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Report Submitted to:

Professor Ángel Rivera and Professor Roberto Pietroforte

Costa Rica, Project Center

By

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Three handwritten signatures are stacked vertically. The top signature is "Katie Archer", the middle one is "Kimberly Morin", and the bottom one is "Jessa Thomas". Each signature is written in black ink and is underlined.

In Cooperation With

Fabiola Rodríguez, Executive Director

El Museo de los Niños, San José

DESIGNING AN INTERACTIVE CHILDREN'S MUSEUM EXHIBIT

July 3, 2000

This project report is submitted in partial fulfillment of the degree requirements of Worcester Polytechnic Institute. The views and opinions expressed herein are those of the authors and do not necessarily reflect the positions or opinions of El Museo de los Niños or Worcester Polytechnic Institute.

This report is the product of an education program, and is intended to serve as partial documentation for the evaluation of academic achievement. The report should not be construed as a working document by the reader.

July 3, 2000

Ms. Fabiola Rodríguez
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Dear Ms. Rodríguez,

Enclosed is our proposal entitled Designing an Interactive Children's Museum Exhibit. It was written at El Museo de los Niños in San José, Costa Rica during the time period of May 13 through July 3, 2000. The preliminary background work was completed in Worcester, Massachusetts, prior to our arrival in San José. Copies of this report are being simultaneously submitted to Professor Ángel Rivera and Professor Roberto Pietroforte for evaluation. Upon faculty review, a copy will be catalogued in the Gordon Library at Worcester Polytechnic Institute. We appreciate the time that you and the other museum staff have devoted to the success of this project.

Sincerely,

Katie Archer

Kimberly Morin

Jessa Thomas

ABSTRACT

This report, prepared for El Museo de los Niños in San José, Costa Rica, outlines the procedures for designing and obtaining funding for an interactive children’s museum exhibit. Fabiola Rodríguez, the museum’s director, commissioned our team to redesign the existing “Los Seres Vivos” (The Living Creatures) exhibit. Upon completion of the design, our team compiled a list of potential sources for funding and prepared the necessary guidelines for the completion of a successful grant proposal.

AUTHORSHIP PAGE

Katie Archer, Kimberly Morin, and Jessa Thomas prepared this report. Initially, the group developed the ideas to be included in each section, individuals within the group then wrote specific sections, however the team, as a whole, edited and revised the entire report. During this process the ideas and suggestions of each team member were applied to each section. It is our opinion, as a group, that the distinct sections are no longer the work of any one person within the group, but are the products of all three team members. For this reason the authorship of this report, in its entirety belongs to the three members of this project team, Katie Archer, Kimberly Morin and Jessa Thomas.

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There are many individuals and institutions that we would like to express our gratitude and appreciation to for their assistance with the completion of this project.

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EXECUTIVE SUMMARY

The primary objective of El Museo de los Niños in San José, Costa Rica is to provide a fun, yet effective, educational supplement to the curriculum of the country's schools. The material presented in the museum is primarily scientific in nature, although significant attention is given to cultural aspects. The museum, founded in 1991, has consistently updated its existing exhibits to reflect changes in technology and knowledge. One such exhibit in need of modification is "Los Seres Vivos," which focuses on the living creatures of the world.

Currently, "Los Seres Vivos" contains little educational content and is not appealing to the children. They frequently hurry through the exhibit area, rarely pausing before quickly moving on to the next. Although the material contained in the museum's exhibits ideally should reflect the standardized curriculum of the nation, this particular exhibit, in its current state, has little educational content. In addition, this exhibit includes few interactive components, despite the fact that the museum prides itself for being a hands-on learning institution. The children's disinterest in the exhibit stems from this lack of innovation and interaction. Although it is of lesser concern to the museum's director, "Los Seres Vivos" also lacks any form of cultural tie to Costa Rica.

Due to the lack of success of this exhibit, the director of El Museo de los Niños commissioned this project team to develop a new design for this exhibit. At the request of the museum, the design focused on the educational content of the five kingdoms of living creatures in the world, while bringing interaction and enjoyment to the exhibit. The interactive, as well as general, features of the exhibit were described in detail and

illustrated prior to the presentation of the design to the museum. The educational content for each component was also outlined in detail, enabling the museum to develop a clear sense of the intellectual content of the exhibit. The design itself was modeled after the rainforests of Costa Rica, which reinforces a strong sense of culture in the children and visitors of all ages.

Although the museum would prefer to update and add exhibits more frequently, it currently does not have adequate funding to do so. El Museo de los Niños receives an annual budget from the Costa Rican government, but this does not support all of the projects the museum would like to undertake. It has become necessary, over the past several years, for the museum to rely more on grants and donations from outside individuals and companies. For this reason, our project team compiled a listing of companies within the United States that may be willing to support the implementation of our design and then contacted them with a brief proposal statement. In addition, a series of guidelines describing the content of a successful exhibit were produced for future use by the museum. Although the time constraints of this project did not allow for the completion of the formal grant proposals by our team, sample proposals were also provided for the museum. These sample proposals will facilitate the completion of the final grant proposals by the museum staff. Upon completion of the formal budget and acquirement of a tax reference number, the museum staff will then be able to insert this required information into the grant proposals provided in this report.

With the potential funds acquired by this project team, the proposed design should be implemented over the next several years. This new “Los Seres Vivos” will serve to

better educate the youth of Costa Rica with respect to the living creatures of the world and their importance in an interesting and appealing environment.

1.0 INTRODUCTION

Museums, once used solely for showcasing artifacts, have now become less structured educational centers primarily due to the introduction of interactive exhibits. Museums have grown tremendously in size, content, and popularity since the implementation of these exhibits, which allow patrons of the museum to become actively involved by physically manipulating the components of the exhibit. One museum that has thrived thus far by using interactive exhibits is El Museo de los Niños located in San José, Costa Rica.

In an effort to develop educational and interactive exhibits, El Museo de los Niños intends to replace the existing “Los Seres Vivos” exhibit. Its purpose is to give children a better understanding of the world in which they live. However, it currently lacks interactive qualities and does not cover the wide range of topics that its name implies. The exhibit contains only a limited selection of creatures from one kingdom. For this reason, the museum director, Fabiola Rodríguez, has commissioned this project group to assist in its redesign and explore funding possibilities for “Los Seres Vivos.” The new design will broaden the range creatures included from each of the five kingdoms and will illustrate the interactions between each.

Since its opening, El Museo de los Niños has played a large role in the educational system of Costa Rica. The majority of school children visit the museum with their classes each year. The exhibits are intended to compliment the curriculum of the nation’s schools, both private and public. The existing “Los Seres Vivos” exhibit contains only

insect displays, a stereoscope for viewing insect slides, and live reptiles. However, these components are not interactive. The redesign of this exhibit will enable children to actively participate in acquiring knowledge about the world around them. By interacting with the exhibit, children use several senses simultaneously, which helps them comprehend and retain a greater amount of material.

There are two primary objectives for this project: 1) To create a design for the exhibit and, 2) To prepare the necessary guidelines for the museum to follow to obtain funding for the implementation of the design. To accomplish the first objective, we worked closely with a design team at the museum to create a potential design idea. This design included an informal layout depicting the generalized components and illustrations of specific components. Later, a formal design team will develop the detailed architectural plans and compile a complete list of the necessary materials to implement the design. Our team assessed the availability of specialized components through research of local and international suppliers. To obtain funding for this project, we contacted several United States based companies with branches in Costa Rica with a proposal statement, which outlined the goals of the museum and requested the guidelines for grant applications. Also, we contacted local companies for donations of either materials or services.

In addition to completing these objectives, we assessed the existing “Los Seres Vivos” exhibit to determine the necessity of the redesign and establish which successful components should remain. We also evaluated other museum exhibitions in order to distinguish what types of components work in other areas. This information was applied to our exhibit design. The educational aspects of our proposed design were fully developed to include all relative background for each exhibit component as well as suggestions for

information to be provided in the exhibit. It is not possible to incorporate all available educational material into the exhibit, therefore our recommendations focused on the most important and relevant facts. The design is centered on the living creatures of Costa Rica in an effort to increase the child's familiarity with the world and culture around him.

The anticipated design results included a detailed outline of the exhibit, a model displaying the area recommended for each section, and detailed illustrations of individual components. In-depth descriptions of the educational content of each component and an analysis of successful exhibit features are also included. The results of our funding research include an outline for grant proposals, as well as a compilation of possible companies from which the museum may solicit.

El Museo de los Niños will utilize the proposed design in the implementation of an improved exhibit featuring the living creatures of the world. The results of the funding research will assist the museum in the future by providing a list of potential donors and detailed guidelines for the completion of formal grant proposals.

The purpose of the Interactive Qualifying Project (IQP) is to link scientific technology with the social implications that follow. This project presents biological sciences to both adults and children to educate them on the living creatures of the world. Simultaneously, through an interactive exhibit, the visitors develop cultural awareness about their environment because the exhibit focuses primarily on the biodiversity of Costa Rica. Through this educational process the museum is promoting intellectual growth within the community. This project focuses on new forms of education to increase the intellectual and cultural awareness in Costa Rican society. The relationship of

the Center to the Children's Museum and the relevance of the topic to the Children's Museum are presented in Appendix A.

2.0 LITERATURE REVIEW

In working with the Children's Museum of Costa Rica our goal is to design and find funding for a new interactive exhibit based on the living creatures of the world ("Los Seres Vivos"). In addition to focusing on interaction, the exhibit is also expected to reflect the curriculum of the education system in Costa Rica. The museum, located in San José, caters to over 250,000 children per year and currently houses approximately thirty exhibits, which are primarily scientific in nature.

The first section of this chapter is comprised of information on the history and purpose of interactive exhibits, various types of exhibits, design considerations, and the impact on education and learning. The second section centers on the material on which the exhibit will be based. The final section of this chapter describes the various types of grants that we will be focusing on and strategies for grant proposal writing. The background information contained in this chapter will provide the necessary knowledge to design a new interactive exhibit of this nature and to complete proposals for funding of this exhibit.

2.1 The Exploratorium

In 1969, Frank Oppenheimer founded the Exploratorium, a unique institution located in San Francisco, which created a movement of new interactive exhibits in museums around the world (Exploratorium, 27 March 2000, <<http://www.exploratorium.edu/about/index.html>>). Oppenheimer, a noted physicist and educator, was the director of this museum from its initiation until his death in 1985. Over the years, the Explorato-

rium has established itself as an educational center. “The Exploratorium’s mission is to create a culture of learning through innovative environments, programs, and tools that help people nurture their curiosity about the world around them” (Exploratorium, 27 March 2000, <<http://www.exploratorium.edu/generalsynopsis.html>>). This exceptional museum utilizes its exhibits on science, nature, art, and technology as teaching instruments for the general public.

The Exploratorium introduced a new approach to science that allows concentrated exposure to material, while minimizing the evident educational structure (Exploratorium, 27 March 2000, <<http://www.exploratorium.edu/general/synopsis.html>>). Museums throughout the world have incorporated Oppenheimer’s ideas into exhibits of their own, creating a new genera of museums. Interactive museums, such as the Exploratorium, invite the general public to actively participate in the discovery of science and history. The process of integrating interaction into exhibits eliminates the passivity of traditional museum exhibits. With the introduction of interactive exhibits, attendance levels in museums have increased steadily (Marriot, 1991). While in the past museums were supported mainly through charitable donations, they now survive primarily on their own due to increased visitation (Marriott, 1991).

2.2 Defining Interactive Exhibit

The interactive and educational games in these exhibits are generally designed for children, however, everyone learns in this entertaining and inviting environment (Farmer, 1995). The philosophy behind incorporating games and activities into exhibits is that children will learn the most when they actively participate in the subject being presented.

Since education is the primary focus in these exhibits, interaction helps the museum to achieve this goal by allowing children to learn in a non-threatening environment. This prevents children from feeling pressured by their peers to succeed.

The exhibits emphasize developmentally suitable activities for various ages (Farmer, 1995). The experiments and games involved in an interactive exhibit range in difficulty from very simple to somewhat challenging, according to the age of the user. Experiments are explained through step-by-step instructions at a level that all visitors are able to comprehend. Children learn by role-playing and pretending in the world of science (Farmer, 1995). The exhibits are self-paced, which allows visitors to go as fast or as slow as they feel necessary.

Inside interactive museums, children, parents, and educators, are allowed to explore the exhibits without constant instruction. Children of all ages discover a wide range of subjects and gain enthusiasm for learning. Interactive exhibits stimulate their curiosity by allowing them to actively work with science, mathematics, history, and many other subjects (Farmer, 1995). They allow children not only to see and learn material, but also to participate in activities that entertain them as well as reinforce the learning process for each subject.

Not only are these exhibits exciting, but they also demonstrate how museums are progressing with technology and withdrawing from more traditional showcase exhibitions. Interactive exhibits allow children to observe, feel, and draw conclusions about science for themselves. Museum assistants are often necessary to explain and maintain some interactive components (Marriott, 1991). They are instructed to spark the interests of the museum's visitors by performing demonstrations, and to convince visitors to try

the hands-on projects. Recently, interactive exhibits have become very popular because they demonstrate that scientific activities are interesting and rewarding.

2.3 Objective of Interactive Exhibits

As previously mentioned, museums have become informal educational centers for communities around the world. The main objective of these museums is to create a non-threatening, interactive environment that supplements and positively reinforces the learning that occurs in schools and homes (Farmer, 1995). In general, interactive museums should create an environment where children are encouraged to explore and study many subjects.

Many museums have developed 'classroom kits' to complement the subjects of the exhibits. These kits include activities that schools utilize in the classroom to reinforce the activities in the museum, thereby adding their classroom curriculum (Marriott, 1991). Some museums have also developed workshops that are explicitly tailored to the curriculum of the local schools. There is a developing trend to integrate supplemental material into local schools and the general public. This supplemental material includes formal lessons covering the concepts and theories behind of the subjects displayed in the exhibits. With the addition of supplemental material and workshops, the visitors are better able to structure their learning and comprehension.

2.4 Atmosphere as Interaction

An important element in creating an interactive environment is the development of the appropriate atmosphere. Although the atmosphere does not directly contribute to

the interactive components in the exhibit, it makes the components more appealing and interesting to the children. It is often easier to integrate interaction into an exhibit if the appropriate atmosphere is in place because the exhibit maintains the full attention of the child, directing it toward specific components. Atmosphere serves as a form of interaction when it is complete, meaning that there is no indication of the environment outside the exhibit. In these cases the sense of reality created in the atmosphere engulfs the visitor and appeals to all senses. This is particularly effective when the atmosphere is one that visitors are not normally exposed to, such as outer space.

2.5 Hands-on Works

One of the benefits of interactive exhibits is that they inspire children to take learning into their own hands (Farmer, 1995). They spark imaginations while complementing the school and home learning environments. Hands-on museums have enabled researchers to further study children's motivation and other aspects of the learning process (Henderlong & Paris, 1996).

It has been argued that children interact more successfully with the exhibit when there is a task that must be completed, as compared to a fully completed task. In studies, children spend more time arranging a half-completed puzzle than breaking apart a completed one and restarting. Partially completed exhibits aid children who need motivation to begin a project or who need inspiration to learn. It builds reassurance and self-confidence in completing the task correctly (Henderlong & Paris, 1996). This type of exhibit produces a challenge for children while still enabling them to succeed in an active manner. Challenges allow children to enhance their self-image and feel confident in their

abilities. A variety of exhibits are useful because they allow children to seek individual interests and build on their own learning capabilities in that subject.

2.6 Exhibit Variations

Evidently, different types of exhibits appeal to different children. Some of the exhibits in the world's largest children's museum in Indianapolis, Indiana take interaction to a new level (Kearney, 1996). Some examples of successful exhibits, which are possibilities for future implementation in El Museo de los Niños in Costa Rica, include a waterfall that tells time by filling cups and counting minutes by the height in the cups. Another exhibit is the "mummy's tomb" where, upon entering, you can smell the items used for mummification, play with Egyptian tools, and become a detective, of sorts, by determining the mummy's name by deciphering hieroglyphics. A sea life exhibit educates children by allowing them to role-play as sea creatures in front of a wall of televisions with bubbles trickling upwards, providing an underwater atmosphere. In an archeology exhibit, visitors dig for bones in the sand, put the pieces together, and discover a dinosaur. Throughout the exhibit there are short question-answer stations and guides who assist the visitors in learning about the exhibits.

2.7 Successful Exhibits

Children's museums are popular because both children and adults actively participate in the exhibits (Farmer, 1995). Interaction aids children in comprehending what they are learning and in enjoying the material. Studies show that active participation increases learning capacity and tends to hold their interest and curiosity longer than passive

learning of the same subject (Koran, Longino, & Shafer, 1983). Many typical exhibits allow children to focus on role-playing or pretending to be adults. One explanation for the success of the Indianapolis museum, as an example of interactive museums, is that it asks for the child's opinions on exhibit content before the design process begins (Kearney, 1996). This helps the designers to gain a better sense of what the children like and how they will respond to new exhibit ideas. Another aspect of children's museums is that they compliment the education provided in schools and at home. Combining children, an active learning environment, and valuable educational content provides better relationships between schools, parent, and child. A successful exhibit makes learning interesting and exciting.

2.8 Exhibit Design

Museums are progressive institutions that improve with the development of new technology and styles of exhibition. Exhibits are the most prominent features of a museum because they are the primary source of public interest in the museum. Important exhibit design considerations include: subject and artifact choice, setting, and interpretation. These decisions define the goals of the exhibits, which generally include scientific accuracy, educational value, technical feasibility, and user friendliness.

Each detail of an exhibit must be extensively researched and developed. Children's interactive exhibits, in particular, must be able to withstand a substantial amount of stress from constant use (Fearn, 1991). Therefore, the exhibits must be extremely durable and always remain functional. Safety is also a major concern in exhibits for chil-

dren, due to the nature of many topics. Some exhibits may require electricity and water, which may cause injury (Fearn, 1991).

The introduction of educators to exhibit design teams has improved visitor education. Learning in a museum atmosphere now encompasses more than merely formal styles of learning. The incorporation of such learning processes as social interaction, independent contemplation, imagination, and play has brought museums to a new level. Interactive museums now define their exhibits as "informal, self-paced, three-dimensional, and multisensory" (Roberts, 1997). Nowadays, museums aim to define a new category of activity for educating and entertaining nearby communities. Throughout history, museums have typically focused on collectors, founders, and visionaries. This has enabled museums of the past to allow children to see history, but the museums of today engross children in history and allow them to become an integrated part of the exhibits. Museum exhibit designers have begun to include children in the exhibit planning process (Farmer, 1995). By considering the suggestions of children in the design stage, museums are assured that the exhibits are fully suited to children's needs.

The popularity of interactive museums is due to the hands-on nature of their exhibits (Marriott, 1991). Children's museums are particularly inviting because the visitors act as active participants. The focus of these museums is to educate children by implementing interactive, hands-on activities in the exhibits, thereby enabling children to control the pace at which they learn the subject.

2.9 Design Considerations

The most important step in the process of implementing a new exhibit is the design. There are many aspects that must be considered when designing an exhibit, including accuracy, brevity, unity, clarity, and interest (Hull & Jones, 1961). All graphics and experimental material included in the exhibit must be accurate and relevant to the topic. Experimental exhibits accurately educate the visitors by allowing them to both succeed and fail in experimental process. The brevity of an exhibit is often difficult to determine but always a necessary consideration. Exhibit designers must realize that it is impossible to illustrate every detail of a subject, thus they must include only the most important topics. The unity of an exhibit refers to the logical sequence of each part of the exhibit. Each section must have a purpose, supporting data, and final conclusions (Hull & Jones, 1961). All text and graphics must have a high degree of clarity. Lettering must be clear, highly visible, and spaced adequately to ensure that all visitors understand it. The arrangement of the text, graphics, models, specimens, and colors is crucial in communicating the content of the exhibit to the visitors. In all cases, the interest level is dependent on all of the other factors, as well as the relevance and importance of the material.

Space availability is an important consideration in the design of an exhibit, as is cost of the exhibit. The available space includes, not only the floor space, but also the wall space that is available for graphics and text. Shelves and counters must be constructed at a height that is accessible to all visitors. From top to bottom, the vertical space should include areas for titles and subtitles, large headings, the main exhibit area, counters or shelves, and finally, unusable space (Hull & Jones, 1961). In the considera-

tion of all of these aspects, it is important to bear in mind the cost of implementing the potential design.

The effectiveness of an exhibit is greatly increased when appropriate and attractive lighting is installed. The intensity of light on graphics and displays should be increased in some areas to highlight their importance. If there are windows in the exhibit, then sunlight, and its changes throughout the day, must be accounted for. Usually, when museums do have windows, they are usually partially covered because they allow too much lighting in morning hours and create shadows in the evening. Some general rules for lighting include: the source of light should be hidden, the shadows of an object should not be in front, and the light should be of such quality that the colors remain in proper relation to one another (Hull & Jones, 1961).

The type of light is also a consideration. Fluorescent lights are available in white or blue. A benefit of these types of lights is that only a small amount of heat is produced. Polarized light, ultraviolet light, and black light are often used to create special effects within an exhibit. An advantage of floodlights is the illumination of a large portion of the exhibit (Hull & Jones, 1961). The main disadvantage, however, is that they cause large shadows because of their size and distance from the exhibit. In other instances, spotlights may be used to emphasize important aspects of the exhibit. Mirrors are also useful to illuminate exhibits by projecting light to particular areas of interest. One of the most prevalent concerns with the use of lighting is the reflection and glare caused by lighting on framed graphics. To avoid this, it is best to avoid covering them with glass or plastic (Hull & Jones, 1961). Not only does the lack of covering reduce reflection and glare, but it also reduces the cost of such items.

The use of words in exhibit explanations must be evaluated both qualitatively and quantitatively. Titles are necessary to express the content of the exhibit. Nevertheless, lengthy titles or titles containing scientific terminology generally fail to catch the interest of the visitors: “A good title states the subject of the exhibit story clearly and tersely” (Hull & Jones, 1961). Decisions on the size and color of the text are left to the judgment and good taste of the exhibit designers. Titles and headings should be larger than all other text in the exhibit, but should not have over-large or billboard type lettering. The size of the title should harmonize with the rest of the exhibit (Hull & Jones, 1961). Also, the lettering of titles and headings should be all upper case to improve the clarity of the text.

Exhibits often require clear and concise explanations to enhance the meaning and significance of the presented topic. The placement, size, and quality of the text must be carefully considered. The legends and labels necessary to describe graphics, models, and specimens should be placed either directly below or adjacent to the subject. These require smaller text than that of the body of the exhibit, and should be written with a combination of lower case and capital letters. Readability is always necessary and should not be sacrificed in any case (Hull & Jones, 1961). The size and style of the lettering also affects its readability. ‘Hand lettering’ font is generally most legible for all wording in an exhibit, while typewritten and fancy lettering are avoided due to their low legibility when enlarged.

Another important factor is color, which makes the content of the exhibit more appealing and easier to understand. In some cases, important words and graphics are emphasized with the addition of color. However, color should not be added indiscrimi-

nately, it must be used only where appropriate. One disadvantage of using color is that excess color detracts from the exhibit.

2.10 Interaction in Education

It is commonly assumed that the best method of teaching is instruction. However, it has been proven that children learn better by actively participating in the learning process. Active participation requires the use of many senses, while instruction requires the use of only listening. By requiring the use of several senses the child absorbs material in many different ways simultaneously, thus increasing his or her retention. Also, in allowing the children to actively touch and move the components, they focus more on the content of the exhibit. This often inspires more varied questions, which, in turn, leads to an increased understanding of all of the material.

By permitting children to interact with the exhibits, they acquire more knowledge than by merely viewing a display (Cohen, 1989). In order to maximize the educational potential of an exhibit there are several situations that should be avoided. For example, exhibits should refrain from using imitative interactions, or activities that require the child to listen to an explanation or discussion without being allowed to explore their surroundings. Similarly, exhibits with confusing or unclear objectives should be discouraged. If the expected behaviors or outcomes are not apparent, it may create difficulties for the child. Exhibits should reflect, in some manner, the life-like experiences of the participants. However, a demand for sustained attention span or high level of persistence on the part of the child should also be discouraged. Most importantly, because prior knowledge of a subject cannot be assumed in a museum environment, exhibits should not

be designed for children already possessing a given level of understanding (Cohen, 1989). A successful exhibit, while allowing for many types of interaction, will include a variety of age appropriate activities that appeal to several senses simultaneously (Cohen, 1989).

2.11 Shared Learning: Parent and Child

The wide range of difficulty in activities allows museums to become multigenerational learning centers. Adults, in addition to children, are encouraged to participate in the exhibits and become involved in the learning processes of children. Many museum settings allow adults to learn while informally educating the younger generation (Farmer, 1995). “For the involved adult learner, museums may re-ignite a long forgotten dream, a postponed interest, or even a misplaced curiosity” (Cohen, 1989). This often leads to a rekindled enthusiasm for a given topic in adults. Children tend to follow the example set by their parents and, when the parent is interested in the subject, it often sparks a deeper interest in the child. Children also learn better when there is family involvement in the experience (Cohen, 1989). Interaction between children and adults creates a positive educational environment and an opportunity for the parent and child to bond.

2.12 In-depth Learning in a Museum Environment

Although entertainment is a consideration in the design of exhibitions, education also plays a significant factor. The objective of science exhibits is to create a fun learning environment. However, it is often difficult to develop in-depth educational experiences in an exhibit because often visitors “are in a ‘leisure time’ frame of mind” (Schau-

ble and Bartlett, 1997). This means that they are visiting the museum for the purpose of seeing a variety of exhibits that explore a multitude of subjects. Due to this, museums offer a large number of separate and distinct exhibits. This often serves as a barrier to visitors, preventing them from engaging in deep exploration of any one subject (Schauble and Bartlett, 1997). Large amounts of in-depth material cannot be adequately processed in a short period of time, and many visitors do not have the time to invest in discovering, in detail, all of the educational attributes an exhibit may have. For this reason, it is often difficult for museums to create exhibits that cater to both the casual visitor and the one who would like to learn every detail of the subject. One suggestion is to adopt what many museum specialists refer to as the ‘funnel approach’ (Schauble and Bartlett, 1997).

