when I was just sitting there wondering what I should be doing. . . . But that just happened initially, then we figured out how to use my time and . . . things got better as [the partnership] went along.

APPENDICES

Appendices A, D, and E have been removed for proprietary reasons.
The remaining appendices are included.

APPENDIX B: *Genetics: Technology with a Twist* Master Exhibit List with Tech Identification Numbers

RKA#	Tech Exhibit #	Exhibit	Exhibit Type
1	LT-4600.c	High-tech Biology Can Help Improve Human Health introduction	Panel with looping video
2	LT-4600.g front	Genetics and Ethics	Panel
3	LT-4600	Genetic Portraits	Video
4	LT-4680.c.03	Unique You	GeneKid card
5	LT-4602.b,d	Baker/Scientist	Video
6	LT-4601.b	Genes, like Family Recipes, Pass from Ancestors to Parents to You	Panel
7	LT-4601.c	Like Recipes, Genes Contain Instructions	Panel
8	LT-4601.d	It Takes More than Genes to Make You	Panel
9	LT-4602.a,c	Zoom in on a Gene: You'll Find Genes in Almost Every Cell	Panel with looping video
10	LT-4620	Gene Sequencer	Computer interactive/artifact
11	LT-4620.a,b	Technology Helps Scientists Look for Gene Mutations	Panel
12	LT-4620.c,e	Randy's Story: Hemochromatosis	Case study panel
13	LT-4680.c.07	Genes on Board	GeneKid card
14	LT-4625	Ashanthi	Video
15	LT-4625.a,b	Treatments Offer Hope for Curing Genetic Disease	Panel
16	LT-4625.c,k	Ashanthi's Story: Severe Combined Immune Deficiency	Case study panel
17	LT-4628.a,b	Wet Lab: Be a Geneticist: Grow Jellyfish Protein in Bacteria	Panel
18	LT-4628	Wet Lab	Interactive
19	LT-4629.a,b	Calling all GeneKids: View Your GeneKid Cards Here	Panel
20	LT-4629	Calling all GeneKids	Computer interactive
21	LT-4629	Demonstration bench	Staffed exhibit
22	LT-4680.c.02	Making Medicine	GeneKid card
23	LT-4624.a,b	Bacteria Plus Human Genes Equals Better Medicine	Panel and artifact
24	LT-4680.c.05	Model Mice	GeneKid card
25	LT-4623.a,b	Technology Tailors Drugs and Doses to Suit Your Genetic Profile	Panel
26	LT-4623	Gene Array Scanner	Computer interactive/artifact
27	LT-4622.a.b	Profiling Breast-Cancer Genes Help Guide Treatment	Panel
28	LT-4622.h	How Does a Gene Array Work?	Panel
29	LT-4622	Gene Array Simulator	Mechanical interactive
30	LT-4662.a,b	Pigs-to-People Transplants: Life Saving Treatment or Serious Threat?	Panel
31	LT-4662	Pigs-to-People Activist: photographer	Interactive
32	LT-4661.a,b	Genetic Technologies Suggest the Need for New Law and Policies	Panel
33	LT-4661	Address the Senate: video recorder	Interactive
34	LT-4661	Address the Senate: playback station	Interactive
35	LT-4660.d,e	Emily's Story: Phenylketonuria	Case study panel
36	LT-4660.a,b	Newborn Screening: Each State Screens for Genetic Disorders	Panel
37	LT-4663.a,b	How Should New Genetic Technology be Used?	Panel
38	LT-4663.i	Who Should Receive Human Growth Hormone (Pros and Cons)	Panel
39	LT-4663	Who Should Receive Human Growth Hormone? voting	Interactive
40	LT-4600.f	High-tech Biology Can Help Improve Human Health (repeat of #1)	Panel
41	LT-4600.g back	Genetics and Ethics (repeat of #2)	Panel
42	Curiosity Counter	Curiosity Counter	Staffed exhibit
43	LT-4640.a,b	Patients Can Turn to Experts for Guidance	Panel
44	LT-4640	Meet a Genetic Counselor (4)	Video
45	LT-4642.c	Genetic Testing and You	Talk-back board
46	LT-4621	Explore Genetic Tests	Computer interactive
47	LT-4621.a,b	Genes Help Diagnose Disease and Predict Future Health Risks	Panel
48	LT-4680.c.06	Real Genes?!	GeneKid card
49	LT-4680.c.04	Seeing Color? Girls Rule!	GeneKid card

