

The Creation of an Animated Teaching Tool used to Educate Medical Students
about the Immune System's Response to *Trichinella Spiralis*.

APPROVED BY SUPERVISORY COMMITTEE

Kim Hoggatt Krumwiede, M.A, Associate Professor
Biomedical Communications Department Graduate Program

Richard P. Howdy, M.A, Associate Professor Biomedical
Communications Department Graduate Program

Ellen Vitetta, Ph.D, Professor, Immunology, Graduate
School of Biomedical Science

DEDICATION

I would like to thank the members of my Graduate Committee,
Kim Hoggatt Krumwiede, M.A, Richard P. Howdy, M.A, and Ellen Vitetta Ph.D.

I would also like to thank my parents, for all their support and encouragement.

THE CREATION OF AN ANIMATED TEACHING TOOL USED TO EDUCATE
MEDICAL STUDENTS ABOUT THE IMMUNE SYSTEM'S RESPONSE TO
TRICHINELLA SPIRALIS

by

KATHERINE MICHELLE BROWN

THESIS

Presented to the Faculty of the Graduate School of Biomedical Sciences

The University of Texas Southwestern Medical Center at Dallas

In Partial Fulfillment of the Requirements

For the Degree of

MASTER OF ARTS

The University of Texas Southwestern Medical Center at Dallas

Dallas, Texas

January 2007

Copyright

by

Katherine Michelle Brown, 2007

All Rights Reserved

THE CREATION OF AN ANIMATED TEACHING TOOL USED TO EDUCATE
MEDICAL STUDENTS ABOUT THE IMMUNE SYSTEM'S RESPONSE TO
TRICHINELLA SPIRALIS

Publication No. _____

Katherine Michelle Brown, M.A

The University of Texas Southwestern Medical Center at Dallas, 2007

Supervising Professor: Kim Hoggatt Krumwiede, M.A

The main objective of this thesis project is to visually communicate, through the use of Adobe Flash animations, the process the immune system uses in eliminating *Trichinella spiralis* from the body. The use of animation, along with the Immunology syllabus text, will possibly increase the medical students' understanding of the subject. Medical students evaluated the animation, which detailed the immune systems' anatomical and cellular reaction to *Trichinella spiralis*. These students use the animation as a study guide and review. These evaluations determine the usefulness of the animation in the Immunology course. This

thesis project documents the scientific research on *Trichinella spiralis* in the immune system, the process of storyboarding, design, and audio production used to create the animation.

TABLE OF CONTENTS

| | |
|---|------|
| ABSTRACT | v |
| LIST OF FIGURES | x |
| LIST OF APPENDICES..... | xii |
| LIST OF DEFINITIONS | xiii |
| CHAPTER 1- INTRODUCTION | 1 |
| THESIS QUESTION | 1 |
| SOURCE OF THE PROJECT | 1 |
| GOALS AND OBJECTIVES | 2 |
| BACKGROUND | 3 |
| SIGNIFICANCE AND CONTRIBUTION | 4 |
| LIMITATIONS..... | 5 |
| CHAPTER 2 – LITERATURE REVIEW | 6 |
| ANALYSIS | 6 |
| NECESSITY OF AN ADDITIONAL EPISODE..... | 7 |
| MAST CELL | 7 |
| TRICHINELLA SPRIALIS | 9 |
| ASSESSMENT OF PREVIOUS ANIMATIONS..... | 11 |
| CONCLUSION | 11 |
| CHAPTER 3 - METHODOLOGY | 13 |
| OBJECTIVES | 13 |

| | |
|---|----|
| REVIEWING PREVIOUS ANIMATIONS | 14 |
| SUBJECT DISCUSSION | 18 |
| REVIEWING THE SCIENCE OF <i>TRICHINELLA SPIRALIS</i> WITH | |
| DR. NIEDERKORN | 20 |
| CREATION OF THE SCRIPT | 21 |
| AUDIO..... | 22 |
| STORYBOARD | 26 |
| DESIGNING GRAPHICS AND ANIMATING IN FLASH | 34 |
| REFERENCES | 37 |
| LAYERS | 41 |
| MOVIE CLIPS | 43 |
| SCRIPTING | 47 |
| SETTINGS | 48 |
| UPLOADING HTML PAGES | 49 |
| CONCLUSION | 49 |
| CHAPTER 4 - EVALUATION | 52 |
| QUESTIONNAIRE | 52 |
| QUESTIONNAIRE DISTRIBUTION | 53 |
| EVALUATION RESULTS | 53 |
| STATEMENT 1 | 54 |
| STATEMENT 2 | 54 |
| STATEMENT 3 | 55 |

| | |
|---|----|
| STATEMENT 4 | 55 |
| STATEMENT 5 | 55 |
| STATEMENT 6 | 56 |
| STATEMENT 7 | 56 |
| STATEMENT 8..... | 56 |
| STATEMENT 9 | 57 |
| STATEMENT 10 | 57 |
| STATEMENT 11..... | 57 |
| BACKGROUND QUESTIONS | 58 |
| ADDITIONAL QUESTION | 58 |
| ADDITIONAL COMMENTS | 60 |
| CHAPTER 5 – CONCLUSIONS AND RECOMMENDATIONS | 62 |
| PROJECT SUMMARY | 62 |
| CONCLUSIONS | 64 |
| SUGGESTIONS FOR FUTHER RESEARCH | 64 |

LIST OF FIGURES

| | |
|---|----|
| FIGURE 3-1–ADOBE ILLUSTRATOR LAYERS..... | 16 |
| FIGURE 3-2 – CHARACTERS AND ALL ITS LAYERS | 17 |
| FIGURE 3-3 – IMAGE OF AUDIO TRACK IN ADOBE PREMIERE | 24 |
| FIGURE 3-4 – 37 .WAV FILES..... | 25 |
| FIGURE 3-5 – THE SETTING FOR EXPORTING .WAV FILES | 25 |
| FIGURE3-6 – STORYBOARD 1..... | 27 |
| FIGURE 3-7 -- STORYBOARD 2 | 28 |
| FIGURE 3-8 -- STORYBOARD 3 | 29 |
| FIGURE 3-9 -- STORYBOARD 4 | 30 |
| FIGURE 3-10 -- STORYBOARD 5 | 31 |
| FIGURE 3-11 – STORYBOARD 6..... | 32 |
| FIGURE 3-12 – STORYBOARD 7..... | 33 |
| FIGURE 3-13 -- STORYBOARD 8..... | 34 |
| FIGURE 3-14 – PREVIOUS GRAPHIC OF MALE CHARACTER..... | 35 |
| FIGURE 3-15 – PREVIOUS GRAPHIC OF FEMALE CHARACTER | 36 |
| FIGURE 3 –16 – PREVIOUS GRAPHIC OF GIRL CHARACTER | 37 |
| FIGURE 3 -17 – SCREAMING MAN FROM THIRD EPISODE..... | 38 |
| FIGURE 3 –18 – SILHOUETTE SCENE | 39 |
| FIGURE 3 –19 – GRAPHITE SKETCH OF CHARACTER | 39 |
| FIGURE 3 –20 – FULLY DEVELOPED CHARACTER | 39 |

| | |
|---|----|
| FIGURE 3 -21 – ADOBE ILLUSTRATOR CELL SHAPES..... | 41 |
| FIGURE 3 -22 – ADOBE FLASH CELLS EXTRAVASTING | 41 |
| FIGURE 3 -23 --ADOBE FLASH LAYERS 1 | 42 |
| FIGURE 3 -24 --ADOBE FLASH LAYERS 2 | 42 |
| FIGURE 3- 25 – ADOBE FLASH LAYERS 3 | 43 |
| FIGURE 3 -26 --ADOBE FLASH MOVIE CLIP 1 | 45 |
| FIGURE 3 -27 –ADOBE FLASH MOVIE CLIP 2 | 45 |
| FIGURE 3 -28 –ADOBE FLASH MOVIE CLIP 3 | 46 |
| FIGURE 3 -29 –ADOBE FLASH MOVIE CLIP 4 | 47 |
| FIGURE 3 -30 –PUBLISHED SETTINGS..... | 48 |
| FIGURE 3 -31 –SOUND SETTINGS | 49 |
| FIGURE 4 -1 –SUMMARY OF RESPONSES..... | 54 |

LIST OF APPENDICES

| | |
|------------------------------------|----|
| APPENDIX A - STORYBOARDS | 65 |
| APPENDIX B –PREMINARY SURVEY | 72 |
| APPENDIX C -QUESTIONNAIRES | 73 |

LIST OF DEFINITIONS

Degranulation – the release of cellular granule content

Eosinophil – white blood cells that are responsible for combating infection by parasites in the body.

Extravasate – To translocate from a vessel into the surrounding tissue.

Granules – cytoplasmic particle

Integrin– One of a large and very important family of adhesion molecules that promote stable interactions between cells and their environment.

Trichinella spiralis – parasitic nematode occurring in the intestines of pigs, rats and human beings, and producing larvae that form cysts in skeletal muscle

Adobe Flash Movie Clips – an animation that could be nested inside another animation

Tweening – a key action in Macromedia Flash that allows the program to draw frames in between two chosen positions

CHAPTER 1

Introduction

Thesis Question:

Can an animation be created to expand upon an existing animated teaching tool on Immunology and still maintain visual integrity and incorporate in new information?

Source of the Project

Initially, I planned on doing a project based on cancer research. I contacted Dr. Ellen Vitetta, director of the Cancer Immunobiology Center at the University of Texas Southwestern Medical Center (UT Southwestern), and expressed my interest in working with her and venturing into a project for cancer research. Dr. Vitetta is also on the UT Southwestern Medical School faculty. She teaches part of the Immunology course to the medical students and approximately six years ago co-created a series of movies with the Web Curriculum department at UT Southwestern. Dr. Vitetta wanted to update the audio of the previous animations and also want to create an entirely new segment for the teaching tool. We met and discussed what the thesis would involve and agreed on the development of a new animation for the teaching tool.

Goals and Objectives

The goal of this thesis is to create a teaching tool about the immune system's response to *Trichinella spiralis* by using a series of animations that review the interactions and responsibilities of various structures of the immune system in an entertaining fashion and expands upon the existing teaching tool. Dr. Ellen Vitetta, a professor in the Microbiology Department at The University of Texas Southwestern, will oversee the specificities of the information being portrayed in the animations. Previously, Dr. Vitetta commissioned two other animations to be created. This animation was added to the pre-existing animations showing the immune system's response to a parasite invasion.

The following is a list of objectives for this thesis:

- 1 . Review existing animations
- 2 . Discuss new subject matter with Dr. Vitetta
- 3 . Discussing science of parasites with Dr. Niederkorn, a professor of UT Southwestern who specializes in parasites
- 4 . Piece together the old story to the new storyline based around the outline provided by Dr. Vitetta
- 5 . Producing the story board and designing new characters and cells
- 6 . Recording and editing audio
- 7 . Animating in Adobe Flash
- 8 . Evaluation of the third episode by past and present medical students

Background

The major target audience for the animated teaching tool is second year medical students taking Dr. Vitetta's Immunology course. Other students from previous years or anyone who has keen knowledge on the subject of immunology would also benefit from watching the new animation.

The Immunology department at UT Southwestern has the challenging responsibility of teaching their second year medical students the entire complex immune system in a mere fifteen days. In less than two weeks these future doctors must have a complete understanding of our bodies' defense system and its mechanisms. Dr. Vitetta decided to develop a teaching tool that would review all the details of the immune system in a way other than traditional lectures and textbooks. Dr. Vitetta wanted this tool to be easily understood, clear in its intention, and dynamic enough to capture the attention of the medical students who are already inundated with copious amounts of information that are often difficult to piece together into a 'big picture'.

These animations tied in all the interactions and activities in the immune system and portrayed three separate cases in which the student could see the immune system reacting to a against different pathological bacterial infection. The first two animations portrayed the immune system's response to virus infection and wound intention. The project leader, David Killpack, and the UTSouthwestern Web Curriculum created the earlier animations. They organized and created these animations over six years ago using Macromedia Flash. The third concept for an animation was the body's immune response to a parasite and had not

been created. Once the third episode was created the new animation combined with the existing animations would provide a comprehensive lecture guide for Dr. Vitetta.

Regarding the previous animations Dr. Vitetta wrote the storyboard and script leaving the design and animation to the Web Curriculum staff. The updating, writing, storyboarding, designing and animating of the new animation became the focus of this thesis project.

Significance and Contribution

The animations created for the teaching tool are unique in that they are educational as well as visually stimulating and entertaining in a non-traditional style. This educational tool was custom developed and will be included in Dr. Vitetta's syllabus as a review for all the topics covered in the Immunology course. An interesting visual review, different from the traditional lectures and textbooks on cellular interaction could be an effective review for medical students who had only a two weeks to cover the extensive subject of Immunology. Frank Dwyer, a professor at Penn State College of Education News, states in his research "As learners, we can more easily grasp educational materials that are with illustrations, photos, and other graphics. Images grab out attention... a reinforcing dimension to any communication. It is no surprise, then, most effective learning materials are those that include visual aids".¹

¹ Drywer, Frank, *Visual Aids in Instruction and Their Relation to Student Achievement*, www.ed.psu.edu/news/visualaids.asp. Accessed 2006.

Limitations

There are a number of limitations that affect the scope of this thesis.

- 1) Due to new discoveries being made in the scientific field, there is a possibility the information contained in the animation may become outdated over time.
- 2) The design of the third animation was limited to match the existing animations
- 3) The target audience was pre-determined as the second year medical students as well as first year graduate students, taking the immunology course.

CHAPTER 2

Literature Review

Analysis

Why is there a need for cartoon-based animation to review medical students on high-level educational scientific subjects? A few years ago, Dr. Vitetta came up with the idea of having an animation depicting the cells of the immune system as human-like characters. While teaching the Immunology course, she discovered how similar cellular interactions were to human interactions. For instance, she imagined that memory T-cells could have a romantic relationship with B-cells or endothelial cells reaching womanhood in order to attract cells for transcytosis. Her conclusion was to personify these cellular interactions and incorporate them into an animation, which could be used as a review at the end of the Immunology course. The cells would change into characters were also introduced as part of a story. One that could summarize the important topics covered in the course's brief time frame. Dr. Vitetta's question was, "Why not make it entertaining, at the least?"²

To get feedback on how effective a review the movie was, Dr. Vitetta passed out surveys in the end of her course. The students who answered her question gave positive responses. When asked whether the movie helped the students learn, the average answer given by students was 3.49 on a 5 point scale, with 5 being the highest and 1 being the lowest. Based on these responses, with 3 being Agree, the students stated the movie helped them learn.³

² Dr. Ellen Vitetta, June 2006

³ Block 1 Immunology Survey 2006

Necessity for An Additional Episode

A question which has been brought up with this thesis is why, after six years since the creations of the previous animations, is there a need for a third animation or episode? The first two episodes of the movie depicted the immune response against a virus and a bacterium. This episode concerned a parasite. The immune system responds differently to each pathogen. In addition, a mast cell graphic had to be created since it plays an important role in parasite infection, but not in viral or bacterial infection.

Mast Cell

Mast cells contain large granules and are usually found in the submucosa and dermis, but are also located in connective tissue. Mast cells express FcεRs and bind to IgE, which produce local or systemic immediate hypersensitivity reactions when the mast cells release various mediators. Mast cells release their granules in response to infection alone. They also can secrete IL-4. The role mast cells play in the immune system is two parts. First and most importantly, they provide immunity against parasites. Second, they help the body produce an allergic reaction response in the form of inflammation. For this thesis, we will solely concentrate on the mast cells primary role in parasite infection.

A study conducted by the Department of Medicine, Division of Rheumatology, Immunology, and Allergy at the Brigham and Women's Hospital, covers the specifics of how a mast cell reacts in the immune system's fight against *Trichinella spiralis*. The infection caused by the

parasite “elicits a vigorous IgE response and pronounces intestinal and splenic mastocytosis (in mice).” After experimenting with mice who had deficient levels of IgE compared with those who have normal amounts, it was concluded that ‘IgE promotes parasite expulsion from the gut following *T. spiralis* infection and participates in the response to larval stages of the parasite. Furthermore, our observation support a role of IgE in the regulation of mast cell homeostasis in vivo.’

Other interesting studies about mast cells’ reaction to nematodes, such as *Trichinella spiralis*, state the infection caused by these parasites trigger mucosal mast cell hyperplasia.⁴ The study investigated the “temporal sequence of the appearance of mast cell precursors in various tissues in comparison with the timing of proliferation/differentiation of gut intra-epithelial mast cells in parasite infected mice.”⁵

A primary response in the immune system’s elimination of nematodes from the body is the degranulation of mast cells. The process of degranulation starts when the worm antigen binds to the Fab portion of the IgE antibody, then this binds to the mast cell triggering the release of its granules. The histamine and vasoactive amines (products of the

⁴ AJ Dessein, WL Parker, SL James and JR David, *IgE Antibody and resistance to infection. Selective suppression to the IgE antibody response in rats diminishes the resistance and the eosinophil response to *Trichinella spiralis**, <http://intl.jem.org/cgi/content/abstract/153/2/423>. Accessed 2005

⁵ AJ Dessein, WL Parker, SL James and JR David, *IgE Antibody and resistance to infection. Selective suppression to the IgE antibody response in rats diminishes the resistance and the eosinophil response to *Trichinella spiralis**, <http://intl.jem.org/cgi/content/abstract/153/2/423>. Accessed 2005

mast cell degranulation) increase vascular permeability. This action aids in the transudation of IgA antibody into the lumen of the gut.