The funnel approach “features a wide array of options at entry level for browsing visitors and successively narrower and deeper learning options for visitors who elect to spend more time and more focused participation” in a given subject area (Schauble and Bartlett, 1997). The major exhibit components are designed to immediately pull the visitors into activities that highlight significant scientific ideas. It is recommended that this entry level material focus on concepts that can be learned cumulatively and whose understanding does not require radical insights. However, there are also quieter, more restricted areas where visitors can go beyond the initial features of the exhibit and delve into deeper experimentation of slightly more complex ideas and concepts than presented in the exhibit. For repeat visitors who wish to explore a subject even further, activities and experiments are designed to bring these ideas into other contexts, such as the child’s home. Visitors may have the option of borrowing materials from the museum to further

experiment on their own (Schauble and Bartlett, 1997). This method allows for both casual and in-depth learning experiences in the same exhibit.

There are several examples of how the educational value of an exhibit is successfully layered through the funnel approach. One exhibition at the Children's Museum of Indianapolis, called 'The Creek', consists of a large water stream table that allows for experimentation with turbulence, buoyancy, and flow (Schauble and Bartlett, 1997). Visitors interact with this exhibit by building and racing model boats, and working with canal locks. Children also experiment with building and testing systems of pipes and valves in various ways to move water from one part of the stream to another by maneuvering around obstacles with the use of paddlewheels, pumps, etc. In the deeper learning area, referred to as the 'Dock Shop,' visitors learn about the aspects of boat design and its effect on performance by building boats from provided instructions or from their own design. While the entry-level components are not lacking in either education or interaction, the secondary level components allow the participants to go much further in-depth (Schauble and Bartlett, 1997).

A second example of this type of exhibit, entitled 'Nature's Backyard,' takes an idea with which many children are at least somewhat familiar and makes it more intriguing. The entry-level components, designed to simulate a child's backyard, include a freshwater pond, complete with live plants and animals, and a watershed table and rain-maker. To enhance the interaction between the child and the exhibit, there is a rock-climbing wall, the base of which simulates a fossil dig, where children can find, identify, and catalog fossils. There is also a crawl-through in which visitors can explore the habitats of underground animals. On the secondary level of this exhibit, called Nature's

Workshops, materials are provided to further aid the understanding of the animals in that environment including microscopes with both prepared and blank slides, which allow children to view the microscopic aspects of the habitat (Schauble and Bartlett, 1997). Through the fun and interactive play in these exhibits children acquire new knowledge.

The funnel approach to museum exhibits primarily emphasizes the educational necessity in the exhibitions, while stressing the benefit of interactive learning. Interaction is not only a key element in maintaining the attention of children, but also in teaching them the basic concepts of science.

2.13 Education Through Experimentation

Although exhibits frequently do not cover all there is to know about a subject, they generally inspire the visitor to formulate questions and seek further information or explanations. One technique to allow for more open-ended exploration is the development of exhibits resembling “working laboratories, where visitors can pursue their own short research projects and find their own answers to questions they themselves pose” (Bell, 1997). The benefit of this type of exhibit is not the content of the knowledge the visitor takes home, but rather the process by which that knowledge is obtained. The visitors could easily learn this material through textbooks, but in these exhibits they learn the methods for finding the answers to their own questions. “Visitors stay longer at experiment benches than at the museum’s more traditional interactive exhibits” (Bell, 1997).

However, the open-ended nature of these exhibits often causes some difficulty for the visitor. When there are too many options, the visitor may not know how to approach

the experiment. To make it easier for the participant, it is helpful to provide some instruction for experiments of varying difficulty. This provides guidance for those who may need assistance, while allowing those who are more creative to design their own tests. This type of exhibit “focuses on the skills associated with conducting an experiment: asking questions, formulating a hypothesis, planning and carrying out a procedure, collecting data, analyzing evidence, and drawing conclusions” (Bell, 1997).

2.14 Educational Content in Exhibits

Children’s Museums must often design exhibits appropriate for many age levels. This often creates a problem when attempting to integrate education into the exhibit because children have variant skills at different age levels. The material must be simple enough for children as young as six to comprehend, yet in-depth enough to maintain the interest of a fourteen year-old. Although museums generally create specific guidelines regarding the material content displayed in an exhibit, the presentation of this material determines the appropriateness for each age group. The same basic facts must be presented differently across the entire age range. The new exhibit for the Costa Rican Children’s Museum focuses on the living creatures of the world.

2.15 Background: Living Creatures of the World

The “Los Seres Vivos” exhibit in the Costa Rican children’s museum focuses on the five kingdoms of living creatures and the interactions between each.

2.15.1 Diversity of Living Creatures

The number of different species of living creatures on the earth is high. Many of the species are closely related and thus sometimes are difficult to distinguish from one another. To clearly delineate these species and have an accurate and consistent method of classification, natural taxonomy is utilized. Taxonomy is defined as any system of classification for organisms, usually by means of similarities and differences according to established rules. Natural taxonomy is a method of classification that reflects the evolutionary relationships of organisms. This process is also known as systematics (Booolootian & Stiles, 1981).

In 350 B.C., Aristotle arranged the animal world into a hierarchy, which is a graded series in which one category is ranked above another. This was the first system of classification. However these advances were largely forgotten until the sixteenth and seventeenth centuries. It was then that John Ray, an Englishman, classified about 18,600 species of plants according to general anatomical organization, and then did the same for animals. Shortly after, Carl Linnaeus, a Swede, devised a classification method that is still fundamentally used today. The current taxonomic system is based on evolution and focuses on the genetic relationships between creatures. According to this system, the living world is divided into five kingdoms. Each kingdom is divided into phyla, which, in turn, are divided into classes, and then orders. Each order is divided into families, which are then divided into genera. Each genus is divided into species. A species is comprised of only one type of animal, all genetically the same and potentially freely interbreeding organisms that are isolated from other such groups. A genus includes one or more species that have an assumed common phylogenic origin as expressed by many

shared characteristics, this set of species is distinct from all other genera. A phylum is a group of plants or animals sharing a common body plan (Booolootian & Stiles, 1981). Although each of the five kingdoms is different, they are all made up of the same basic cellular components.

All life is made up of cells, whether it is a single celled organism or complex and multicellular. Cells are the building blocks of life, which together comprise tissues. Tissues make up organs, which in turn form systems, and the systems together form an organism. The simplest cell type is a prokaryote, which lacks a membrane bound nucleus. Most bacteria are prokaryotic. The second cell type is a eukaryote, which does contain a membrane bound nucleus. It is widely believed that eukaryotes evolved from the endosymbiosis of other prokaryotic cells, which means that a separate, smaller cell was engulfed by a first. This second cell performs a distinct function within the first. Unlike prokaryotic cells, eukaryotes possess the ability to reproduce sexually, which allows for genetic recombination and thus perpetuates evolution. Prokaryotes reproduce by binary fission, which is the splitting of a single cell into two. Eukaryotic and prokaryotic cells also differ in size. A typical prokaryotic cell is approximately one micrometer in diameter, while a eukaryotic cell can be up to ten times that size. Although most eukaryotes still thrive as single celled organisms, many now live in colonies. In these colonies, individual members take on specific duties imperative for the survival of the whole colony. For example, some cells work specifically to digest food for energy while others work for respiratory functions. This colonization eventually led to the evolution of tissues, organs and complex organisms (Raven & Johnson, 1996).

2.15.2 Kingdom Monera

This kingdom is made up prokaryotic organisms, which include all bacteria and viruses. Viruses are strands of nucleic acid that are encased within a protein coat. They cannot grow or replicate on their own, rather they require a host cell in which to regenerate. For this reason, viruses are not technically considered to be living organisms.

Viruses are very small in size, ranging from seventeen nanometers to approximately 1000 nanometers in diameter, thus they are not visible through light microscopes. Viruses reproduce upon entering a host cell, where they utilize the cellular components within. The genes carried by the virus are translated in the host cell to create proteins that lead to the mass production of more viruses. Many diseases are caused by viruses including smallpox, chicken pox, measles, encephalitis, influenza, yellow fever, polio, rabies, and AIDS. These viruses can be passed between organisms in a variety of manners, but many are prevented through vaccination, which is the process of injecting a harmless or dead strain of virus into the bloodstream. This forces the body to form antibodies against the virus, which allow the body to combat the harmful disease if it enters the bloodstream at a later date (Raven & Johnson, 1996).

Bacteria, the most abundant of all living organisms, are the oldest and simplest forms of life on earth. Bacteria are very diverse and live in a large range of environments. Many are autotrophic, meaning they make their own energy supply from chemicals or light, and make significant contributions to the carbon balance in the earth's soil, freshwater, and marine environments. Others are heterotrophic, meaning they gain their energy supply from outside sources, and break down organic compounds. Some heterotrophic bacteria cause disease in plants and animals. However, they also have many

benefits, such as food production and antibiotics. Generally, bacteria are simple in shape, and are classified as either bacilli (rod-shaped), cocci (spherical), or spirilla (spirally coiled) (Raven & Johnson, 1996).

2.15.3 Kingdom Protista

This kingdom is made up of eukaryotic organisms that are generally unicellular. Although some form multicellular colonies, they are usually independent and never form tissues. The members of this kingdom do not necessarily share significant characteristics. They are linked by the lack of specialized traits present in the other kingdoms. Protists that contain chloroplasts are autotrophic and are informally called algae. Heterotrophic organisms in this kingdom are collectively called protozoa. Due to the wide variety of organisms in this kingdom, there are no consistent characteristics for reproduction, nutrition, and mobility. Some protists reproduce by binary fission, while others reproduce sexually. While some make their own food photosynthetically, others must obtain their food from other organisms. The methods of locomotion also vary. Amoebas, for example, move through the use of pseudopodia, which are flowing projections of cytoplasm that extend and pull the amoeba forward. Euglenas, on the other hand, move with the help of a single flagellum, which is similar to a tail that whips through the water and propels the organism forward. A third method of mobility that is utilized by paramecium are cilia, which are little hair-like appendages that completely surround the cell and beat together to move the cell forward (Raven & Johnson, 1996).

2.15.4 Kingdom Fungi

This kingdom is made up of multicellular eukaryotic organisms. They are similar to plants, but the lack of chlorophyll separates them from the Plantae Kingdom. Many fungi are harmful because they cause decay and destroy many materials to obtain food. They also cause disease in plants, animals and humans. Other fungi are extremely useful in the production of foods, such as yeast, and as antibiotics, such as penicillin. Fungi obtain their food by decomposing both living and dead organic material. They exist primarily in the form of long slender filaments, called hyphae, which are usually not visible to the naked eye. A mass of hyphae is called mycelium, which makes up the body of a fungus. In the sexual reproduction of fungi, the hyphae of two genetically different mating types fuse together. Another common form of reproduction in this kingdom is by the production of spores. When the spores are released and land in an appropriate environment they germinate and form a new fungus (Raven & Johnson, 1996).

2.15.5 Kingdom Plantae

This kingdom is made up of multicellular eukaryotic organisms that have cellulose rich cell walls and chloroplasts. There are two main categories in this kingdom. First are vascular plants, which refer to all plants that have water and food conducting strands in their roots and stems. The second is bryophytes, which lack the strands present in vascular plants. This category contains all mosses. Plants have several specialized parts that are not present in other cell types. First is the cell wall, which gives the plant structure and rigidity, and also prevents it from falling down. Second are the chloroplasts, which are involved in photosynthesis, the process of converting sunlight into en-

ergy and producing oxygen from carbon dioxide. This process is important for all other life because all life depends on oxygen for respiration.

Plants are an important source of food for most of the animal kingdom. They are the lowest members of the food chain because they produce their own nourishment and do not rely on other organisms for survival. Plants reproduce sexually when the pollen of one plant enters another. The seed is then released so that it may grow into a new plant. There are two types of seed producing plants. First are the gymnosperms, which refer to plants that have their ovules (area where the seed is produced) exposed during pollination. This group includes pines and spruces as well as many other plant types. The second type is the angiosperm, which refers to flowering plants that have their ovules enclosed by tissues. In these plants the pollen is brought to the ovule by the stigmata (Raven & Johnson, 1996).

2.15.6 Kingdom Animalia

The animal kingdom is comprised of thirty-five diverse phyla, however all share three things in common. They are all heterotrophic, multicellular organisms that develop from embryos. Most animals are invertebrates, meaning they lack a backbone. Approximately one percent of all animals are vertebrates, which have a backbone, distinct skull, and brain. Animals are unique in that they are able to move rapidly and in complex manners that include flying. Most reproduce sexually. The animal kingdom is a diverse group that has adaptations to fit many environments. This kingdom has developed a variety of appendages for moving from one place to another (legs, wings, and tentacles) and

also for moving objects in the world around them. Other adaptations include lungs and gills, both of which are used for respiration and many others (Raven & Johnson, 1996).

2.16 Educational Funding of Exhibits

To implement an improved interactive “Los Seres Vivos” exhibit is expensive. If it were left to El Museo de los Niños alone to fund this exhibit, it would be nearly impossible because the majority of its support is from outside sources. For this reason outside grants are often sought. A grant provides funding for a specific project that meets the requirements and expectations of the grantor. However, there is generally a large amount of freedom with respect to how the project is completed. Grants require a written proposal of the project plans, the approximated time until completion and, most importantly, an estimate of all costs. Education is considered an important and worthy cause for support that is recognized by most agencies. Therefore, El Museo de los Niños has limitless possibilities of available funding, since its primary focus is education. These funds, primarily grants, are available from a variety of sources.

2.17 Corporate and Foundation Grants

A public foundation is defined as “a non-governmental, non-profit organization with funds and programs managed by its own trustees or directors and established to maintain or aid social, educational, charitable, religious or other activities serving the common welfare, primarily through the making of grants” (Margolin, 1983 pg. 108). The primary difference between governmental and private funds is the number of restrictions in the guidelines for the grant proposal (Bauer, 1984). Private foundations have less need

for extensive forms and interviews. They rely on a trustee board to review grant proposals and determine which projects to fund. Moreover, private organizations maintain the right to grant funds to whomever they select. Generally foundations contribute ten percent of their annual charity budget for each accepted proposal (Bauer, 1984).

Corporate donations in United States have steadily increased because there are many ways to receive tax exemptions for these contributions (Bauer, 1984). Many corporations fund projects that benefit the company, workers, or appeal to consumers. Some critics argue that the potential benefits for the company take precedence over assisting an organization (Bauer, 1984).

2.18 Grant Proposals

There are several steps involved in completing a final grant proposal. The proposal must clearly explain the problem and potential resolution, both of which must comply with the given guidelines. These guidelines are usually obtained in the initial contact with the organization (Quick, 1999), which should include a brief statement of objectives, description of the project, and the potential benefits for the company. Common guidelines for all proposals include:

- Eligibility: Is the organization legally eligible to receive funds?
- Geography: Are there any geographical limitations?
- Subject: Does the content of the project comply with the organization's guidelines?
- Budget: Will the grant adequately support the budget necessary for the project?

- Materials: What types of materials is the organization willing to cover?
- Duration: Will the organization provide funding for the full duration of the project?
- Deadline: Will the proposal be completed on time (Quick, 1999)?

Upon finalization of the project details, the proposal must be drafted in compliance with all guidelines and deadlines. Proposal guidelines vary greatly between companies, therefore each requires separate attention. However, the description of the problem and proposed solution should remain consistent in each.

3.0 METHODOLOGY

As mentioned previously, there are two main objectives in completing this project: 1) To create a new design for “Los Seres Vivos” exhibit and, 2) To prepare the necessary guidelines for the museum to obtain funding for the implementation of this design. In addition, we have developed several secondary objectives on which to focus during this project: 1) To evaluate the existing exhibit, 2) To compile the educational and cultural content for inclusion with each exhibit component, and 3) To estimate the cost of the implementation of our proposed design. This chapter describes the methodology that our team employed to meet each of these objectives.

3.1 Exhibit Design Propositions: *Prior to seeking funding, an exhibit design was completed.*

3.1.1 Determine Available Space

Since the new design of “Los Seres Vivos” will occupy the same space as the existing exhibit, the architectural floor plans were accessed and viewed to establish the precise dimensions of the area. With these plans, a design was developed to fit within each section of the available space. To ensure this, it was necessary to observe the area to assess the structure of the walls, floor, and ceiling in order to utilize each to its fullest potential. Our team then proceeded to discuss the reconstruction possibilities for the existing area with the museum directors.

3.1.2 Analyze the Existing “Los Seres Vivos” Exhibit

The existing exhibit must be redesigned to include a greater number of interactive components, and increase the children’s interest in the exhibit. To determine which areas must be altered, the exhibit sections were evaluated. Initially, our team observed the interactions of the children with the exhibit. This demonstrated which components are most appealing and interactive. Based on these observations we determined which areas needed to be redesigned or updated.

3.1.3 Survey Museum Assistants

Since the museum assistants view the children’s interactions with the exhibits on a daily basis, they were given a survey. This was administered in written Spanish to avoid the language barrier. The responses to this survey gave insight to the interests of the children. The responses provided by the assistants established which exhibits and interactive components children utilize most frequently. These results allowed our team to include the interactive and atmosphere components that children enjoy most, while excluding those that were not appealing. It also inquired about the assistants’ personal suggestions for the redesign of “Los Seres Vivos.” These suggestions served as ideas for consideration in our team’s design. Upon creation of the survey questions, they were approved by the museum director. Of the approximately forty museum assistants who work in El Museo de los Niños, twenty were randomly selected to complete the survey.

3.1.4 Compile Necessary Exhibit Components

The first step in designing an exhibit is the review of the required thematic specifications. These specifications are outlined in the educational guidelines set forth by the Costa Rican Ministry of Education and the educational guidelines (Appendix B) created by the museum for each exhibit. Several meetings with the museum's teams of designers determined the general layout and interactive components expected in the new exhibit. The design team is composed of professional exhibit designers and several of the museum assistants. By combining their expertise, previous research, and the subject of the exhibit, an innovative interactive exhibit design was created. The term design, as applied to this project, refers to the collection of ideas and recommendations for elements to be included in the exhibit. It does not, however, consist of formalized architectural plans or a precise layout of each detail.

3.1.5 Formulate Design Possibilities

After the overall components of the exhibit had been determined with the design team, it was necessary to further develop the details. Many informal meetings were held among the project team members to discuss the potential design options. These discussions allowed our team to develop many general ideas and later detail several design outlines. The feasibility of the design was determined by the cost and availability of the necessary materials, as these were the primary constraints of exhibit construction. This was evaluated for each material using catalogs and internet databases. Based on this research, implausible ideas were eliminated. Our final design proposal will be further researched and developed by the professional design staff in the museum.

3.1.6 Finalize Design Proposal

A finalized design proposal was created from the various design ideas formulated. This design proposal outlined all of the features in the exhibit while highlighting the educational content in each. This content was researched on the internet and in local libraries. The design proposal describes the manner in which each component will be utilized by the children, and the instructions to be administered by the museum assistants. These instructions provide detailed information about the exhibit content. However, the presentation of these is left to the discretion of the assistant. In addition, the design include an informal layout of the components, which are displayed through illustrations and a three-dimensional model. The model, made primarily from cardboard and construction paper, serves to visually divide the exhibit area into its thematic sections and depicts general, rather than specific, features. Through the comprehensive outline, the model, and the illustrations, a clear picture of the design ideas was developed. The museum's professional design team will work with contractors to develop the formal layouts and plans for construction based on these recommendations.

3.1.7 Present Proposal for Approval

The exhibit design must fulfill all of the requirements, both aesthetic and academic, set forth by the museum. This means that it must include all of the educational content deemed necessary, be visually appealing to children, and include interaction to fit all needs of the museum. To ensure this, the finalized design proposal was presented to the museum directors for approval. This presentation included the description, model, and illustrations as indicated above, as well as an in-depth explanation for the inclusion

of each component and the exclusion of alternative ideas. Based on this information the directors were given the opportunity to critique and offer suggestions for the improvement of the potential design. With these recommendations, the design was altered to best suit the expectations of the museum.

3.1.8 Outline Educational Material

Upon approval of the proposed design, the educational value of implementing the design was assessed. A broad overview of the knowledge that the children will gain by interacting with this exhibit included an explanation of the benefits of having this particular environment. Further details provided an in-depth description of the educational content for each specific component within the exhibit. This information was obtained by researching each detail using encyclopedias, textbooks, and internet resources.

3.1.9 Estimate Cost of Implementation

A preliminary estimate of the cost of implementing this proposed design was provided for the museum. The first step in assessing the cost was to speak with a professional exhibit designer, who is familiar with the process of creating a budget and obtaining materials. Based on the advice of this professional, we contacted several companies that specialize in many areas. Among the costs investigated were the reconstruction, animatronics, molded plastics, and flooring alternatives. With the information provided by these companies, a preliminary cost estimate was created to ensure the feasibility of the design. This estimate is a starting point from which the museum will develop the final budget for the implementation of the design.

3.2 Possible Funding: After completing the design, the funding for its implementation was sought.

3.2.1 Review Previous Sources of Funding

The financial department of the museum maintains records of all companies and individuals that have contributed to the museum or to particular exhibits since its inception. Through the initial viewing of these records, an overall conception of the types of companies willing to donate to the museum was obtained. It is also important to exclude companies that have once donated funds or materials from future solicitations because most continue to donate on a regular basis.

3.2.2 Compile Possible Sources of Funding

Since the government currently provides the museum with an annual budget and funding for several other projects, its assistance was not pursued. At the request of our liaison, emphasis was placed on United States based companies with branches in Costa Rica for financial donations. Due to the biological aspects of this exhibit and its focus on the rainforest, biological companies were also a primary focus. Costa Rican based companies were sought for possible donations of materials. A listing of these companies was compiled based on a search of Costa Rican directories and internet listings, which has served as the primary basis for this investigation.

3.2.3 Search for Contact Information

Once a preliminary list of potential donors was compiled, the contact information for each was obtained. The internet and local directories were utilized to determine either the email address or phone or fax number of the public relations department. This department provided guidelines for the grant proposal process. The initial proposal statement was sent or faxed to the address supplied in the guidelines.

3.2.4 Contact Companies with Proposal Statement

Successful contact, through a proposal statement, with the donating company is one of the most important steps in obtaining funds. The proposal statement included a brief overview of the goals of the museum, the objectives of the project, and benefits for the company. It also requested further information regarding the grant application process. Since this was not the final grant proposal, the letter was clear and concise while revealing interest in the company's financial assistance. This statement was composed on formal letterhead and provided the necessary information for the company to contact the museum upon review.

3.2.5 Prepare Guidelines of Grant Proposal for Museum Staff

The final grant proposals contain all of the specific details required by the company to determine the allocation of funds. The grant proposals submitted by the museum must adhere to the guidelines specified by the company. Due to the length of time required for the company to respond to the initial proposal statement, the museum's staff must complete the final grant proposal after the project team's departure. This time will allow the museum to complete all of the necessary requirements such as the detailed

budget and list of necessary materials. To assist in the completion of the final grant proposals, the museum has been provided with a detailed outline for inclusion in each proposal. This outline included the problem statement and the projected solution. The specific guidelines for each company have been clearly outlined for individual proposals. Upon the acceptance of the initial proposal statements, the museum must complete the final grant proposals in accordance with the outlined specifications.

4.0 DATA PRESENTATION AND ANALYSIS

Using the methods described above, our team collected a variety of data, which was analyzed and organized to formulate recommendations for the design and potential funding of this exhibit. This chapter describes the data we collected and the results of the analyses.

4.1 The Existing “Los Seres Vivos” Exhibit

The current “Los Seres Vivos” exhibit, designed in 1991, is among the oldest in the museum. Now nine years old, it lacks the interactive qualities that are essential in the newer areas of the museum. The existing components include a stereoscope, an animal cell model, nine insect display cases, a DNA strand, a terrarium with a live turtle, goldfish, and snakes, and a mural of children’s faces.



Figure 4-1: Stereoscope

The first area of the exhibit contains a stereoscope with large plated insects for magnification. The machine is difficult to operate because the buttons do not work properly, preventing the stereoscope from focusing. The slides of insects are easily viewed without magnification, thus making the

stereoscope unnecessary.

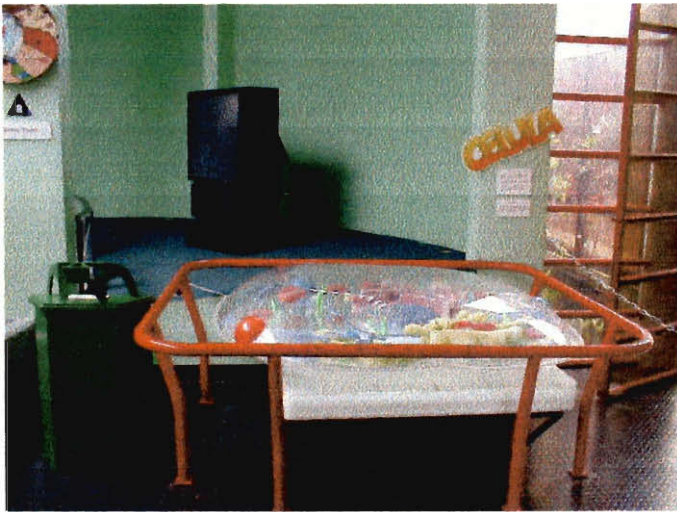


Figure 4-2: Amoeba Cell

Near the stereoscope, there is a large model animal cell, which shows the parts of the cell, but lacks labels and interactive qualities. A large plastic bubble and railing surround it, preventing the children from touching the cellular components. The cell is not clearly labeled as an animal cell,

and also lacks a description of its role as a single-celled organism. The majority of children display little interest in the cell.



Figure 4-3: Insect Display Cases

Along the downward curved path of the exhibit is a collection of display cases housing many types of insects, both preserved and molded plastic. The children may not be able distinguish the different species because they are not properly labeled. The

model insects are often incorrect

sizes and do not appear lifelike.



Figure 4-4: DNA Strand

the strand, however they do not learn of its importance because it is not interactive and no explanation is provided.