APPENDIX C: Description of Intended Use and Misuse of Exhibits

Introductory Area

	Exhibit	Intended Use	Misuse
1	High-tech Biology Can Help Improve Human Health intro panel with looping video	Watch the looping video.	Touch the screen trying to stop/activate video.
3	Genetic Portraits video	Watch already running video or push button to start video.	Touch the screen trying to stop/activate video or randomly push buttons without waiting for videos to start.
4	GeneKid Card (Unique You)	Place TechTag bracelet on TechTag icon.	Push TechTag icon with hand or rub TechTag bracelet back and forth on TechTag icon.
5	Baker/Scientist video	Watch already running video or push button to start video.	Touch the screen trying to stop/activate video or randomly push button without waiting for video to start.

Genetic Medicine: Scientists' Lab

	Exhibit	Intended Use	Misuse
9	Zoom in on a Gene: You'll Find Genes in Almost Every Cell panel with looping video	Watch the looping video.	Touch the screen trying to stop/activate video.
10	Gene Sequencer computer interactive and artifact	Touch computer screen and follow program prompts.	Touch sequencer machine not computer screen. Randomly touch computer screen without following prompts.
13	GeneKid Card (Genes on Board)	Place TechTag bracelet on TechTag icon.	Push TechTag icon with hand or rub TechTag bracelet back and forth on TechTag icon.
14	Ashanthi video	Watch already running video or turn pages of journal to activate video.	Touch the screen trying to stop/activate video Turn pages of journal without paying attention to video or randomly turn pages without waiting for video to start.
18	Wet Lab: Experiment Station (4 identical stations)	Follow computer instructions, including placing TechTag bracelet on TechTag icon.	Push TechTag icon with hand or rub TechTag bracelet back and forth on TechTag icon. Do not follow computer instructions (e.g., randomly play with lab supplies).
20	Calling all GeneKids computer kiosks	Place TechTag bracelet on TechTag icon and see which GeneKid Cards you have collected.	Push TechTag icon with hand or rub TechTag bracelet back and forth on TechTag icon. Touch computer screen rather than scan TechTag. Trying to use computer without having collected any GeneKid Cards. Randomly touch computer screen without following prompts.

Genetic Medicine: Scientists' Lab (con't)

	Exhibit	Intended Use	Misuse
22	GeneKid Card (Making Medicine)	Place TechTag bracelet on TechTag icon.	Push TechTag icon with hand or rub TechTag bracelet back and forth on TechTag icon.
24	GeneKid Card (Model Mice)	Place TechTag bracelet on TechTag icon.	Push TechTag icon with hand or rub TechTag bracelet back and forth on TechTag icon.
26	Gene Array Scanner computer interactive and artifact	Use touch-screen to activate computer program, follow prompts, and select a case to follow.	Quit before selecting a case or randomly touch screen without following prompts.
29	Gene Array Simulator mechanical interactive	Push button to take genetic sample, lift until all the balls fall, return to starting position, and lift answer flip panel.	Randomly push button without waiting for sample to be taken or not pushing the button. Randomly move the ball container without watching to see what happens. Does not check answer under flip panel.

Genetic Policy: Policy Maker's Office

	Exhibit	Intended Use	Misuse
31	Pigs-to-People Activist photo interactive	Follow computer instructions, including placing TechTag bracelet on TechTag icon. Use computer touch screen to select a protester and position yourself so that the camera takes a photo of your face. Look at photo.	Does not position self in proper place to photograph face. Tries to photograph other body parts. Randomly touch computer screen without following prompts. Repeatedly takes photograph of self without reading text or spending time thinking about which protester to select. Do not look at photo.
33	Address the Senate: video recording interactive	Follow computer instructions, including placing TechTag bracelet on TechTag icon. Use computer touch screen to select a speech and reading speed. Looks at teleprompter and reads speech.	Push TechTag icon with hand or rub TechTag bracelet back and forth on TechTag icon. Randomly touch computer screen without following prompts. Does not read speech but talks about topics unrelated to exhibition or plays in front of camera.
34	Address the Senate: playback station	Follow computer instructions, including placing TechTag bracelet on TechTag icon. Watch the playback.	Push TechTag icon with hand or rub TechTag bracelet back and forth on TechTag icon. Randomly touch computer screen Does not watch footage.