The science behind mast cells and its relationship to IgE and IgA antibodies, along with its role in parasite eradication is extensive and complicated. Its reference in the Immunology syllabus is limited and mostly demonstrated in black and white schematics. Therefore, it is an essential addition to the review.

Trichinella spiralis

Trichinella spiralis is one of the eight genotypes derived from the genus *Trichinella*. Although, these particular types of nematodes are known for their ability to infect a wide range of mammalian hosts, *Trichinella spiralis* is responsible for most of the human infected cases.

The infection begins with the ingestion of raw or undercooked pork housing the Nurse cell complex. The Nurse cells release the larvae in the stomach. Digestive enzymes in the stomach release the larvae from the muscle tissue. The larvae then travel to the upper two-thirds of the small intestine. The epicuticle, the outermost layer of the cuticle of an arthropod exoskeleton, becomes partially digested. This allows the parasite to receive signals from its environment. This helps the parasites choose a place in the small intestines to infect. The juvenile parasites penetrate the columnar epithelium at the base of the villus. Once these parasites settle into the columnar epithelium they are called 'intro-multi-cellular organisms'.

Over a period of thirty hours the immature parasites will molt four times before becoming adult parasites. During this time they are sword shaped. The sharp tip of this shape helps them penetrate through the columnar epithelial cells and enter the lamina propria and from there go into the mesenteric lymphatics or the bloodstream. The parasites enter the general circulation and become distributed through the circulation. They then leave capillaries and enter cells. 'Patency occurs within five days after mating. Adult females produce newborn larvae and will continue doing so as long as the host's immunity does not develop.'⁶ In due time the immune system intervenes with the parasites' life cycle, and forces the adult parasites to exit their infected area and relocate farther down the intestinal tract. The last step in the immune system's response is discharging the parasites from the host's body.

Trichinellosis is often misdiagnosed due to the fact after a period of time it resembles a variety of common clinical conditions. After the initial infection, the host develops a series of symptoms. There are basically two different types of symptoms. The first is from the worm being in the intestine and the second are from the worm being in another place. The initial days of infection include diarrhea, abdominal pain, fatigue, fever and vomiting. The infected individual experiences headaches, chills, cough, eye swelling, muscle pains, hemorrhages and increased number of leukocytes as the worm settles in different areas of the body. The host may have difficulty coordinating movements once the worm enters the nervous tissue, although they cannot survive there. Both a blood test or muscle biopsy can detect *Trichinella spiralis*, and stool samples can confirm adult worms living in the body.

⁶ Despommier, Gwadz, Hotez, Khirsch, Parasitic Diseases Fifth Edition (New York; Apple Trees Production, L.L.C, June 2005)

All the information just presented on *Trichinella spiralis* is a highly compacted to emphasize the role of the immune system in eliminating parasitic infection.

Assessment of Previous Animations

The first approach to this thesis was to review the previous animations created by Web Curriculum. A meeting was organized to assess the Flash files and discuss what the most effective and efficient approaches to the project. The discussion was an informative preparation into understanding the various ways each individual animated his/her delegated Flash scenes. After examining each file and noting upon the methods tried, it was apparent which of the files seemed more effective than the others.

Investigating these files aided in anticipating which programs will be needed and most used to create the third animation. It also assisted in organizing how to approach this thesis and which files types to become familiar with. An example is that Dr. Vitetta prefers to view these animations as swf files, which are proprietary vector graphics file format, instead of Quick Time movies and the audio should be handled as .wav forms instead of mp3s.

Conclusion

After reviewing the previous animations and examining the lack of information concerning mast cells and parasites, it was apparent a third episode was needed. Becoming

familiar with the scientific aspects of the third episode, as well as the creative aspects was the first step. Once all the information was organized and steps to beginning the project took shape, the exact process of creating the third episode was the next course of action.

CHAPTER THREE

Methodology

In this chapter the objectives of this thesis will be reviewed and information on how each objective has been met will be discussed.

Objectives

Fulfilling these objectives is the goal of this thesis. Chapter three discuss the methods it took to complete the following is a list of objectives, which were necessary for the creation of the third episode:

- 1) Review existing animations in the immunological teaching tool
- 2) Discuss new subject matter with Dr. Vitetta
- 3) Discuss the science of parasites with Dr. Niederkorn, Ph.D a
professor in Microbiology of UT Southwestern who specializes in
parasites
- 4) Piece together the old story to the new storyline, which was based
around an outline provided by Dr. Vitetta
- 5) Produce the storyboards and design new characters and cells
- 6) Record and edit audio
- 7) Combine graphics and audio components in Adobe Flash (formerly
Macromedia Flash) to create animations

8) Incorporate animations into html format and post online

Evaluate the teaching tool by getting feedback from medical students

Reviewing Previous Animations

The first step to starting this thesis was to review the previous two animations. UTSouthwestern's Web Curriculum created the first two animations. The Web Curriculum consisted of several medical illustrators, and the project leader was David Killpack. The problems this group faced with these animations were the complexity of the subject matter in correspondence with the group's knowledge of the Macromedia Flash program. A few of the animators were familiar with Flash, whereas the rest had never seen the program before. This unfamiliarity with Flash lead to the group delegating scenes to each individual. One person took on several scenes to animate and due to the experience level of each person the animations were done very differently and the congruity of the animations retained a choppy transition.

Another problem the Web Curriculum faced was recording the audio script. There were several people who volunteered to do various voices for each cell character and one to do the narration. Unfortunately, the budget for the project was insufficient for expert audio recording and much of it was done with minimal recording equipment in an empty closet. The quality was an issue, but without the finances to hire a professional recording studio it was not possible to make the audio as clear as it should have been.

Viewing the animations and their corresponding Flash files revealed various ways on how to and how to not approach animating the third episode. As state previously, there were several people involved in designing and animating the first two animations. Each individual had different methods they used in animating and adding in audio. It quickly became apparent as to which methods worked and how others were more troublesome by comparison.

Then there was the topic of designing the characters. Depending on the complexity or use of the images, some were made in Adobe Illustrator and others in Flash. Characters with extensive line work were built in Adobe Illustrator using the pen tool and expanding the lines. They were then exported in Flash and filled with color to make a graphic symbol. Most of the graphics were built in Flash. Due to unequal level of Flash experience among the illustrators and time constraints, they built the cells and surrounding images simply for consistency. Therefore, the graphics have few 3D elements, such as volume depicted by core shadow. The preceding use of Illustrator graphics and Flash graphics taught me a great deal on how to handle the graphic content for this thesis. Forethought is required to perceive how one would want the images animated. If there is to be a shape change or morphing it is best to create the same graphic in Illustrator and on separate layer change the shape of the graphic by moving its vertices. But each shape on its separate layer must have the same amount of vertices otherwise the animated morphing will not be smooth. An example of this is a cell extravasating through epithelial cell layers.

Another mention of the previous animations is the technique they used for animating people in motion. Many of the earlier scenes have whole figures of the same character in the animation. Therefore, the animation is essentially switching between one figure and the next.

A method taken to make the animation's actions more fluid was to build a figure in Illustrator much like a paper doll, with different limbs to attach for different movements. Such as a forearm attached at the elbow and set in a downward motion and another forearm (on a different layer) attached at the same point only in an upward motion. The more arms made at different points creates a more believable looking wave/action. Each limb and component of the body were on separate layers and were brought into Flash on separate layers so they could move without effecting each other.

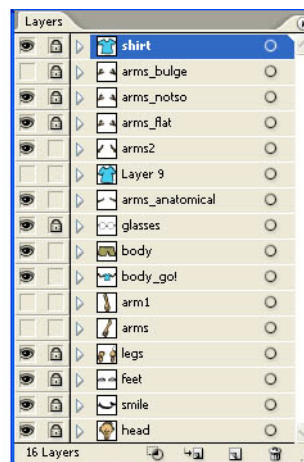


Figure 3-1. Adobe Illustrator layers.

Figure 3-1 is an example from an Illustrator file displaying the many layers containing various body parts of the male character in Episode 3. This image also corresponds with the Figure 3-2.

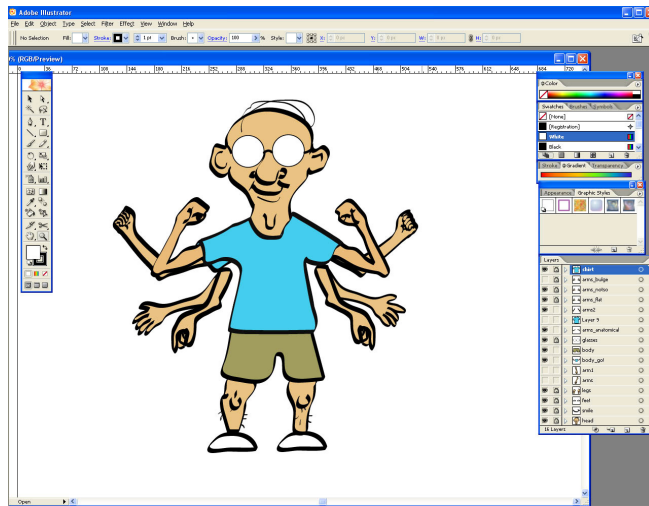


Figure 3-2. Characters and all its layers

The purpose of this figure is to demonstrate how a character's action is contemplated before the actual animating is done. In this example the character is flexing his arms. The more arms drawn in different positions will create a more fluid motion. If the arms were only drawn in a down position and then animated into a flexed position there would not be any movement in-between the two points. Thus the movement would look less natural.

Another consideration is that each small action affects another part of the body. In the above image, the arms affect the shirt. Therefore, a shirt in the corresponding position

will accompany the arms in the same position. These shirt graphics are on different layers as well.

Subject Discussion

After assessing the earlier animations the next step was to discuss the science and subject matter of the new animation with Dr. Vitetta. In the previous animations Dr. Vitetta provided the script. For this animation she supplied me with a script outline with a loose story base as a guideline for the science aspect.

The science portion of the guideline was set up in a three parts. The first part discussed the initial reaction of the body's immune system to the worm antigen and the body's process of increasing cellular resistance to the worm.

The second portion discussed the preparation of the gut for action. These arming processes included:

- a) IL-5 influenced mastocytosis in the lamina propria
- b) Increased number of goblet cells in the intestine
- c) Increased arming of intestinal mast cells with IgE antibody that recognizes excretory/secretory products of the nematodes
- d) Antibodies directed against the worm cuticle accumulate in the mucus.

Lastly, the third portion of the guideline covers the execution of the expulsion of the parasite. This course of action follows the sequential list below:

- a) Excretory and secretory products elaborated by the worms trigger mast cell degranulation.
- b) Histamine and vasoactive amines lead to increased vascular permeability and transudation of IgE and eosinophils into the intestinal mucosa
- c) Transudated IgE and perhaps other antibody coat the parasites in the intestine.
- d) “Immune” mucus also contains antibodies and incarcerates the worms.
The worms are shackled and cannot maintain their position in the gut
- e) Under the influence of IL-13 the intestinal epithelial cells move upward from the crypts to the tips of the villi, thus moving the worms from the crypts to the lumen
- f) Gut motility is increased and the mucus trapping the worms prevents them from maintaining their position in the gut. Peristalsis forces the worms to try to swim upstream
- g) The end product is elimination of the parasites from the body

Although, the guideline gave many important and necessary facts about the immune systems’ fight against roundworms, many of the details were left unaccounted for. An example was under the second part of the guideline there was mention of antibodies accumulating in the mucus. One of the steps to writing the script and storyboard was to fill

in these gaps to be certain the animation is accurate. After reviewing the facts given and consulting Dr. Vitetta's syllabus it was made clear the antibody containing mucus was produced by the goblet cells in the intestine. There are many instances where studying the syllabus and conferring with medical students who have taken Dr. Vitetta's course were necessary to fill in the gaps left over from the guideline.

In addition to the science of the animation, Dr. Vitetta also had a concept of how the story should unfold. It was important for the new animation to be connected to the story of the previous animations. The end of the episode two had the female character enter into medical school after a furious legal fight with the male character. Therefore, Dr. Vitetta suggested in the third animation the female character should be finishing medical school and starting residency in Africa where we could introduce male character again and the parasite.

Other suggestions were to have a scene where the male character partakes in a traditional African tribal ceremony in which he ingests raw boar meat. Thereby, contracting *Trichinella spiralis*. She also provided jpegs of worm expulsion, intestinal cross sections and wild boars for references.

After examining the suggestion, there was a small problem with one of the suggestions. It was agreed that the matter of having the American male character dressed in African tribal wear and eating wild boar might be construed as culturally offensive. This and other parts of the guideline provided some challenges, which will be covered in the creation of the storyboard portion of this chapter.

Reviewing the Science of *Trichinella spiralis* with Dr. Niederkorn

After discussing the subject matter of the script with Dr. Vitetta, a meeting with Dr. Niederkorn was required to review the accuracy of the science with *Trichinella spiralis*. Dr. Niederkorn is a parasite expert and professor at UTSouthwestern. Dr. Vitetta is an expert on immunology, but she preferred to have someone knowledgeable in nematodes to have input on the subject matter.

Dr. Niederkorn read an early version of the script, which was basically the guideline with notes on the side to tie all the science facts together. He gave helpful advice and pointed out some incorrect facts in the side notes. An example of his correction is the note written described IgA and eosinophils moving through the blood vessels to extravasate through epithelial cells, when only IgA travels through the bloodstream in this case.

Dr. Niederkorn also provided his power point presentation about *Trichinosis* for further reference for this thesis, along with a jpeg Dr. Vitetta desired for the end scene of animation. This jpeg shows the expulsion of nematodes from the body.

Creation of the Script

Once all the science aspects of the story were corrected and assembled into an easy to understand, fluid set of sequences, it was time to set the entire story into motion.

The comic aspect of this animation is longer than its counterparts. The female character's graduation from medical school is the start of the story. Incorporated into her graduation is her choice of residency, thus introducing her travels to Africa into the script.

Her adversary, the male character, journeys to Africa as well to partake in an African safari. The initial approach to having our male character ingest wild boar meat was discussed throughout a few meetings with Dr. Vitetta. After entertaining several scenarios we decided to have the male character ingest the *Trichinella spiralis* infected boar meat by dining at a fast food restaurant resembling McDonalds. This way there is direct involvement with the ingestion of undercooked meats and there is avoidance of any misunderstanding or chances of offending the audience with references to African traditions or culture.

Once the subject of infecting our character with *Trichinella spiralis*, was covered the next challenge was to convey the symptoms of being infected with *Trichinosis*, and then lead to the cellular aspect of the animation. This was done with a mixture of humor and education. The transition starts initially by showing the infected character displaying symptoms of being infected with the parasite. After being hospitalized, the next scene enters into his body to see the worm antigen making its way through his system. From there the audience will follow the immune system's process for eliminating the nematode.

This script was written to be the final chapter of these animations. We end with the two characters becoming friends and ending their long feud.

Audio

Once the script was finalized it was ready to be recorded by Dr. Richard King, the same narrator used in the preceding two movies. Dr. Vitetta stressed the importance of the quality of the audio for this animation. The animation is played every year before two

hundred students seated in a stadium style auditorium. Any static or problems with the clarity of the narration cause distraction. Also, the script is essential to the review and the audio must be clear so the students can understand every word.

The quality of the audio was a priority and the budget with this animation was more extensive than the last two. Therefore, we were able to work with Medical Television, an on campus recording studio. The first step was to contact Mr. David Bullock, who worked with Medical Television. The second step was to agree upon a schedule that suited Medical Television and Dr. King. The third was to send both a copy of the script so Dr. King could familiarize himself with the narration and Mr. David Bullock could read along with Dr. King and correct any errors in pronunciation. Lastly, we all met at Medical Television for the recording. Mr. Bullock and I assisted Dr. King in voice variation or pronunciation and Dr. King read the script smoothly. There were times Dr. King would record a sentence twice with different pronunciations of words Mr. Bullock or I were not familiar with. This way Dr. Vitetta would be able to listen to both sentences and choose which was more suitable.

Editing the audio was done in Adobe Premiere. The original recording was brought into the program as a .wav file and was cut into paragraphs according to its corresponding scene as shown below as Figure 3-3.