Further down the ramp lies an area containing live animals. Four tanks contain various animals, which include snakes, a turtle and fish. The two snakes and the turtle are in adjacent terrariums. The Plexiglas used for the terrariums is damaged due to the

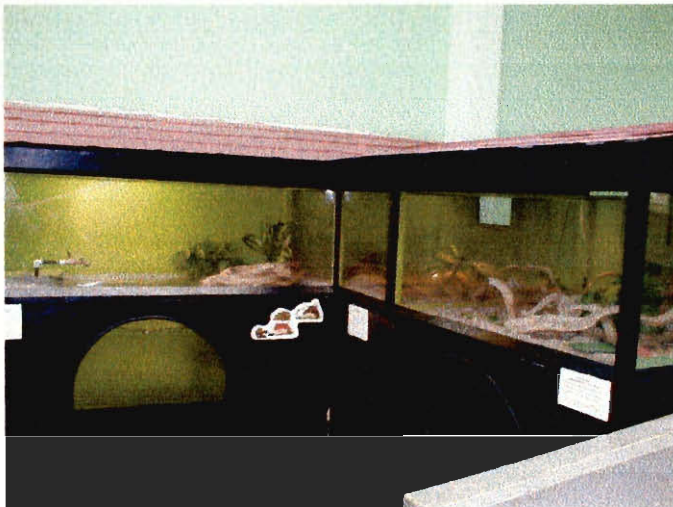


Figure 4-5: Live Animal Terrariums

As the children progress down the ramp they view a DNA strand, which spirals down from the ceiling at the center of the ramp and attracts attention with its large size and colors. The children observe the structure of

children tapping and scratching the glass, which also agitates the animals. Opposite the reptiles, in a small fish tank, reside two goldfish. A video camera and television lie on the top of the tank. The camera no longer projects onto the television and there is no labeling on the fish tank. While the chil-

dren enjoy looking at the snakes and turtle, information about the animals and their habitats is lacking.



Figure 4-6: Mural of Children's Pictures

At the base of the ramp there is a large mural that consists of a variety of pictures of Costa Rican children. As with many of the other components, this mural lacks labeling and merely utilizes wall space. This final component of “Los Seres Vivos” does not contain any information about liv-

ing creatures. However, it does serve as a transition to the next exhibit about the human body.

4.1.1 Necessity of Change

Currently, “Los Seres Vivos” lacks many of the interactive qualities that successful exhibits possess. As illustrated above, the majority of the components do not actively involve children in the learning process, and others do not contain significant educational content. Although the museum prides itself on being an exciting learning environment, this exhibit does not currently meet its expectations. Most children, when observed in the exhibit, hurried through, pausing at the terrariums before continuing to the next exhibit. The redesign of this area will enable children to learn more about living creatures while enjoying its interactive nature.

4.2 Survey Results

The primary objective of the survey (Appendix C) administered to the museum assistants was to determine which exhibits visitors utilize most frequently. A description of the exhibit components that visitors find most appealing was also requested in this survey. Through the survey results it was determined that visitors are attracted by, not only the interactive components, but also the atmosphere created by special lighting, colors, and illustrations. Of the twenty surveyed museum assistants, approximately 80% referenced several of the same exhibits as being the most appealing to children. The comments provided by the assistants specified which components within each exhibit are most intriguing. According to the museum assistants, the most popular exhibits are “El Universo y el Sistema Solar,” “La Tierra,” “La Casa de las Torrejas,” “Luz y Color,” and “El Sueño Mágico.” Upon analysis of these exhibits it was noted that, although not all contained interactive components, in many cases the atmosphere gained the interest and attention of the children. This was evident because one of the mostly highly enjoyed exhibits, as stated by most of the assistants, is a space exhibit with few interactive components.

The exhibit entitled “El Universo y el Sistema Solar” (the Universe and the Solar System) is one of the museum’s more popular exhibits, as determined by the museum assistants. A large rotating universe, model rocket, and large pictures of Orion are among the attractive components included in this exhibit. Although there are few interactive components in the exhibit, the atmosphere of the room makes it a successful exhibit. Specialized lights, sounds, and pictures have been used to create an inviting atmosphere for the visitors.

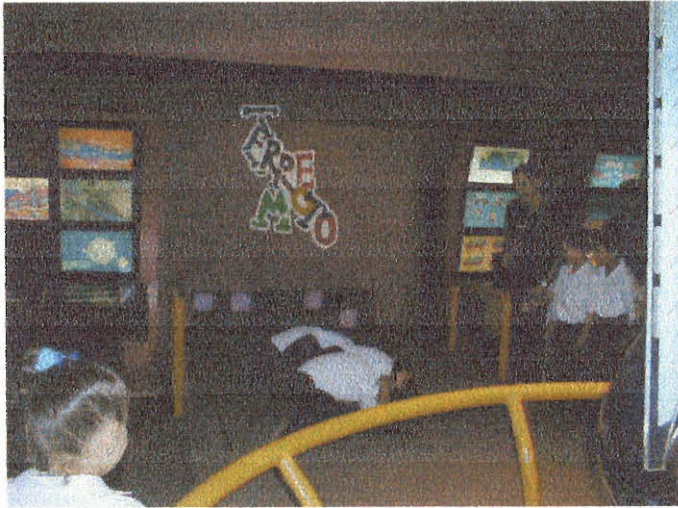


Figure 4-7: La Tierra Exhibit

simulator to experience the earthquake. In addition, there are blocks with which the visitors are able to build small structures on the simulator. They are then allowed to watch the way the buildings react to an earthquake.

“La Casa de las Torrejas” (the Equilibrium House) is a house with steeply slanted



Figure 4-8: La Casa de las Torrejas Exhibit

“La Tierra,” an exhibit concerning land formations, is also very popular. This is primarily due to the interactive component called the earthquake simulator. The simulator is approximately one square meter and moves in a sideways motion to replicate an earthquake. Visitors stand on the

floors. Only small groups are allowed into the house at one time, which causes a line of visitors to gather at its entrance. The house, located outside of the main building, is brightly painted and contains several interactive components such as a pool table, bed, and stairs. A museum assistant leads

the visitors through the house, providing facts about equilibrium. Since the floor is extremely slanted, the visitors view the pool table as slanted in the opposite direction of the floor. The museum assistant tests this theory by placing a ball on the table and allowing visitors to see the truth: the table tilts in the same direction as the floor. The next section of the house contains a bed placed along the same slant as the floor. Visitors are able to lie on the edge of the bed and attempt to perform a sit-up, which is difficult due to the slant. The final area of the house has two sets of stairs that the visitors attempt to walk over. Mirrors on the walls allow the visitors to see the awkwardness of their steps. The museum assistant provides educational information on the effects of equilibrium on objects and people.



Figure 4-9: Luz y Color Exhibit

The exhibit entitled “Luz y Color” (Light and Color) has a popular component called “Atrapá Tu Sombra,” which translates to “trap your shadow.” This component is supplemented with educational material, and serves as a fun, interactive use of light that complements the other topics in the exhibit.

A museum assistant instructs the visitors to stand in a creative pose as a light flashes over them. The wall behind the visitors then displays their shadows.

“El Sueño Mágico” (the Magic Dream) is a small exhibit designated for the youngest of the museum’s visitors. The entrance to the exhibit is a small door that leads



Figure 4-10: Sueño Mágico Exhibit

to a brightly colored area with toys. The murals on the wall are vibrantly painted and appeal to small children. Although there is no formal educational material in this exhibit, young children gain coordination and cooperation skills through play. The main objective of this exhibit is to entertain young children.

4.2.1 Design Elements

Although these exhibits vary greatly in content, each contains components that make them interesting and appealing to the children. These components are applied to the new “Los Seres Vivos” design. Atmosphere is an important element in several exhibits including “El Universo y el Sistema Solar.” Although this exhibit contains few interactive qualities, it is popular among children due to the space environment it creates. Interaction is also essential as the most successful interactive components are those that react to the visitors’ actions, such as the shadow area of “Luz y Color” and the earthquake simulator of “La Tierra.” These essential elements were considered in the new design of “Los Seres Vivos.”

In addition to requesting information about the most appealing exhibits, the survey also inquired about the museum assistants’ suggestions for the redesign of this exhibit. These suggestions served as considerations for inclusion in the compilation of ex-

hibit components. With the exception of only a few, the museum assistant staff commented that all available space should be utilized for the exhibit. Currently a large slanted area beside the walkway does not contain any exhibit components. To utilize this section, reconstruction may be necessary to create a more flattened area.

Most of the museum assistants also suggested that the redesign should include creatures and specimens from each of the five kingdoms of living creatures, rather than only insects and reptiles. Although there is a stereoscope in the exhibit, it includes only slides of insects. Their suggestions for this section included the use of scientific microscopes with sides of unicellular organisms from the Monera and Protista kingdoms.

4.3 Design Proposals

Several design possibilities were considered, two of which were developed in detail. Both proposals focus on the five kingdoms of living creatures, however, one presents each as a separate entity, while the other combines all five. The first design utilizes all available space without the need for reconstruction, but some restructuring of the exhibit layout is necessary for the second design. Both contain interactive, educational components, although they differ greatly from one another. More specific details of the final design proposal are included in the Conclusions and Recommendations chapter of this report.

Each design was developed to occupy all of the available space for the exhibit as shown in the floor layout, which is illustrated in Figure 4-11. The entrance to the exhibit area is shown on this layout as number one. The path is sloped slightly between points one and two, however, between areas three and eight the path is slanted with a greater

angle. The floor level of areas seven and eight are one story below the floor level of area number two.

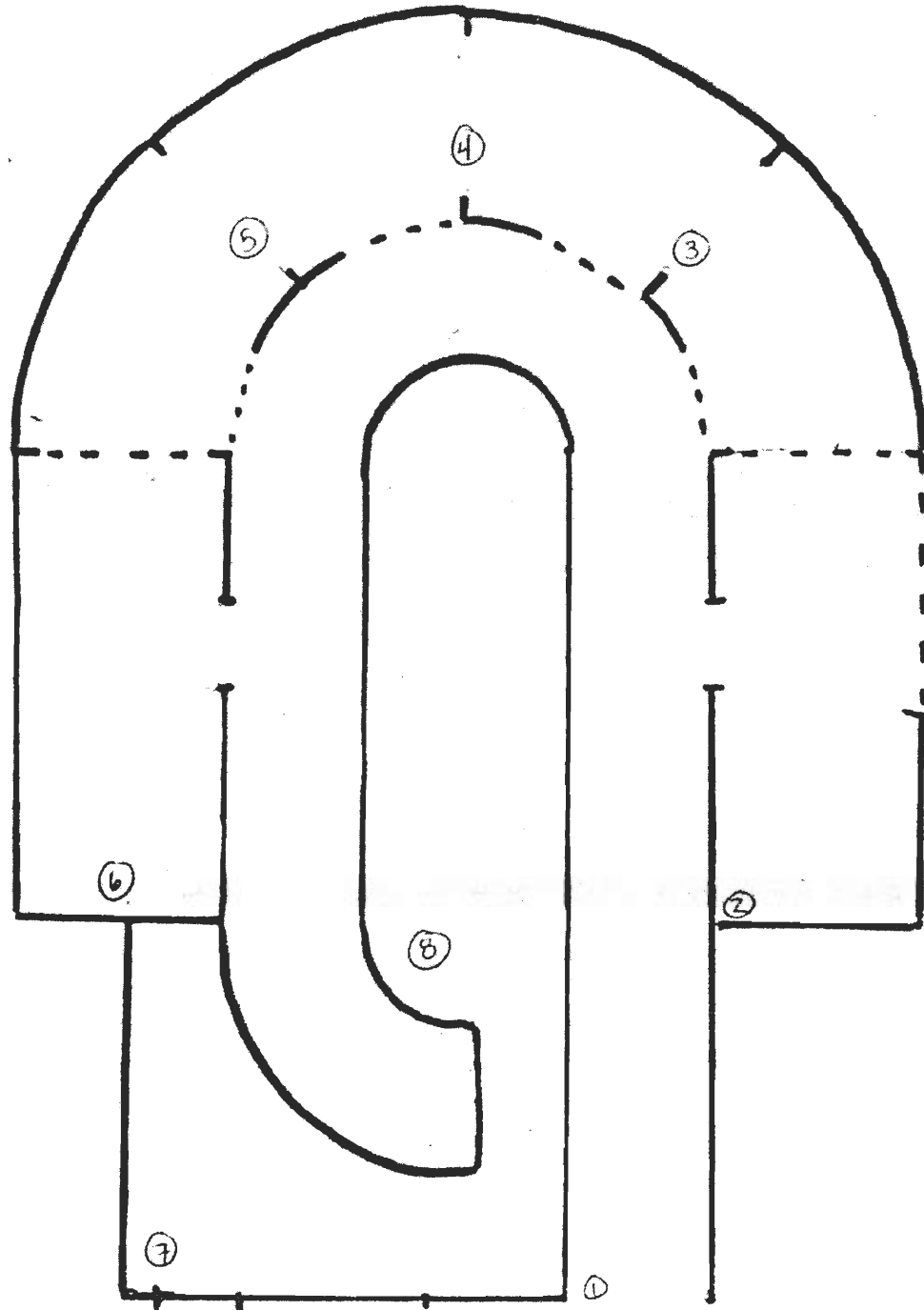


Figure 4-11: Floor Layout of "Los Seres Vivos"

4.3.1 Design One: Five Distinct Themes

In the first design, each of the five kingdoms of living creatures is given a distinct section within the available space and contains information pertaining specifically to each. This design was developed from the outline of required educational content for the exhibit provided by the museum and shown in Appendix B. Nonetheless, the outline separates the kingdoms and does not allow for connection between the themes. Based on this outline the design included seven areas: Monera/Protista, Fungi, Plantae, Animalia, a Live Animal area, Evolution (both Life and Human), and a Role Play area.

The section designated for the Monera and Protista kingdoms utilizes the area currently occupied by the stereoscope and animal cell model (area number two of the above floor plan). A laboratory area includes microscopes and slides of the microscopic organisms in these kingdoms. Normal microscopes are to be used by older children who have some understanding of their workings and more refined motor skill. An oversized microscope with moving parts demonstrates the concepts for younger children. We suggest displaying posters to illustrate the many uses of these organisms in common items such as bread, yogurt, beer, and medicines. Our team also recommended that information on the lives, diet, and movement of these organisms be provided. In this area the animal cell model of the existing exhibit is replaced with similar ones, both animal and plant, with more interactive qualities. Each takes the form of an oversized puzzle with movable pieces color-coded and labeled with descriptions of their functions.

The Fungi section (area three) of this first exhibit design utilizes all available wall space with posters depicting various types of fungi and their reproductive cycles. Enclosed in display cases are a variety of fungi including toadstools, regular mushrooms,

and other types, with attention given to those native to Costa Rica. Microscopes positioned on a lab bench allow children to examine the filament structure of the fungus. The many uses of fungi, such as decomposition and medicines, are also demonstrated in this area through pictures and descriptions.

The Plantae section (area four) contains different types of plants from around the world. The children discover the morphology and the role of plants in ecology. A large flower mounted low on the wall has removable parts revealing the inner structures of the plant. The reproductive and water transduction systems are depicted so that children may learn facts about each part of the plant and how it helps the plant survive. Small squeezable bottles contain various flower scents that the children use to identify flowers. We propose that samples of petals, leaves and bark are openly displayed allowing the textures to be felt. The photosynthesis process is displayed on the remaining wall space and shows how plants create and use energy. To better illustrate the manner of pollination, a video simulation would show how insects, birds, and wind aid in the reproduction cycle. Museum assistants should be in place to explain the importance of plants to the earth as the primary source of oxygen.

The Animalia section (area five) displays all types of animals and explains their roles in the ecosystem. Different types of furs and skins are openly displayed for the children to touch and connect with pictures above while headphones enable sounds of different animals to be heard. A mural of the primary phyla utilizes the wall space and shows the kingdom's hierarchy. Near this mural, children test their knowledge with a matching game by placing animals with the correct phyla. In addition, several types of insects are displayed in cases because children enjoy viewing these.

Children are generally fascinated with life, thus several live animals are included in this design. A small bee area consists of a clear enclosure to house the bees and a tube connects the hive to the open air outside the museum. This illustrates the way bees gather nectar from flowers to make honey. The social classes of bees, such as workers and the queen, are easily viewed. This exhibit teaches visitors about the complete social environment of bees.

A second live animal section focuses on aquatic life. A small tide pool, approximately twenty-five centimeters deep, houses various small sea creatures such as sea urchins, starfish, snails, and hermit crabs. The children touch these animals with assistance of a museum assistant who ensures that they do not mistreat the animals. Information about the diet, habitat, and ecological importance of these animals is provided while children interact with nature. Both animal sections are in area six as labeled in Figure 4-11.

Evolution is also a focus of this exhibit. Along the wall of the inner curve of the pathway is a pictorial timeline of evolution. Beginning with the first unicellular organisms, this line illustrates the changes of multicellular organisms into complex creatures and finally humans. Although this section is not interactive in nature, it compliments the other, more prominent, areas of the exhibit while utilizing the open wall space. The section at the base of the ramp (area seven) illustrates human evolution through freestanding figures of apes to man.

The Role Play area (area eight) beneath the ramp is designed specifically for the youngest children. Here they learn about the habitats, lifestyles, and other details about animals through active play. To enhance the cultural aspect of the exhibit, this area fo-

cuses on the habitats of Costa Rica. The space is divided into two regions: the rainforest and the ocean.

The rainforest region is modeled after local forests, and includes trees and foliage to create the atmosphere. Painted walls mimicking forestry and model animals, such as frogs, birds, and monkeys, further complete this atmosphere. The children dress in costumes of common forest animals including monkeys, parrots, and frogs. These costumes would be contained in a small chest made to look like rainforest wood. Museum assistants instruct them on how the creatures interact with the environment. It is encouraged that the children act out the specific roles of each animal. Since the area is designed for the younger children, it is not required that they follow exact guidelines. Imagination is encouraged and, in addition to following the actions directed by the museum assistant, the children may develop their own games and interactions between themselves and other children acting as animals. Along with these costumes, which consist primarily of masks and aprons to cover the children's faces and clothing, there are puppets with which the children play to inspire their interest in the creatures of the forest.

The ocean section focuses on aquatic life, particularly in Pacific and Caribbean waters. The walls are painted in shades of blue and green with bubbles and aquatic animals to create an oceanic atmosphere. An oversized plastic hermit crab shell contains the puppets and dress-up outfits that the children use to act out the lives of undersea creatures. A large rock, similar to the volcanic rock formations along the Costa Rican coast, is in the center for the children to climb on. This rock is made of durable yet soft plastic and is not dangerous. Blue cellophane material is draped over the top of the area to pro-

duce a blue tint in the lighting. The museum assistants provide similar instruction in this area as in the rainforest section.

4.3.2 Design Two: Unity of Themes

A second design possibility combines the five kingdoms in a more complex rainforest. A stronger cultural connection is drawn through the use of the Costa Rican rainforest. In addition to learning the components of each kingdom, the children learn the value of their country's ecosystem. The main sections of this exhibit include a laboratory, the rainforest, the subterranean life, and an area focusing on evolution. These sections flow into each other as the exhibit progresses down the ramp. The first section of the rainforest is a laboratory that includes the Monera and Protista kingdoms.

This laboratory (area two) is set within the forest region and is designed to simulate a small hut. A sign stating "Laboratorio" lies over the entrance, supported by a pole at each end. Two large-scale puzzles, animal and plant cells, display the differences between the two while defining the functions of their components.

Two large lab benches, located in the right corner of the room, contain microscopes and a television. A large microscope projects images onto the screen while four smaller microscopes are on the bench top for individual use. Several slides are available with various microorganism specimens. Upon examination the children identify each based on the large colored pictures on the walls. A brief description of the cellular function accompanies each. The slides are stained and fixed to accurately portray the organisms. Near the microscopes lie several Petri dishes showing colonies of bacteria strains with descriptions of their disadvantages and benefits. These dishes are sealed and contain

non-living organisms allowing the children to handle and examine them closely. This section of the exhibit teaches children about the many living creatures that cannot be seen with the naked eye.

The next area simulates a typical Costa Rican rainforest (areas three, four, and five), including plants, animals, and fungi. This section educates children about the interactions between plants, animals, and the environment, while increasing their sense of cultural awareness. The content of this section is presented in interactive components allowing the visitors to see, hear, touch, and experience the exhibit.

Important Costa Rican commerce products such as banana, coconut, and pineapple trees, are included in this exhibit. The national tree and flower are included to strengthen the cultural ties. Replicas of animals and insects are strategically placed throughout the rainforest in the areas they would live in the wild. Fungi are included throughout the forest accompanied by explanations of how it grows and their typical uses. These elements, when integrated, complete the atmosphere of the rainforest.

According to our design the existing slanted path must be reconstructed to create an upward slope around the curve of the exhibit. This slope is slight and, at its completion, is about one meter high. At the end of the rainforest section, which utilizes the entire upward slope, is a ramp leading to a subterranean section. The snakes and turtle from the existing exhibit are placed beside the ramp allowing visitors to view them both at ground level and from below.

The subterranean area (area six) is beneath the end of rainforest region. A cove, one meter high and the width of the forest area, creates an underground atmosphere with special lighting and wall paintings. Subterranean life is illustrated through an ant farm

and model tree roots. Information on subterranean life, including the importance of ants aerating the soil, which facilitates the growth of roots, is provided.

The base of the ramp (area seven) is reconstructed by removing the railing to open the area, which creates more space for the evolution section. The large wall is covered with a mural depicting the course of evolution beginning at the ceiling with earth's first unicellular organisms. The progression of evolution is shown moving down the wall and depicts all living creatures including plants, animals, fungi, monera, and protozoa. The main feature of this area is a chick hatchery. The hatchery illustrates how eggs become chicks in incubators, displaying the smaller scale evolutionary process as the egg becomes a chick. The hatchery and the evolution mural are connected with the question, 'Which comes first, the chicken or the egg?' Possible answers to this question are provided and the children are encouraged to vote for what they believe is the correct answer.

4.3.3 Selection of Design

Careful consideration of the design possibilities, educational content, interaction, and interest levels for the children led to one proposal being pursued. Based on these factors the second design, which combined the five themes, was chosen. Although the first design contains a greater number of interactive components, the atmosphere created in the second combined with interactive components is more appealing to children, particularly in this exhibit. The reason for redesign was to create an appealing exhibit, and atmosphere is a useful interaction element. A well-developed atmosphere makes the exhibit and its components more interesting and appealing to children. It is generally easier

to integrate interaction into an exhibit with an inviting atmosphere because the exhibit maintains the full attention of the child and directs it toward specific components.

The separation of themes in the first design makes it difficult for the child to understand the interactions between each kingdom. Although this first exhibit contains a large amount of educational material, it is easily recognized and does not leave significant room for imagination or creativity. Each area is straight forward with respect to the expected actions of the child. While the child may interact with many of the components, many still involve large amounts of passive learning. Since only a few children can utilize the interactive components at a given time, the exhibit is inefficient, and many children would not have the opportunity to use them during their time in the exhibit.

The live animal section of this first exhibit design was aborted for several reasons. The tide pool of small sea creatures, although an intriguing possibility, was abandoned due to strict Costa Rican regulations on the care and handling of live animals. The purpose of this pool was to allow children to hold and closely examine creatures such as starfish, sea urchins, and snails. However, local laws forbid this, making the design unfeasible. The beehive, a second interesting possibility, was bypassed primarily for safety reasons. Bees, in general, are startled and angered by loud noises and movements, which are frequent within the museum. Despite the exit to the open air outside the museum, it was still considered a danger because many people use the grounds of the museum and an angry bee may sting. In addition to the safety concerns, the INBio, a local ecological park, currently has a hive exhibit with small bees found in the rainforest. The Children's Museum exhibit must be original and innovative, therefore new ideas have been explored.

The role-play section of the first design proposal was also abolished. Although this was a creative way to teach younger children about the interactions between animals and the environment, the area originally considered for this section was determined to be unavailable upon consultation with the museum director. This section of the exhibit requires a significant amount of space, which is not available in any other area of the exhibit.

The second design possibility based on the rainforest is described in greater detail in the Conclusions and Recommendations chapter of this report. This design was selected because it fully engages children in a world of living creatures while simultaneously educating them. Although this design contains fewer interactive activities than the first, the intense forest atmosphere instills a sense of wonder in the visitors and for a brief time they forget they are in a museum. Atmosphere is a means of interaction because it requires the use of several senses simultaneously. However, there are many other interactive features in this exhibit, which, combined with the total atmosphere, will create a successful exhibit.

The design also reinforces the Costa Rican culture in the forest environment, while providing a closer look at the interactions between each of the five kingdoms. The educational content is more subtle, meaning children are less aware that they are being taught. This subtlety does not imply that there is less material included, but rather it allows for a greater quantity of knowledge to be passed onto the child. The specific reasoning for inclusion of each section of this exhibit is included in the Conclusions and Recommendations chapter of this report.

4.4 Cost Considerations: Interview with Ivar Zapp

On June 15th, we interviewed Ivar Zapp, a professional exhibit designer, who is currently working on a new exhibit about Costa Rican Coffee in El Museo de los Niños. In this interview he provided suggestions to aid in our analysis of the cost and availability of materials. A large cost in the implementation of our design is the necessary reconstruction of areas three, four, and five. He offered to provide a contractor to estimate the cost of this reconstruction. Another large cost in this exhibit design is the use of molded plastics to create the trees and other features of the rainforest. He also provided general prices for common areas in our exhibit. In this area he informed us of a local mall that displays some of the materials necessary for our design, and recommended that we contact them for the necessary cost information.

Mr. Zapp also informed us that murals cost approximately fifty dollars per square meter for most detailed designs. Flooring was another design attribute that he commented on. The basic flooring currently utilized by the museum is approximately twenty-seven dollars per square meter. However, he suggested that we investigate alternatives that would better fit with the atmosphere of our exhibit. Lighting and sound were among the other components that were of concern for this project. Issues of concern included light and sound activity and ways to prevent sound from traveling beyond the exhibit. He suggested a type of switch that is activated by touch, meaning the children simply make physical contact with the component to activate it. To contain the sound within the desired area, he recommended spot-sound speakers, which prevent echo.

The information provided by Mr. Zapp allowed us to contact several companies about the costs of each necessary material. With these prices, we developed an estimate

of the implementation cost of our design. The most valuable information provided in this interview was the necessity of adding ten percent to the estimate of materials and construction to account for unexpected price increases or other problems that may arise.

4.5 Possible Funding

Many companies, which we categorized into three main groups, were contacted after the search of databases. The first category includes large American based corporations that have branches in Costa Rica, from which the museum requested we solicit. Currently, most large Costa Rican companies donate some funds to the museum, and these American companies will provide new possibilities for support. These connections with the United States will also aid in future endeavors of the museum.