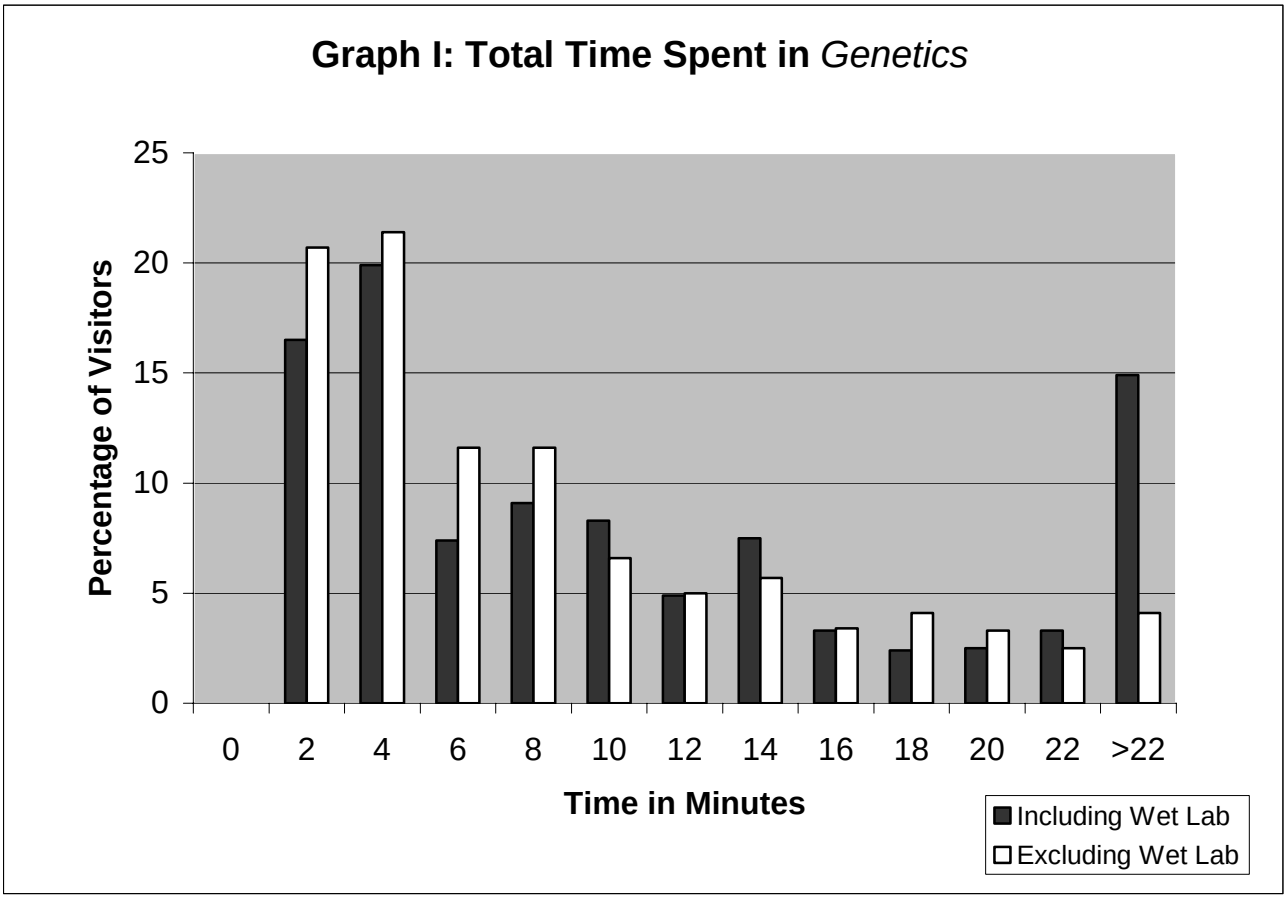
Genetic Policy: Policy Maker's Office (cont'd)

	Exhibit	Intended Use	Misuse
39	Who Should Receive Human Growth Hormone? voting interactive	Place TechTag bracelet on TechTag icon to select one letter. Look at voting tallies.	Push TechTag icon with hand or rub TechTag bracelet back and forth on TechTag icon. Try to select more than one letter. Does not look at voting tallies.