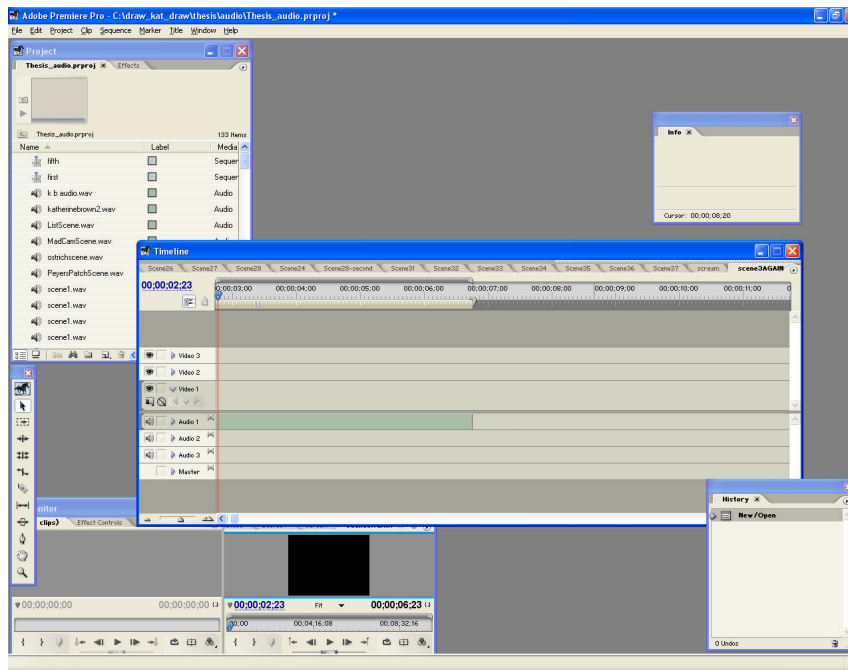


Figure 3-3. Image of audio track in Adobe Premiere.

Since there were 37 scenes in the animations, the audio was sliced into 37 paragraphs and titled to match up with its scene. For example, the audio file for Scene1 would be titled Scene1.wav.

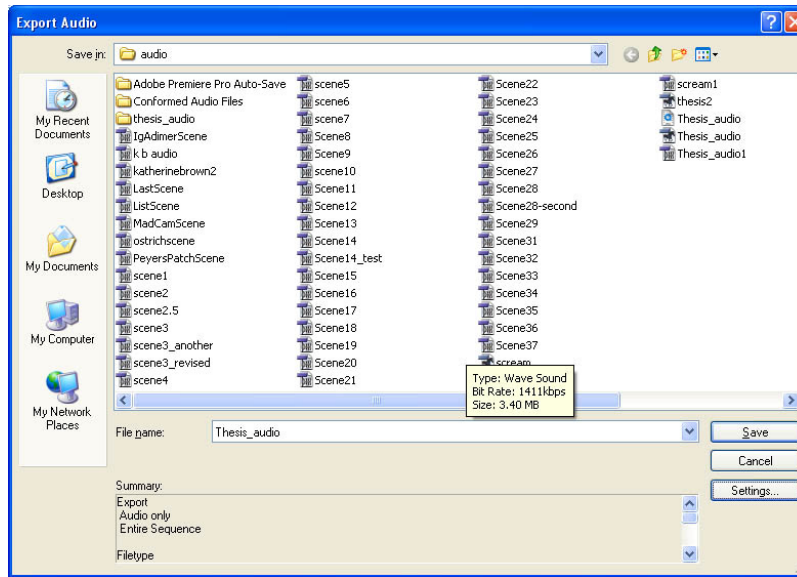


Figure 3-4. 37 .wav files

Once all the audio was cut into paragraphs and all the extraneous noises were edited out, the audio was prepared for being exported into the animations. The setting saved for the audio is shown below in Figure 3-5.

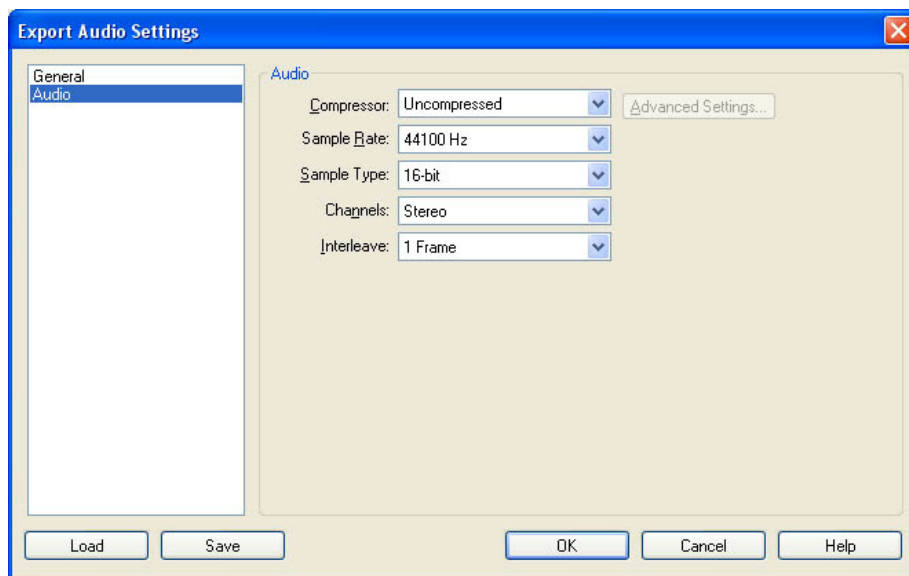


Figure 3-5. The setting for exporting the .wav files.

The audio files were edited and prepared before the animations, therefore each scene could be built around the length of its audio clip.

Storyboard

While the audio was being edited, it was time to start the storyboard. The storyboard was generally written around the script and displays the ideas of the animation scene by scene. This way Dr. Vitetta was able to look at each scene and understand what action was taking place. This was extremely helpful in this fact by eliminating any miscommunications about what is involved in each scene and what exactly must be animated. After several discussions and revisions of the storyboard one was finalized for the animation.

The first page of the storyboard displays the process of the medical student character graduating and traveling to Africa. It also shows the entrance of the male character. Each storyboard page has approximately six scenes.

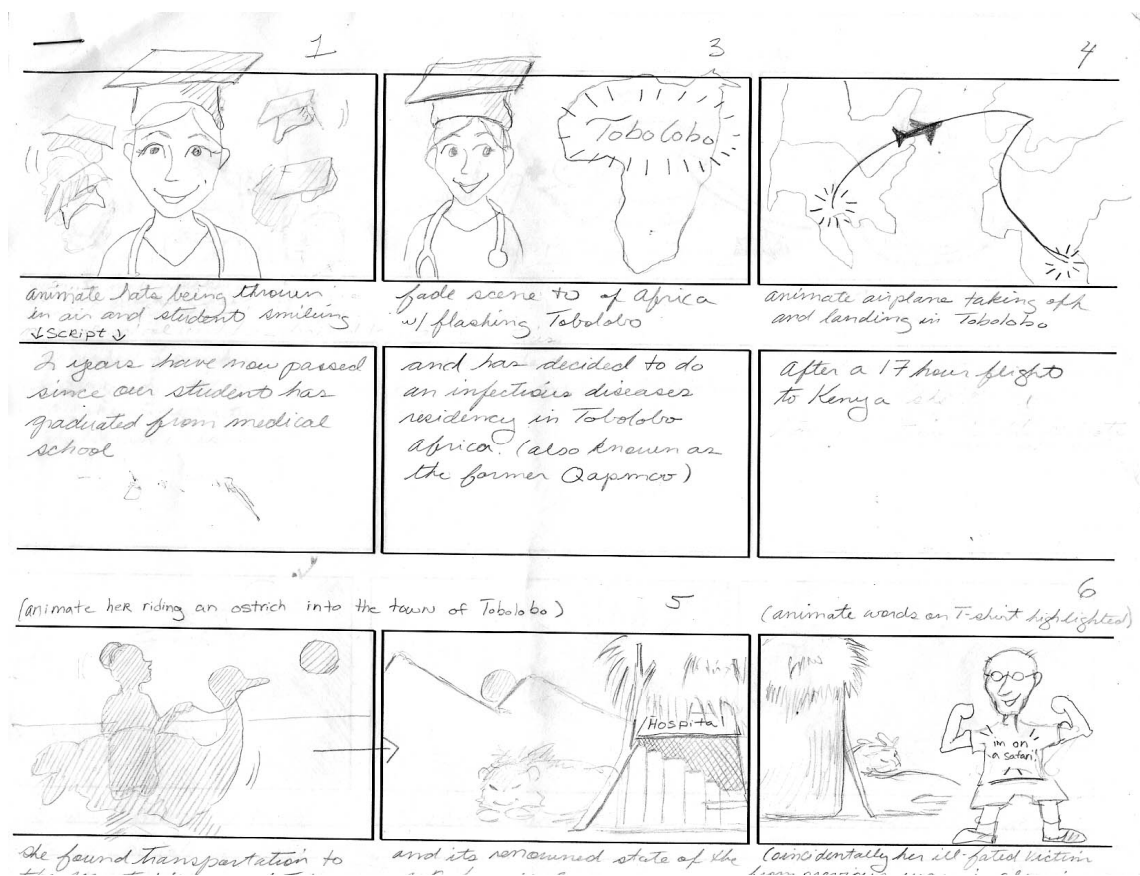


Figure 3-6. Storyboard 1

The next page of the storyboard continues with the two characters. In these scenes the male character becomes infected with the parasite and starts to show symptoms.



Figure 3-7. Storyboard 2

The script is written below each scene, so Dr. Vitetta could read which portions of the script would correspond with its correct scene. There is also a small note detailing what animation would be taking place. For example, in the last scene with the male character in obvious pain, the storyboard notes there will be rays of pain radiating from the areas of muscle cramping.

The third storyboard page shows the characters being reintroduced to each other and the hospitalization of the parasite infected character. This storyboard also contains the first scene of cellular interaction. Although, the storyboard is a strict guideline for what should be

graphically designed and animated a few details have been improvised in some of these scenes. In this case, Dr. Vitetta agreed with these changes, because they were part of the comical aspect of the animation and did not interfere with the science. Also, once the general idea of the storyboard scenes was carried out, the changes were mostly compositional.

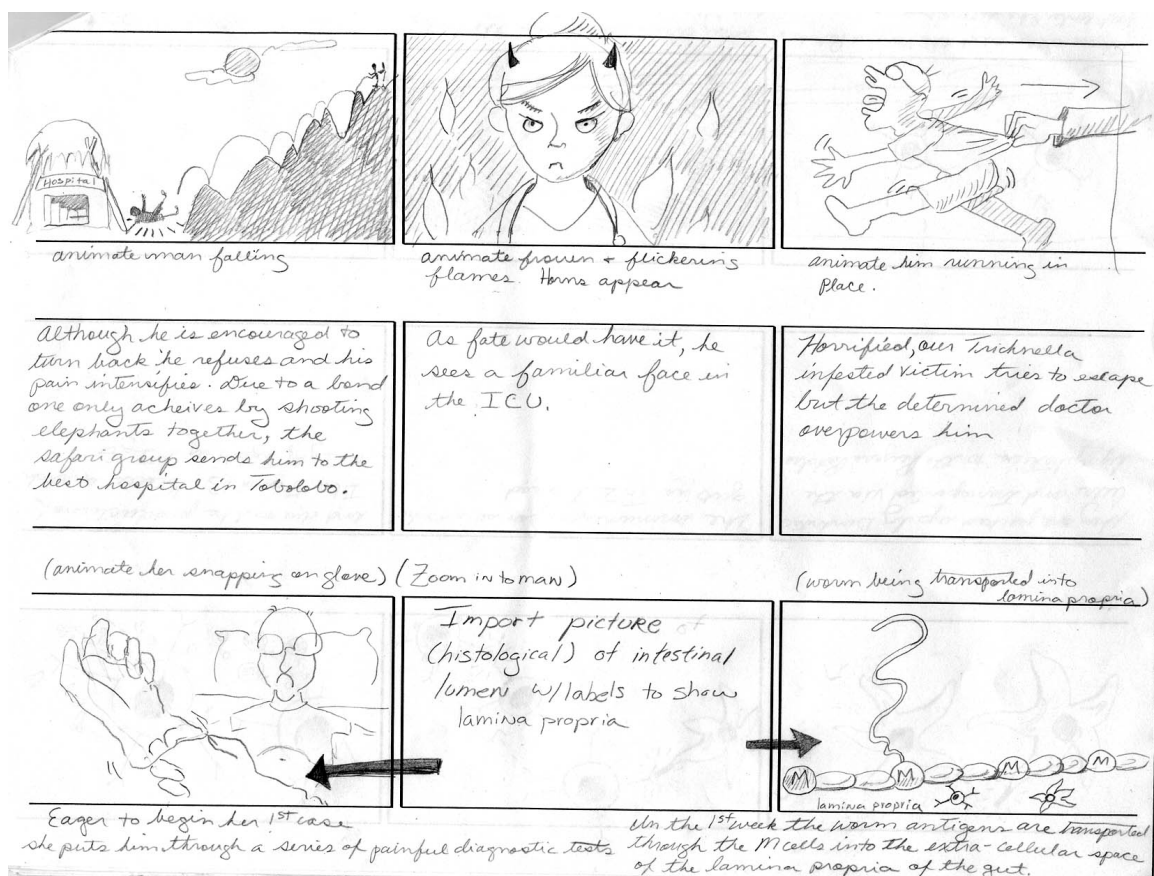


Figure 3-8. Storyboard 3

The fourth page of the storyboard illustrates the initial cellular response to the worm antigen. The first three scenes show T and B cell collaboration and how the worm antigens are presented to each cell. The last illustrated scenes show the cells traveling through the lymphatic and blood stream.

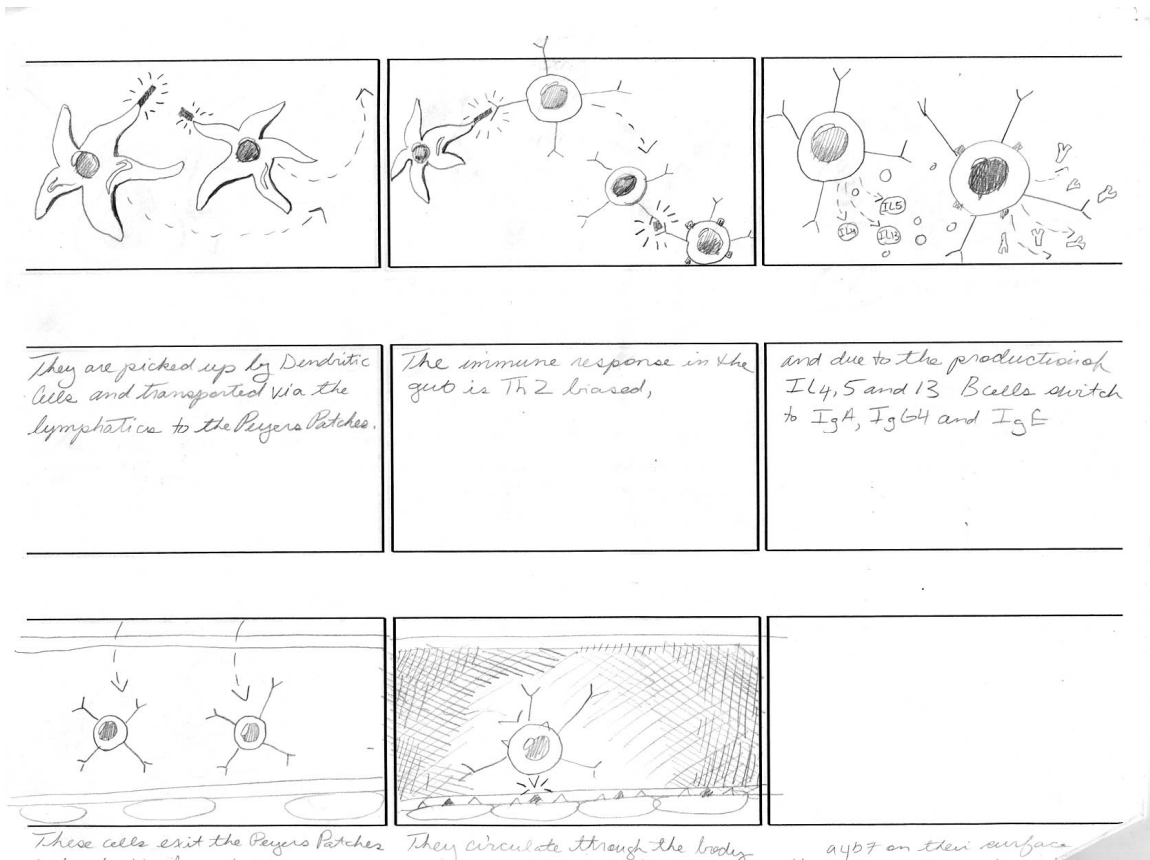


Figure 3-9. Storyboard 4

Page five of the storyboard is more complicated than the previous pages. The first scene describes how the cells extravasate into the lamina propria. The second scene displays the interaction between macrophages, T-cells and B-cells to get B-cells to differentiate into plasma cells. In the next scene plasma cells secrete IgA and have secretory component added to make it secretory IgA. The last scene shows the secretory IgA binding to the worm in the lumen.