The second, and largest, category focuses on biological companies. Again, these companies are based in the United States. This type of company was pursued because of the biological nature of the exhibit and its strong connection to the rainforest. The educational content is used to build an association with the exhibit design and the company. The theory is that these corporations will donate funds to this project to help educate children in their areas of expertise.

The third, and smallest, category includes one small local company. This contact inquired about the material donation of the chick hatchery. The small size of this company prevents them from assisting the museum monetarily, although it would like to aid in the education of children. By contributing materials, it helps the community without causing financial strain for its company. A list of all companies contacted is included in Appendix F.

4.6 Initial Contact

Each company was contacted, initially, through the email address provided on their respective web pages. This first communication requested the title and name of person heading the donations division of the company to whom we should direct our inquiries. Once this information was supplied a proposal statement was transmitted. Many companies did not provide the necessary information, thus the statements were faxed to the head of the public relations department in the corporate office.

4.7 Response to Proposal Statement

The proposal statements sent to the targeted companies (Appendix G and Appendix H) contained an explanation of the goals of the museum, a brief description of the exhibit, the benefits the company receives by donating to this project, and a formal request for their grant guidelines. Based on this statement the companies were given the opportunity to decline interest in the project. Table 4-1, on the following page, provides a list of companies that declined and their reasons.

Table 4-1: Denials for Grant Support

COMPANY NAME	REASON FOR DENIAL
Avax Technologies Inc.	Not in a position to work with a non-profit organization.
Avitar Inc.	Does not give donations.
Bigmar Inc.	Does not give donations.
Bio-Plexus, Inc	Company is too small to make donations.
Biopure Corporation	Company is too small to make donations.
Chiron Corporation	Only give donations to community organizations.
Conceptus	Company is too small to make donations.
CYGNUS, Inc.	Not able to give funds at this time.
Ergo Science Corporation	Company already donated all the funding available.
Immucor, Inc.	Does not give donations.
Lauder, Estee Companies, Inc.	Only give donations to already determined foundations.
NPS Pharmaceuticals, Inc.	Does not give donations.
Rockwell Medical Technologies Inc.	Company not in a position to donate.
VaxGen Inc.	Does not give donations.
Warner-Lambert Co.	Not able to give funds at this time.

Most companies have very specific guidelines for formal grant requests that must be followed. The guidelines that have been provided are included in Appendix J.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the collected data, the following recommendations have been made with respect to the redesign of “Los Seres Vivos” exhibit and to the process of obtaining funds for its implementation.

5.1 Final Design Proposal

The recommended design is based on the unity of themes design possibility as discussed in the previous chapter. This design illustrates the interconnections of all kingdoms of living creatures. At the entry to the exhibit, a large sign raised on posts over the walkway announces “Los Seres Vivos”. The sign has the appearance of wood with bright red lettering and marks the entrance to the forest path that leads to the laboratory before continuing through the forest.

5.1.1 Reconstruction

Our team recommends that the existing area of “Los Seres Vivos” be redesigned to fully accommodate our proposed design. Currently, areas three, four, and five (see Figure 4-11) are raised higher than the walkway and are not level, but rather are angled toward the center. It is these areas that require reconstruction according to our design. The elevated platform is to be removed and replaced with a ramp beginning at the level of the path at area three. This ramp continues at a slight angle to the edge of area eight. The downward slope of the path and the inclination cause the forest to end approximately one meter from floor level. The perimeter of this new ramp is lined with a sturdy railing

to ensure safety. At the height of the ramp, a second narrow wheelchair accessible ramp leads to the floor level path. The purpose of the elevation is to allow for the underground cove of the subterranean section to be created beneath the forest.

Two models, pictured in Appendix E, illustrate the necessary changes to the existing structure. Model one depicts the exhibit space as it currently stands, while model two shows the intended redesign. These models are not built to scale, but rather elaborate the recommended alterations. This serves as a visual representation of the required reconstruction, making the new structure clearly evident in comparison to the existing one.

5.1.2 Laboratory

A second large sign, similar to the “Los Seres Vivos” sign, marks the laboratory entrance. Thick plaster posts in each corner, which further creates an on-site laboratory atmosphere, support this palm-thatched roof. This atmosphere is completed within the laboratory by white counters, microscopes, and scientific posters. On the following page (figure 5-1) is a simplistic illustration of the Laboratory section. It shows the inclusion of light microscopes, slides and posters, and one of the cell puzzles.

Oversized three-dimensional plant and animal cell puzzles, which are large enough that several children may utilize them simultaneously. These are located along the left wall of the laboratory. The cellular components are labeled with a brief description of function and the board displays the proper place for each. The pieces are connected to the board with a cord to ensure that they will not be misplaced. They are large enough to be easily manipulated by small hands. Each is made of durable brightly colored plastics to be long lasting and appealing to small children.

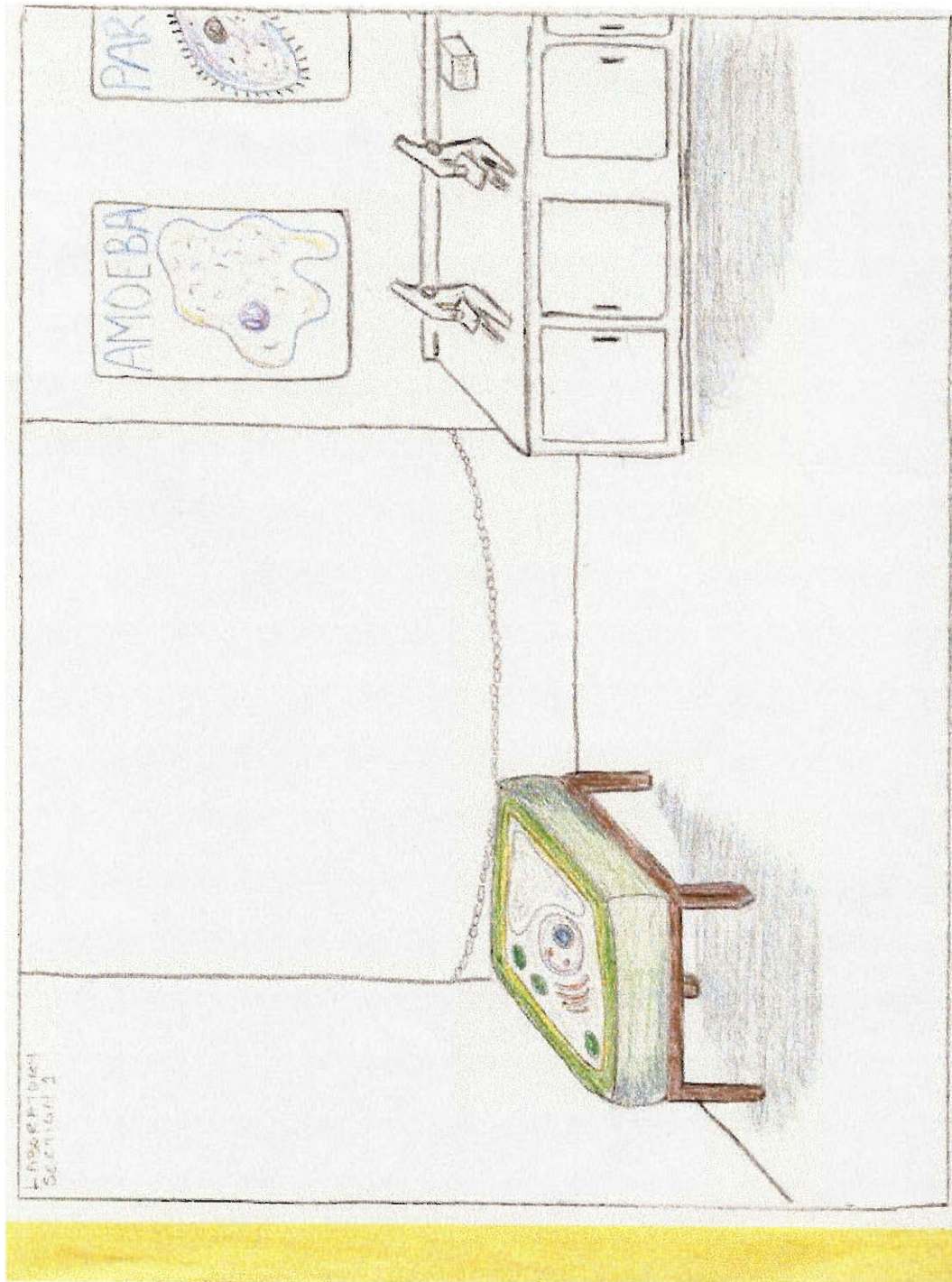


Figure 5-1: Laboratory Area Illustration

A laboratory bench against the right wall supports an oversized, plastic light microscope featuring two eyepieces, a focus knob, and a slide tray. It is connected to a mounted television that displays the magnification of the object on the slide tray. On the back wall, on a second bench top, lie smaller microscopes for individual use. These are intended for older children who have a firmer knowledge of microscopic workings, while the larger scope is intended for younger children. All of the microscopes are made of lightweight metal and appear professional while remaining simple enough for the children to easily manipulate. Several slide types in cases along the bench allow the children to explore the microscopic world. These slides are fixed and stained to highlight specific cellular components of each. They are color-coded, although unlabeled, and the children must identify the type of cell based on its characteristics. The cell types include a paramecium, an amoeba, a euglena, a leaf section, and samples of bacteria types including spirilla, cocci, and bacilli. On the wall space behind the bench, several pictures of each cell are mounted to aid in the identification of each. These pictures include a brief explanation of the function and life of the microorganisms, and the distinguishing features are highlighted.

At the end of the bench is a collection of Petri dishes with replicated cultured bacteria. These are sealed to ensure the safety of the children while allowing them to view different strains of bacteria. By viewing the actual colony size, in addition to the magnified versions under the microscopes, the children gain a better understanding of the importance of the microscopic world. Brief explanations of the many disadvantages and benefits of bacteria are also included.

This section of the exhibit combines the Monera and Protista kingdoms, encouraging children to learn the many benefits of microorganisms. In addition, a clear distinction is made between the plant and animal cell types by the inner cellular components, which allows children to easily understand why these two kingdoms are different. As with many exhibits, the museum assistant plays a key role in developing the child's understanding of their world. Microscope use must be supervised to ensure that it is being used properly and explanations must be provided where necessary. Younger children are encouraged to use the cell puzzles and the oversize microscope, while older children will be more interested in using the smaller microscopes to analyze the specimens.

5.1.3 The Rainforest

The main section of the exhibit simulates a typical Costa Rican rainforest and includes plants, animals, insects, and fungi. The forest begins at the entrance of the exhibit, where the edges of the path are lined with foliage. A denser forest starts at the laboratory walls and continues along the curve of the exhibit, engulfing the visitors in the forest. The educational material is presented in interactive components allowing the visitors to see, hear, touch, and experience the exhibit. The material focuses on the interactions between plants, animals, and the environment while increasing cultural awareness. The illustration on the following page (figure 5-2) represents the Rainforest. As depicted, there is a walkway through the forest. The completed exhibit section, however, must contain fuller foliage.



Figure S-2: Rainforest Area Illustration

To create a complete rainforest atmosphere some reconstruction is necessary, however, for accessibility and emergency purposes, the original path remains intact to provide a safe route around the forest. This path, although clear from any obstacles, maintains the forest atmosphere through murals and foliage along the edges. It allows visitors to proceed through the exhibit without entering the forest.

The rainforest area contains a variety of native plant models such as banana trees, coconut trees, palm trees, ferns, and other foliage. It is important to note that the trees are not in the same dimensions as found in the true forests and this should be reflected in the explanations provided by the museum assistants. The limited area of the exhibit requires that these model be scaled down, allowing a greater number of trees to be placed in the forest. Although they are not life-sized, the trees and plants will provide the desired atmosphere of rainforest.

Each tree type is grouped together with one tree spotlighted to depict all of its features. For example, among a group of banana trees one is focused on with special lighting to attract the attention of the children. This tree is referenced in the explanations provided by the museum assistant. On this tree, the leaf, trunk, and fruit structure are highlighted and the life cycle is illustrated through detailed explanatory cards. These explanations provide information about the type, maximum height, life span, common uses, and all other pertinent information. The fruit of these trees is removable, allowing closer inspection.

The trees that supply valuable commodities to Costa Rica, such as bananas, coconuts, and pineapple are discussed in greater detail. The other tree types are modeled after rainforest foliage and will be used to complete the rainforest atmosphere. Although less

detail is used, the function of these trees in the forest is explained in a manner similar to that of the high commodity trees.

The trees to be displayed are made of molded plastic and fiberglass, which provide durability. Each has areas of texture, allowing the visitor to feel the trunk, leaves, and fruit. The visitors smell the scents on the surface of flowers and fruits without being overpowered. The leaves are constructed from vinyl to give them a more natural feeling. Since each tree contains these aspects of scent and texture, many visitors are able to interact with them simultaneously. Ferns, bushes, flowers, and other small plants are throughout the exhibit to complete the rainforest atmosphere. Fungi are included to ensure that all five kingdoms of the living creatures are represented. Although they are not a primary focus in the same capacity as the trees, the museum assistant and explanatory cards provide details about each. The main objective of these other plants and fungi, however, is to fill the space of the forest. They are constructed from soft plastic, vinyl or rubber to create a more natural texture. Explanatory cards near each plant along the path describe the type, uses, habitat, and importance of each.

Also included in this section are many animals native to Costa Rica such as frogs, monkeys, birds, and bats. Model insects such as butterflies, leaf cutter ants, bees, spiders, and beetles, are strategically placed throughout the forest on leaves and trees. Larger animals, including the Costa Rican national bird, are displayed throughout the rainforest in the areas illustrating their natural habitats. Tree frogs, for example, are attached to trees, while birds rest on branches. The animals are plastic representations of real animals. Where possible, fur, feather, and skin textures are emulated on these models and

visitors can touch them. Explanatory cards accompany each animal and provide information about the diet, life span, size, habitat, and other details.

In addition, there are interactive animals including monkeys, macaws, toucans, and sloths. These are animatronics that are activated by touch, which speak and move before the children to explain the relevant details about their species and importance to the rainforest. A large variety of animals are displayed in their natural rainforest habitats. However, in many cases, they are also shown at a more in-depth level. For example, a bird's nest, which generally lies high in the tree, is on a lower tree branch to allow the visitors to clearly view the nest components. This allows visitors to better understand how the bird lives and to see the eggs or baby birds inside the nests. The museum assistant briefly and accurately describes both the habitat and characteristics of the animals. This description is similar for all the animals in the forest. Throughout the forest, hidden speakers project the animal and bird sounds, which also add to the tropical atmosphere.

The material used to create the floor closely resembles the color and texture of the ground in the rainforest. A flattened path, clear of trees and foliage, extends through the forest. The path is close to the back wall to ensure the safety of children while traversing the forest. The back wall is painted to resemble the rainforest. Information about conservation includes textual displays with reasons why the rainforest is necessary and valuable to all species on the earth, even those that do not live within it. Again, the museum assistant verbally reinforces the importance of preservation of the rainforest.

The painted mural resembles the rainforest with many trees and animals represented in the three-dimensional section. This increases the forest atmosphere. A combination of flat, semi-gloss and hi-gloss paints is used to create a three-dimensional effect

in the mural. The flat paints are used for the background coloring. The trees trunks and plants in the foreground are painted with semi-gloss paint, while the leaves are painted with hi-gloss paint. Animals, such as jaguars and margays, in the mural are depicted with varying types of paint depending on the perspective, which must be consistent with those used for the trees and plants. A variety of colors are used, with many different shades of green for the plants. A section of this mural space is devoted to the conservation of the rainforest and all of its creatures to teach children of the importance of this area.

Although the forest does not contain a large number of complex interactive components, the interaction it does contain, combined with the atmosphere of the forest, will make the exhibit appealing to children. By immersing the visitor in the complete environment it evokes imaginations and active participation because it demands the visitors' full attention.

5.1.4 Subterranean Life

The rainforest section ends at the top of a ramp approximately one meter from ground level. A wheel chair accessible ramp along the wall serves as the exit to the forest area and entrance to the underground region. The ramp is painted similar to the forest path. Beside the ramp are the snakes and turtle terrariums from the existing exhibit and the visitors can view them during their descent down the ramp. In the current exhibit, these terrariums are the most popular components and are therefore maintained in the new design. The terrariums are constructed from Plexiglas with an area beneath the tanks where visitors view the reptiles from below. The illustration in Figure 5-3 represents the

Subterranean area. As depicted, the root system extends from the back wall and ceiling. Along one wall lie the terrariums, while the ant farm occupies the opposing wall.

The subterranean area is cove-like, and illustrates the habitats of ants and the structure of roots. The cove is beneath a small section of the rainforest and one large tree. It is from this tree that the displayed roots appear to extend. A connection between the ants and the roots is that the ants aerate the soil to allow the roots to grow. This illustrates how plants and animals rely on one another for survival.

On one wall of the cove, the large ant farm utilizes two-thirds of the wall space. The outside of the farm is Plexiglas to ensure its safety and durability while allowing the children to view the ants. Large black ants that are easily viewed live in the intricate paths of the farm. The remaining third of the wall is used for explanatory text and illustrations of the different areas of the farm, which are labeled with colored numbers on the glass. These areas include the queen's nest, ant hatchery, food storage, and any other areas of interest. Information about the ants' diet, habitat, and life cycle is also included here. The museum assistant provides explanations reinforcing the educational content. He must also control the number in the cove to prevent a crowd from developing, which could cause anxiety and fear in both children and adults. Further maintenance of the ants includes feedings and monitoring of the colony.

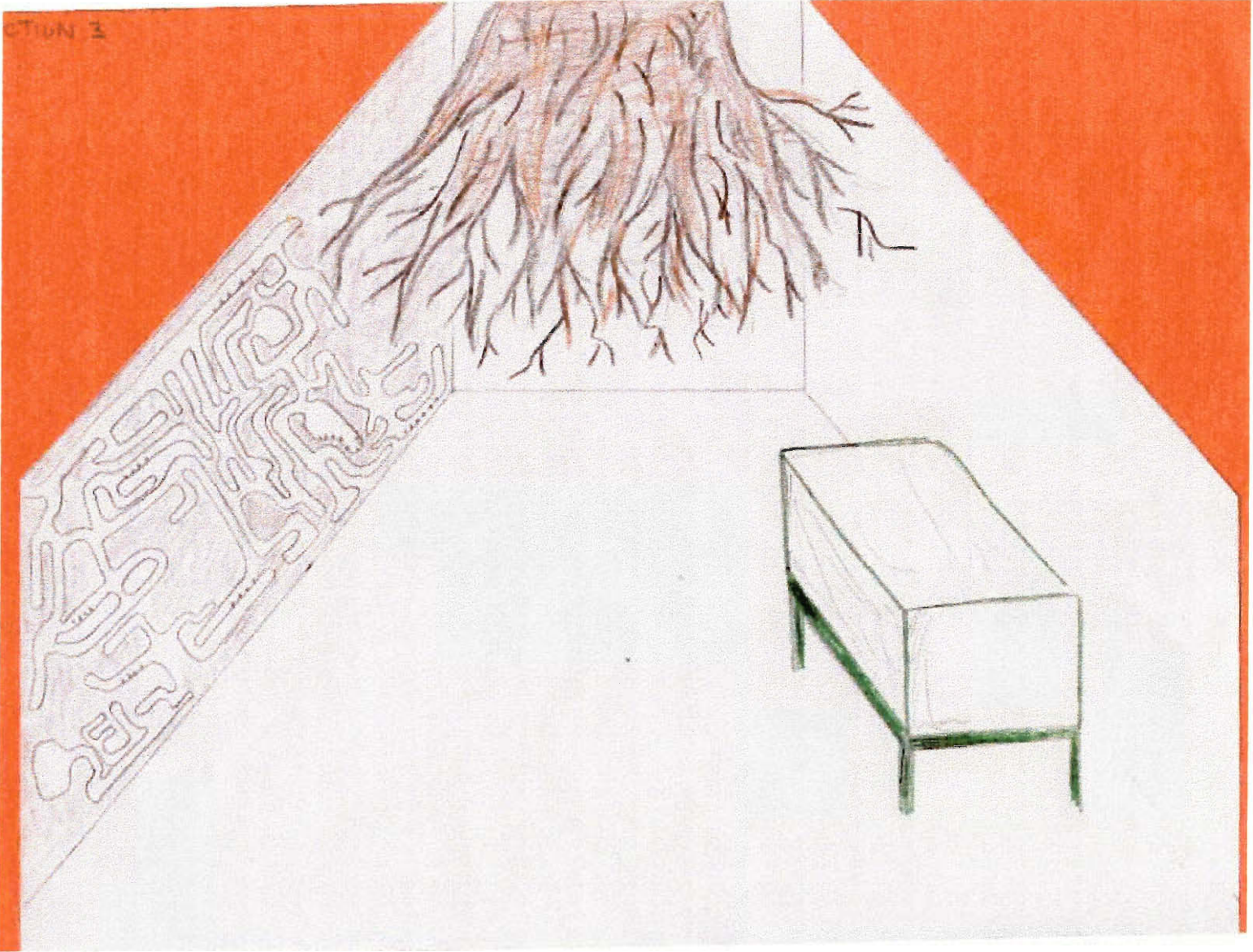


Figure 5-3: Subterranean Area Illustration

The plastic tree roots hang from the ceiling and extend down the back wall, illustrating the formation and functions of roots. Explanations on the wall describe the connection between ants aerating the ground and root growth. Several roots are cross-sectioned to show water and nutrient absorption through capillary action, which is also explained in the text. Colored plastic is used for the walls rather than painted plastic, as this more durable and long lasting.

5.1.5 Evolution

The final section of the “Los Seres Vivos” exhibit lies at the base of the curved path and presents the theory of evolution. A mural utilizing all of the wall space depicts an evolutionary timeline beginning with a prokaryote and progressing through more complex organisms. Near the bottom of the mural is a chick hatchery where children watch baby chicks break from eggs. The diagram on the following page (figure 5-4) represents the general spacing of the evolutionary mural. In place of each title, brightly colored illustrations should exemplify the types of creatures that fall under each heading.

The chick hatchery relates to evolution with the theoretical question, ‘Which came first, the chicken or the egg?’ The hatchery consists of a large rectangular Plexiglas incubator. Each week fresh eggs are added to the incubator and the chicks returned to the chicken farm. A farm sponsors the hatchery and is responsible for the general maintenance the hatchery requires.

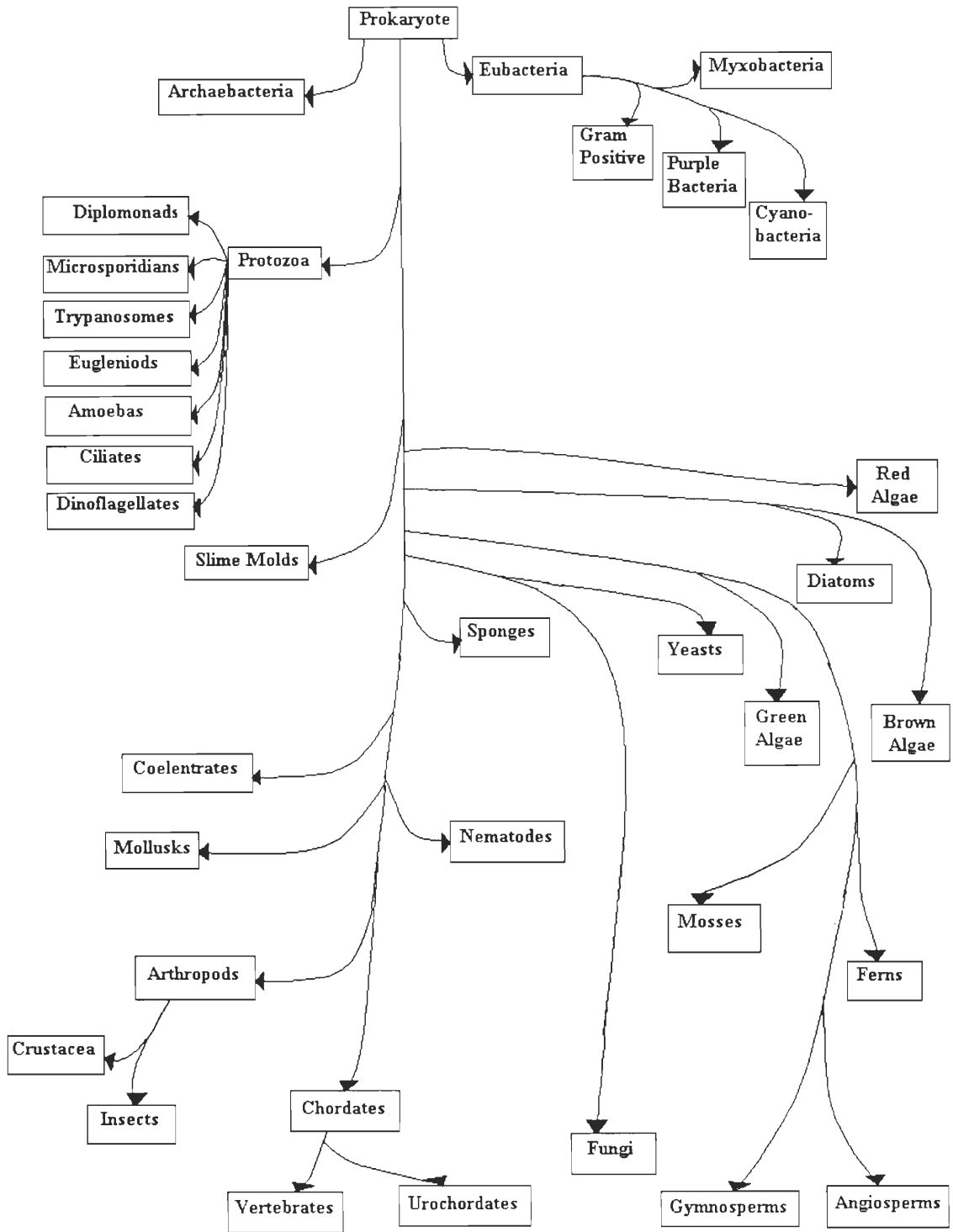


Figure 5-4: Mural Depicting Evolution

The hatchery is placed one meter from the wall, allowing children to view the chicks from all sides. Small steps surround it to allow young children to easily see the chicks. Several different groups of eggs are in the incubator simultaneously to ensure that some hatch daily. Illustrations and explanations describe the maturation of the chick within the egg. The diet, habitat, and life cycle of chickens are also explained in this text. In addition, the use of chickens in the creation of the flu vaccine is explained, reinforcing the idea that all the living creatures are dependent on one another.