Genetic Counselor's Office

	Exhibit	Intended Use	Misuse
44	Meet a Genetic Counselor video	Watch already running video or push button to start video.	Touch the screen trying to stop/activate video or randomly push buttons without waiting for video to start.
44	Genetic Testing and You talk-back board	Read or write comment.	Doodle or write comment unrelated to exhibition.
46	Explore Genetic Tests computer interactive	Touch computer screen and follow program prompts.	Randomly touch computer screen without following prompts.
48	GeneKid Card (Real Genes?!)	Place TechTag bracelet on TechTag icon. Listen to audio.	Push TechTag icon with hand or rub TechTag bracelet back and forth on TechTag icon. Does not listen to audio.
49	GeneKid Card (Seeing Color? Girls Rule!)	Place TechTag bracelet on TechTag icon Look at colorblind test graphic.	Push TechTag icon with hand or rub TechTag bracelet back and forth on TechTag icon Does not look at colorblind test graphic.

APPENDIX F


Graph I: Total Time Spent in Genetics
Percentage of Visitors
25
20
15
10
5
0
0
2
4
6
8
10
12
14
16
18
20
22
>22
Time in Minutes
Including Wet Lab
Excluding Wet Lab

APPENDIX G: Stops at Each Exhibit by Age Group

Overall, interactive exhibits were visited by a range of ages; whereas, panels were almost exclusively visited by adults (see Table 17, below and next page). Readers should note, however, that because of the moderate sample size, the evaluator was not able to determine whether the differences among age groups and visitation to specific exhibits were statistically significant. As such, the data presented below are intended to be descriptive and do not show statistically significant differences.

Table 17
Stops Made at Each Exhibit by Age Group

	Age Group (Number of Visitors)			Total
Exhibit	**9 to 12**	**13 to 18**	**19 and older**	***n***
Genetic Portraits video	15	12	34	61
Genes, like Family Recipes, Pass from Ancestors to Parents to You panel	6	6	38	50
Wet Lab: Experiment Station	6	7	25	38
Curiosity Counter	6	6	26	38
Pigs-to-People Activist photo interactive	7	5	22	34
Address the Senate: video recording interactive	6	7	20	33
Calling all GeneKids computer kiosks	7	6	19	32
Meet a Genetic Counselor video (4)	7	11	12	30
Gene Sequencer computer interactive/artifact	4	3	18	25
Baker/Scientist video	2	1	22	25
Newborn Screening: Each State Screens for Genetic Disorders panel	1	4	19	24
Bacteria Plus Human Genes Equals Better Medicine panel/artifact	3	2	19	24
Address the Senate: playback station	4	4	11	19
Gene Array Simulator mechanical interactive	6	2	8	19
High-tech Biology Can Help Improve Human Health panel/looping video	1	1	17	19
Explore Genetic Tests computer interactive	2	3	13	18
Ashanthi video	2	1	16	18
Like Recipes, Genes Contain Instructions panel	4	3	9	16
Gene Array Scanner computer interactive/artifact	2	2	12	16
Zoom in on a Gene: You'll Find Genes in Almost Every Cell panel/looping video	2	0	13	15
Who Should Receive Human Growth Hormone? voting interactive	2	2	10	14