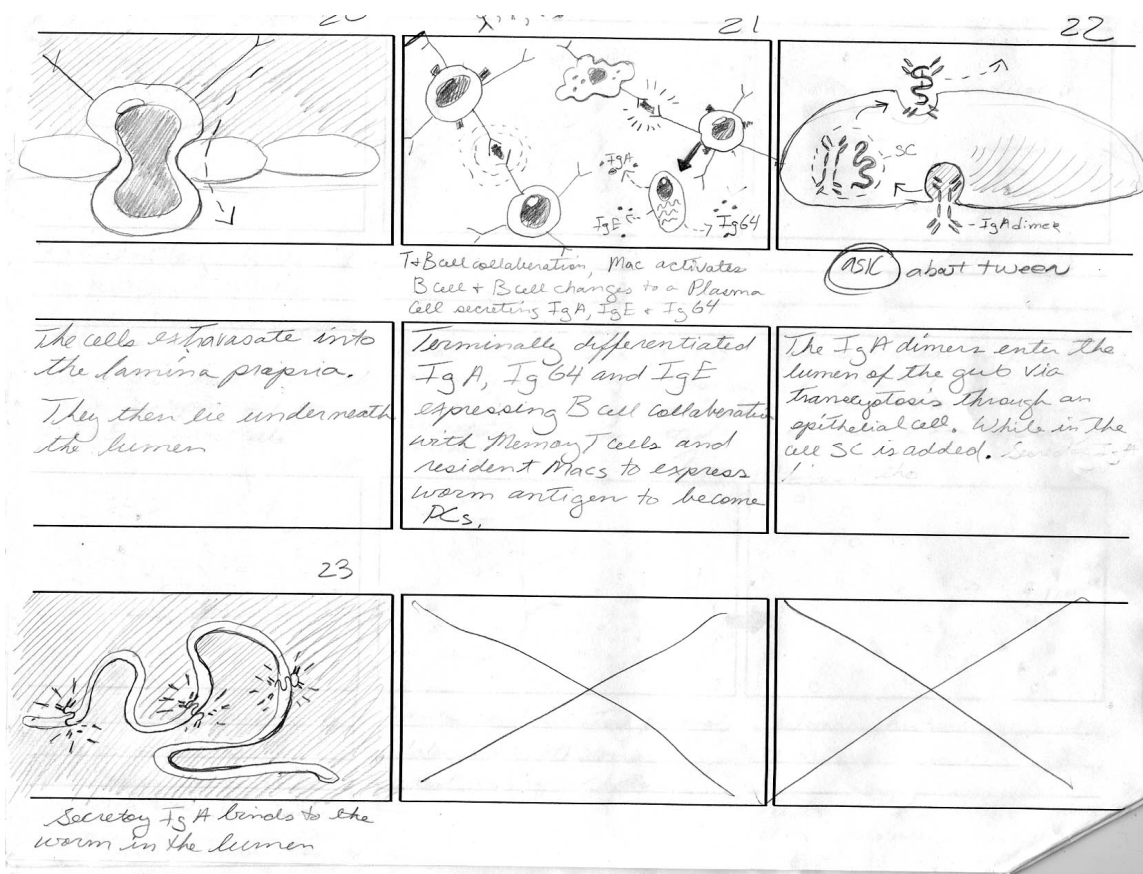


Figure 3-10. Storyboard 5

Page six of the storyboard is just as complicated as the fifth page. The first scene shows IgE antibody binding to a mast cell. This illustration for the mast cell is inaccurate and was designed differently in Flash. The rest of the scenes show how the rest of the cells react together to ultimately release IgA into the mucus and the degranulation of mast cells.

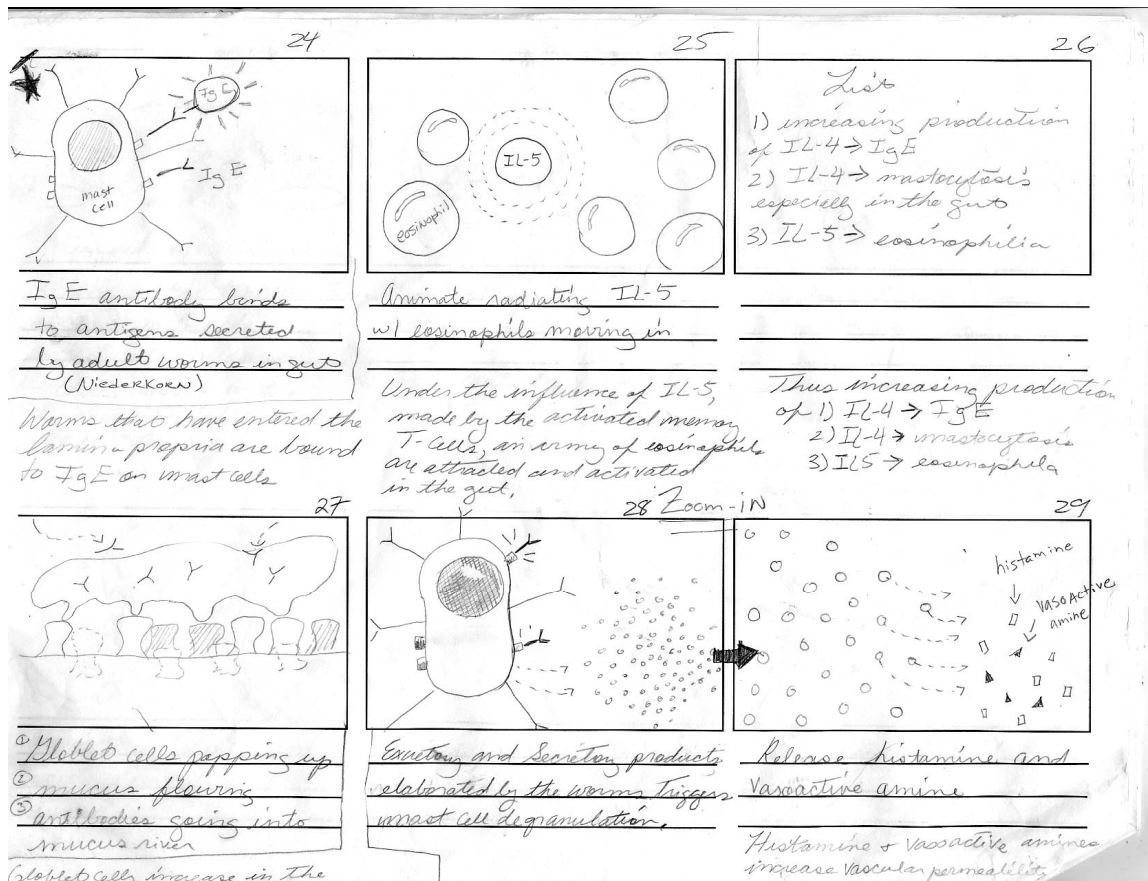


Figure 3-11. Storyboard 6

The seventh page of the storyboard displays the secretory IgA traveling into the lumen to coat the worms. The mucus containing secretory IgA incarcerates the worms. Since the worms cannot move, peristalsis forces them out of the body. The last scene is a jpeg of the worms being expelled from the body.

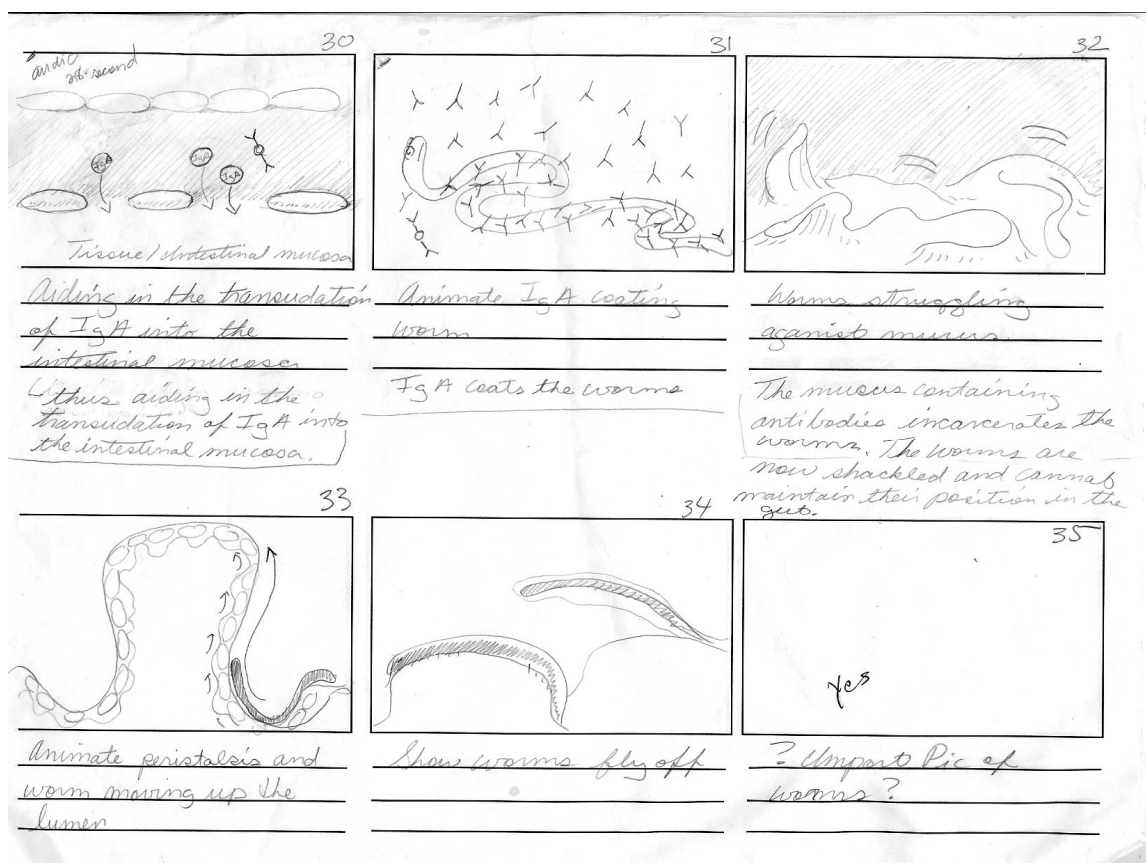


Figure 3-12. Storyboard 7

The last page of the storyboard has only a few scenes to end to the animations. These scenes display the characters resolving their difference and becoming good friends as they walk off into the African sunset.

The storyboard is a crucial element to the production of this thesis. All the illustrated scenes gave Dr. Vitetta an accurate 2D replication of what the animations will be like. Therefore, any changes or problems can be solved before the actual process of creating the animations.



Figure 3-13. Storyboard 8

Designing Graphics and Animating in Flash

The animation began by creating each scene of the storyboard in chronological order. This method insured an organized approach to the challenges set in each scene. The complication levels vary from scene to scene.

In previous paragraphs the subject of limitations were mentioned. One of the most limiting factors of this thesis was the pre-designed graphics. Dr. Vitetta's syllabus contains a majority of the graphics from the previous animations. The medical students are accustomed to associating certain graphics with their corresponding cells. Therefore, altering the image of the cells was not an option. The graphics are very simple and could use some elaboration, but suddenly modifying an image the audience is so familiar with would confuse them. Another limiting factor with the graphics was matching third episode to the previous two episodes. Dr. Vitetta put an emphasis on how the graphics of the new animations should fit

with the previous graphics. This way the movie appears to be a continuation of the same story, instead of a whole new one.

There were three problems encountered when trying to match the style of the previous animations. The first was creating a more modern style while keeping it similar to the earlier versions. The second was shaping the new style to match the earlier artists. The third problem was that several different artists designed the preceding graphics. As a result those various graphics do not have the same style. Below are examples of the old graphics. Most were created in Adobe Illustrator as vector images and then exported in to Flash for

color addition.

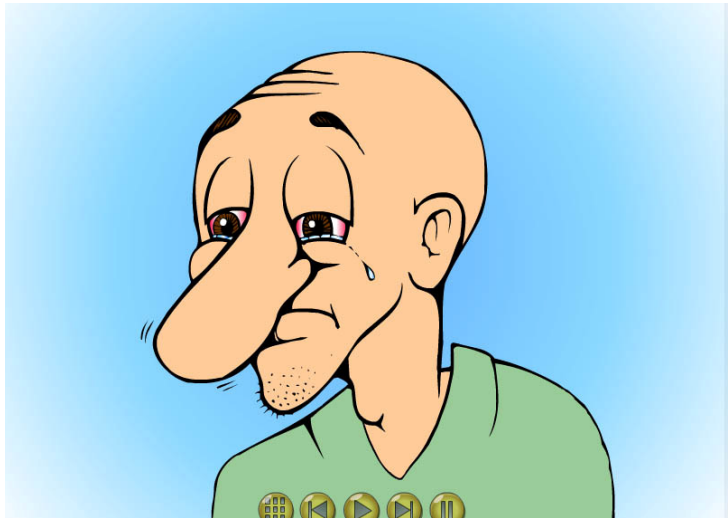


Figure 3-14. Previous graphic of male character

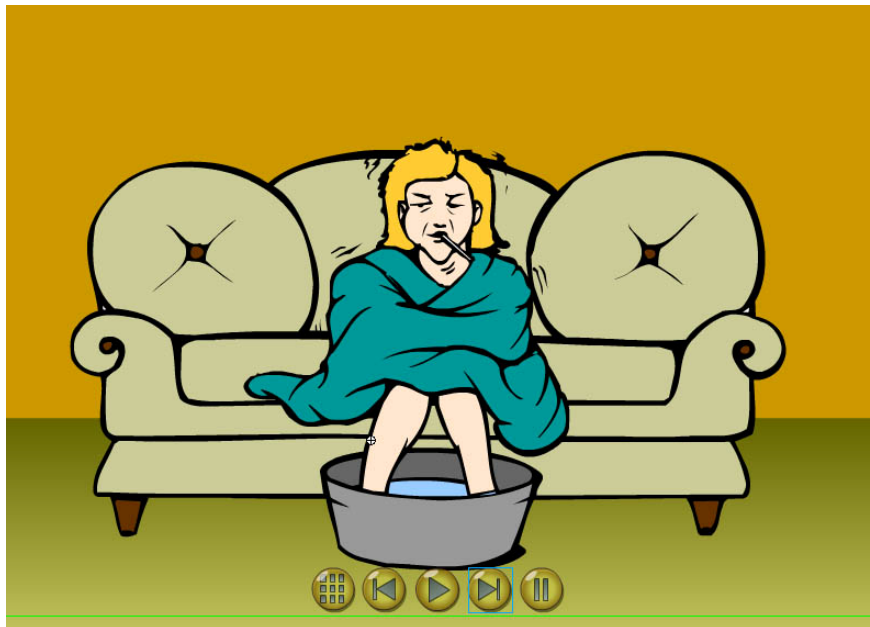


Figure 3-15. Previous graphic of female character.

David Killpack, the project manager of the first two animations, designed the images shown on the previous page. The image below was created in the same style and method, but was designed by another artist working with Web Curriculum.

The styles are the same in use of flat color and cartoon appearance, but the designs of the characters are different.

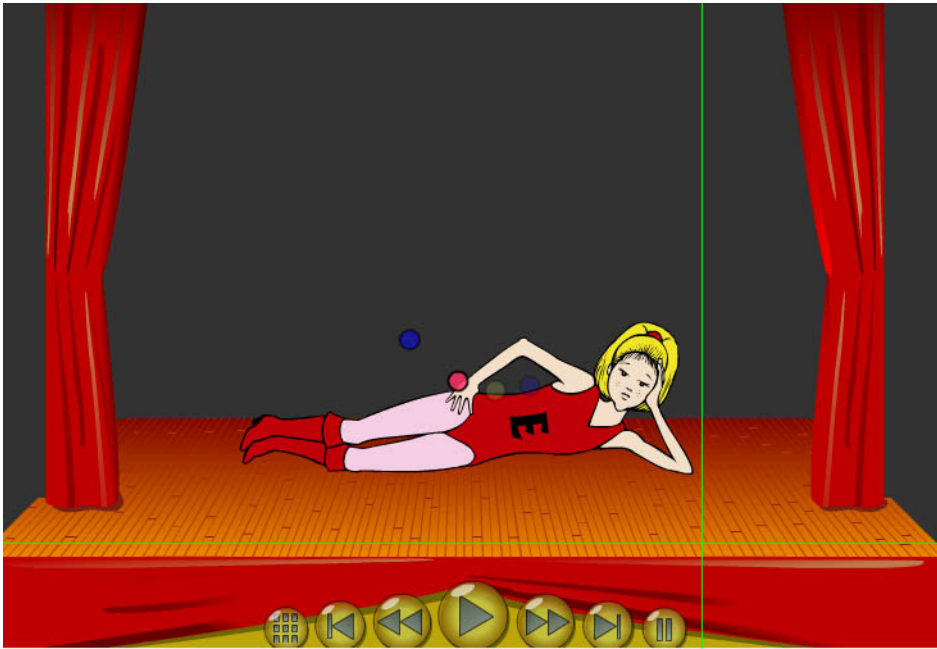


Figure 3-16. Previous graphic of girl character.