Beneath the question, 'Which came first, the chicken or the egg?,' is an explanation of this philosophical question and its application to evolution. Children vote on the answer to this question and are encouraged to consider possible explanations supporting each. To vote the children place either a chick or an egg into its respective container where the votes are tallied. After the votes are counted the museum assistant verbally draws the connection of this vote to evolution.

The mural of evolution occupies all available wall space. It begins with a prokaryote at the top and branches down to illustrate how this single cell evolved to form complex organisms. The mural illustrates life's changes throughout time, from the earth's creation to present day. Complex organisms such as humans, plants, dinosaurs, and fungi are at the bottom of the mural, closest to the children. Brightly colored flat paint is used to illustrate a large variety of creatures in the earth's evolutionary history.

5.2 Educational Specifics

In addition to providing a detailed design, our team has outlined recommendations for the educational content of each component in the exhibit. The main focus of El

Museo de los Niños is to educate children about science and culture in an entertaining environment. Our proposed exhibit teaches children the basics of the five kingdoms of living creatures while emphasizing their own culture. The laboratory section introduces the children to the monera and protista kingdoms and their ‘real life’ applications. Also in this section the children learn that the building blocks of life are cells, and also the differences between plant and animal cells. The remaining three kingdoms, fungi, plantae, and animalia, are presented in the rainforest area of the design as the interactions between each are demonstrated and explained. Here, children also gain a greater cultural sense since the focus of this area is Costa Rican plant life and animals. The subterranean section is an extension of these themes. The final area, which provides information on evolution, connects all of the kingdoms by showing the common origin of each. The specific details of each educational component have been compiled for integration into the exhibit.

5.2.1 Laboratory Educational Components

This section contains a large amount of educational material focusing on the two kingdoms with the smallest of the world’s organisms. Despite the small size of these creatures, they make up the largest group of organisms on the earth. In this area, the children utilize microscopes to view, first hand, those beings they cannot see. The museum assistant will be responsible for aiding in this discovery and further explaining the characteristics and functions of these. It is the recommendation of this team that El Museo de los Niños include the information listed below in the Laboratory section through informational cards and the explanations of the museum assistants.

5.2.1.1 Plant and Animal Cells: In this section a clear distinction between plant and animal cells should be made based on the educational material provided below. The first major components of the laboratory area are the large cell shaped puzzles. The removable pieces of these puzzles represent the organelles of both the animal and plant cells. The animal cell is more rounded in shape than the plant cell, which is rectangular. The removable pieces are brightly colored and labeled with the name and a brief description of the function.

These cellular organelles include the endoplasmic reticulum, golgi apparatus, lysosomes, peroxisomes, nucleus, and mitochondria. The plasma membrane and cytoplasm are also labeled and defined, although both are stationary components (Alberts, 1994).

The endoplasmic reticulum (ER), which is present in both smooth and rough forms, specializes in the synthesis and transport of the lipids and proteins that make up the cell membrane. These are present throughout the cell, however they must appear as a structural continuation of the nuclear membrane, meaning they must attach to the nucleus in a minimum of one place. The golgi apparatus appears as a system of flattened stacks, which package molecules or secretions from the cell for delivery to other organelles. These are fewer in number than the ER, as there are usually two or three in various locations within the cell. Lysosomes are very small (comparatively) vesicles that contain enzymes for intracellular digestion, while peroxisomes are small vesicles containing enzymes to create and destroy hydrogen peroxide. There are many of these two vesicle types throughout the cell. The nucleus is the most important organelle of the cell because it contains all of the genetic material necessary for reproduction and synthesis of proteins.

It is the largest component of the animal cell, usually lying near the center of the cell. The mitochondria create energy by combining oxygen with food molecules. The inner lining of these, which are present in high numbers throughout the cell, increases the area for making energy. Each of these components should be a distinct color to avoid confusion. The cell membrane, which serves as the boundary of both the cell and the puzzle, is made up of lipids and proteins. The cytoplasm is the liquid within the cell where all of the organelles reside (Alberts, 1994).

Plant cell, although shaped differently than the animal cell, is approximately the same size and contains all of the same organelles with some additional ones. Those organelles that remain consistent with the first cell should be portrayed in the same colors to emphasize this consistency. However, the plant cell has three components that distinguish it from the animal cell: chloroplasts, the vacuole, and the cell wall. The chloroplasts contain green chlorophyll and within this organelle photosynthesis is carried out, which is the process of making energy from sunlight. The vacuole is a large vesicle that occupies over ninety percent of the cell volume and functions in digestion and supporting the cell. The cell wall, which would be a stationary piece, lies along the outside edge of the cell membrane giving the cell rigid support. These components should be colored differently from any of the animal cell organelles to reinforce the separation between plant and animal (Alberts, 1994).

5.2.1.2 Microorganisms: In this section, the children will learn the basics of several microorganisms and the important role they play in the world. The subject matters suggested for inclusion in the exhibit by this project team have been described below

with all of the relevant educational material. The second major educational components in the laboratory section are the microorganisms for display under the microscopes. Although the slides containing these organisms will be unlabeled, a description of each will be provided, along with a large picture, on the wall behind the microscopes. The children will compare the image they inspect under the microscope to these pictures to determine which organism they are viewing. Among the fixed organisms are an amoeba, a paramecium, a euglena, cocci bacteria, spirilli bacteria, bacilli bacteria, and a section of leaf. Each should be appropriately stained to highlight its most prominent features. It is recommended that the following educational specifics be focused on in this exhibit.

Amoebas are single-celled organisms made up of a jelly-like cytoplasm containing food vacuoles, a contractile vacuole, and a nucleus. They are identified by their ability to form temporary cytoplasmic extensions called pseudopodia, or false feet, which they use to move. Since they have no mouths, food is taken in and material excreted from any point on the cell surface. To obtain food, extensions of the cytoplasm flow around food particles, surrounding them and forming a vacuole into which enzymes are secreted to digest the particles. The contractile vacuole removes excess water from the cell. Amoebas reproduce by binary fission, meaning that once they reach a certain volume they simply divide into two (Encyclopedia Britannica-Amoeba, 14 June 2000, <<http://www.britannica.com>>).

A paramecium is a single-celled organism completely covered with fine hair like filaments called cilia, which beat rhythmically to propel them forward and to move food particles into their mouths. Digestion takes place within the food vacuoles and, similar to the amoeba, contractile vacuoles excrete excess water from the cell. The cell contains

two nuclei, the macronucleus and the micronucleus. The organism cannot survive without the macronucleus, which is the center of all metabolic activities, and it cannot reproduce without the micronucleus, which stores all genetic information. The primary method of reproduction for paramecium is binary fission (Encyclopedia Britannica-Paramecium, 14 June 2000, <<http://www.britannica.com>>).

Euglenas are single-celled organisms that have both plant and animal characteristics and contain a nucleus, pigmented chloroplasts, a contractile vacuole, and flagella. The flagellum is a tail-like extension on one end of the cell that moves it forward with a rapid whipping motion. Energy is obtained by the chloroplasts from sunlight and the only method of reproduction is binary fission (Encyclopedia Britannica-Euglena, 14 June 2000, <<http://www.britannica.com>>).

Since there is an immeasurable number of bacterial species in the world, only the basic shapes, cocci, spirilli, and bacilli, of bacteria are shown on the microscope slides. Cocci bacteria refer to those that are spherical in shape, while spirilli are those that are shaped like small spirals and bacilli refer to the rod shaped bacteria. In addition to providing the standard shapes of bacteria, general information is also provided (Encyclopedia Britannica-Bacteria, 14 June 2000, <<http://www.britannica.com>>).

Bacteria lack membrane bound organelles such as a nucleus, and, although they are single-celled organisms, they often form colonies. Many reproduce by binary fission, however some form spores, which allow for a period of time to pass before the life of the organism begins. This is helpful for species preservation through harsh environmental periods such as drought. Bacteria obtain their food in a variety of ways. Some, the phototrophs, make their own energy from light sources, while others, the heterotrophs, must

obtain their food from an outside source. The environments in which bacteria survive in also vary greatly. These microorganisms can thrive in almost any environment, regardless of the conditions (Encyclopedia Britannica-Bacteria, 14 June 2000, <<http://www.britannica.com>>).

Although most bacteria are harmless to man, many cause disease when present in the food or water we consume. However, this can be prevented through sterilization, which kills the bacteria without harming the food products. Some types of bacteria are useful in cleansing agents and there are many types that reside in the digestive tracts that the human body relies on for survival. Bacteria are also used in the production of many foods such as yogurt, pickles, beer and cheeses (Encyclopedia Britannica-Bacteria, 14 June 2000, <<http://www.britannica.com>>).

The slide containing the section of leaf will show the compactness of cells and relates to the larger plant cell puzzle. The main visual components of the cells are the chloroplasts, which appear green, and the vacuole, which occupies most of the cell. This also serves to further distinguish plant cells from the other slides that contain cells more similar to animal cells.

5.2.2 Rainforest Educational Components

The rainforest area, as compared with the other areas of the exhibit, contains the greatest amount of educational content. Here the specific animals, plants and fungi existing in the rainforest are fully explained. The animatronic creatures (monkey, macaw, toucan and sloth) will present this information in response to the children's touch. However, the other animals, plants, and fungi will be described on small cards

near the feature. The museum assistant will also play an important role in ensuring that the children absorb this knowledge by explaining each exhibit component and answering any questions that may arise. It is the recommendation of this project team that the rainforest section contain, at minimum, the following educational material.

5.2.2.1 Monkeys: Monkeys are an important feature in the rainforest and the four types of monkeys found in Costa Rica should be explained. The Central American Squirrel Monkey, whose scientific name is *Saimiri oerstedii*, is the smallest and most endangered monkey in Costa Rica. Each weighs less than one kilogram and measures between sixty-three and sixty-eight centimeters long. More than half of their body length is devoted to the non-prehensile (without gripping capabilities) tail. They squeal and chirp while jumping through forested areas in search of food such as insects and fruit. In Costa Rica, they are found only in isolated areas of the south Pacific coastal rainforests in the middle and lower levels of the lowland forests (Fogden, 1997).

Scientifically known as the *Cebus capucinus*, the White-Faced Capuchin Monkeys travel in groups through all levels of the forest, occasionally descending to ground level, in search of insects and fruits. Weighing between 1.5 and 3.9 kilograms, they are between seventy centimeters and one meter in length. Their prehensile tails account for more than half of their length and are utilized for gripping tree branches. In Costa Rica, they are found in both the wet and dry tropical forests on both shores (Fogden, 1997).

Scientifically known as the *Ateles geoffroyi*, the Central American Spider Monkey is usually found swinging arm to arm across the canopy of the forests. A scream, grunts, barks, and whines are among their most common vocalizations. During the day, they

travel in small groups through areas of wet forest across Costa Rica. On rare occasions they descend to ground level. They weigh between seven and nine kilograms and use their prehensile tails as another hand. Their diet consists primarily of fruits, although they also eat nuts, seeds, leaves, insects and eggs. An endangered species in Costa Rica due to logging and hunting, the recovery of this species is slow because of the long gestation period of seven and a half months and each female having only one infant every three years. The first two months of the infants' lives is spent riding on their mothers' chests. This is followed by several months of riding on the back of their mothers. During the first year, they only leave their mothers' backs only for small trips (Fogden, 1997).

The Mantled Howler Monkeys, scientifically known as the *Alouatta palliata*, travel throughout the forest less frequently than other monkeys. They live in groups numbering between two and twenty-five individuals. Each group is subdivided into home areas of about ten hectares. Daylight hours are spent browsing for food or resting in the canopy. They are noted for loud vocalizations, which are often heard as far as three kilometers away. Mostly leaves constitute their diet, although they also eat fruit, insects, seeds and flower parts. They are the largest of the monkeys in Costa Rica, with weight ranging between four and ten kilograms and length between one to 1.25 meters. As with the other monkeys, more than half of their body length is their prehensile tail (Fogden, 1997).

5.2.2.2 Mammals: The mammals that reside in the forest are also important and it is our recommendation that the following be explained the exhibit. The three-toed sloth,

Bradypus tridactylus, is commonly found in Costa Rica (Encyclopedia Britannica-Sloth, 22 June 2000, <<http://www.britannica.com>>). These flat faced, tree-dwelling mammals are generally between sixty and seventy centimeters in length. Sloths sleep for nearly twenty hours each day and spend additional time lying in the sun rather than moving about the forest or searching for food. This small expenditure of energy makes them greatly adapted to the rainforests of Costa Rica. They do not require large amounts of food because of the little energy they use. They are able to avoid the attention of predators by remaining still and quiet and often remain in the same tree for several days at a time. Their diet consists of a variety of coarse foliage, which is generally low in nutritional value. Their large complex stomachs allow the digestion of this coarse food through the aid of bacteria. The nightly decrease in body temperature explains their constant need to sunbathe, which allows them to increase their body temperature without expending energy (Foder, 1997).

The *Felis onca*, also known as the jaguar, are among the largest mammals in the rainforests of Costa Rica. At about two meters in length and one meter in height, the males weigh between fifty and one hundred kilograms, while the females range between thirty and sixty kilograms. This species is one of the largest of carnivores in Central America. The typical diet consists of turtles, tapirs, peccaries, monkeys, agoutis, deer, birds, fish and lizards and they are capable of killing prey of equal mass to themselves. As a result of deforestation and hunting, these creatures have become endangered. They are found in coastal mangroves, lowland savannas, wet and dry shrub lands and forests up to 1,000 meters in elevation. Jaguars require a large roaming area of at least one hundred

square kilometers (Encyclopedia Britannica-Jaguars, 14 June 2000, <<http://www.britannica.com>>).

The Maragay, scientifically known as *Felis weidii*, is also commonly found in the rainforests of Costa Rica. Small felines weighing between three to five kilograms, they are approximately the size of a domestic house cat. They are considered an endangered species primarily due to deforestation, although hunting is an increasing threat. The most common habitat of margays is forested watershed reserves in elevations ranging up to three thousand meters. Much of their time is spent in trees and they eat monkeys, rodents, birds, lizards and insects (Encyclopedia Britannica-Margay, 14 June 2000, <<http://www.britannica.com>>).

5.2.2.3 Birds: The tropical birds of the rainforest area among its most beautiful sights, it is our recommendation that the following birds be explained with the necessary educational content in this exhibit. The Scarlet Macaw, scientifically known as the *Ara macao*, is one of the parrots found in Costa Rica. At full length, it is ninety centimeters long and colored bright red, blue, white and yellow. These birds inhabit the lowland forests of Costa Rica, rarely rising above one thousand meters in elevation. They generally nest in holes, approximately ten to thirty centimeters in diameter, in both dead and living trees. Macaws eat mainly fruits, but are able to crack open nuts with their beaks. The male and female macaws have very similar features and often live for sixty-five years. Although their vocalizations are mostly screech like, they are also able to mimic other sounds. Most find one mate that they maintain for life, and fly in pairs of small flocks.

The Great Green Macaw, scientifically, the *Ara ambigua*, is similar in size and shape to the Scarlet Macaw, however, its feathers are mainly colored green and blue. Found on the Caribbean coast of Costa Rica, this macaw has similar habits as its close relative the scarlet macaw (Encyclopedia Britannica-Macaw, 14 June 2000, <<http://www.britannica.com>>)

The Chestnut-Mandibled Toucan, scientifically named the *Ramphastos swainsonii*, is the largest toucan in Central America. It resides in the wetland forests on the Caribbean coast of Costa Rica, weighing 670 grams (males) and 600 grams (females). Their diet includes fruits of all types, insects, eggs, nestlings and lizards. They have an important role in the rainforest by dispersing seeds throughout the rainforest (Encyclopedia Britannica-Toucan, 14 June 2000, <<http://www.britannica.com>>).

Hummingbirds, small brightly colored birds of the family *Trochilidae*, are also abundant in Costa Rica. The largest measures a mere twenty centimeters in length and weighs only twenty grams. With a length of 5.5 centimeters and weight of two grams, the bee humming bird of the Caribbean is the smallest. Hummingbirds have muscular bodies with long wings, which are connected to their bodies only at a shoulder joint and allow them to fly in all directions and to hover in the air. They beat their wings at a rate between ten and eighty times per second, depending on their size. Generally, the smaller hummingbirds beat their wings at faster rates. Their beaks are long and narrow, allowing them to reach the nectar deep within flowers (Encyclopedia Britannica-Hummingbird, 22 June 2000, <<http://www.britannica.com>>).

Hummingbirds nest in tiny cups made of the plant materials, spider webs, lichens and mosses usually in the branches of trees. The females lay two white eggs in the nest

and must incubate them for fifteen to twenty days. However, both parents participate in feeding the young, which remain in the nest for three weeks (Encyclopedia Britannica-Hummingbird, 22 June 2000, <<http://www.britannica.com>>).

The Violet Sabrewings, scientifically known as the *Campylopterus hemileucurus*, live in the mountains of Costa Rica and are the largest hummingbirds in Costa Rica. The Green-Crowned Brilliant, scientifically, the *Heliodoxa jacula*, is found in the wet highland forests and is one of the fastest flying humming birds found in Costa Rica.

5.2.2.4 Bats: Bats are an interesting species because, although they are mammals, they fly like birds. These creatures should also be explained with some educational material. Vampire Bats, weighing between fifteen and fifty kilograms and measuring between 6.5 and 9.3 centimeters in length, have anywhere between twenty and twenty-six teeth, which is less than most other bats. Their diet centers on the blood of small to midsize mammals, including horses, pigs, borrows, birds and cattle. Each consumes about twenty milliliters of blood per night, which is half their weight. Their large, sharp incisors and anticoagulants in their saliva aid their feeding process. These anticoagulants are twenty times more potent than any other known anticoagulant. Draculin, a drug used in the treatment of heart attacks and strokes in humans, was developed from the saliva of vampire bats. Some species of vampire bats live in groups of twelve or less while others reside in colonies of over two thousand. They are found in both forests and open areas and live up to 19.5 years (Encyclopedia Britannica-Vampire Bats, 14, June 2000, <<http://www.britannica.com>>).

The Honduran White Bat, scientifically referred to as the *Ectophylla alba*, lives in dense thickets and abandoned banana groves. They cut large leaves, creating protection against the heavy rain. Weighing approximately six grams and measuring between 3.5 to 5.0 centimeters in length, the diet of Honduran White Bats consists of fruits (Encyclopedia Britannica-Honduran White Bat, 14 June 2000, <<http://www.britannica.com>>).

5.2.2.5 Amphibians and Reptiles: In the moist environment of the rainforest, amphibians thrive. As an important animal in the forest they should be explained with the content provided below. Many species of arrow-poison frogs, scientifically referred to as *Dendrobates*, are found in Costa Rica and are small, brightly colored, terrestrial frogs that secrete a poisonous substance from their skin. Colors of red orange, yellow, green and pink warn prey of the dangers in their skins. The poisons are lethal for birds and small animals and cause illness in larger animals. Costa Rican natives use the poison to coat the tips of their arrows for hunting. Unlike most frogs, in the reproductive cycle the fertilized eggs are affixed on the male's back. After hatching, the tadpoles remain attached to his back until he carries them to a stream (Encyclopedia Britannica-Arrow-Poison Frogs, 14 June 2000, <<http://www.britannica.com>>).

Strawberry Poison Dart Frogs are one of the many species of poison dart frogs found within the forests of Costa Rica. These frogs secrete enough poisons to kill twenty thousand mice simultaneously and humans have been known to become ill by merely touching the skin. The frogs lay their eggs in small pools of water on jungle plants. The tadpoles remain in these pools until they have fully developed into young frogs. Strawberry Poison Dart Frogs return to the tadpoles frequently through the development of

their young to lay more eggs for the other tadpoles to eat (Strawberry Poison Dart Frog BioBytes, 14, June 2000, <<http://www.owl.on.ca/owl/spdfrog.html>>).

Geckos are small and harmless, yet very noisy lizards from the scientific family *Gekkonidae*. Many species are nocturnal with soft skin, suction-padded feet and hands, and weak appendages. Their feet and hands have small suction plates with hair like sections, enabling them to cling to a variety of surfaces and some are equipped with retractable claws. Most species grow to a length between three and fifteen centimeters. The skin color of gekkos varies from greens to browns. They eat mainly insects and their tails serve as an area of nutritional reserve where they store energy for use during unfavorable conditions. Since their tails are very fragile, they detach easily, but all gekkos are able to regenerate the tail with ease. Gekkos lay their white eggs under bark or leaves (Encyclopedia Britannica-Gekko, 14 June 2000, <<http://www.britannica.com>>).

Iguanas, among the most common lizards in Costa Rica, belong to the scientific family *Iguanidae*. The common iguana, scientifically called the *Iguana iguana*, is the most prevalent in Central and South America and reaches a maximum length of 1.8 meters. Living primarily in trees over-hanging a river or lake, these lizards will plunge into the water if disturbed. Generally, iguanas are green in color with brown bands forming rectangular rings over the tail. Although their diet consists primarily of tender leaves and soft fruits, they occasionally eat small birds and mammals (Encyclopedia Britannica-Iguana, 26 June 2000, <http://www.britannica.com>).

Boas are snakes of the scientific subfamily, *Boinae*, of the family *Boidae*. Living chiefly in warm climates, these snakes are abundant in Costa Rica. Most have distinct patterns of diamonds or blotches on their brown, green or yellowish bodies. Unlike most

snakes, the young are born live, not in eggs. Although these snakes seldom grow beyond 3.3 meters long, they have been recorded to lengths at 5.5 meters. Boas eat mammals, killing them by first biting them and then constricting them (Encyclopedia Britannica-Boa, 26 June 2000, <http://www.britannica.com>).

Anacondas, scientifically referred to as *Eunectes murinus* and commonly known as a water boa, is a heavily built snake, generally five meters in length. The giant Anaconda is dark green with alternating oval black spots and resides primarily in water. These snakes eat animals as large as young pigs and occasionally enter the forest in search of birds (Encyclopedia Britannica-Anaconda, 26 June 2000, <http://www.britannica.com>).

5.2.2.6 Insects: Insects are among the most important, although smallest, creatures in the forest. The educational material below should be included in this exhibit. The Morpho butterflies, of the scientific family *Morphidae*, are among the most well known insects in Costa Rica. The seventeen species of Morpho butterflies found in the rain forests of Costa Rica have wings with thousands of microscopic scales that separate and reflect light, creating iridescent blues in some and dull browns in other species. The females are generally duller in color with broader wings than the males. When at rest they hold their wings upright and together revealing tan camouflage, which protects them from predators. The larvae of these butterflies eat plants and live in a communal web. Upon maturation, they live in the tops of trees, rarely descending to the ground. Their diets then consist of tree sap and the juices of rotting fruits. Some species of Morphos have poisonous hairs, which cause rashes on the skin of humans. These butterflies are

also bred commercially, as their wing coatings are used in jewelry, lampshades and pictures (Encyclopedia Britannica-Morpho, 14 June 2000, <<http://www.britannica.com>>).

Scarab beetles, of the scientific family *Scarabaeidae* and order *Coleoptera*, number over 30,000 species throughout the world. Their compact bodies and unusual antennae distinguish them from other types of beetles. The toothed edges of their legs facilitate digging. Some feed on manure, decomposing plant fibers, growing roots, leaves, and fungi (Encyclopedia Britannica-Scarab Beetles, 22 June 2000, <<http://www.britannica.com>>).

The Rhinoceros beetle, scientifically the *Megasoma spp*, of Costa Rica is among the largest beetles in the world. At approximately eighty millimeters in length, the males have long horns, which curve upward. The females lack these horns, which are for fighting. Rhinoceros beetles lay their eggs, which require three to four years to mature, in large fallen logs (Costa Rican Rainforest Gallery -- Room 4, 22 June 2000, <<http://www.interlog.com/~rainfrst/gallery4.html>>).

5.2.2.7 Plants: The rainforest has many plants in its population, which should be explained in the exhibit with the following educational material. Banana plants, of the scientific family *Musa cavendishii*, have a false trunk, which means the trunk section is composed of the base portion of leaf sheaths and is between three and six meters high. Between ten and twenty oblong leaves, between 3.0 and 3.5 long and sixty-five centimeters across, are found at the top of the plant. A mature banana plants have between fifty and 150 individual fruits in groups of ten or twenty. Each ripe banana is seventy-five percent water. When the plant has developed the fruits it is cut down because each plant

produces fruit only once. The underground portion of the stem is left in the ground and produces new plants in six-month intervals. Banana plants thrive in humid tropical environments such as Costa Rica (Encyclopedia Britannica-Banana Plants, 14, June 2000, <<http://www.britannica.com>>).

Plantain plants, scientifically referred to as the *Musa paradisiaca*, are closely related to the banana plant. These grow to be ten meters high and have a false trunk similar to that of the banana plant. The leaves are between 1.5 and 3.0 meters long and approximately 0.5 meters wide. The fruit of the plantain plant are similar in shape to bananas, but are green when ripe and much larger. These fruits also have more starch than bananas. They are not usually eaten raw, but rather are boiled or fried (Encyclopedia Britannica-Plantain, 14 June 2000, <<http://www.britannica.com>>).

Ferns, of the family *Filicophyta*, are characterized as non-flowering vascular plants with true roots, stems and complex leaves. The leaves have branched vein systems and newly forming leaves unroll from fiddleheads. Ferns range in size from two or three millimeters to ten or fifteen meters, depending on the species. Ferns, although present all over the world, are most abundant in tropical areas like Costa Rica. They are not considered of great economic value, but they are a very important part of the rainforest. Their quick growth helps to prevent deforestation and their root system prevents erosion. Some species are used as a minor food source for animals while others have medicinal uses (Encyclopedia Britannica-Ferns, 14 June 2000, <<http://www.britannica.com>>).