Exhibit	Age Group (Number of Visitors)			Total
	9 to 12	13 to 18	19 and older	*n*
Randy's Story: Hemochromatosis case study panel	2	1	10	13
Pigs-to-People Transplants: Life Saving Treatment or Serious Threat? panel	0	2	10	12
Genetic Testing and You talk-back board	2	5	4	11
It Takes More than Genes to Make You panel	0	0	7	7
Technology Helps Scientists Look for Gene Mutations panel	0	0	7	7
Emily's Story: Phenylketonuria case study panel	0	1	4	5
Calling all GeneKids: View Your GeneKid Cards Here panel	1	0	4	5
Genetics and Ethics panel	0	0	4	4
Treatments Offer Hope for Curing Genetic Disease panel	0	0	4	4
Technology Tailors Drugs and Doses to Suit Your Genetic Profile panel	0	0	4	4
How Does a Gene Array Work? panel	0	0	4	4
How Should New Genetic Technology be Used? Panel	0	0	4	4
Patients Can Turn to Experts for Guidance panel	0	0	4	4
Ashanthi's Story: Severe Combined Immune Deficiency case study panel	1	0	2	3
Wet Lab: Be a Geneticist: Grow Jellyfish Protein in Bacteria panel	0	0	3	3
Profiling Breast-Cancer Genes Help Guide Treatment panel	0	0	3	3
Genetic Technologies Suggest the Need for New Law and Policies panel	0	0	3	3
Genes Help Diagnose Disease and Predict Future Health Risks panel	0	0	3	3
Demonstration bench	0	0	2	2
Who Should Receive Human Growth Hormone (Pros and Cons) panel	0	0	2	2

APPENDIX H: Behaviors at Individual Exhibits

Table 18
Misuse of Individual Exhibits

Exhibit	*n*	% Misuse Exhibit
Ashanthi video	18	50.0
Gene Array Simulator mechanical interactive	19	36.8
Address the Senate: playback station	19	26.3
GeneKid Card (Unique You)	8	20.0
Calling all GeneKids computer kiosks	32	18.8
Pigs-to-People Activist photo interactive	34	17.6
Meet a Genetic Counselor video (4)	30	16.7
Address the Senate: video recording interactive	33	15.2
Genetic Portraits video	61	14.8
Who Should Receive Human Growth Hormone? voting interactive	14	14.3
GeneKid Card (Model Mice)	15	13.3
GeneKid Card (Real Genes?!)	15	13.3
Explore Genetic Tests computer interactive	18	11.1
GeneKid Card (Genes on Board)	9	11.1
Gene Array Scanner computer interactive/artifact	16	6.3
Baker/Scientist video	25	4.0
Gene Sequencer computer interactive/artifact	25	4.0
High-tech Biology Can Help Improve Human Health panel/looping video	19	0.0
Wet Lab: Experiment Station	38	0.0
Genetic Testing and You talk-back board	11	0.0
GeneKid Card (Making Medicine)	12	0.0
GeneKid Card (Seeing Color? Girls Rule!)	14	0.0
Zoom in on a Gene: You'll Find Genes in Almost Every Cell panel/looping video	15	0.0

Overall, misuse of exhibits was quite low. A few exhibits were misused by adults and children—such as the Ashanthi video, Calling all GeneKids compuer kiosks, and the Gene Array Simulator mechanical interactive, suggesting that these exhibits' operating instructions and design were confusing (see Table 19). Conversely, exhibits such as Genetic Portraits video and Meet a Genetic Counselor video, were misused mostly by children most likely because they included push-buttons. Readers should note, however, that, the data presented below are intended to be descriptive and do not show statistically significant differences.

Table 19
Misuse at Each Exhibit by Age Group

Exhibit	Age Group (Number of Visitors)			Total Misuse *n*
	9 to 12	13 to 18	19 and older	
Genetic Portraits video	5	3	1	9
Ashanthi video	2	1	6	9
Gene Array Simulator mechanical interactive	1	2	4	7
Calling all GeneKids computer kiosks	3	1	2	6
Pigs-to-People Activist photo interactive	2	0	4	6
Address the Senate: video recording interactive	2	2	1	5
Address the Senate: playback station	2	2	1	5
Meet a Genetic Counselor video (4)	2	2	1	5
GeneKid Card (Unique You)	1	1	0	2
GeneKid Card (Model Mice)	0	0	2	2
Who Should Receive Human Growth Hormone? voting interactive	1	0	1	2
Explore Genetic Tests computer interactive	1	0	1	2
GeneKid Card (Real Genes?!)	1	1	0	2
Baker/Scientist video	0	0	1	1
Gene Sequencer computer interactive/artifact	0	0	1	1
GeneKid Card (Genes on Board)	0	1	0	1
Gene Array Scanner computer interactive/artifact	0	1	0	1
High-tech Biology Can Help Improve Human Health panel/looping video	0	0	0	0
Zoom in on a Gene: You'll Find Genes in Almost Every Cell panel/looping video	0	0	0	0
Wet Lab: Experiment Station	0	0	0	0
GeneKid Card (Making Medicine)	0	0	0	0
Genetic Testing and You talk-back board	0	0	0	0
GeneKid Card (Seeing Color? Girls Rule!)	0	0	0	0