In keeping with the previous graphics' style, the graphics for episode three had their line work designed in Illustrator and color added in Flash. Some of the more simpler or secondary graphics were made in Flash by using the line tool, which is similar to the pen tool in Illustrator. These graphics were more environmental subjects, such as the sun or mountain.

References

To approach the challenge of matching the characters of each animation, the first step was to sketch out the character to a new style that was still similar to the earlier graphics. The next step was reviewing the previous animations and looking through comic books of Bloom County and Calvin and Hobbes for references. Figure 3-17, is an example of a scene

that was inspired by the two references. The use of extruding eyes and facial expressions were a great aid to designing the screaming man character.



Figure 3-17. Screaming Man from the third episode

The Figures 3-18 below displays a scene with the use of silhouette, inspired by Bloom County cartoons, which use silhouettes often in their comic strips for mood settings.

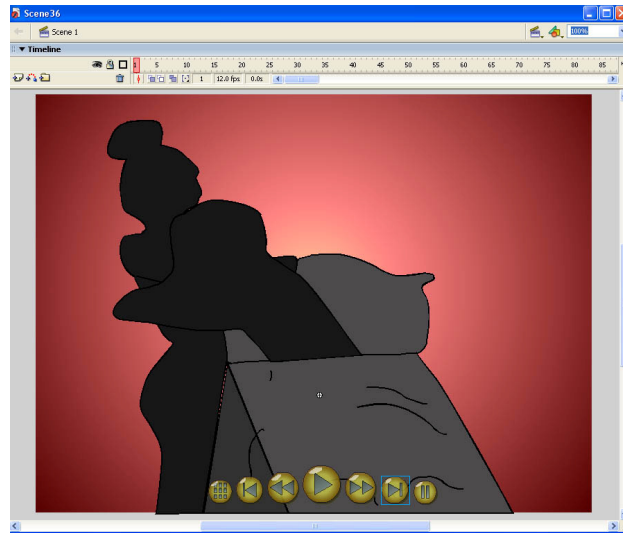


Figure 3-18. Silhouette scene.

The sketch of the male character is below. The images to the right are the character built in Flash.



Figure 3-19. Graphite sketch of character. **Figure 3-20.** Fully developed character

Although, designing graphics in Flash was more time efficient, there are many benefits to designing graphics in Illustrator. One of the many is the flexibility Illustrator gives in providing many options for the user. Options for different brush strokes or building your own brush help make the look of the lines unique. Also, Illustrator is an efficient tool for organization. Instead of having a graphic built in Flash and saving it as just one graphic, Illustrator aids in saving the graphic for options of altering it. For example, one of the animations depicts a T-cell extravasating through endothelial cells. This animation was done by creating one cell in Illustrator and then on separate layers altering the vector points of the cell graphic until each layer showed a different stage of the cell pushing itself through the endothelium.

Figures 3-21 and 3-22 shows the method of creating different phases of the cells by changing the same graphic's vector points. The image showing the cells extravasate show the actual animation and how the cells look morphing into each other.

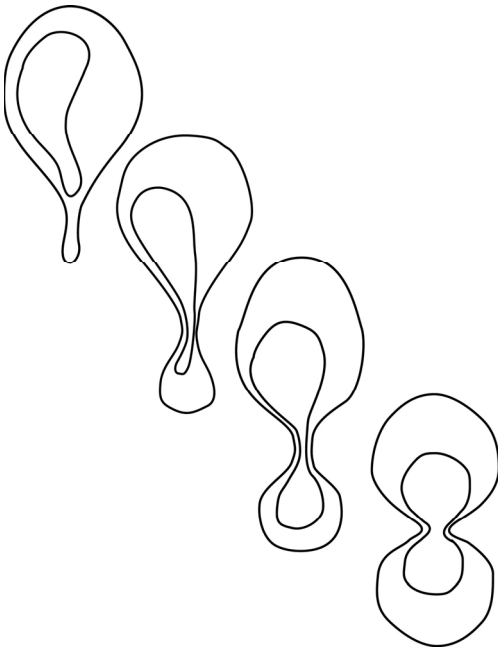


Figure 3-21. Adobe Illustrator cell shapes

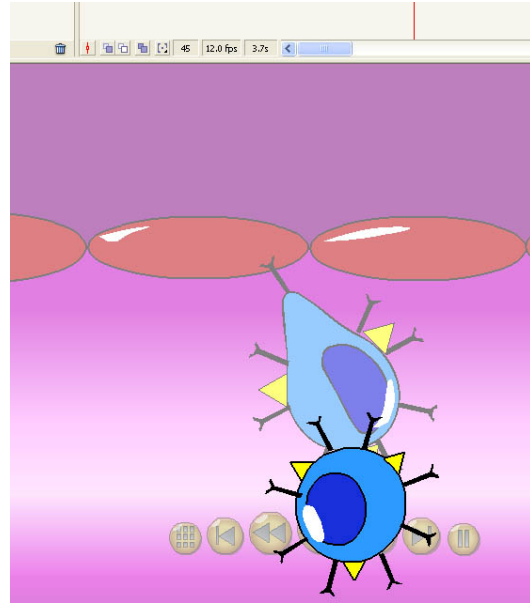


Figure 3-22. Adobe Flash cells extravasating

Layers

One of the essential lessons learned from editing the previous two movies is the use of layers. Editing the earlier scenes proved to be difficult because of the vast number of layers. One of the reasons why there were so many layers is because of the method used for animating most the actions. Many of the actions were animated key-frame by key-frame instead of using motion or shape tweening. In the later scenes the use of motion tweening were more evident, but even that technique used a lot of layers. Animating this thesis presented an opportunity to come up with a solution to this problem.

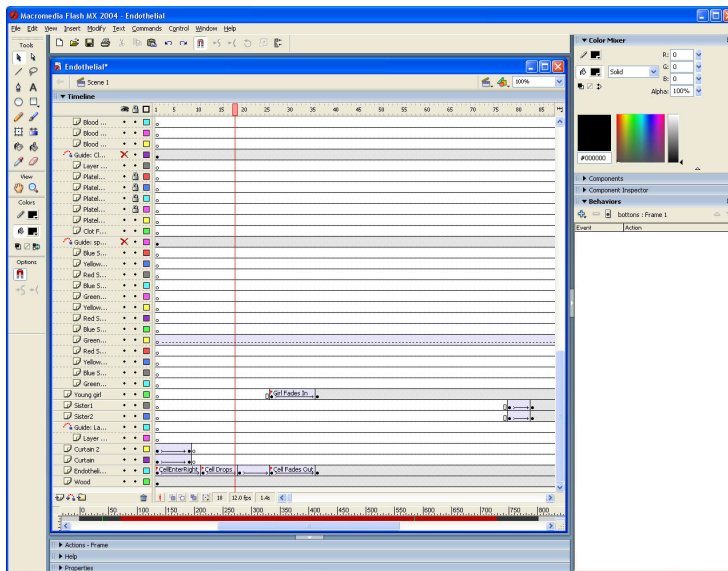


Figure 3-25. Adobe Flash Layers 3

It is very difficult to work with so many layers. As Figures 3-23, 24 and 25 demonstrate, if the animator wanted to view all the layers not only would he have to scroll continuously, unfortunately he would not be able to view the working screen. Because of this obstruction the layers would have to be very accurately labeled or the animator would not know what actions or graphics he would be affecting.

Movie Clips

The most effective way of avoiding a huge quantity of layers is to use movie clips. A movie clip is the best thing to use when the scene calls for an action to be repeated or if the action has too many variables that will take up many layers. A movie clip takes up only one

layer in the actual screen, but the animator has the ability to look inside the movie clip, which contains its own layers. This way the animator can edit the movie clip to his desire. The episode three animations uses many movie clips for various actions, such as when any cell releases any element, when a character walks or when there are a number of the same object doing similar actions. In the last case it is much easier to create a movie clip of this subject doing its action and putting numerous movie clips in the scene instead of animating each subject individually.

Figure 3-26 shows the interior of a movie clip. The movie clip has its own layers and key-frames, but it is all neatly contained within itself instead of taking up space in the actual scene. In this scene the movie clip is used twice as each of these blue cells. They're identical just set in different time frames.

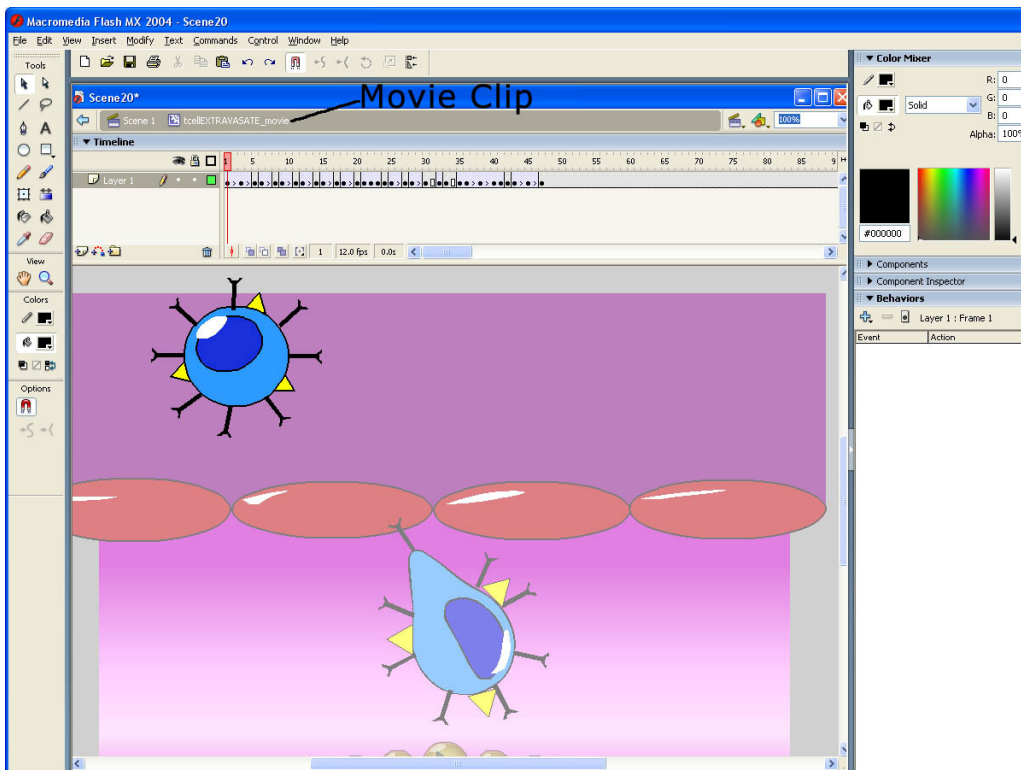


Figure 3-26. Adobe Flash movie clip 1

Another example of a movie clip similar to the one shown above is one used in Scene 25. The animation called for a multitude of eosinophils being drawn to IL-5. To save time in creating and animating each eosinophil, a movie clip was used many times over in different time sequences. These movie clips differ from the one shown of the T-cell because they move independently of each other. Although, each eosinophil graphic is the same and follows the same guide, as shown below, the actual clip can be rotated. This makes the eosinophil move in a different direction. Therefore, each eosinophil appears to have individual movement.

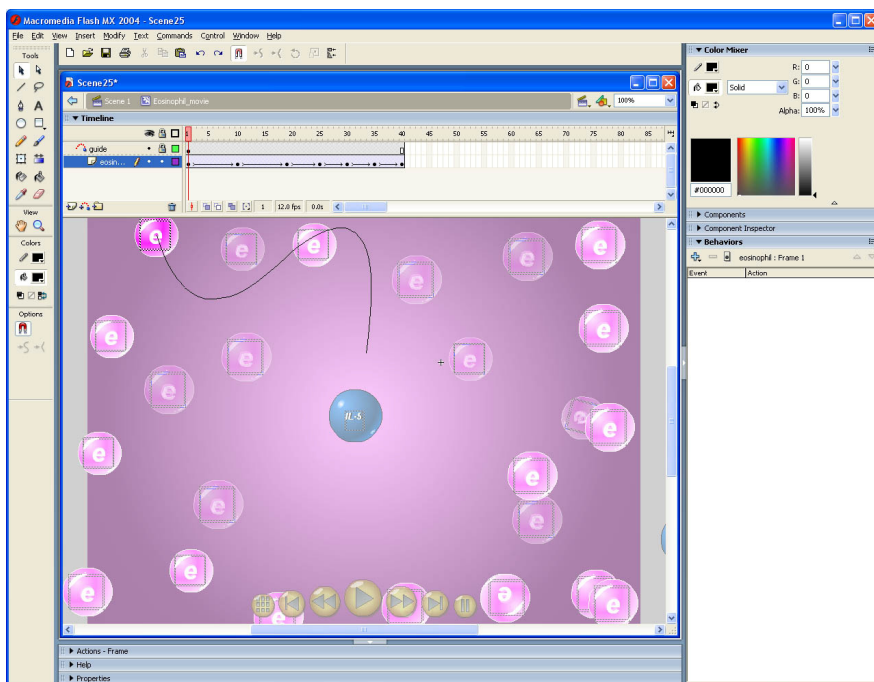


Figure 3-27. Adobe Flash movie clip 2

The image shown on the following page shows the many number of layers each eosinophil move clip occupies alone. If these were not movie clips and just graphics with individual animations, the number of layers would be doubled.

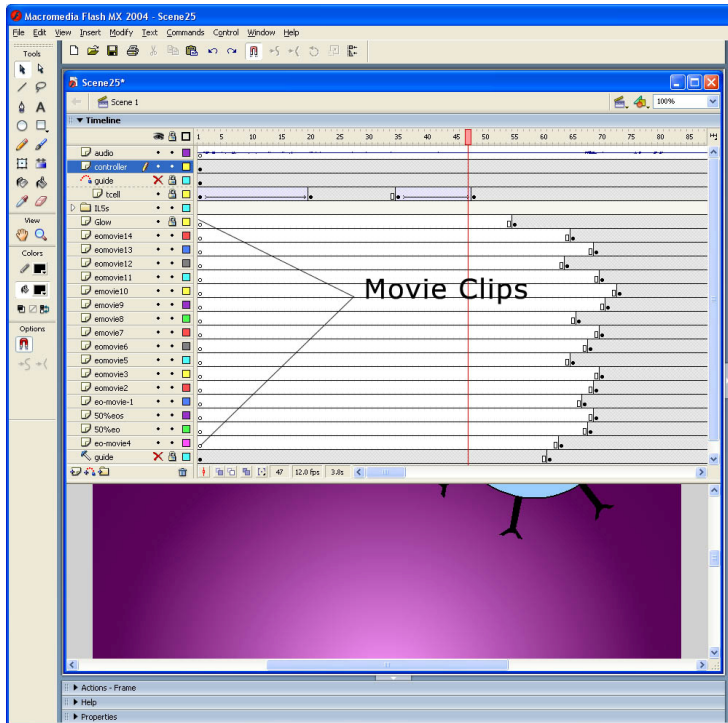


Figure 3-28. Adobe Flash movie clip 3

Another example of a movie clip is shown in the Figure 3-29. These objects are goblet cells and in a scene a multitude of them pop up and excrete mucus. The process of the animation was more complicated than the previous movie clip. This involved transition of transparency while the cells move upward. Each movie clip contains several layers. This

particular movie clip is another example of saving layers.

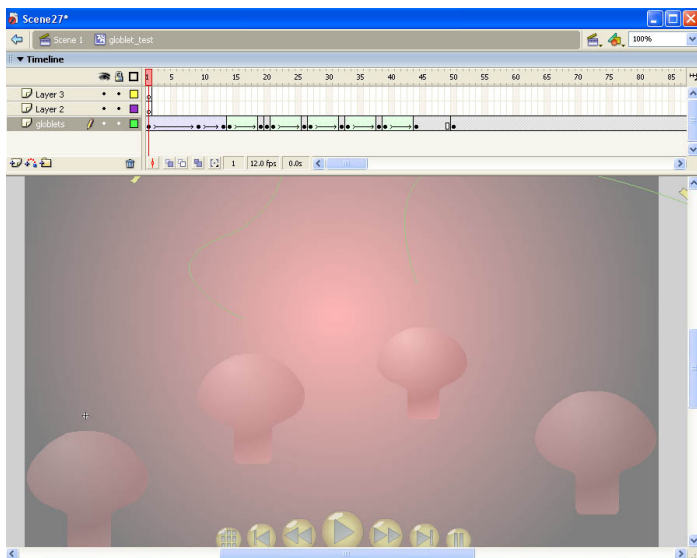


Figure 3-29. Adobe Flash movie clip 4.