5.2.2.8 Trees: Like plants, the trees of the forest are both important and necessary and should be explained with the same type of material. There are many types of palm trees in Costa Rica, some able to grow as high as sixty meters and are generally one me-

ter in diameter. They are commonly used as food, shelter, clothing, timber, fuel, building materials, fibers, starch, oils, waxes and wines. The size of the leaves ranges from several centimeters to over nine meters depending on the species. The Cohune Palm, scientifically called the *Attalea cohune*, grows to approximately eighteen meters in height. Its oil is used in soap (Encyclopedia Britannica-Palm Trees, 14 June 2000, <<http://www.britannica.com>>).

The Coconut Palm, scientifically known as *Cocos nucifera*, grows to heights over twenty-five meters tall and its mature fruits are between 300 and 450 millimeters long and 150 to 200 millimeters in diameter. The trees grow best when planted close to the sea in areas a few meters above sea level. After the seeds are planted, five or six years must pass before the trees bear fruits and they reach the height of their fruit bear stage after fifteen years of growth. The fruits require one year to fully ripen. Some trees produce one hundred fruits per year, although fifty is considered a good harvest. After fifty years of growth, the trees no longer produce fruits. The husks of the coconuts are often used to make ropes, mats and baskets (Encyclopedia Britannica-Coconut Palm, 14 June 2000, <<http://www.britannica.com>>).

Avocados, the fruits scientifically known as the *Persea americana*, grown on tall trees with elliptical shaped leaves, which range between one hundred and three hundred millimeters in length. The flowers of this tree are small and green without petals. Avocados vary greatly in size, shape and color. The skin of the fruit is very thin and coarsely textured, and the colors range from green to dark purple. These fruits are rich in vitamins, including thiamine, riboflavin and vitamin A (Encyclopedia Britannica-Avocado, 14 June 2000, <<http://www.britannica.com>>).

Orchids, of the family *Orchidaceae*, are important plants in Costa Rican culture. The national flower, the purple orchid, scientifically known as the *Orchidaceae mascula* contains a nutritive starch. Each orchid plant bears a single flower spike containing flowers. The tree of the purple orchid is small to middle-sized and the flowers range in height from six to twenty centimeters (Encyclopedia Britannica-Orchis, 14 June 2000, <<http://www.britannica.com>>).

Pineapple trees, scientifically referred to as the *Ananas comosus*, have between thirty and forty succulent leaves. Each fruit weighs between one and two kilograms and are formed when two separate lavender flowers attach to form one central axis core. This core develops a flesh-like tissue and the fused structure later becomes the pineapple fruit. The fruit requires five or six months, after the flowering stage, to fully ripen (Encyclopedia Britannica-Pineapple, 14 June 2000, <<http://www.britannica.com>>).

5.2.2.9 Fungi: Fungi are an often forgotten part of the forest and therefore their explanation is essential. Our project team has included some of the educational material relevant to the fungi in Costa Rica. Orange puffballs, a type of fungus found in Costa Rica, are characterized by their ability to disperse small clouds of spores when struck by rain drops. The small opening at the top of the puffball allows spores to be carried away by the wind. They are usually located on the ground or on rotten wood (Giant Puffballs, 14 June 2000, <<http://herb.lsa.umich.edu/kidpage/Funfacts.htm>>).

Luminous fungi, which appear to glow in the dark, are also present in the forests of Costa Rica. At times, the large number of these fungi makes the forest look like a fairyland. The light created by the fungus attracts beetles, which then disperse the spores

throughout the forest. Some species of lethal fungi found within the forests of Costa Rica invades the bodies of living insects and first consumes the non-vital parts and then later the others. Some of these species are able to influence the behaviors of their victims before causing their death. The fungus then further develops on the newly deceased and the spores of the fungi disperse in the wind (Fogden, 1997).

5.2.2.10 Conservation of the Rainforest: Tropical rainforests, like the ones present in Costa Rica, are by far the richest habitats on Earth. Over 30 million species of plants and animals, which is more than half of all life forms, live in tropical rainforests. At least two-thirds of the world's plant species, including many exotic and beautiful flowers, as well as plants with medicinal value, reside only in the tropics and subtropics. Rainforests are part of the global weather system. Destroying them alters the hydrological or water cycle, which causes drought, flooding, and soil erosion in areas where such events would not normally occur. Cutting down forests also changes the albedo or reflectivity of the earth's surface, which in turn alters wind and ocean current patterns, and changes rainfall distribution. For these reasons the rainforest must be preserved and protected from deforestation and destruction. The children must be educated about its importance and necessity for its preservation. (Defenders of the Rainforest, June 22, 2000 <<http://www.eco-action.org/rforest/defendhome.html>>).

There are many things that the children can do to begin conserving the forests and all its creatures. First they can reduce the use and necessity of wood and paper products in their homes and schools by recycling. They can also refuse to purchase wood products made from rainforest trees, such as rosewood. The most important thing children are able

to do, however, is to educate themselves on the current state of the rainforest (Defenders of the Rainforest, June 22, 2000 <<http://www.eco-action.org/rforest/defendhome.html>>).

5.2.3 Subterranean Educational Components

This section focuses on the plants and animals that are present under the ground. In the case of the plants, these are the roots of the trees that extend down below the surface of the ground. The animals that are portrayed underground are ants, encased in an ant farm. The interactions between these two are also explained. As with the other sections, it is necessary to provide some educational material in this section.

5.2.3.1 Roots: The root system of plants and trees are important yet complex element in the survival of the forest, therefore some educational material should accompany this area of the section. The primary functions of roots include the anchorage of the plant, absorption of water and dissolved minerals, conduction of these to the stem, and storage of reserve foods. One section of root should be cross-sectioned to display its inner cellular make up. This includes: the epidermis, the outermost layer of cells, through which absorption occurs, and the cortex, which conducts water and minerals from the epidermis to the vascular cylinder. This cylinder contains the xylem and phloem, two conductive tissues that transport water/minerals and food, respectively, to the rest of the plant (Encyclopedia Britannica-Root, 14 June 2000, <<http://www.britannica.com>>).

The roots grow downward into the soil, which is aerated by the ants and worms that live under the ground. These help loosen the dirt to make it easier for the plant root to develop. The plants provide nutrients to the soil for the ants to use, while the ants pro-

vide nutrients that are utilized by the plants. Ants form colonies in nests, which are often complex caverns extending through the soil, similar to the ant farm shown in this area.

5.2.3.2 Ant Farm: Although the children will enjoy viewing the ants in this farm, it is necessary for El Museo de los Niños to provide some information about the ants and their habitat. The ants within these colonies are connected through complex social behaviors and a dependence on one another for survival. Typically, an ant has a large head and a slender, oval abdomen joined to the thorax, or midsection, by a small waist. The antennae are elbowed. The mouth has two sets of jaws: the outer pair is used for carrying objects such as food and for digging, and the inner pair is used for chewing. Some species have a powerful sting at the tip of the abdomen (Encyclopedia Britannica-Ant, 14 June 2000, <<http://www.britannica.com>>).

The young ants stay with both parents or with the mother and form social organizations of high complexity. In some societies the parents enslave their first children or their sisters, frequently with chemical secretions thereby ensuring better care of their later ones. Ants are often polymorphic, with small individuals working in the nest and medium or medium-large ones working outside. There are three castes or classes within the ant societies: queens, males, and workers. The queen spends her life laying eggs, while the workers are females who do the work of the nest. Huge-headed individuals become protective soldiers or even use their heads as plugs to stop up the nest entrance to all besides members of the colony (Encyclopedia Britannica-Ant, 14 June 2000, <<http://www.britannica.com>>).

The food of ants consists of both plant and animal substances. Certain species eat the eggs and larvae of other ants or even those of their own species; other species eat the liquid secretions of plants. The leaf-cutting ants, common in the tropics, strip the green leaves from plants and create a paste from them in which they grow fungus. Carpenter ants, present in more temperate zones, eat wood and trees. The army ants do not eat trees or plants, but rather they tear apart arthropods for nourishment (Encyclopedia Britannica-Ant, 14 June 2000, <<http://www.britannica.com>>).

5.2.4 Evolution Educational Components

This area pictorially presents the theory of evolution in a mural. The museum assistant must explain the educational aspects of this mural and the theory while drawing the connection to the chick hatchery.

5.2.4.1 Mural Depicting Evolution: The description of the mural given by the museum assistant will be brief. The main purpose of the mural is to provide an overview of the variety of creatures in the world and the ways in which they have evolved from one another. An outline of where each critical phylum should reside in relation to the others is in Figure 5-4 (page 74). This outline contains only the name of the phylum of animals that should be included. For each, several examples should be illustrated. For example, under the Angiosperms category, plants such as carrots, beans and various flowers should be illustrated, while the Gymnosperms category should depict fir trees. The vertebrate category should show such animals as man, monkeys, chicks, frogs and fish. Urochordates include sea squirts, while the Echinoderm phylum includes starfish and urchins.

Crustacea depicts lobsters and crabs, Mollusks show squid, snails and clams, and Coelenterates depict hydra and sea anemone (Alberts, 1994). These are just some of the possibilities for inclusion on the mural of evolution.

5.2.4.2 Chick Hatchery: Information pertaining to the growth and maturation of the eggs, as well as their care and maintenance will be provided by the company that donates the incubator and eggs. The question of which came first the chicken or the egg is a complex rhetorical question about the evolution of organisms. This will not be explained in great detail to the children, however, they will be invited to propose their own theories and explanations about which was first. Many theories will be presented to the children once they have formulated their own opinions. These opinions will be calculated by a vote, as described in the design recommendation section. The theories will include the theory of evolution as well as the theory of creation, although neither will be biased.

In addition to the suggested design and educational content, our project team has proposed several recommendations for El Museo de los Niños with respect to the funding aspect of this project.

5.3 Estimated Costs

Upon completion of the design and prior to seeking funding for its implementation, it was necessary to determine a cost estimate of the components that we have recommended for inclusion and also for the overall project. The names and contact infor

mation for the suppliers and contractors were found through internet searches and in the museums files of current suppliers.

Ivar Zapp allowed us to utilize his current contractor, Justo Pastor Jarguin, for the reconstruction cost estimation. After determining the dimensions of the area to be reconstructed, Mr. Jarguin was able to make the estimation of \$6,720 US including all materials and labor. Mr. Zapp also offered information on the cost of adding murals to exhibits. Currently the approximate cost of a detailed mural is fifty dollars per square meter. This estimation includes the payment of the artists and the costs of all necessary supplies.

The Dodge-Regupol Company of the United States currently sells a type of playground flooring called ECOearth. This type of flooring is made of shredded rubber and soft to the touch. ECOearth is available in several colors including coffee and cream and green acres, which are recommended for implementation in the redesign. At \$9.75 US per square meter, this type of flooring is less expensive than the basic flooring the museum currently utilizes for most of the exhibits.

The laboratory, rainforest, and subterranean sections require several specialized components. Taylor Studios of the United States provided cost estimations of all of the models included in the exhibit, which are included in Table 5-1. The models are sculpted or carved plastics with detailed paint finishes. Taylor Studios is able to pose the model animals in any position the museum desires.

For the laboratory section, basic light microscopes are necessary. The 20x Elementary Scopes are specifically designed for children in grade school. This type of microscope is available in the online catalogue of the Carolina Biological Supply Company and costs seventy-nine dollars. This company also makes a common microorgan-

isms slide set for seventy dollars. Many unicellular organisms included in the monera and protista kingdoms are included in this slide set. Slides of fungi and animal cells are also included to illustrate the great diversity of microscopic organisms

The subterranean section requires the implementation of Plexiglas to construct the terrariums and ant farm. Just Plastics of the United States provided the cost estimation for the Plexiglas required by these components, which are included in Table 5-1. These estimations are for only the Plexiglas and not for the material that are inside the terrariums or ant farm. The materials not specifically included in Table 5-1, on the following page, are estimated in the final step of the cost estimation, which consists of adding ten percent of the total to account for unexpected expenses.

Table 5-1: Cost Estimation

MATERIAL	COST (USD)	PER (UNIT)	UNITS	TOTAL COST (USD)
Reconstruction	\$6,720.00			\$6,720.00
Murals	\$50.00	square meter	200	\$10,000.00
Flooring	\$9.75	square meter	80	\$780.00
Cell Puzzles	\$2,500.00	puzzle	2	\$5,000.00
Microscopes	\$79.00	microscope	4	\$316.00
Slides	\$70.00	set of 20	1	\$70.00
Large Microscope	\$3,000.00		1	\$3,000.00
Animatronics	\$18,000.00	animal	4	\$72,000.00
Molded Trees	\$4,000.00	tree	10	\$40,000.00
Molded Birds	\$2,500.00	bird	2	\$5,000.00
Molded Small Animals	\$2,500.00	animal	8	\$20,000.00
Molded Frogs	\$200.00	frog	6	\$1,200.00
Molded insects	\$800.00	insect	4	\$3,200.00
Molded Fungi	\$300.00	Fungus	9	\$2,700.00
Molded Roots	\$3,500.00			\$3,500.00
Terrariums	\$1,890.00			\$1,890.00
Ant Farm	\$100.00			\$100.00
Unexpected Costs				\$17,547.60
Total Estimated Cost				\$193,023.60

5.4 Companies Requiring Mail Contact

The companies included in Table 5-2, on the following page, require contact by mail rather than fax or e-mail. We recommended that El Museo de los Niños contact each of these companies by mail using the completed proposal statements in Appendix K. In addition to the letters provided, a self addressed stamped envelope should be included to ensure a rapid reply from each company.

Table 5-2: Companies Requiring Proposal Statements by Mail

Amgen, Inc.	LJL BioSystems, Inc
Anika Therapeutics	Medi-Ject Corporation
Bioprogess Technology	Medimmune, Inc.
Boston Biomedica, Inc.	NBTY, Inc.
COR Therapeutics	Novamatrix Medical Systems, Inc.
Datascope	VidaMed, Inc.
Genetech	Vital Signs, Inc.
LifeCell Corporation	Vitro Diagnostics

5.5 Guidelines for Successful Grant Proposals

The initial grant proposal statement requested each company's grant proposal basic requirements. These requirements state the specific requirements of the company, which would ensure that the proposal includes all of the necessary details for the company to determine if it will support a project. Currently, some companies have already provided this information (Appendix J) and the proposals for these companies should be completed accordingly. The majority of companies, however, have not yet provided this information. There are several general guidelines that our team recommends be adhered to for all formal grant proposals including: a description of the museum's mission, the geographical area influenced by this project, a description of the project goals and how they will be reached, the projected budget, and the museum's most recent financial in-

formation. Other considerations that must be taken into account are the time duration for the completion of the project and any necessary materials.

5.6 Generalized Grant Proposals

The grant proposals, although they should adhere to the specific requirements of the company, will follow the same general format. This letter must include an introduction providing background about the museum, the reason for the redesign of the exhibit, the proposed design and its benefits, a description of the uniqueness of this project, the official request for funds, all necessary budget information, and a closing paragraph. Below, we have included two sample grant proposal letters, which can be referenced when completing each individual proposal. At a later date, when all of the details are finalized, El Museo de los Niños must include the specifics of the budget for the project, tax information, and any other requirements of the company. The companies that have responded favorably and now require a completed grant proposal are shown in Appendix I.

5.6.1 Sample Grant Proposal Letter for Use with Biological Companies:

Name of Company
Address of Company

Dear (contact person specified by company),

Designed in 1991, El Museo de los Niños has maintained its original goal to educate children in science and culture in new innovative ways. As new technologies become available, existing exhibits are redesigned and updated to contain the most relevant information and remain appealing to the children. One exhibit, “Los Seres Vivos” (the

living creatures), is among our top priorities for redesign. Over 250,000 children and adults visit the museum each year to explore exhibits in all areas of science. A brochure describing the history and goals of the museum, and the various exhibits it houses has been included to enable you to better understand its positive impact on society. As the success of the museum continues to increase, the future of Costa Rica, which lies in the hands of the children, will continue to improve.

With the aid of your company, this new innovative exhibit will help educate children on the five kingdoms of living creatures. The major areas in this exhibit focus on microorganisms, plant and animal life, and fungi. A second major focus is conservation of the environment, which will encourage children to work to preserve these organisms for future study. With your help, the museum will continue to educate children in all areas of science, including biology, and ensure that future generations will have the knowledge to become leaders.

The primary goal of the museum is to educate the children; this exhibit focuses on biology through the use of a simulated laboratory, rainforest, and depiction of evolution. This exhibit will be unlike any other in the museum because it will create an atmosphere consistent with the Costa Rican rainforest. The laboratory area will reside in the rainforest atmosphere, and contain four microscopes with microorganism slides, which expose children to the microscopic world. This will teach children the proper use of microscopes and enable them to identify microorganisms. The rainforest area will focus on the plants, animals, and fungus in Costa Rica while incorporating conservation of this ecosystem. Through an evolutionary mural and chicken hatchery, the children connect the evolution of life with the maturation of living beings.

The estimated cost to implement an exhibit of this nature is \$ _____. The museum would also appreciate material donations such as slides or microscopes, in addition to monetary donations. Any and all contributions of funds will greatly aid our project. With the help of your company, the implementation of this exhibit is expected to begin on _____ and be completed by _____ (*dates for construction of the new exhibit*). The donation of funds is necessary to begin the implementation of this project; therefore we would appreciate a rapid reply.

As with any successful donation, tax status plays a key role for your company. Included is our most recent financial information along with our tax exemption number. Currently, donations from the United States are being sent to the museum through the United Nations organization, UNESCO. All funds should be sent to: (*UNESCO Address*). They will then be directed to the museum in Costa Rica for use with this project. If you have any further questions about this process, please contact us. Thank you for your interest in aiding the education of the future leaders of the world.

Sincerely,

Fabiola Rodríguez
P.O. Box 10303-1000 San José
Calle 4, Avenida 9
Antigua Penitenciaría
Museo de los Niños
San José, Costa Rica
011-506-223-7003
fax 011-506-223-3470

5.6.2 Sample Grant Proposal Letter for Use with American-based Companies:

Name of Company
Address of Company

Dear (contact person specified by company),

Designed in 1991, El Museo de los Niños has maintained its original goal to educate children in science and culture in new innovative ways. As new technologies become available, existing exhibits are redesigned and updated to contain the most relevant information and remain appealing to the children. One exhibit, “Los Seres Vivos” (the living creatures), is among our top priorities for redesign. Over 250,000 children and adults visit the museum each year to explore exhibits in all areas of science. A brochure describing the history and goals of the museum, and the various exhibits it houses has been included to enable you to better understand its positive impact on society. As the success of the museum continues to increase, the future of Costa Rica, which lies in the hands of the children, will continue to improve.

With your help, the museum can continue to educate children in all areas of science, and ensure that future generations will have the knowledge to become leaders. The primary goal of the museum is to educate the children; this exhibit focuses on biology through the use of a simulated laboratory, rainforest, and depiction of evolution. This exhibit will be unlike any other in the museum because it will create an atmosphere consistent with the Costa Rican rainforest. The laboratory area will reside in the rainforest atmosphere, and contain four microscopes with slides microorganisms, which expose children to the microscopic world. This will teach children the proper use of microscopes and enable them to identify microorganisms. The rainforest area will focus on the plants,

animals, and fungus in Costa Rica while incorporating conservation of this ecosystem. Through an evolutionary mural and chicken hatchery, the children connect the evolution of life with the maturation of living beings.

The estimated cost to implement an exhibit of this nature is \$_____. The museum would also appreciate material donations such as slides or microscopes, in addition to monetary donations. Any and all contributions of funds will greatly aid our project. With the help of your company, the implementation of this exhibit is expected to begin on _____ and be completed by _____ (*dates for construction of the new exhibit*). The donation of funds is necessary to begin the implementation of this project; therefore we would appreciate a rapid reply.

As with any successful donation, tax status plays a key role for your company. Included is our most recent financial information along with our tax exemption number. Currently, donations from the United States are being sent to the museum through the United Nations organization, UNESCO. All funds should be sent to: (*UNESCO Address*). They will then be directed to the museum in Costa Rica for use with this project. If you have any further questions about this process, please contact us. Thank you for your interest in aiding the education of the future leaders of the world.

Sincerely,

Fabiola Rodríguez
P.O. Box 10303-1000 San José
Calle 4, Avenida 9
Antigua Penitenciaría
Museo de los Niños
San José, Costa Rica
011-506-223-7003
fax 011-506-223-3470

These letters are merely for use as reference in preparing the final proposal. It is recommended that the specific guidelines and format provided by each company should be used to ensure accuracy and appropriate sequencing whenever possible.

5.7 Registration as an International Non-Profit Organization

As suggested by the museum, our group contacted the UNESCO organization, in reference to the transfer of funds from the United States to Costa Rica. However, there has been some confusion about this process and for this reason it is the recommendation of our team that El Museo de los Niños registers as an international non-profit organization in the United States. By doing so, the museum will be issued a tax-exemption number from the federal government and this number is required for most grant applications. Also, more North American companies are familiar with granting funds to these organizations rather than donating through UNESCO.

5.8 Conclusions

The existing exhibit, “Los Seres Vivos”, currently lacks interactive features and is not particularly interesting or entertaining for the children. The new design for this exhibit encompasses education and culture in an appealing atmosphere that forces the use of many senses simultaneously. It provides an interactive learning environment for both children and adults where the living creatures of Costa Rica are presented. Each of the five kingdoms of these creatures, depicted in this exhibit, is distinctly separated by specific characteristics. However, together they create the ecosystem that is known today

and without any one of them the world would not continue to thrive. For this reason educating the children on their importance is essential.

El Museo de los Niños, a non-profit organization, depends on the monetary donations of companies and individuals to subsidize the annual budget provided by the government. The implementation of this new design requires the financial assistance of one or more outside sources and some possibilities for this aid have been provided. More importantly the steps that the museum should take to find funding in the future have been provided to ease this tedious process. These guidelines to obtaining funds will help the museum to achieve its goal to educate the children on topics of science and culture by allowing it to develop new learning aids.

5.8.1 Relevance of the IQP

The Interactive Qualifying Project (IQP) is designed to expose students to the interdependence of society, science, and technology. The focus of this project was the development of a new exhibit design to aid the education of children in the field of biology. By doing so the community was also helped, as these children will grow into knowledgeable, problem solving adults. The museum utilizes new technologies and presents the public with complex ideas and theories in innovative and interactive ways to promote the learning process. Throughout the duration of this project, the team members became increasingly aware of the necessity of technology in creating an active learning environment and its positive effects on the learning process.

5.8.2 Future IQP Possibilities

Among our final recommendations are suggestions for future Interactive Qualifying Projects involving El Museo de los Niños. These possibilities included the complete design of a new, innovative exhibit or the redesign of other existing exhibits, and the creation of a system of evaluation for the existing exhibits to determine their success or the necessity of redesign, and to develop stronger relations with potential sponsors in the United States and other foreign nations.

The first of these possibilities would follow similar methods as those explained in this report. However, to develop a completely innovative exhibit on a new topic would require surveying the children, schools, and the public to determine which subjects would be of interest. Based on such research, the students could make recommendations for future projects the museum should consider.

Currently, El Museo de los Niños does not have a specific process for determining which exhibits require redesign. A project of this nature would provide the museum with a step-by-step method for evaluating their exhibits. WPI students could also use this form to evaluate the existing exhibits and make recommendations pertaining to those that may require updating. This project would require extensive observations of each exhibit, the creation of an accurate rating system applicable to all exhibits, and a clear definition of what constitutes a successful exhibit. Interviews or surveys with the museum assistants, children, and other visitors would prove necessary to gather this information.

The final suggestion for a project alliance between Worcester Polytechnic Institute and El Museo de los Niños involves creating stronger relations with foreign nations, including the United States. The primary objective in this project would be to ease the

process of obtaining monetary support from other nations. This could involve the creation of a database of worldwide companies scientifically or culturally linked to the types of projects El Museo de los Niños may undertake. It could also involve the development of some form of multinational publicity that would make the objectives and history of the museum widely recognized.

These are only a few of the museum's possibilities for projects enlisting the aid of WPI. The alliance formed between these groups, El Museo de los Niños and Worcester Polytechnic Institute, will help the museum to achieve its primary goal of educating the youth of Costa Rica.

5.8.3 Final Thoughts

The members of this project team would like to express their appreciation to El Museo de los Niños for providing us with the opportunity to complete this project. We firmly believe that the design that we have presented will not only educate the children of Costa Rica, but also allow them to enjoy learning about the living creatures of the world. It is our hope that this exhibition will inspire children to learn more about the world around them.

In addition to aiding the education of the children, this opportunity has also helped us to further understand the connection between society and technology, particularly the positive effects that innovative technologies can have on a nation. It is our view that El Museo de los Niños is a valuable asset to the people and the country, one that will aid the nation in rising to a higher level. We truly appreciate the experience we have had in working with such an institution.

APPENDIX A: MISSION AND ORGANIZATION OF EL MUSEO DE LOS NIÑOS

In 1991, the notion of establishing an interactive children's museum to supplement the education of Costa Rican children was formulated. The idea, initially, was to model this new museum after the best in the world. The goal was simple: to provide the opportunity for intellectual growth to both children and adults and, by doing so, guarantee a better future to succeeding generations. This seemed like an impossible dream for a developing nation, but it was accomplished with the help of many enthusiastic supporters.

The former first lady, Gloria Bejarano de Calderon, initiated the concept of the Children's Museum. She, with the help of many passionate followers, gained the support of the Fundaciones Ayudenos para Ayudar (the Help us to Help Foundation) and began to motivate interested parties to take part in the plans for the large project. Through many generous donations from private enterprises, individual Costa Ricans, and the government, the plans began to take shape.

With all of the support the foundation had acquired, they still needed a location for the museum. As is common in Costa Rica, they began to look for an old military institution, an old liqueur factory or an old prison to convert into a recreational and cultural area for the people. A turn of the century penitentiary, sitting atop a hill in the heart of San José, was considered ideal, despite the fact that it was abandoned and in ruins. Its imminent demolition was stopped and the reconstruction was initiated through the support of the support of the Rafael Angel Calderon Fournier administration.

The museum is currently a member of the CCCC, the Centro Costarricense de la Ciencia y la Cultura (the Costa Rican Center for Science and Culture), which works to

bring science and culture to all of Costa Rica. The goals of the museum, although they have remained fundamentally the same since the beginning, have developed more in detail. The primary objective of the museum is to educate children, however they have moved away from traditional museums and created an innovative, stimulating environment. Their motto is “to educate the child to avoid punishing the adult”, which essentially means that in order for the Costa Rican youth to thrive in society as adults they must gain the knowledge necessary to succeed, otherwise they will end up lost. The museum encourages the learning process by allowing children to enter a world of experimentation where theories become unforgettable experiences through direct involvement with the exhibits.