Table 20
Interacting with Staff at Individual Exhibits

Exhibit	*n*	% Interact with Staff
Curiosity Counter	38	65.8
Wet Lab: Experiment Station	38	50.0
Demonstration bench	2	50.0
Calling all GeneKids computer kiosks	32	43.8

Table 21: Reading/Talking about Exhibit Content at Individual Exhibits

Exhibit	*n*	% Read/Talk
Pigs-to-People Transplants: Life Saving Treatment or Serious Threat? panel	12	8.3
Baker/Scientist video	25	8.0
Who Should Receive Human Growth Hormone? voting interactive	14	7.1
Zoom in on a Gene: You'll Find Genes in Almost Every Cell panel/looping video	15	6.7
Curiosity Counter	38	55.3
Demonstration bench	2	50.0
High-tech Biology Can Help Improve Human Health panel*/looping video	19	5.6
Ashanthi video	18	5.6
Wet Lab: Experiment Station	38	34.2
Bacteria Plus Human Genes Equals Better Medicine panel/artifact	24	29.2
Newborn Screening: Each State Screens for Genetic Disorders panel	24	29.2
Gene Array Simulator mechanical interactive	19	26.3
Technology Tailors Drugs and Doses to Suit Your Genetic Profile panel	4	25.0
Gene Array Scanner computer interactive/artifact	16	25.0
Gene Sequencer computer interactive/artifact	25	24.0
Calling all GeneKids: View Your GeneKid Cards Here panel	5	20.0
Address the Senate: playback station	19	20.0
Like Recipes, Genes Contain Instructions panel	16	18.8
Address the Senate: video recording interactive	33	18.2
Genetic Testing and You talk-back board	11	18.2
Pigs-to-People Activist photo interactive	34	17.6
Explore Genetic Tests computer interactive	18	16.7
Genes, like Family Recipes, Pass from Ancestors to Parents to You panel	50	16.0
Calling all GeneKids computer kiosks	32	15.6
Ashanthi's Story: Severe Combined Immune Deficiency case study panel	3	12.5
Genetic Portraits video	61	1.6
Genetics and Ethics panel*	4	0.0
It Takes More than Genes to Make You panel	7	0.0
Technology Helps Scientists Look for Gene Mutations panel	7	0.0
Randy's Story: Hemochromatosis case study panel	13	0.0
Treatments Offer Hope for Curing Genetic Disease panel	4	0.0
Wet Lab: Be a Geneticist: Grow Jellyfish Protein in Bacteria panel	3	0.0
Profiling Breast-Cancer Genes Help Guide Treatment panel	3	0.0
How Does a Gene Array Work? panel	4	0.0
Genetic Technologies Suggest the Need for New Law and Policies panel	3	0.0
Emily's Story: Phenylketonuria case study panel	5	0.0
How Should New Genetic Technology be Used? Panel	4	0.0
Who Should Receive Human Growth Hormone (Pros and Cons) panel	2	0.0
Patients Can Turn to Experts for Guidance panel	4	0.0
Meet a Genetic Counselor video (4)	30	0.0
Genes Help Diagnose Disease and Predict Future Health Risks panel	3	0.0