Scripting

To make the animations easy for navigation, the previous two animations had a tool bar on each scene. The tool bar allowed the viewer to rewind, fast-forward, pause, go back to the previous scene or skip to the next scene. The same buttons used in the first two episodes was used in the third episode. The action scripting, which is the code assigned to the button, used in the previous animations was used in the third episode. The first step to putting an action script on a button is clicking on the graphic of the button. Once the button is clicked the action script panel appears under the action menu. Next view the action scripts listed in panel and, click on the type of action the button required. The action code appears in its own panel and can be edited or deleted.

Settings

Once the animations were completed, it was time to edit the sound settings so the audio could sound its best. Without the correct setting the audio would sound unprofessional and much louder than necessary. Figure 3-29 below shows the Publish Settings of a Flash scene.

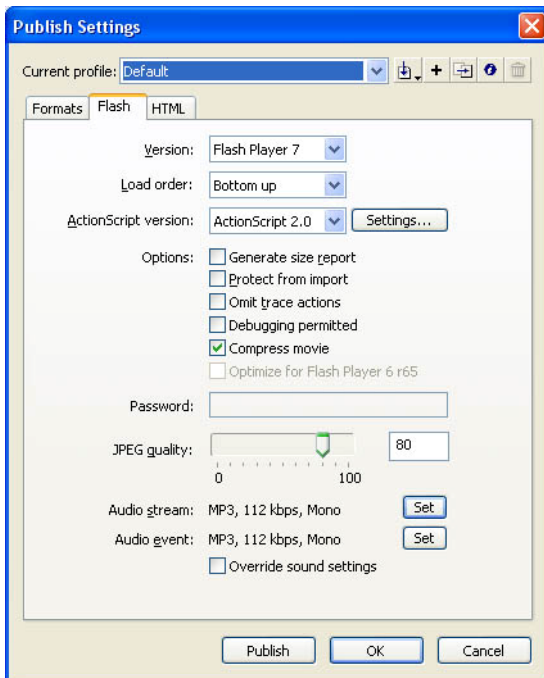


Figure 3-30. Published settings

To edit the settings the Set button can be clicked for editing. The setting for Mp3, 112 kbps and medium quality is what was used for episode three. The Settings Image shown below demonstrates what each scene was set at.

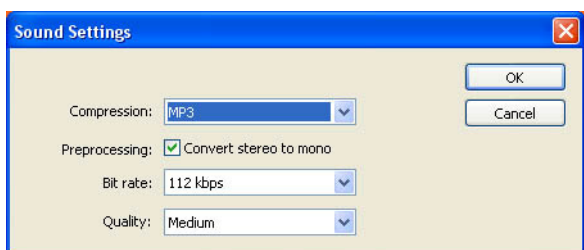


Figure 3-31. Sound settings.

Once the published settings were set, each animation was exported as a swf file.

Uploading HTML Pages

After all the scenes were published, their swf files were uploaded on to the Bio Communications department's server. The first swf file was placed in an html file to be played in a browser. Each scene was linked by action script, enabling the scenes to automatically play through the entire animation.

Conclusion

This chapter reviewed the process of creating the third episode. The first step was analyzing the previous animations to see how best to approach the thesis project in matters of designs; methods, organization and what needed improvement.

After the review, the approach chosen was to illustrate the characters in Adobe Illustrator and to divide up the body parts used for different actions on different layers. This method proved to be the most organized and best for natural looking movement.

Once the approach was chosen for the project, the next step was to research the subject, *Trichinella spiralis*. Dr. Vitetta provided a guideline about the science of *Trichinella spiralis*, and how the parasite is eliminated from the body. Dr. Niederkorn reviewed the guideline to ensure its accuracy and supplied a power point presentation from his lecture for additional information. The parasite's natural progression from its invasion into the body and its expulsion is the backbone of the script. The comic aspect of the script was built around the story line from the previous animations.

After the script was finalized, the audio was ready to be recorded. Dr. King, the narrator from the previous animations, was the narrator for the third episode. The audio was recorded at Medical Television to guarantee its quality. Once the entire script was recorded, the audio was brought into Adobe Premiere for adjusting and was cut into paragraphs to fit each scene from the animation. These cut sections of the audio were saved out as different .wav files.

The storyboard was written around the script and was designed the same time as recording the audio. The storyboard provided a great way for revisions of ideas and for Dr. Vitetta to look at each scene and understand the actions in the animation.

Once Dr. Vitetta approved the storyboard, it was time for designing and animating in Adobe Flash. Dr. Vitetta emphasized the need for graphics from the new animations to match the ones from the previous animations. Therefore the first step was to assess the

graphics from the previous animations. The second step was to look up references of cartoons for inspiration in creating some unique designs and background. The animating process started with organizing the layers in Adobe Flash and determining which actions from the animations should be key-frame or movie clips. The movie clips were much more efficient and saved layer space. A tool bar was added to each scene with action scripting, so the viewer could rewind, fast-forward or pause the animation. The tool bar also allowed the viewer to go back and forth between scenes. After the animation was completed, all the scenes were published and saved as .swf files. These files were posted on the BioMedical Communication department's browser for viewing.

The link to the browser was emailed to more than ten students. Only ten responded. Three of the students were second year medical students, who just finished the Immunology course. Seven of the students were third year medical students and one of the students was a fourth year. These ten students were sent the link and a questionnaire evaluating the third episode.

CHAPTER FOUR

Evaluation

Upon completion of the animation an informal evaluation was conducted for feedback. Medical students reviewed the animation and completed a questionnaire. A review of the completed questionnaire provided a feedback on the animation.

Questionnaire

The animation's .swf files were posted online for evaluation by the target audience, consisting of three second year medical students, seven third year medical students and one fourth year medical student from the University of Texas Southwestern Medical Center to evaluate the usefulness of the animations, as well as determine whether the goals and objectives had been met. A questionnaire was created and distributed by email to accompany a link to the animations. The survey was created using a 5-point Likert scale ranging from Strongly Agree (SA) to Strongly Disagree (SD). Eleven statements were given pertaining to the goals and objectives of the animation. The medical students were asked to check the box that corresponded to their level of agreement with the statement. Also included in the questionnaire, were three background questions regarding the type of computer used in viewing the animations, internet connection, and type of browser used. Two additional questions were put at the end of the eleven statements for additional comments. The questionnaire and completed questionnaires can be seen in Appendix C.

Questionnaire Distribution

In order to distribute the questionnaire to the correct audience for this project, my content advisor, Dr. Vitetta, was enlisted to send out both the questionnaire and the link to students she knew and believed were responsible and would take the time to give serious answers to the questionnaire. Eight other medical students, who have taken the Immunology course, were also enlisted in the evaluation process. After watching the animations and completing the questionnaires, the students were requested to email the survey back to me as an attachment.

Evaluation Results

After collecting the evaluations from all ten students, and reviewing their individual responses, the results for each of the eleven statements were compiled. Then the statistics were calculated, and a bar chart was created showing the percentages for agreement or disagreement of each statement. The graph represents the overall effectiveness of the animations. (Figure 4-1).

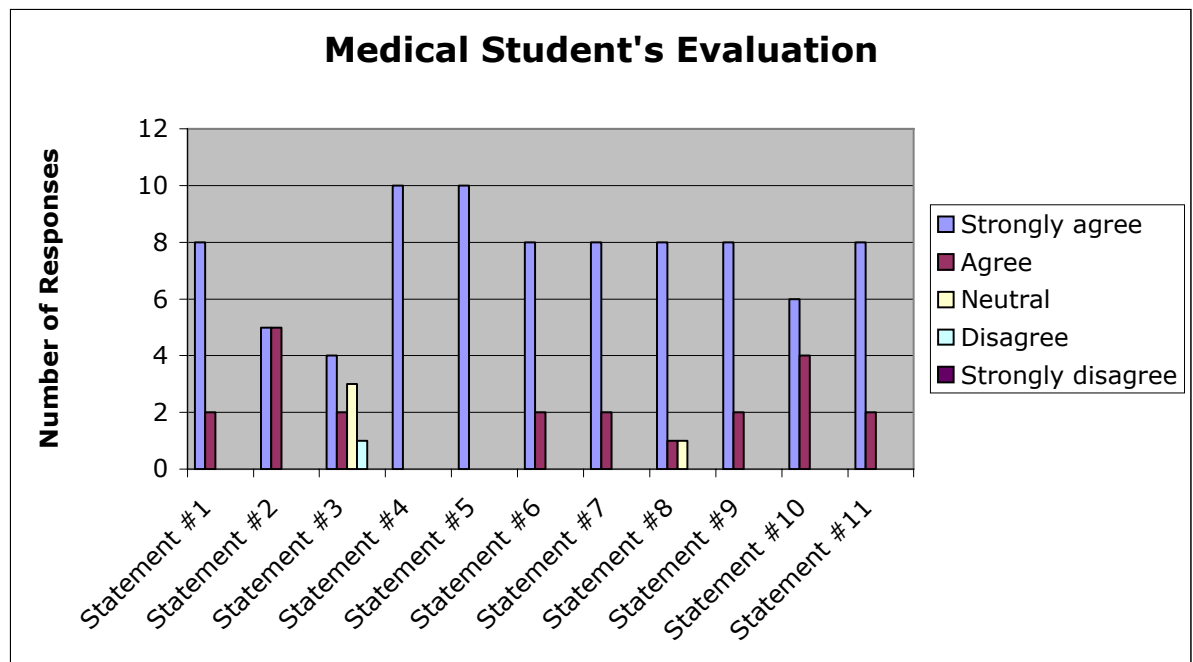


Figure 4-1. Summary of responses

Statement 1: The narration was easy to understand.

Eight students strongly agreed and two students agreed. One of the students who agreed commented that the “narration was choppy at times, making it a little hard to follow.”

Statement 2: You would watch this again for studying purposes.

Five students strongly agreed and five students agreed. The positive response to this statement shows the students felt it was a useful teaching tool. All students agreed they would use it for review. A comment made was, “for a complicated subject such as

immunology, I think being able to visualize the process is very helpful not only for learning, but for reviewing the material.”

Statement 3: These animations would be a more effective teaching tool if it had an interactive component.

Four students strongly agreed, two students agreed, three students were neutral and one student disagreed. This statement was given to see what could be improved in this third episode. If there were to be any changes made later, this could a possible addition. This comment was made by a student who strongly agreed with the statement: “I think an interactive component such as multiple choice questions would force the viewer to actively learn the material instead of just sitting back and watching.”

Statement 4: The graphics of this episode (the characters, cells, background, ect) meshed well with the graphics in the previous movie.

All ten students strongly agreed. The goal was to maintain visual consistency with the existing immunology teaching tool. The responses to this statement indicate this was achieved. One student commented that she thought the graphics improved in this episode.

Statement Five: The immunology was accurately portrayed in this episode.

All ten students strongly agree. Another goal of this thesis project was to create an animation on the immune system’s response to *Trichinella spiralis* that would expand on the

existing teaching tool. The positive response to this statement indicates the achievement of this as well.

Statement Six: Scenes that list cellular actions along with the narration are effective for learning.

Eight students strongly agree and two students agreed. The past animations used scenes displaying a text list of cellular interactions and the third episode used one. This statement was used to assess the student's response to this style of teaching cellular interactions. The students agreed that they felt this, along with the narration were effective.

Statement Seven: Scenes showing the cellular actions through animations are effective for learning.

Eight students strongly agreed and two students agreed. This statement was presented to measure how effective the students thought reviewing scientific material was using animation. The response was good and indicates the students felt visualizing cellular interactions is an effective method of learning. One student who agreed strongly commented, "Loved the part with the cytokines and the Ig going through the lumen wall. Makes so much more sense visually."

Statement Eight: You prefer scenes with animations to scenes with lists of cellular interactions.

Seven students strongly agreed, one student agreed and one was neutral. While the response from Statement Six indicates the response from this statement showed the students preferred animations to lists. A comment made by a student who strongly agreed with the

statement wrote, “Being able to visualize these interactions is much easier to learn than through memorizing lines.”

Statement Nine: This episode was a good transition from the last movie.

Eight students strongly agreed and two students agreed. Part of the goal was to expand on the information within the existing teaching tool. They are shown back to back and a smooth transition is important to the flow of the story line.

Statement Ten: The animation was clear and easy to understand.

Six students strongly agreed and four agreed. It is essential for the students to be able to understand the information presented in the animation. The response shows the students agree it is easy to understand.

Statement Eleven: Visualizing scientific information via animations is an effective way to retain information.

Eight students strongly agreed and two students agreed. This statement asks about the usefulness of the visual teaching tools. The animations should not only help the students understand the material, but help retain the information as well. The response showed the students believed that visual aid helps in retention of information. A student commented, “As with anything, the concepts are easier to understand than the details. This animation did an

excellent job of showing the big picture, and I know where to click to if I need to refresh the details in my mind.”

Background Questions

Eight of the ten students answered the background questions, which consist of which type of platform, operating system and browser they used to view the third episode. Five the students used PC platforms and three students use Macs. The three students, who used Macs, also used the OSX operating system, whereas the PC users used Windows XP. Four of the students used Explorer as a browser, two used Safari and two used Mozilla Firefox. No comments were made regarding any difficulty or slowness in viewing the animation.

Additional Question

A question was asked of the medical students as to what they enjoyed most about the movie. This question was intended to see what was most effective about the third animation.

Student 1: “The picture at the end with all the worms coming out that guy’s butt – gross AND funny!”

Student 2: “It’s a good way to review since it keeps you engaged more than reading a book would.”

Student 3: “The drawings! They were clever, cute and funny not to mention an effective teaching tool.”

Student 4: "I like the color choices and the use of silhouette."

Student 5: "I thought it was funny and kept my attention. The animation was good and I could follow the story. Great addition to the other movies!"

Student 6: "The animation helps cement my knowledge of the physiology of the immune system."

Student 7: "A generally more enjoyable experience compared to a book or notes."

Student 8: "It engaged me more than the others did. The details about IL-13 stimulating the migration of epithelial cells out of the intestinal crypts and the plot developments seemed to be integrated well compared to some of the previous episodes. The movie also had an element of satire (characterization of the tourist and McTobolobo) that was fun. The ambiguous relationship between the resident and tourist in the last scene was a completely unexpected twist."

Student 9: "It puts scientific material in an entertaining form. The animations were excellent and really helps the viewer to visualize what is going on."

Student 10: "I enjoyed the story. It was entertaining yet informative at the same time and the animations did an excellent job of portraying this story and the actions of the immune system fighting off parasitic infection."

Additional Comments

A space was reserved at the end of the questionnaire for additional comments. The additional comments is for the students to explain what they thought could have been done better or state other thoughts on the third episode.

One of the third year students thought the animations went too fast. Although, he admitted he could have thought it was too fast because a year has past since he took Immunology. The animations were built around the recorded narration. The tempo of the third episode matched with the tempo of the narrations in the previous movies. This consistency was important to the whole process and to slow down the animations would make the actions longer than the audio.

Another student pointed out a graphic didn't match the narration. At one point in the animation, raw boar meat is shown with a bubble containing a withering worm implicating the worm is inside the meat. The actual narration states the meat is infested with cysts. The graphic was designed this way because a worm graphic is more easily identifiable than a cyst. Since this portion of the animation was the last in the scene and moved rather quickly, it was decided that the worm graphic would be less confusing.

One student commented that Immunology could be a very difficult subject to grasp, especially when faced with lists of non-descript items such as all the interleukins or integrins. Visualizing their interactions through the animation was an extremely valuable tool for the medical students to learn and review the material that is presented in the syllabus. He went

on the state that, “The animations were very well done. They were not only accurate, but also entertaining.”

CHAPTER FIVE

Conclusions and Recommendations

Project Summary

The proposed thesis question was if an animation could be created to expand upon an existing animated teaching tool on Immunology and still maintain visual integrity and incorporate new information.

To answer this question, I created an animated teaching tool that medical students could use to review the subject of the immune system's reaction to an invasion of *Trichinella spiralis*. The thesis project was created using Adobe Illustrator, Macromedia Flash and Adobe Premiere. A goal was to design the additional animation to blend in with the previous two movies, but still maintain a certain level of uniqueness and contemporariness.

The goal of this thesis was to create a teaching tool about the immune system's response to *Trichinella spiralis* by using a series of animations that review the interactions and responsibilities of various structures of the immune system in an entertaining fashion and expands upon the existing immunological teaching tool

The following is a list of objectives for this thesis:

- 9 .** Review existing animations
- 10 .** Discuss new subject matter with Dr. Vitetta
- 11 .** Discussing science of parasites with Dr. Niederkorn, a professor of UT Southwestern who specializes in parasites

- 12 .** Piecing together the old story from the previous animations
 along with the science aspect of parasites
- 13 .** Producing the story board and designing new characters and
 cells
- 14 .** Recording and editing audio
- 15 .** Animating in Adobe Flash
- 16 .** Evaluation

The previous chapters concluded the goal and objectives of this thesis were achieved.

After the completion of the animation an evaluation was distributed to ten medical students for feedback. The questionnaire consisted of three background questions, eleven statements with 5 different levels of agreeing responses and an elective question asking what was the most enjoyable component of the movie. A space was left at the end of the evaluations for the students to give additional comments. The questionnaire was sent out through email along with a link to the animation. All ten medical students responded and sent their evaluations to me.