The museum’s continual goal is to contribute to the improvement of the education system, which means that the museum will never truly be completed. New exhibits are designed and implemented as often as possible, and existing exhibits are updated as technology changes and new options become available. Because of the non-profit nature of the museum, they rely primarily on government funding, which provides them with an annual budget, and on donations from corporations and individuals. The museum has tremendous support from the community and the government and will continue to expand as a result. Many new exhibits are in the design process currently and will be integrated into the museum over the next several years. As the success of the museum continues to increase, the future of Costa Rica, which lies in the hands of the children, will continue to improve.

APPENDIX B: OUTLINE OF EDUCATIONAL MATERIAL PROVIDED BY EL MUSEO DE LOS NIÑOS

**Centro Costarricense de la Ciencia y la Cultura
Museo de los Niños
Departamento de Museografía y Apoyo Educativo**

Guión Temático de Seres Vivos

Elaborado por:
M.Sc Frank Cedeño
Licda. Tatiana Camacho

1.0 Introducción

Desde el inicio del proyecto se destinó un espacio dentro del Museo de los Niños para desarrollar el tema de los Seres Vivos. Por carencia de presupuesto en el CCCC en años anteriores y de un patrocinador externo, esta área cuenta en la actualidad solamente con un estereoscopio, un rastreador biológico, una colección de insectos, y terrarios con culebras y tortugas.

Dada la importancia del tema y de la existencia del espacio para desarrollar una exhibición a cabalidad, en el presupuesto del Centro de 1999 se le asignó a esta sala por 5 millones de colones. Como este no alcanza para concluir el proyecto, sugerimos que se destine para contratar el diseño y la construcción de una primera etapa. La Segunda etapa se podría concluir con el presupuesto interno del año 2000 o mediante el patrocinio externo.

A continuación se desglosan los objetivos, los temas, la meta y algunos recursos museográficos sugeridos para dicha exhibición.

2.0 Objetivos

2.1 Objetivo general

Mostrar la diversidad existente en los seres vivos

2.2 Objetivos específicos

2.2.1 Dar a conocer las características fundamentales de los 5 reinos en los que se agrupan los seres vivos en biología: monera, protista, fungi, plantae y animalia.

2.2.2 Promover en los visitantes el respeto a los seres vivos y su entorno.

3.0 Meta

Involucrar a los visitantes en el estudio y el respeto por las otras formas de vida existentes en nuestro Planeta.

4.0 Areas Temáticas

Temas	Sub-temas	Recursos museográficos
1- Diversidad de los seres vivos	-Definición de biología Sistema de clasificación utilizado en biología (taxonomía o sistemática) Características de las células procariota y eucariota Organización de las células eucariotas: unicelulares, multicelulares (niveles de organización)	Mural donde se muestran los cinco reinos biológicos y sus representantes. Proyección de imágenes de los distintos representantes de los reinos biológicos.

Temas	Sub-temas	Recursos museográficos
2- Reino Monera	Referencia sobre los virus y su ciclo de vida Integrantes del reino: Bacterias (y archibacterias) y algas verde azules. Características generales: Distribución, reproducción, alimentación. Tipos de bacterias: bacilos, espirilos, cocos Importancia de las bacterias: En la agricultura, en la industria, ecológica (como decomponedoras) etc. Bacterias beneficiosas y perjudiciales (ejemplos) Características de las algas cianofíceas	- Reproducción de fotografías gigantes al microscopio electrónico como escenografía - Láminas transparentes iluminadas con gráficos e información - Placas petri con cultivo de Bacterias - Juego interactivo con preguntas y respuestas sobre bacterias beneficiosas y perjudiciales - Muestras de productos que se hacen con la ayuda de las bacterias: yogurt, vinagre. Vinos, etc. - Fotografías que ilustren enfermedades ocasionadas por bacterias.

Temas	Sub-temas	Recursos museográficos
3- Reino Protozoo	<p>Características generales de los protozoos (distribución, alimentación, reproducción, etc.)</p> <p>Tipos de protozoos: Zarcodiaris, flagelados, esporozoos, ciliados.</p> <p>Relación con el hombre: ejemplos de los protozoos parásitos que causan enfermedades al hombre y a la agricultura</p> <p>Importancia ecológica: la producción de oxígeno.</p> <p>Consejos para la conservación.</p>	<p>-Reproducción de fotografías gigantes al microscopio electrónico como escenografía</p> <p>- Modelos de los distintos grupos de protozoos</p> <p>- Microscopios con láminas fijas para observar los diferentes tipos de protozoos.</p> <p>- Láminas transparentes con información y gráfica</p> <p>- Fotografías que ilustren enfermedades ocasionadas por protozoos</p>

Temas	Sub-temas	Recursos museográficos
Reino Fungi	<p>- Características generales de los hongos (ciclo de vida, distribución, alimentación, etc.)</p> <p>- Hongos microscópicos y macroscópicos</p> <p>- Tipos de hongos: basidiomicetes, ascomicetes, zigomicetes, quitridiomycetes</p> <p>- Importancia de los hongos beneficiosos y perjudiciales para el hombre, la agricultura y la industria: La penicilina, las levaduras.</p> <p>- Consejos para la conservación.</p>	<p>- Fotografías gigantes como escenografía.</p> <p>Colección de hongos (secos) macroscópicos con lupas para observar sus detalles</p> <p>Gráficos e información en láminas transparentes</p> <p>- Microscopios con láminas fijas de hongos microscópicos</p> <p>Muestras de productos que se hacen con la ayuda de los hongos: pan, medicinas, etc.</p> <p>Fotografías que ilustren enfermedades causadas por hongos en plantas y personas, etc.</p>

Temas	Sub-temas	Recursos museográficos
Reino Plantae	-Características generales	-Fotografías gigantes como

	<p>de las plantas (partes de las plantas, ciclo de vida, distribución, alimentación, etc.)</p> <p>-Importancia de las Plantas: fotosíntesis</p> <p>-Tipos de plantas: Briofitos y Plantas Vasculares (gimnospermas y angiospermas: monocotiledóneas y dicotiledóneas y características usadas por los botánicos en su identificación</p> <p>-Usos de las plantas: alimentación, medicina, construcción, industria, ornamentación etc.</p> <p>Ejemplos de plantas beneficiosas y perjudiciales. Árbol y flor nacionales. Consejos para la conservación.</p>	<p>escenografía.</p> <p>-Gráficos iluminados con información.</p> <p>-Modelo con las partes de la planta y su función.</p> <p>-Representación de la fotosíntesis.</p> <p>-Colecciones de hojas, semillas y frutos.</p> <p>-Mostrar los usos de las plantas a través de un dispositivo interactivo.</p> <p>-Referencias al árbol y flor nacional.</p> <p>-Equipo de computo con software sobre el tema.</p>
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Temas	Sub-temas	Recursos museográficos
Reino Animalia	<p>-Características generales del reino.</p> <p>-Clasificación en el reino animal: Invertebrados e invertebrados.</p> <p>-Características de cada grupo: invertebrados vertebrados (locomoción, ciclo de vida, distribución, alimentación, etc.</p> <p>-Invertebrados: Esponjas, corales, parásitos, moluscos, artrópodos, crustáceos.</p> <p>-Ejemplos de adaptaciones en animales: mimetismo, características morfológicas (picos, patas, pelaje, etc.)</p>	<p>Fotografías gigantes como escenografía.</p> <p>-Gráficos iluminados con información.</p> <p>-Modelos o elementos reales: esponjas corales colecciones de invertebrados (insectos, moluscos, crustáceos y otros)</p> <p>-Tipos de pieles: plumas, escamas, pelos.</p> <p>-Ejemplos ilustrados o reales de adaptaciones.</p> <p>-Disfraces de animales.</p> <p>-Dispositivo interactivo en que se muestren diferentes ciclos de vida.</p> <p>-Utilización del</p>

	<p>-Importancia de los animales: ecológica (cadena alimenticia), relación con el hombre: beneficiosos (alimento, trabajo, transporte, etc. y perjudiciales (plagas y enfermedades).</p> <p>-Consejos para la conservación.</p>	<p>estereoscopio.</p> <p>-Equipo de computo con software sobre el tema.</p> <p>-Audífonos con sonidos de diferentes animals: aves, ranas, mamíferos, etc.</p>
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5.0 Exhibición

5.1 Espacio

El espacio destinado para dicha exhibición se encuentra en el pabellón 1 en la rampa que desciende al nivel sótano (ver anexo 1).

La sala Cuenta con un total de 94 metros cuadrados para el desarrollo de la temática.

Público

Por las características del tema esta exhibición está dirigida a un público amplio que va desde niños en edad escolar, estudiantes de colegio y la familia en general. Esto se debe a que los contenidos expuestos en la propuesta se estudian en diferentes niveles de profundidad en los ciclos escolares de los programas del M.E.P.; además se pretende que la exhibición también motive al público adulto a interesarse más en el conocimiento de los seres vivos y genere en los visitantes una actitud proteccionista.

6.0 Museografía

De acuerdo al espacio destinado a la exhibición, se propone que esta se desarrolle en 6 módulos:

El primero abordaría los aspectos generales de los seres vivos (tema 1) en el espacio 11 A (ver anexo).

El segundo modulo abordaría el Reino Monera y el Protista, en el espacio 12 A.

El tercero, el Reino Fungi en el espacio 13 A.

El cuarto, el Reino Plantae, en el espacio 14 A.

El quinto modulo, el Reino Animalia, en los espacios 15 A y 16 A.

Como escenografía, se propone que se utilice el recurso de la fotografía gigante en murales tipo collage, debido a que esta es una forma efectiva de presentar la riqueza del tema y la variedad de organismos que existen (Ver anexo 2).

Esto además es concordante con el recurso utilizado al final de la rampa (el mural de las fotos de niños).

APPENDIX C: SURVEY QUESTIONS

English Questions:

Good afternoon, we are working with Fabiola to redesign the Seres Vivos Exhibit. Since you work with the children daily and see their reactions to the exhibits, we would appreciate your assistance in determining which aspects of the exhibits the children enjoy the most. If you could answer these questions and return them to Karla by the end of the day that would help us tremendously. Thank you very much.

1. In your opinion, which exhibit is frequented most often by children? Why?
2. Which interactive components do children utilize most within the exhibit that you believe is the best? Which interactive components are utilized most often throughout the museum?
3. Do you have any suggestions to bring interaction to Los Seres Vivos?

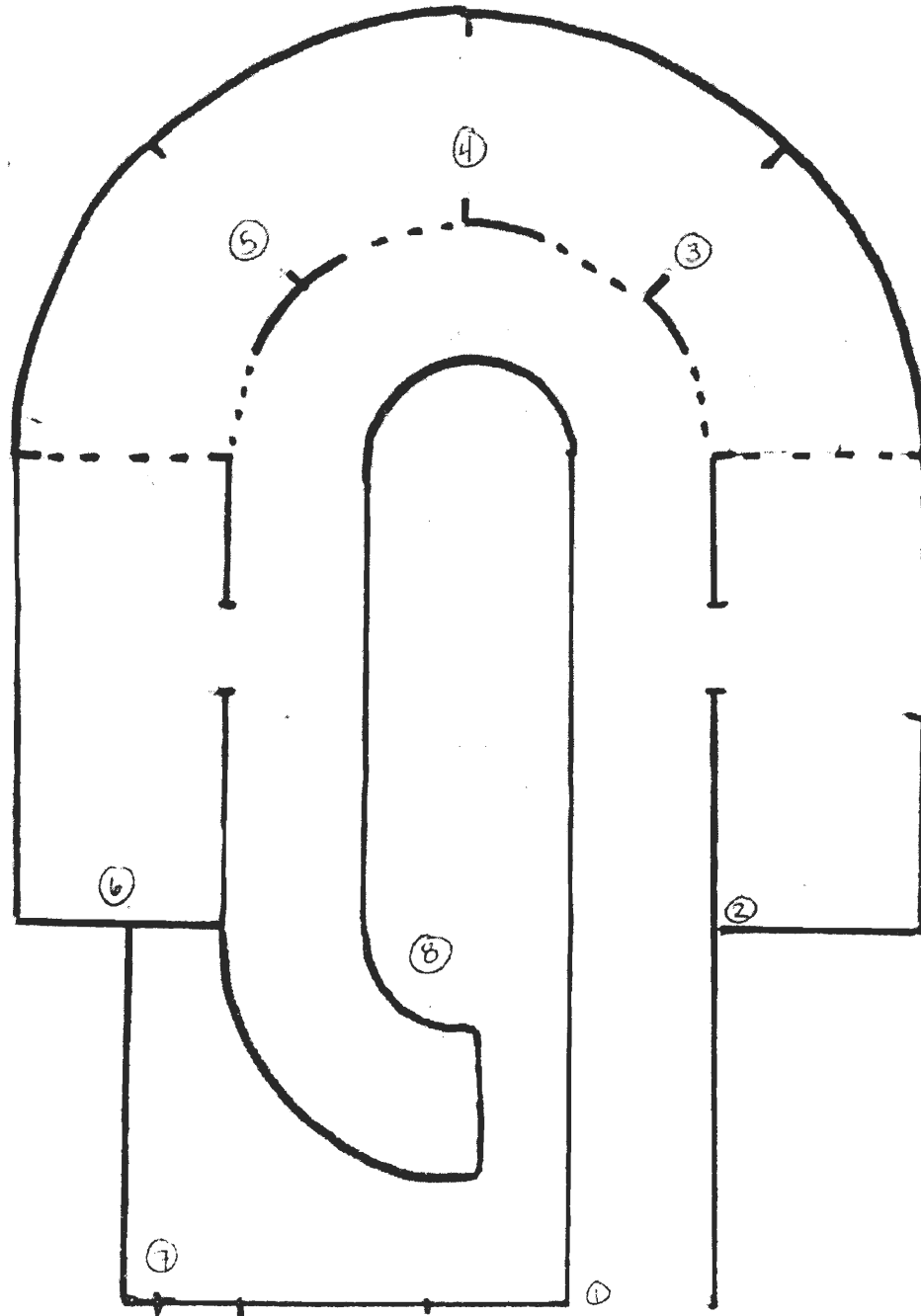
Spanish Translation Distributed to Museum Assistants:

¡Buenos días! Nuestro grupo de WPI está actualmente trabajando para rediseñar la Exhibición de los Seres Vivos. Puesto que Ud. trabaja con los niños diariamente y puesto que ven sus reacciones ante las exhibiciones, nosotros apreciaríamos la asistencia que nos pudiera brindar en determinar cuáles aspectos de las exhibiciones los niños disfrutaban más. Agradeceríamos mucho si Ud. pudiera responder las siguientes preguntas y una vez completadas las devolviera a Karla al final del día. ¡Muchas gracias!

1. En su opinión, ¿cuál exhibición es la más frecuentada por los niños? ¿Cómo Ud. llega a esta conclusión?
2. ¿Cuáles componentes interactivos los niños utilizan más en la exhibición que Ud. piensa es la mejor? ¿Cuáles componentes interactivos utilizan más en todo el museo?
3. Tiene Ud. alguna sugerencia para incorporar elementos interactivos a la Exhibición de los Seres Vivos. ¿Cuáles son sus sugerencias?

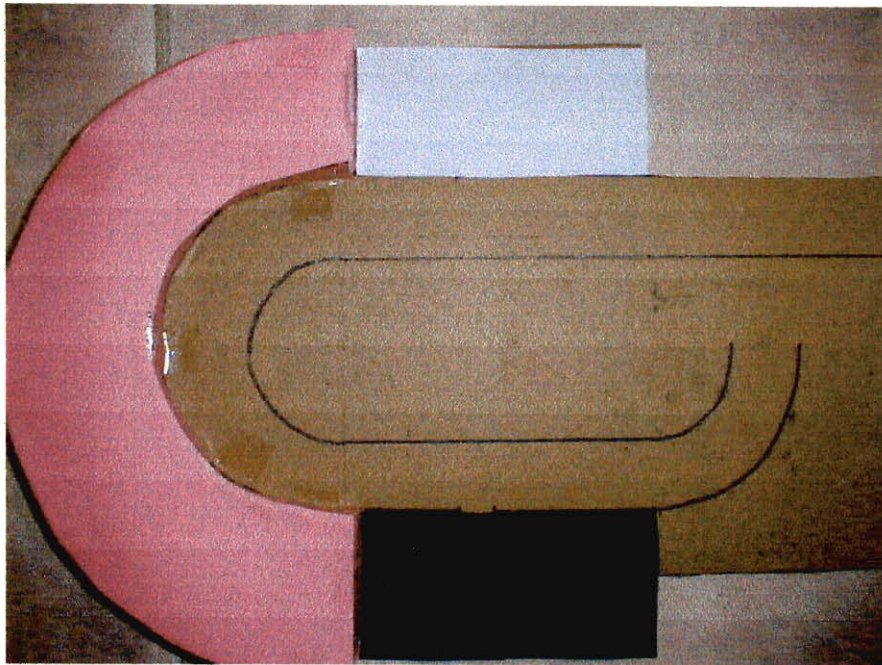
APPENDIX D: LAYOUT OF PROPOSED DESIGN

This scale representation of the floor layout of Los Seres Vivos exhibit displays the areas in which section of the new design will reside. Number one marks the entrance to the exhibit. The area marked by number two is the Laboratory section. In the areas denoted three, four and five is the Rainforest section. The area numbered six represents the area designated for the Subterranean section and the area designated as number seven is the Evolution section.

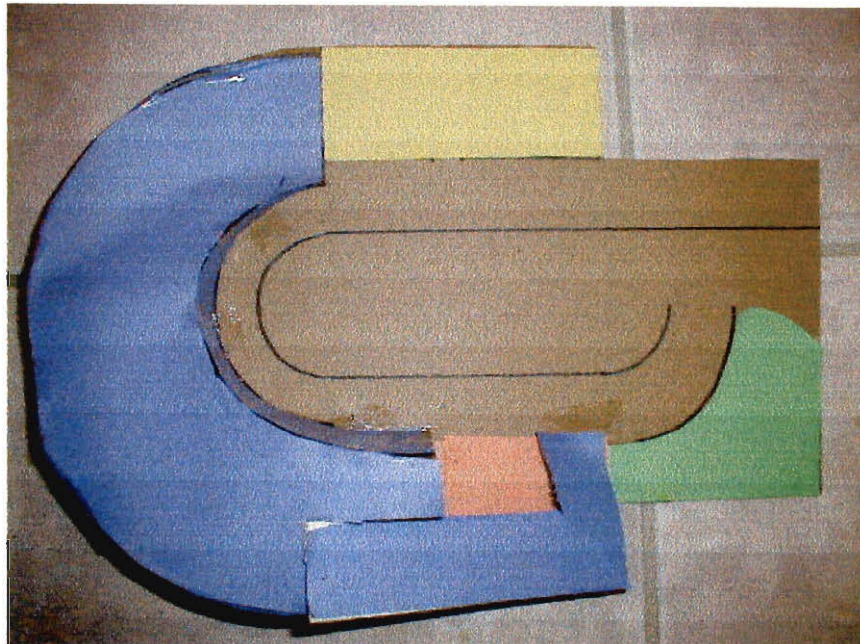


APPENDIX E: MODELS FOR RECONSTRUCTION

This model shows the current structure of the exhibit. The area on pink is a raised platform, which will be removed in the reconstruction



This model shows the proposed structure with a ramp, shown in blue, which forms a cove, which is shown in orange.



APPENDIX F: POSSIBLE SOURCES OF FUNDING

Each of the following companies was contacted by general email requesting information regarding the email address and fax number of the person within each company to contact in regard to donations and grants. The grant proposal statements were forwarded to the appropriate person within each company that responded to this initial request. Those companies that did not reply were received the grant proposal statements via the general fax number of the main offices. This table contains the names of each companies contacted, the dates on which the general email and grant proposal statements were sent, and the date on which each company responded, if at all.

COMPANY NAME	GENERAL EMAIL	RESPONSE	PROPOSAL STATEMENT	RESPONSE
Abbott Laboratories	6/5/00	6/5/00		
ADAC Laboratories	6/5/00		6/20/00	
Akorn, Inc.	6/5/00		6/19/00	
Alaris Medical Systems, Inc.	6/5/00		6/16/00	
Alpharma, Inc.	6/5/00		6/19/00	
Aphton Corporation	6/5/00		6/19/00	
Ascent Pediatrics, Inc.	6/5/00		6/16/00	
Atrion Corporation	6/5/00		6/16/00	
Aurora Biosciences Corporation	6/5/00		6/16/00	
Avax Technologies Inc.	6/5/00	6/10/00		
Aviron	6/5/00		6/16/00	
Avitar Inc.	6/5/00	6/10/00		
Barr	6/5/00		6/19/00	
Baxter International Inc.	6/5/00	6/5/00		
Bigmar Inc.	6/5/00	6/11/00		
Bionx Implants	6/5/00		6/19/00	
Bio-Plexus, Inc	6/5/00	6/11/00		
Biopure Corporation	6/5/00	6/11/00		
Biospecifics Technologies Corporation	6/5/00		6/19/00	
Bio-Technology General Corporation	6/5/00		6/13/00	
Bradley Pharmaceuticals, Inc.	6/5/00		6/19/00	
Cadus Pharmaceuticals Corporation	6/5/00		6/15/00	
Cardima, Inc.	6/5/00		6/20/00	
ChiRex	6/5/00		6/15/00	
Chiron Corporation	6/5/00	6/10/00		

Cholestech	6/5/00		6/19/00	
Cistron Biotechnology	6/5/00		6/15/00	
Coca-Cola				
Collagenx Pharmaceuticals, Inc.	6/5/00		6/15/00	
Conceptus	6/5/00	6/10/00		
Crayola	6/5/00	6/5/00	6/21/00	
CV Therapeutics	6/5/00		6/19/00	
CYBEX International	6/5/00		6/19/00	
CYGNUS, Inc.	6/5/00		6/19/00	6/21/00
Cytec Corporation	6/5/00		6/19/00	
Diacrin	6/5/00		6/9/00	
Diatide, Inc.	6/5/00		6/19/00	
Docplanet.com	6/5/00		6/19/00	
Embrex, Inc.	6/5/00		6/19/00	
Endosonics Corporation	6/5/00		6/19/00	
EP Medsystems	6/5/00		6/20/00	
Epimmune, Inc.	6/5/00		6/19/00	
EPIX Medical, Inc.	6/5/00		6/9/00	
Ergo Science Corporation	6/5/00	6/10/00		
Exactech, Inc.	6/5/00		6/19/00	
E-Z-EM	6/5/00		6/19/00	
Propokodusa	6/5/00		6/16/00	
Fusion Medical Technologies, Inc.	6/5/00		6/19/00	
General Electric	6/5/00	6/5/00	6/21/00	
Genzyme	6/5/00		6/19/00	
Gillette Company	6/5/00	6/5/00		
Guidant Corporation	6/5/00		6/5/00	6/9/00
Guilford Pharmaceuticals Inc.	6/5/00			
Hauser, Inc.	6/5/00			
Hemispherx Biopharma, Inc.	6/5/00		6/15/00	
Heska Corporation	6/5/00			
Hycor Biomedical Inc.	6/5/00		6/15/00	6/8/00
Hyseq, Inc.	6/5/00		6/7/00	6/8/00
ICN Pharmaceuticals, Inc.	6/5/00		6/15/00	
I-Fow Corporation	6/5/00		6/15/00	
Ilex Oncology, Inc.	6/5/00		6/15/00	
Immucor, Inc.	6/5/00		6/7/00	6/8/00
Immunex	6/5/00		6/7/00	6/8/00
Incara Pharmaceuticals Corporation	6/5/00		6/19/00	
InnerDyne, Inc.	6/5/00		6/19/00	
Insite Vision Incorporated	6/5/00		6/15/00	
Integ Incorporated	6/5/00		6/15/00	
Interferon Sciences, Inc.	6/5/00		6/15/00	
InterLeukin Genetics, Inc.	6/5/00		6/15/00	
International Isotopes Inc.	6/5/00		6/15/00	
International Remote Imaging Systems Inc.	6/5/00		6/15/00	

Invacare Corporation	6/5/00		6/19/00
IOMED, Inc.	6/5/00		6/15/00
IRIDEX Corporation	6/5/00		6/19/00
IVAX Corporation	6/5/00		6/19/00
Ivc Industries, Inc.	6/5/00		6/19/00
Keravision, Inc.	6/5/00		6/15/00
Kos Pharmaceuticals, Inc.	6/5/00		6/15/00
La Jolla Diagnostics, Inc.	6/5/00		6/15/00
Laser Corporation	6/5/00		6/19/00
Lauder, Estee Companies, Inc.	6/5/00	6/7/00	
Levi Strauss	6/5/00	6/5/00	
Life Medical Sciences, Inc.	6/5/00		6/15/00
Life Technologies, Inc.	6/5/00		6/15/00
LifeCell Corporation	6/5/00		6/15/00
Lifecore Biomedical, Inc.	6/5/00		6/15/00
LifePoint, Inc.	6/5/00		6/15/00
Ligand Pharmaceuticals Incorporated	6/5/00		6/19/00
Lilly (ELI) and Company	6/5/00		6/19/00
LJL BioSystems, Inc.	6/5/00		6/19/00
Lunar Corporation	6/5/00		6/19/00
Luxtec Corporation	6/5/00		6/20/00
Lynx Therapeutics, Inc.	6/5/00		6/19/00
Macrochem Corporation	6/5/00		6/19/00
Mallinckrodt Inc.	6/5/00		6/19/00
Medarex, Inc.	6/5/00		6/19/00
Medical Action Industries, Inc.	6/5/00		6/19/00
Medicis Pharmaceuticals Corporation	6/5/00		6/19/00
Medi-Ject Corporation	6/5/00		6/19/00
Medimmune, Inc.	6/5/00		6/19/00
Medstone International, Inc.	6/5/00		6/19/00
Medtronic, Inc.	6/5/00		6/19/00
Merck & Co., Inc	6/5/00		6/19/00
Milestone Scientific Inc.	6/5/00		6/19/00
Misonix, Inc.	6/5/00		6/19/00
Mylan Laboratories Inc.	6/5/00		6/19/00
NABI	6/5/00		6/19/00
National Dentex Corporation	6/5/00		6/19/00
Natrol, Inc.	6/5/00		6/19/00
Natural Alternatives International, Inc.	6/5/00	6/13/00	
Nature's Sunshine Products, Inc.	6/5/00		6/19/00
NBTY, Inc.	6/5/00		6/19/00
Neogen Corporation	6/5/00		6/19/00
NeoTherapeutics, Inc.	6/5/00		6/20/00
Neurocrine Biosciences, Inc.	6/5/00		6/20/00
Nexell Therapeutics, Inc.	6/5/00		6/19/00
North American Vaccine, Inc.	6/5/00		6/19/00