Table 22
Noticing Artifacts at Individual Exhibits

Exhibit	*n*	% Noticing Artifacts
High-tech Biology Can Help Improve Human Health panel*/looping video	19	22.2
GeneKid Card (Unique You)	10	80.0
Baker/Scientist video	25	20.0
Genes, like Family Recipes, Pass from Ancestors to Parents to You panel	50	86.0
Like Recipes, Genes Contain Instructions panel	16	75.0
It Takes More than Genes to Make You panel	7	57.1
Zoom in on a Gene: You'll Find Genes in Almost Every Cell panel/looping video	15	6.7
Gene Sequencer computer interactive/artifact	25	64.0
GeneKid Card (Genes on Board)	9	88.9
Bacteria Plus Human Genes Equals Better Medicine panel/artifact (Vincent)	24	70.8
Bacteria Plus Human Genes Equals Better Medicine panel/artifact (biovat)	24	66.7
GeneKid Card (Model Mice)	15	60.0
Gene Array Scanner computer interactive/artifact	16	31.3
Newborn Screening: Each State Screens for Genetic Disorders panel (map)	24	95.8
GeneKid Card (Seeing Color? Girls Rule!)	14	78.6

Table 23
Using GeneKid Cards at Individual Exhibits

GeneKid Card	*n*	% Used Card
Pigs-to-People Activist photo interactive	34	44.1
GeneKid Card (Your Glowing Bacteria)	38	39.5
Address the Senate: playback station	19	40.0
Who Should Receive Human Growth Hormone? voting interactive	2	28.6
GeneKid Card (Real Genes?!)	121	12.4
Address the Senate: video recording interactive	33	12.1
GeneKid Card (Making Medicine)	121	9.9
GeneKid Card (Model Mice)	121	9.9
GeneKid Card (Seeing Color? Girls Rule!)	121	7.4
GeneKid Card (Unique You)	121	6.6
GeneKid Card (Genes on Board)	121	6.6

Table 24
Watching Videos at Individual Exhibits

Videos with Activation Button	*n*	% Video Already Playing	% Selected Video	% Watched Partial Video(s)[1]	% Watched Whole Video(s)[2]
Genetic Portraits video[3]	61	63.9	36.1	100.0	19.7
Baker/Scientist video	25	76.0	24.0	92.0	8.0
Ashanthi video	18	39.0	61.0	50.0	22.2
Meet a Genetic Counselor video (4)	30	60.0	40.0	66.7	13.3

Looping Videos	*n*	% Watched Video	% Watched Partial Video	% Watched Whole Video
High-tech Biology Can Help Improve Human Health panel*/looping video	19	38.9	100.0	0.0
Zoom in on a Gene: You'll Find Genes in Almost Every Cell panel/looping vide	15	53.3	100.0	0.0

[1]At exhibits with more than one video to watch (Genetic Portraits, Ashanthi, and Meet a Genetic Counselor), the percentage denotes how many visitors watched one or more partial videos.
[2]At exhibits with more than one video to watch (Genetic Portraits, Ashanthi, and Meet a Genetic Counselor), the percentage denotes how many visitors watched one or more whole videos.
[3]Visitors watched a median of one partial video at Genetic Portraits. Of the 12 visitors who watched whole videos, 8 watched one video in its entirety.

Table 25
Doing Activities at Individual Exhibits

Exhibit	*n*	% Doing Activities
Gene Sequencer computer interactive/artifact	25	72.0
Pigs-to-People Activist photo interactive	34	55.9
Wet Lab: Experiment Station	38	55.3
Calling all GeneKids computer kiosks	32	59.4
Gene Array Simulator mechanical interactive	19	52.6
Gene Array Scanner computer interactive/artifact	16	50.0
Who Should Receive Human Growth Hormone? voting interactive	14	35.7
Address the Senate: playback station	19	35.0
Address the Senate: video recording interactive	33	21.2
Genetic Testing and You talk-back board	11	9.1
Explore Genetic Tests computer interactive	18	83.3

Table 26
Watching Others Do Activities at Individual Exhibits

Exhibit	*n*	% Watching
Gene Sequencer computer interactive/artifact	25	32.0
Wet Lab: Experiment Station	38	39.5
Gene Array Scanner computer interactive/artifact	16	31.3
Gene Array Simulator mechanical interactive	19	26.3
Pigs-to-People Activist photo interactive	34	70.6
Address the Senate: video recording interactive	33	72.7
Address the Senate: playback station	19	40.0
Who Should Receive Human Growth Hormone? voting interactive	14	7.1
Genetic Testing and You talk-back board	11	9.1
Explore Genetic Tests computer interactive	18	33.3