Conclusion

The evaluations gave extremely positive comments on the animation and the values of the movie as a teaching tool. A majority of the responses strongly agreed with a number of statements, and all of them felt the animation was a useful teaching tool.

Many of the students agreed that visualizing the non-descript cellular items helped them understand that material better. They all agreed that they would use this animation to review the Immunology course and the Board Exam. Overall, it appears the thesis project is a beneficial addition to the previous movies. In conclusion, based on the responses given from the target audience, the goal and objectives of this thesis were achieved.

Suggestions for Further Research

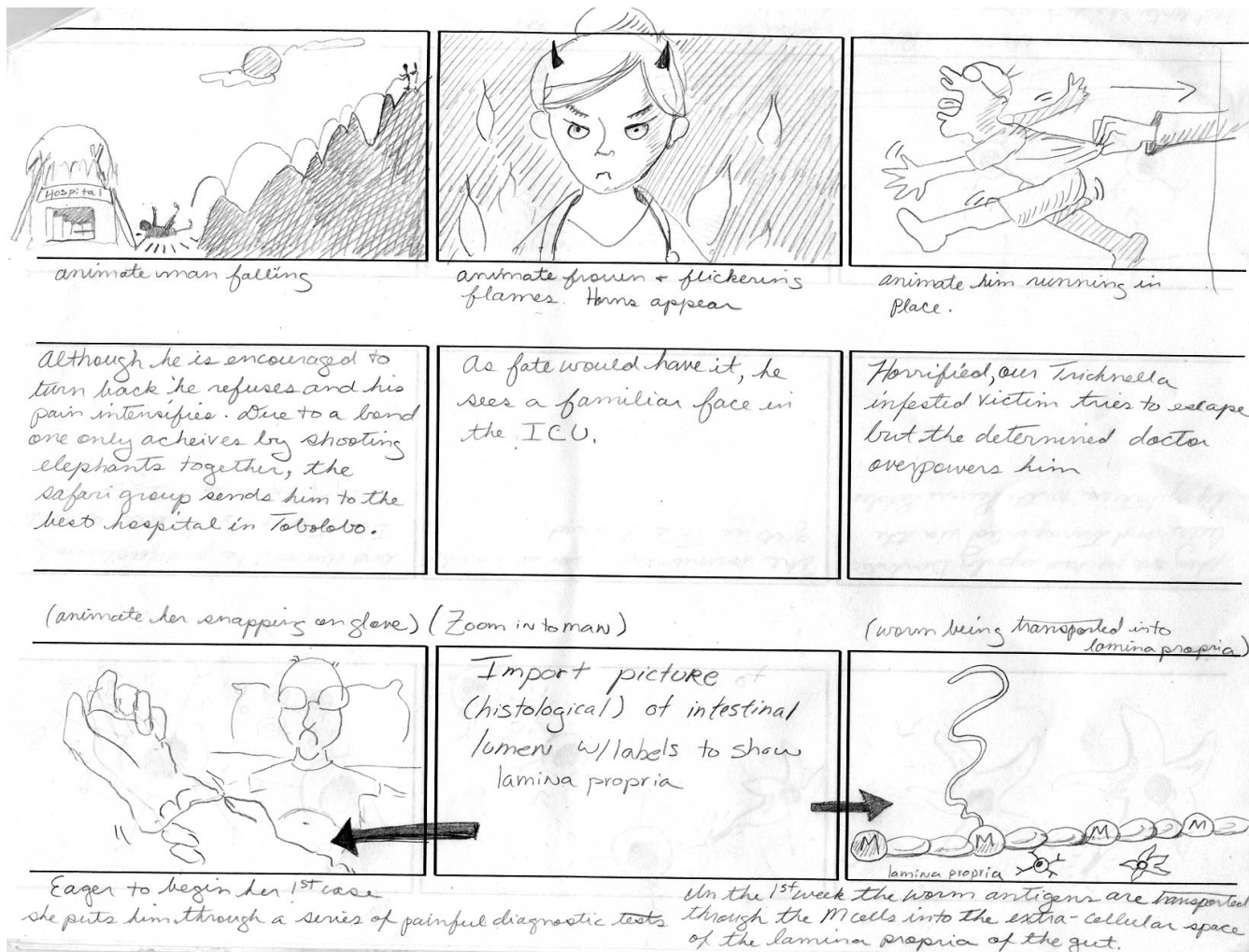
On suggestion for further research in which a majority of the evaluators agreed with, is implementing the use of interactivity into the animations. Instead of having the movies play through while the audience watches, the element of interactivity will engage the viewers in an active learning process.

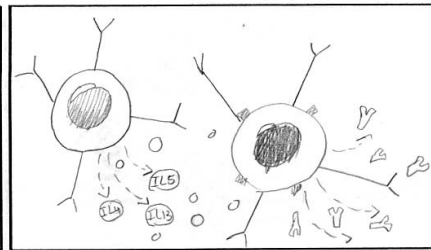
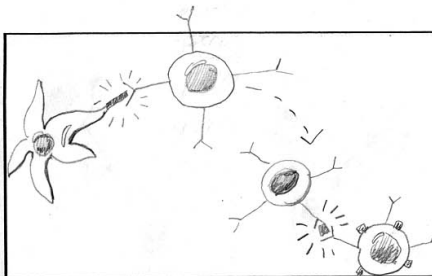
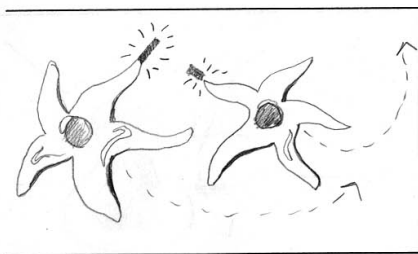
Another suggestion is applying animated teaching tools in other areas of the medical school curriculum, such as Embryology where the students have a limited time to learn the information.

APPENDIX A Storyboards





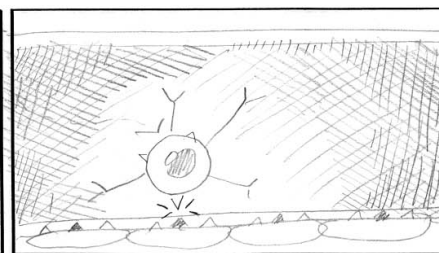
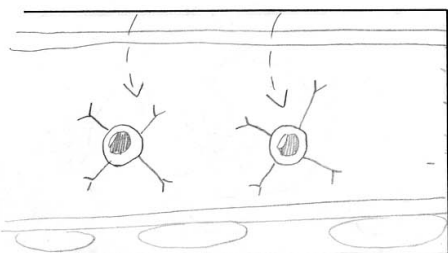




They are picked up by Dendritic cells and transported via the lymphatics to the Peyer's Patches.

The immune response in the gut is Th2 biased,

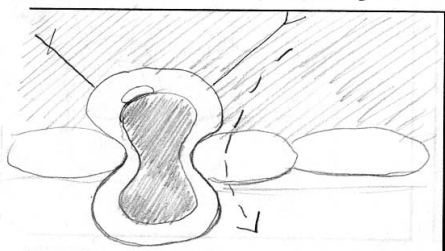
and due to the production of IL4, 5 and 13 B cells switch to IgA, IgG4 and IgE



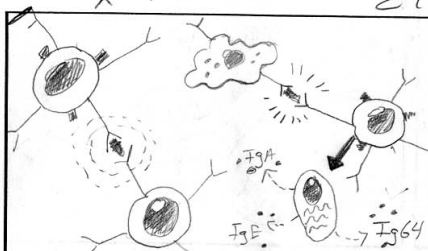
These cells exit the Peyer's Patches

They circulate through the body

... a4b7 on their surface

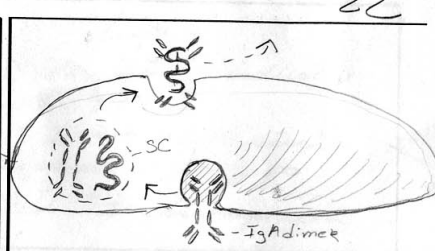


The cells extravasate into the lamina propria. They then lie underneath the lumen



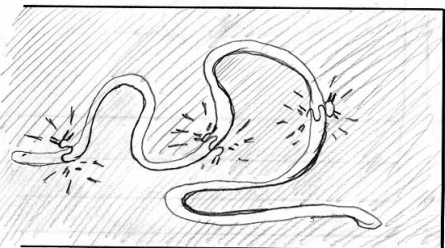
T cell collaboration, Mac activates B cell + B cell changes to a Plasma cell secreting IgA, IgE + IgG4

Terminally differentiated IgA, IgG4 and IgE expressing B cell collaboration with Memory T cells and resident Macs to express worm antigen to become PCs.

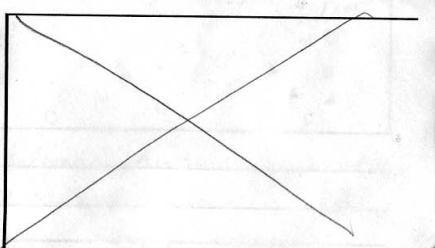
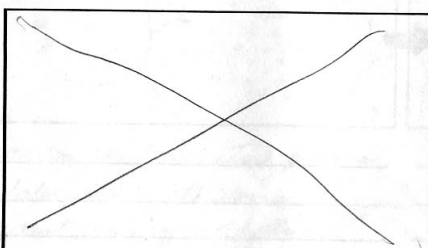


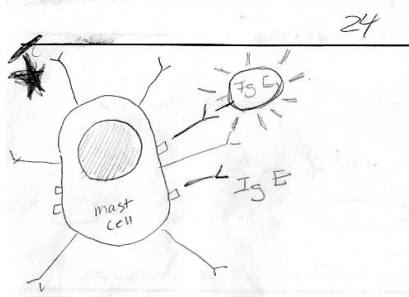
ASK about tween

The IgA dimers enter the lumen of the gut via transcytosis through an epithelial cell. While in the cell SC is added. Secreted IgA



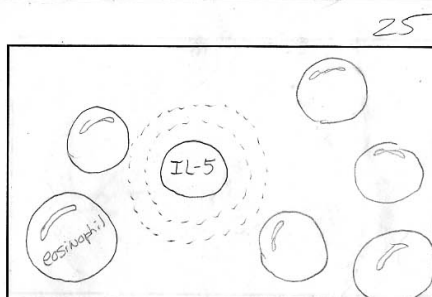
Secretory IgA binds to the worm in the lumen





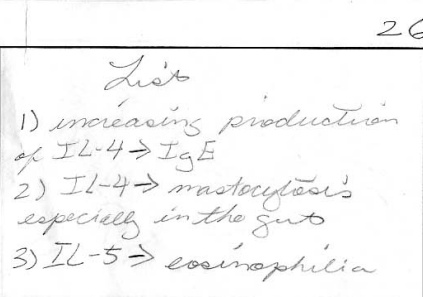
IgE antibody binds to antigens secreted by adult worms in gut (NiederKorn)

Worms that have entered the lamina propria are bound to IgE on mast cells

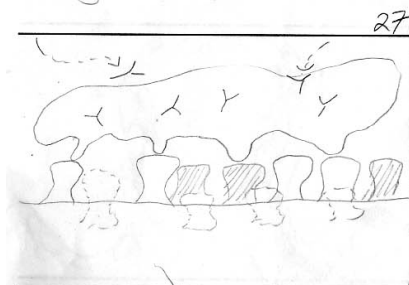


Attract radiating IL-5 w/ eosinophils moving in

Under the influence of IL-5, made by the activated memory T-cells, an army of eosinophils are attracted and activated in the gut,

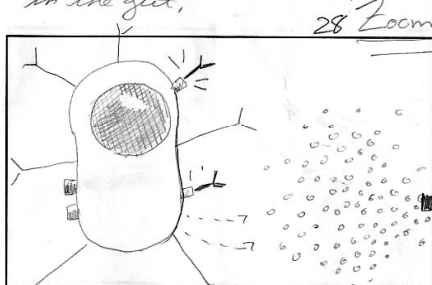


Thus increasing production of 1) IL-4 \rightarrow IgE
2) IL-4 \rightarrow mastocytosis
3) IL-5 \rightarrow eosinophilia

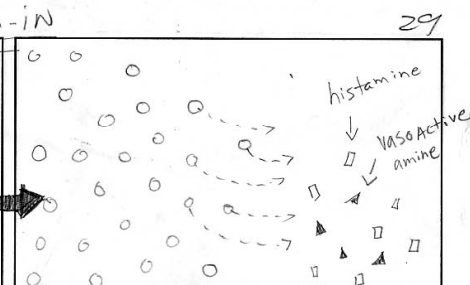


① Goblet cells popping up
② mucus flowing
③ antibodies going into mucus river

Goblet cells increase in the

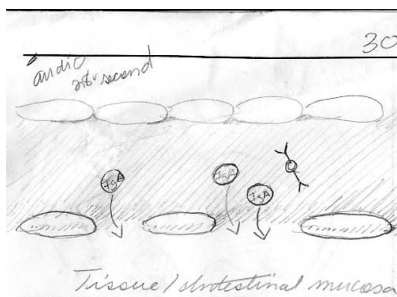


Excretory and secretory products elaborated by the worms trigger mast cell degranulation.



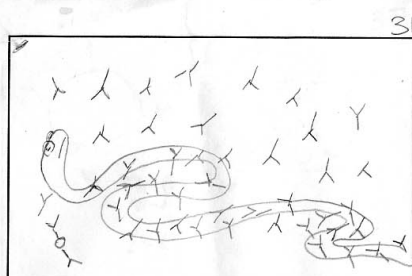
Release histamine and vasoactive amine

Histamine + vasoactive amines increase vascular permeability



Aiding in the transudation of IgA into the intestinal mucosa.

[this aiding in the transudation of IgA into the intestinal mucosa.]



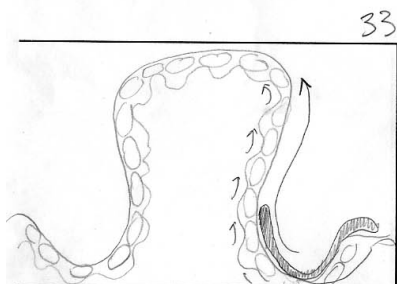
Animate IgA coating worm

IgA coats the worms

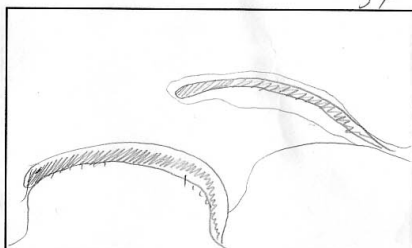


Worms struggling against muscles

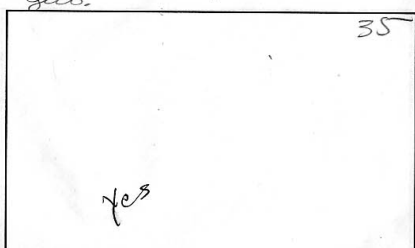
The muscles containing antibodies incarcerates the worms. The worms are now shackled and cannot maintain their position in the gut.



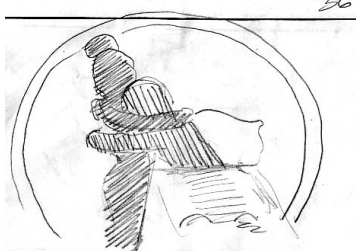
Animate peristalsis and worm moving up the lumen



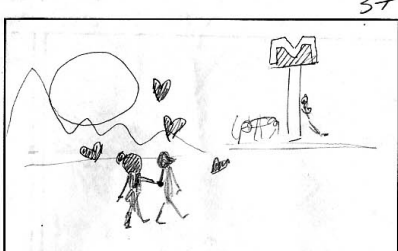
Show worms fly off



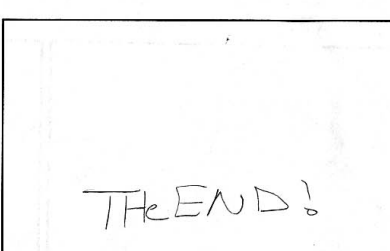
? Unimportant Pic of worms?