Novamatrix Medical Systems Inc.	6/5/00		6/19/00
Noven Pharmaceuticals, Inc.	6/5/00		6/19/00
NPS Pharmaceuticals, Inc.	6/5/00		6/19/00
Nutramax Products, Inc.	6/5/00		6/19/00
OEC Medical Systems, Inc.	6/5/00		6/19/00
Onyx Pharmaceuticals, Inc.	6/5/00		6/19/00
OraLabs Holding Corporation	6/5/00		6/19/00
Organogenesis Inc.	6/5/00		6/19/00
Pharmaceutical Formulations, Inc.	6/5/00		6/20/00
Pharmacia and UpJohn, Inc.	6/5/00		6/16/00
Pizza Hut	6/5/00	6/5/00	6/21/00
Progenics Pharmaceuticals, Inc.	6/5/00		6/16/00
Protein Design Labs, Inc.	6/5/00		6/16/00
Protein Polymer Technologies, Inc.	6/5/00		6/19/00
Rochester Medical Corporation	6/5/00		6/16/00
Rockwell Medical Technologies Inc.	6/5/00		6/19/00
Sabratek Corporation	6/5/00		6/16/00
SafeScience, Inc.	6/5/00		6/16/00
Schein Pharmaceutical	6/5/00		6/16/00
Schering-Plough Corporation	6/5/00		6/19/00
Sicor, Inc.	6/5/00		6/16/00
Somanetics Corporation	6/5/00		6/16/00
Somnus Medical Technologies	6/5/00		6/16/00
SONUS Pharmaceuticals, Inc.	6/5/00		6/16/00
SpectraScience, Inc.	6/5/00		6/16/00
Stericycle, Inc.	6/5/00		6/16/00
Summit Technology, Inc.	6/5/00		6/16/00
SuperGen, Inc.	6/5/00		6/16/00
Synbiotics Corporation	6/5/00		6/16/00
Synthetech, Inc.	6/5/00		6/20/00
Technical Chemicals and Products, Inc.	6/5/00		6/16/00
Texas Biotechnology Corporation	6/5/00		6/19/00
Thermogenesis Corporation	6/5/00		6/16/00
Toys R Us			
Urologix, Inc.	6/5/00		6/16/00
UroMed Corporation	6/5/00		6/16/00
Vaso Medical, Inc.	6/5/00		6/16/00
VaxGen Inc.	6/5/00	6/7/00	
Ventana Medical Systems, Inc.	6/5/00		6/16/00
Vertex Pharmaceuticals, Inc.	6/5/00		6/16/00
Vion Pharmaceuticals, Inc.	6/5/00		6/16/00
Warner-Lambert Co.	6/5/00	6/15/00	

**APPENDIX G: PROPOSAL STATEMENT LETTERS
FOR GENERAL COMPANIES**



*FUNDACIÓN AYÚDENOS PARA AYUDAR
CENTRO COSTARRICENSE DE LA CIENCIA Y LA CULTURA*

Dear Sir or Madame:

I would like to request formal guidelines for the grant application process. As director of El Museo de los Niños, I am currently developing a new interactive exhibit on the living creatures of the world. This museum, founded in 1991, is a member of the Costa Rican Center for Science and Culture, which works to educate all of our nation's people in these areas. Our motto is "to educate the child to avoid punishing the adult." We believe that in order for today's youth to thrive in society as adults they must gain the knowledge necessary to succeed at an early age. The museum encourages the learning process by allowing children to enter a world of experimentation where theories become unforgettable experiences through direct involvement with the exhibits. Currently we have over thirty exhibitions, primarily scientific in nature and approximately 250,000 children visit with their schools and families each year.

To assist in the design and implementation of this new exhibit, I have enlisted the help of three United States students from Worcester Polytechnic Institute located in Worcester, Massachusetts. They have been creating an exhibit design that will actively involve children in the learning process. This new exhibit will teach children about the

living creatures of the world while focusing the rain forest environment and its preservation.

The financial assistance of your company will assist us in providing children with the necessary knowledge to succeed in the future. By aiding the education of children today, you are ensuring that in the future your employees and customers are enlightened with the necessary skills for achievement. In addition, the museum would allow the association of your company with the exhibit.

Upon receipt of the guidelines I have requested you will be provided with information as to how you may receive a federal tax credit for your donation. These guidelines can be faxed or sent to address list below. We would greatly appreciate a prompt reply. Thank you for your time and consideration.

Sincerely,

Fabiola Rodríguez

P. O. Box 10303-1000
Calle 4, Avenida 9
Antigua Penitenciaría
Museo de los Niños
San José, Costa Rica
011-506-223-7003
fax-011-506-223-3470

**APPENDIX H: PROPOSAL STATEMENT LETTER
FOR BIOLOGICAL COMPANIES**



*FUNDACIÓN AYÚDENOS PARA AYUDAR
CENTRO COSTARRICENSE DE LA CIENCIA Y LA CULTURA*

Dear Sir or Madame:

As director of El Museo de los Niños, I am developing a new exhibit to educate the youth of Costa Rica on the living creatures of the world. This museum, founded in 1991, is a member of the Costa Rican Center for Science and Culture, which works to educate all of our nation's people in these areas. Our motto is "to educate the child to avoid punishing the adult." We believe that in order for today's youth to thrive in society as adults they must gain the knowledge necessary to succeed at an early age. The museum encourages the learning process by allowing children to enter a world of experimentation where theories become unforgettable experiences through direct involvement with the exhibits. Currently we have over thirty exhibitions, primarily scientific in nature and approximately 250,000 children visit with their schools and families each year.

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preservation. In addition, the exhibition will teach the youth about the many medicinal benefits of the forest through a “laboratory” that will allow them to analyze bacteria and microorganisms.

Our hope is that your company would be interested in assisting in the funding of this project. This assistance will assist us in providing children with the necessary knowledge to succeed in the future. By aiding the education of children today, you are ensuring that in that future generations will care for and support the rain forest. In addition, the museum would allow the association of your company with the exhibit.

We would like to request any formal guidelines for the grant proposal process that you may. Upon receipt of these guidelines you will be provided with information as to how you may receive a federal tax credit for your donation. These guidelines can be faxed or sent to address list below. We would greatly appreciate a prompt reply. Thank you for your time and consideration.

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Antigua Penitenciaría
Museo de los Niños
San José, Costa Rica
011-506-223-7003
fax-011-506-223-3470

COMPANY NAME	CONTACT NAME	ADDRESS	PHONE	FAX	EMAIL
Abbott Laboratories Fund		Dept. 379, Bldg AP6D-2, 100 Abbott Park Road Abbott Park, IL 60064-6048			
Baxter Allegiance Foundation		1 Baxter Parkway DFE-ZE Deerfield, IL 60015	847-948-4605		
Coca-Cola Foundation		P. O. Box Drawer 1734 Atlanta, GA 30301			
Crayola	Becky Sapora Day Art Educational Program	Administrator Binney & Smith Inc. P. O. Box 431 Easton, PA, 18044-0431			bsapora-day@binney-smith.com
General Electric Fund		3135 Easton Road Detroit, MI			edith.nelson@corporate.ge.com
Gillette Company		Civic Affairs-W48 The Gillette Company Prudential Tower Building Boston, MA 02199-8004			
Guidant Corporation	James R. Baumgardt President	111 Monument Circle, Suite 2900 Indianapolis, IN 46204	317-971-2272	317-971-2118	
IRIDEX Corporation	Patty Najarro International Sales Coordinator	1212 Terra Bella Avenue Mountain View, CA 94043	650-940-4700 ext 3066	650-962-0486	pnajarro@IRIDEX.com
Levi Strauss	Public Affairs	Rakoczi ut 42 Budapest 1072, Hungary			
Pizza Hut		TLP c/o Pizza Hut Promotions, Ste 2800 Dallas, TX 75201			ph.promotions@tlp.com
Propokodusa	Florence Corhnelsen	P. O. Box 2293-3000 Heredia, Costa Rica	238-2333	262-3000	
Toys R Us	Linda Galati Community Relations Coordinator	Toys R Us Children's Fund 461 Fran Road Paramus, NY 07652	201-599-7152	201-599-8992	galati@toysrus.com

APPENDIX J: COMPANY OUTLINES FOR GRANT PROPOSALS

Abbott Laboratories:

- Description of your organization's mission
- Geographic area served
- Description of the project(s)/programs(s) for which support is requested
- Amount of money requested
- Budget information
- List of corporations and foundations supporting the organization
- Most recent audited financial statement

The Coca-Cola Foundation:

- Organization mission statement
- General program description
Why does your organization want to do this program? Why should The Coca-Cola Foundation fund it?
- Program detail
Please answer the following detailed questions about the proposed program:
What are the goals and purposes of the program?
How does the program relate to the goals of The Coca-Cola Foundation?
What are the objectives for the program? Are they measurable?
What are the specific activities that must be carried out to meet the objectives?
Are they on schedule?
Who are the members of the staff who will carry out the program? What are their backgrounds and qualifications?
What is the relationship of this program to your organization's/institution's overall mission?
- Program budget and narrative
Please prepare a summary budget as outlined on the last page of this form.
Please also attach a narrative description and include an explanation of each line item in the budget (direct and indirect costs) and how the cost was determined. The following guidelines will help categorize program expenses.
- Expenses:
Salaries and Fees: Include all staff salaries that are allocated to the program. Identify each position, salary and percentage of time to be devoted to the program.
Fringe Benefits: Include related benefits and taxes allocable to the salaries listed below. Identify fringe benefits as a percentage of salaries.
Consultants: Include all fees, honoraria and expenses paid for consulting and professional services of individuals or organizations that are not paid staff of your organization. In the budget narrative, identify consultants and anticipated costs individually.

Printing/Publications: Include expenses for production of all printed materials. Identify specific publications, number of copies planned and anticipated size of each publication.

Media Costs: Include radio, television, billboards, etc.

Telephone: Include all telecommunication expenses. Identify how anticipated usage is determined.

Supplies: Include office supplies, subscriptions, books and other materials under \$500.

Postage: Include postage expense not incorporated in above categories. Identify basis for calculating estimate.

- Additional information

Please append to this application the following legal and tax documentation for the proposing organization and for each participating organization if it is a joint or cooperative effort:

- Copy of the latest IRS documentation letter(s) of tax-exempt status under Section 501(c)(3) and foundation classification under Section 509(a).
A brief statement, signed and dated, on the organization's letterhead, that there has been no change in the purpose, character or organizational structure subsequent to the issuance of the IRS letter(s).
- Original proposal information should be sent regular mail.
- Do not send multiple copies.

APPLICATION FORM:

Program category applying for:

- Higher Education
- Classroom Teaching and Learning
- Global Education

Legal Name of Organization as Listed with IRS Section 501(c)(3)

Name of Organization (if different from above)

Has your organization previously requested funding from us?

- Yes No

Mailing Address

Street Address

City, State, ZIP Code

Chief Executive Officer of Organization

Amount Requested (please complete)

Program Name

Name and Title of Contact Person at Organization for Program

Office Telephone Numbers of Contact Person Fax

Signature/Date

RESPONSE POLICY: The Coca-Cola Foundation reviews and

approves funding on a quarterly basis.

Our Board of Directors will review funding recommendations in February, April, July and October. All requests will receive a written response. Deadlines for receiving completed proposals are: March 1, June 1, September 1, and December 1.

PROGRAM BUDGET SUMMARY

EXPENSES:

Salaries and Fees	\$
Fringe Benefits	\$
Consultants	\$
Printing/Publications	\$
Media Costs	\$
Telephone	\$
Supplies	\$
Postage	\$
Other	\$
Total Expenses	\$

REVENUE:

Grant Request from The Coca-Cola Foundation	\$
Other Foundations*	\$
Public Agencies*	\$
Corporations*	\$
Individuals*	\$
Operating Income Contributed by Applicant to the Program	\$
Total Income	\$

* Identify individually in the budget narrative. Additional sources of revenue are encouraged but not required. Please indicate only revenues that are fully committed and allocated specifically for the purposes of this program.

Gillette Company:

Applicants should submit a short (one- or two-page) cover letter summarizing the intent of the program and the amount requested.

Additional materials should include:

- IRS letter of determination of 501(c)(3) tax exemption
- A brief history of the organization and its mission statement
- Program description and budget
- A copy of the organization's most recent financial statement
- List of officers and board of directors
- List of current corporate and foundation funding sources, public and/or private, with amounts contributed within the most recent twelve months or fiscal year

Guidant Corporation:

- Standard grant proposal for a biological company.

IRIDEX Corporation:

- Standard grant proposal for a biological company.

Levi's Struass:

- All organizations must:
Operate in accord with our grants policy
Have current certification as a charity from the appropriate government agency.
Public agencies are also eligible.
- How to Apply:
To apply for a grant, please send a brief letter of inquiry (no more than three pages) that includes the following:
Brief statement of the organization's goals and accomplishments; and purpose of requested funds, description of population to be served, and time-frame for activities
- Deadlines:
Letters are accepted throughout the year.
- What Happens Next:

Your letter will be reviewed within six weeks. Based upon this review, you will be informed whether we are able to encourage a full proposal.

Toys R Us:

The Fund welcomes requests for support that meet the criteria outlined. All grant requests must be submitted in writing by September 1 in order to be considered for funding the following year. Requests must include the following information:

- Background of the organization
- A detailed proposal, including the amount of funding requested and an outline of how the funds will be used
- A copy of the most recent certified audited financial statement
- IRS 501 (c) (3) ruling confirming the organization's tax exempt status
- A copy of the most recent Form 990 filed with the Internal Revenue Service

**APPENDIX K: LETTERS FOR COMPANIES REQUIRING
PROPOSAL STATEMENT CONTACT**

This appendix contains the proposal statements for each of the potential sources of funding. Each of the letters has been individually addressed for each company.



*FUNDACIÓN AYÚDENOS PARA AYUDAR
CENTRO COSTARRICENSE DE LA CIENCIA Y LA CULTURA*

Amgen, Inc.
Amgen Center
Thousand Oaks, CA 91320-1799
805-447-1010

Dear Sir or Madame:

As director of El Museo de los Niños, I am developing a new exhibit to educate the youth of Costa Rica on the living creatures of the world. This museum, founded in 1991, is a member of the Costa Rican Center for Science and Culture, which works to educate all of our nation's people in these areas. Our motto is "to educate the child to avoid punishing the adult." We believe that in order for today's youth to thrive in society as adults they must gain the knowledge necessary to succeed at an early age. The museum encourages the learning process by allowing children to enter a world of experimentation where theories become unforgettable experiences through direct involvement with the exhibits. Currently we have over thirty exhibitions, primarily scientific in nature and approximately 250,000 children visit with their schools and families each year.

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Our hope is that your company would be interested in assisting in the funding of this project. This assistance will assist us in providing children with the necessary knowledge to succeed in the future. By aiding the education of children today, you are ensuring that in that future generations will care for and support the rain forest. In addition, the museum would allow the association of your company with the exhibit.

We would like to request any formal guidelines for the grant proposal process that you may. Upon receipt of these guidelines you will be provided with information as to how you may receive a federal tax credit for your donation. These guidelines can be faxed or sent to address list below. We would greatly appreciate a prompt reply. Thank you for you time and consideration.

Sincerely,

Fabiola Rodríguez

P. O. Box 10303-1000
Calle 4, Avenida 9
Antigua Penitenciaría

Museo de los Niños
San José, Costa Rica
011-506-223-7003
fax-011-506-223-3470



*FUNDACIÓN AYÚDENOS PARA AYUDAR
CENTRO COSTARRICENSE DE LA CIENCIA Y LA CULTURA*

Anika Therapeutics
236 West Cummings Park
Woburn, MA 01801
781-932-6616

Dear Sir or Madame:

As director of El Museo de los Niños, I am developing a new exhibit to educate the youth of Costa Rica on the living creatures of the world. This museum, founded in 1991, is a member of the Costa Rican Center for Science and Culture, which works to educate all of our nation's people in these areas. Our motto is "to educate the child to avoid punishing the adult." We believe that in order for today's youth to thrive in society as adults they must gain the knowledge necessary to succeed at an early age. The museum encourages the learning process by allowing children to enter a world of experimentation where theories become unforgettable experiences through direct involvement with the exhibits. Currently we have over thirty exhibitions, primarily scientific in nature and approximately 250,000 children visit with their schools and families each year.

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fax-011-506-223-3470



*FUNDACIÓN AYÚDENOS PARA AYUDAR
CENTRO COSTARRICENSE DE LA CIENCIA Y LA CULTURA*

Bioprogress Technology
P.O. Box 500127
Atlanta, GA 31150

Dear Sir or Madame:

As director of El Museo de los Niños, I am developing a new exhibit to educate the youth of Costa Rica on the living creatures of the world. This museum, founded in 1991, is a member of the Costa Rican Center for Science and Culture, which works to educate all of our nation's people in these areas. Our motto is "to educate the child to avoid punishing the adult." We believe that in order for today's youth to thrive in society as adults they must gain the knowledge necessary to succeed at an early age. The museum encourages the learning process by allowing children to enter a world of experimentation where theories become unforgettable experiences through direct involvement with the exhibits. Currently we have over thirty exhibitions, primarily scientific in nature and approximately 250,000 children visit with their schools and families each year.

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P. O. Box 10303-1000
Calle 4, Avenida 9
Antigua Penitenciaría
Museo de los Niños
San José, Costa Rica
011-506-223-7003
fax-011-506-223-3470



*FUNDACIÓN AYÚDENOS PARA AYUDAR
CENTRO COSTARRICENSE DE LA CIENCIA Y LA CULTURA*

Boston Biomedica, Inc.
375 West Street
West Bridgewater, MA 02379
508-580-1900

Dear Sir or Madame:

As director of El Museo de los Niños, I am developing a new exhibit to educate the youth of Costa Rica on the living creatures of the world. This museum, founded in 1991, is a member of the Costa Rican Center for Science and Culture, which works to educate all of our nation's people in these areas. Our motto is "to educate the child to avoid punishing the adult." We believe that in order for today's youth to thrive in society as adults they must gain the knowledge necessary to succeed at an early age. The museum encourages the learning process by allowing children to enter a world of experimentation where theories become unforgettable experiences through direct involvement with the exhibits. Currently we have over thirty exhibitions, primarily scientific in nature and approximately 250,000 children visit with their schools and families each year.

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*FUNDACIÓN AYÚDENOS PARA AYUDAR
CENTRO COSTARRICENSE DE LA CIENCIA Y LA CULTURA*

COR Therapeutics
256 E. Grand Ave.
South San Francisco, CA 94080
650-244-6800

Dear Sir or Madame:

As director of El Museo de los Niños, I am developing a new exhibit to educate the youth of Costa Rica on the living creatures of the world. This museum, founded in 1991, is a member of the Costa Rican Center for Science and Culture, which works to educate all of our nation's people in these areas. Our motto is "to educate the child to avoid punishing the adult." We believe that in order for today's youth to thrive in society as adults they must gain the knowledge necessary to succeed at an early age. The museum encourages the learning process by allowing children to enter a world of experimentation where theories become unforgettable experiences through direct involvement with the exhibits. Currently we have over thirty exhibitions, primarily scientific in nature and approximately 250,000 children visit with their schools and families each year.

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Calle 4, Avenida 9
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Museo de los Niños
San José, Costa Rica
011-506-223-7003
fax-011-506-223-3470



*FUNDACIÓN AYÚDENOS PARA AYUDAR
CENTRO COSTARRICENSE DE LA CIENCIA Y LA CULTURA*

Datascope
14 Phillips Parkway
Montvale, NJ 07645

Dear Sir or Madame:

As director of El Museo de los Niños, I am developing a new exhibit to educate the youth of Costa Rica on the living creatures of the world. This museum, founded in 1991, is a member of the Costa Rican Center for Science and Culture, which works to educate all of our nation's people in these areas. Our motto is "to educate the child to avoid punishing the adult." We believe that in order for today's youth to thrive in society as adults they must gain the knowledge necessary to succeed at an early age. The museum encourages the learning process by allowing children to enter a world of experimentation where theories become unforgettable experiences through direct involvement with the exhibits. Currently we have over thirty exhibitions, primarily scientific in nature and approximately 250,000 children visit with their schools and families each year.

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fax-011-506-223-3470



*FUNDACIÓN AYÚDENOS PARA AYUDAR
CENTRO COSTARRICENSE DE LA CIENCIA Y LA CULTURA*

Genetech
1 DNA Way
South San Francisco, CA 94080-4990
650-225-6000

Dear Sir or Madame:

As director of El Museo de los Niños, I am developing a new exhibit to educate the youth of Costa Rica on the living creatures of the world. This museum, founded in 1991, is a member of the Costa Rican Center for Science and Culture, which works to educate all of our nation's people in these areas. Our motto is "to educate the child to avoid punishing the adult." We believe that in order for today's youth to thrive in society as adults they must gain the knowledge necessary to succeed at an early age. The museum encourages the learning process by allowing children to enter a world of experimentation where theories become unforgettable experiences through direct involvement with the exhibits. Currently we have over thirty exhibitions, primarily scientific in nature and approximately 250,000 children visit with their schools and families each year.

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*FUNDACIÓN AYÚDENOS PARA AYUDAR
CENTRO COSTARRICENSE DE LA CIENCIA Y LA CULTURA*

LifeCell Corporation
One Millennium Way
Branchburg, NJ 08876-3876
908-947-4300

Dear Sir or Madame:

As director of El Museo de los Niños, I am developing a new exhibit to educate the youth of Costa Rica on the living creatures of the world. This museum, founded in 1991, is a member of the Costa Rican Center for Science and Culture, which works to educate all of our nation's people in these areas. Our motto is "to educate the child to avoid punishing the adult." We believe that in order for today's youth to thrive in society as adults they must gain the knowledge necessary to succeed at an early age. The museum encourages the learning process by allowing children to enter a world of experimentation where theories become unforgettable experiences through direct involvement with the exhibits. Currently we have over thirty exhibitions, primarily scientific in nature and approximately 250,000 children visit with their schools and families each year.

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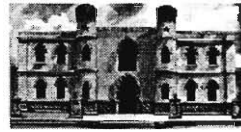
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Antigua Penitenciaría
Museo de los Niños
San José, Costa Rica
011-506-223-7003
fax-011-506-223-3470



*FUNDACIÓN AYÚDENOS PARA AYUDAR
CENTRO COSTARRICENSE DE LA CIENCIA Y LA CULTURA*

LJL BioSystems
404 Tasman Drive
Sunnyvale, CA 94089
408-541-8786

Dear Sir or Madame:

As director of El Museo de los Niños, I am developing a new exhibit to educate the youth of Costa Rica on the living creatures of the world. This museum, founded in 1991, is a member of the Costa Rican Center for Science and Culture, which works to educate all of our nation's people in these areas. Our motto is "to educate the child to avoid punishing the adult." We believe that in order for today's youth to thrive in society as adults they must gain the knowledge necessary to succeed at an early age. The museum encourages the learning process by allowing children to enter a world of experimentation where theories become unforgettable experiences through direct involvement with the exhibits. Currently we have over thirty exhibitions, primarily scientific in nature and approximately 250,000 children visit with their schools and families each year.

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living creatures of the world while concentrating on the rain forest environment and its preservation. In addition, the exhibition will teach the youth about the many medicinal benefits of the forest through a “laboratory” that will allow them to analyze bacteria and microorganisms.

Our hope is that your company would be interested in assisting in the funding of this project. This assistance will assist us in providing children with the necessary knowledge to succeed in the future. By aiding the education of children today, you are ensuring that in that future generations will care for and support the rain forest. In addition, the museum would allow the association of your company with the exhibit.

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Sincerely,

Fabiola Rodríguez

P. O. Box 10303-1000
Calle 4, Avenida 9
Antigua Penitenciaría
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*FUNDACIÓN AYÚDENOS PARA AYUDAR
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Medi-Ject Corporation
161 Cheshire Lane
Minneapolis, MN 55441
612-476-1009

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*FUNDACIÓN AYÚDENOS PARA AYUDAR
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Medimmune, Inc.
35 West Watkins Mill Road
Gaithersburg, MD 20878
301-417-0770

Dear Sir or Madame:

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*FUNDACIÓN AYÚDENOS PARA AYUDAR
CENTRO COSTARRICENSE DE LA CIENCIA Y LA CULTURA*

NBTY, Inc.
90 Orville Drive
Bohemia, NY 11716

Dear Brenda Scaranato:

As director of El Museo de los Niños, I am developing a new exhibit to educate the youth of Costa Rica on the living creatures of the world. This museum, founded in 1991, is a member of the Costa Rican Center for Science and Culture, which works to educate all of our nation's people in these areas. Our motto is "to educate the child to avoid punishing the adult." We believe that in order for today's youth to thrive in society as adults they must gain the knowledge necessary to succeed at an early age. The museum encourages the learning process by allowing children to enter a world of experimentation where theories become unforgettable experiences through direct involvement with the exhibits. Currently we have over thirty exhibitions, primarily scientific in nature and approximately 250,000 children visit with their schools and families each year.

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*FUNDACIÓN AYÚDENOS PARA AYUDAR
CENTRO COSTARRICENSE DE LA CIENCIA Y LA CULTURA*

Novamatrix Medical Systems, Inc.
5 Technology Drive
Wallingford, CT 06492-1926
203-265-7701

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*FUNDACIÓN AYÚDENOS PARA AYUDAR
CENTRO COSTARRICENSE DE LA CIENCIA Y LA CULTURA*

VidaMed, Inc.
46107 Landing Parkway
Freemont, CA 94538
510-492-4900

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Vital Signs, Inc.
20 Campus Rd.
Totowa, NJ 07512

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