Animate glow



Animate hearts + walking



Most of this story: Personal communication like cellular communication

APPENDIX B

Survey

University of Texas Southwestern Medical Center at Dallas
8/30/2006

Page 1 of 2

Block 1 - Immunology (06-07)

Total Mean: 4.23

Block 1 - Immunology Overall

| <u>Item</u> | <u>A</u> | <u>B</u> | <u>C</u> | <u>D</u> | <u>E</u> | <u>Mean</u> | <u>N</u> |
|--|--------------------|--------------------|-------------------|-------------------|-----------------|--------------------|-----------------|
| The block met the learning objectives stated in the syllabus. | 130 56.8 | 89 38.9 | 8 3.5 | 2 0.9 | 0 0.0 | 4.52 | 229 |
| The block and its various components were well organized. | 107 46.7 | 94 41.0 | 21 9.2 | 7 3.1 | 0 0.0 | 4.31 | 229 |
| Reading the syllabus helped me learn. | 135 58.7 | 77 33.5 | 13 5.7 | 4 1.7 | 1 0.4 | 4.48 | 230 |
| Attending the lecture(s) helped me learn. | 121 56.0 | 78 36.1 | 13 6.0 | 3 1.4 | 1 0.5 | 4.46 | 216 |
| Reading the textbook helped me learn. | 82 49.7 | 62 37.6 | 16 9.7 | 3 1.8 | 2 1.2 | 4.33 | 165 |
| Participating in the conferences (small group discussions) helped me learn. | 77 33.6 | 104 45.4 | 34 14.8 | 8 3.5 | 6 2.6 | 4.04 | 229 |
| The movie helped me learn. | 32 15.2 | 78 37.1 | 67 31.9 | 26 12.4 | 7 3.3 | 3.49 | 210 |
| The clinical relevance of the material was made apparent. | 125 54.8 | 96 42.1 | 6 2.6 | 1 0.4 | 0 0.0 | 4.51 | 228 |
| The exam tested the block goals and lecture objectives. | 84 37.3 | 118 52.4 | 19 8.4 | 4 1.8 | 0 0.0 | 4.25 | 225 |
| The exam was fair. | 65 28.5 | 132 57.9 | 30 13.2 | 1 0.4 | 0 0.0 | 4.14 | 228 |
| The exam was difficult. | 79 34.5 | 122 53.3 | 25 10.9 | 3 1.3 | 0 0.0 | 4.21 | 229 |
| Overall, the faculty lectured well and were helpful. | 122 53.7 | 92 40.5 | 10 4.4 | 2 0.9 | 1 0.4 | 4.46 | 227 |
| The block leader was responsive and helpful. | 163 73.1 | 52 23.3 | 7 3.1 | 1 0.4 | 0 0.0 | 4.69 | 223 |
| Dr. Collins (Bone Marrow Transplantation) overall performance, organization, helpfulness, delivery, etc. | 36 18.7 | 75 38.9 | 63 32.6 | 16 8.3 | 3 1.6 | 3.65 | 193 |
| Dr. Strownowski (HLA) overall performance, organization, helpfulness, delivery, etc. | 35 17.5 | 90 45.0 | 53 26.5 | 19 9.5 | 3 1.5 | 3.68 | 200 |

A=Strongly Agree(5) B=Agree(4) C=No Opinion(3) D=Disagree(2) E=Strongly Disagree(1)

APPENDIX C

Episode Three Questionnaires

Original Questionnaire

Your feedback is important in helping us to increase the quality of these animations.
Please send your evaluations to katherine.brown@utsouthwestern.edu

Instructions: Please mark the square that corresponds to your level of agreement with the statement to the left. Additional comments may be added after each statement.

Which computer platform did you view the case study (Mac, PC, etc)?

Which operating system did you use (OSX, Windows XP, etc)?

Which browser did you use (Explorer, Netscape, Safari, etc)?

| | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | No opinion |
|--|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| Course Presentation | | | | | | |
| The narration was easy to understand | <input type="checkbox"/> | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Comments: | | | | | | |
| You would watch this episode again for studying purposes | <input type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Comments: | | | | | | |
| These animations would be a more effective teaching tool if it had an interactive component. | <input type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Comments: | | | | | | |
| The graphics of this episode (the characters, | <input type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |

| | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | No opinion |
|--|----------------|-------|---------|----------|-------------------|------------|
|--|----------------|-------|---------|----------|-------------------|------------|

cells, background, ect)
meshed well with the
graphics in the previous
movie.

Comments:

Course Objectives

The Immunology was
accurately portrayed in
this episode.

Comments:

Scenes that list cellular
actions along with the
narration are effective
for learning.

Comments:

Scenes showing the
cellular actions through
animations are effective
for learning.

Comments:

You prefer scenes with
animations to scenes
with lists of cellular
interaction.

Comments:

This episode was a
good transition from the
last movie.

Comments:

The animation was
clear and easy to
understand

Comments:

☐1 ☐2 ☐3 ☐4 ☐5 ☐6

☐1 ☐2 ☐3 ☐4 ☐5 ☐6

☐1 ☐2 ☐3 ☐4 ☐5 ☐6

☐1 ☐2 ☐3 ☐4 ☐5 6☐5

☐1 ☐2 ☐3 ☐4 ☐5 ☐6

☐1 ☐2 ☐3 ☐4 ☐5 ☐6

| | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | No opinion |
|--|----------------|-------|---------|----------|-------------------|------------|
|--|----------------|-------|---------|----------|-------------------|------------|

Visualizing scientific information via animations is an effective way to retain this information.

Comments:

What did you enjoy most about this episode of the immunomovie?

Please make additional comments here.

Questionnaire 1

Your feedback is important in helping us to increase the quality of these animations. Please send your evaluations to katherine.brown@utsouthwestern.edu

Instructions: Please mark the square that corresponds to your level of agreement with the statement to the left. Additional comments may be added after each statement.

Which computer platform did you view the case study (Mac, PC, etc)? PC

Which operating system did you use (OSX, Windows XP, etc)? XP

Which browser did you use (Explorer, Netscape, Safari, etc)? Explorer

| | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | No opinion |
|--|----------------|-------|---------|----------|-------------------|------------|
|--|----------------|-------|---------|----------|-------------------|------------|

Course Presentation

The narration was easy to understand

Comments:

X ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6

| | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | No opinion |
|--|----------------|-------|---------|----------|-------------------|------------|
|--|----------------|-------|---------|----------|-------------------|------------|

You would watch this episode again for studying purposes

Comments:

X☐1 ☐2 ☐3 ☐4 ☐5 ☐6

These animations would be a more effective teaching tool if it had an interactive component.

Comments: I think all you really need is to be able to stop and replay certain parts if you need to, which is already there.

☐1 ☐2 X☐3 ☐4 ☐5 ☐6

The graphics of this episode (the characters, cells, background, ect) meshed well with the graphics in the previous movie

Comments:

Course Objectives

The Immunology was accurately portrayed in this episode.

Comments:

X☐1 ☐2 ☐3 ☐4 ☐5 ☐6

Scenes that list cellular actions along with the narration are effective for learning.

Comments:

X☐1 ☐2 ☐3 ☐4 ☐5 ☐6

Scenes showing the cellular actions through animations are effective for learning.

Comments:

X☐1 ☐2 ☐3 ☐4 ☐5 ☐6

| | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | No opinion |
|--|----------------|-------|---------|----------|-------------------|------------|
|--|----------------|-------|---------|----------|-------------------|------------|

You prefer scenes with animations to scenes with lists of cellular interaction.

Comments:

X ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 6 ☐ 5

This episode was a good transition from the last movie.

Comments:

X ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6

The animation was clear and easy to understand

Comments: I think sometimes it moves a little fast. Some of the content is kind of complicated and it takes time to put it all together.

☐ 1 X ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6

Visualizing scientific information via animations is an effective way to retain this information.

Comments:

X ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6

What did you enjoy most about this episode of the immunomovie?

It puts scientific material in an entertaining form. The animations were excellent and really helps the viewer to visualize what is going on.

Please make any additional comments here.

As I mentioned above, I think some of the animations move a little too fast. Maybe it is because I have forgotten some of the immunology, but at times I needed a little more time to process what was going on.

Questionnaire 2

Your feedback is important in helping us to increase the quality of these animations.
Please send your evaluations to katherine.brown@utsouthwestern.edu

Instructions: Please mark the square that corresponds to your level of agreement with the statement to the left. Additional comments may be added after each statement.

Which computer platform did you view the case study (Mac, PC, etc)? Mac

Which operating system did you use (OSX, Windows XP, etc)? OSX

Which browser did you use (Explorer, Netscape, Safari, etc)? Mozilla Firefox (v1.5.0.8)

| | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | No opinion |
|--|---------------------------------------|----------------------------|---------------------------------------|----------------------------|----------------------------|----------------------------|
| Course Presentation | | | | | | |
| The narration was easy to understand | <input checked="" type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Comments: The speaking was at a perfect pace and was very clear. | | | | | | |
| You would watch this episode again for studying purposes | <input checked="" type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Comments: | | | | | | |
| These animations would be a more effective teaching tool if it had an interactive component. | <input type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input checked="" type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Comments: A menu or table of contents may be useful. | | | | | | |
| The graphics of this episode (the characters, cells, background, ect) meshed well with the | <input checked="" type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |

| | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | No opinion |
|--|----------------|-------|---------|----------|-------------------|------------|
|--|----------------|-------|---------|----------|-------------------|------------|

graphics in the previous movie

Comments:

Course Objectives

The Immunology was accurately portrayed in this episode.

Comments:

Scenes that list cellular actions along with the narration are effective for learning.

Comments: If interactions are listed, I can stop the movie, read the interactions, and put it all together before moving on.

Scenes showing the cellular actions through animations are effective for learning.

Comments:

You prefer scenes with animations to scenes with lists of cellular interaction.

Comments: The value of the movie for me is oral and visual, but lists would be useful in the context described above (see above comment about "lists of interactions.")

This episode was a good transition from the last movie.

Comments:

The animation was clear and easy to understand

Comments: The speed of the cellular interactions was just a little too fast for me--by the time I remembered which cell types were interacting, the interaction was finished (this was

| | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | No opinion |
|--|----------------|-------|---------|----------|-------------------|------------|
|--|----------------|-------|---------|----------|-------------------|------------|

most noticeable in the part where the antigens are transported to the Peyer's Patches and the plasma cells go back to the gut lumen.

Visualizing scientific information via animations is an effective way to retain this information. ☒1 ☐2 ☐3 ☐4 ☐5 ☐6

Comments: Visualization of what I'm studying is my primary memory strategy, so I strongly agree.

What did you enjoy most about this episode of the immunomovie?

It engaged me more than the others did. The details about IL-13 stimulating the migration of epithelial cells out of the intestinal crypts and The plot developments seemed to be integrated well compared to some of the previous episodes. The movie also had an element of satire (characterization of the tourist and McTobolobo) that was fun. The ambiguous relationship between the resident and tourist in the last scene was a completely unexpected twist.

Please make any additional comments here.

The graphic that goes along with the narrator's line "...semi-raw boar tenderloin infested with trichinella cysts..." is a picture of worms only. Do you want to put some cysts in there, too, since that's what the narrator is saying?

The first time that interleukins are represented, only one of the "interleukin balls" is labeled with "IL-13." Like later IL graphics, it would be nice if all of the balls were labeled, or at least one of each type. The narration of this frame contains: "...due to the production of IL-4, 5, and 13, the B cells switch..."

The narration, "Peristalsis forces the worms to try to swim upstream," would be less confusing to me if it said something like, "Peristalsis is now able to force the worms through the GI tract because they are immobilized by mucus and IgA antibodies." I don't remember learning about the direct connection between peristalsis and the worms swimming upstream as it is currently described in the movie.

Questionnaire 3

Your feedback is important in helping us to increase the quality of these animations.
Please send your evaluations to katherine.brown@utsouthwestern.edu

Instructions: Please mark the square that corresponds to your level of agreement with the statement to the left. Additional comments may be added after each statement.

Which computer platform did you view the case study (Mac, PC, etc)? PC

Which operating system did you use (OSX, Windows XP, etc)? Windows

Which browser did you use (Explorer, Netscape, Safari, etc)? Explorer

| | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | No opinion |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Course Presentation | | | | | | |
| The narration was easy to understand | <input type="checkbox"/> | x2 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Comments: | | | | | | |
| You would watch this episode again for studying purposes | <input type="checkbox"/> | x2 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Comments: | | | | | | |
| These animations would be a more effective teaching tool if it had an interactive component. | x1 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Comments: | | | | | | |
| The graphics of this episode (the characters, cells, background, ect) meshed well with the graphics in the previous | x1 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

| | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | No opinion |
|--|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|------------------------------|
| movie | | | | | | |
| Comments: | | | | | | |
| Course Objectives | | | | | | |
| The Immunology was accurately portrayed in this episode. | x1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Comments: | | | | | | |
| Scenes that list cellular actions along with the narration are effective for learning. | <input type="checkbox"/> 1 | x2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Comments: | | | | | | |
| Scenes showing the cellular actions through animations are effective for learning. | x1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Comments: | | | | | | |
| You prefer scenes with animations to scenes with lists of cellular interaction. | x1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | 6 <input type="checkbox"/> 5 |
| Comments: | | | | | | |
| This episode was a good transition from the last movie. | <input type="checkbox"/> 1 | x2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Comments: | | | | | | |
| The animation was clear and easy to understand | x1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Comments: | | | | | | |
| Visualizing scientific information via animations is an | x1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |

| | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | No opinion |
|--|-------------------|-------|---------|----------|----------------------|---------------|
|--|-------------------|-------|---------|----------|----------------------|---------------|

effective way to retain
this information.

Comments:

What did you enjoy most about this episode of the immunomovie?

The animation helps cement my knowledge of the physiology of the immune system.

Please make any additional comments here.

While I enjoy the humor in these movies, I find it distracting from the learning material.
Otherwise, I think they are great.

Questionnaire 4

Your feedback is important in helping us to increase the quality of these animations.
Please send your evaluations to katherine.brown@utsouthwestern.edu

Instructions: Please mark the square that corresponds to your level of agreement with the statement to the left. Additional comments may be added after each statement.

Which computer platform did you view the case study (Mac, PC, etc)? PC

Which operating system did you use (OSX, Windows XP, etc)? Windows XP

Which browser did you use (Explorer, Netscape, Safari, etc)? Monzilla Foxfire

| | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | No opinion |
|---|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| Course Presentation | | | | | | |
| The narration was easy to understand | X | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Comments: | | | | | | |
| You would watch this episode again for studying purposes | X | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Comments: | | | | | | |
| These animations would be a more effective teaching tool if it had an interactive component. | <input type="checkbox"/> 1 | X | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Comments: | | | | | | |
| The graphics of this episode (the characters, cells, background, ect) meshed well with the graphics in the previous movie | X | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |

| | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | No opinion |
|--|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|------------------------------|
| Comments: | | | | | | |
| Course Objectives | | | | | | |
| The Immunology was accurately portrayed in this episode. | X | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Comments: | | | | | | |
| Scenes that list cellular actions along with the narration are effective for learning. | X | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Comments: | | | | | | |
| Scenes showing the cellular actions through animations are effective for learning. | <input type="checkbox"/> 1 | X | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Comments: | | | | | | |
| You prefer scenes with animations to scenes with lists of cellular interaction. | X | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | 6 <input type="checkbox"/> 5 |
| Comments: | | | | | | |
| This episode was a good transition from the last movie. | X | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Comments: | | | | | | |
| The animation was clear and easy to understand | <input type="checkbox"/> 1 | X | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Comments: | | | | | | |
| Visualizing scientific information via animations is an effective way to retain | X | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |

| | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | No opinion |
|--|-------------------|-------|---------|----------|----------------------|---------------|
|--|-------------------|-------|---------|----------|----------------------|---------------|

this information.

Comments:

What did you enjoy most about this episode of the immunomovie?

I thought it was funny and kept my attention. The animation was good and I could follow the story.

Please make any additional comments here.

Great addition to the first movie!

Questionnaire 5

Your feedback is important in helping us to increase the quality of these animations.
Please send your evaluations to katherine.brown@utsouthwestern.edu

Instructions: Please mark the square that corresponds to your level of agreement with the statement to the left. Additional comments may be added after each statement.

Which computer platform did you view the case study (Mac, PC, etc)?

Which operating system did you use (OSX, Windows XP, etc)?

Which browser did you use (Explorer, Netscape, Safari, etc)?

| | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | No opinion |
|---|------------------------------|------------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| Course Presentation | | | | | | |
| The narration was easy to understand | x <input type="checkbox"/> | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Comments: | | | | | | |
| You would watch this episode again for studying purposes | <input type="checkbox"/> 1 | x <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Comments: helpful but more 'story' than info. | | | | | | |
| These animations would be a more effective teaching tool if it had an interactive component. | <input type="checkbox"/> 1 | x <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Comments: | | | | | | |
| The graphics of this episode (the characters, cells, background, ect) meshed well with the graphics in the previous movie | x <input type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Comments: | | | | | | |

| | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | No opinion |
|---|------------------------------|----------------------------|----------------------------|----------------------------|----------------------------|------------------------------|
| Course Objectives | | | | | | |
| The Immunology was accurately portrayed in this episode. Comments: | x <input type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Scenes that list cellular actions along with the narration are effective for learning. Comments: | x <input type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Scenes showing the cellular actions through animations are effective for learning. Comments: | x <input type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| You prefer scenes with animations to scenes with lists of cellular interaction. Comments: definitely | x <input type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | 6 <input type="checkbox"/> 5 |
| This episode was a good transition from the last movie. Comments: | x <input type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| The animation was clear and easy to understand Comments: | x <input type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Visualizing scientific information via animations is an effective way to retain this information. | x <input type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |

| | | | | | | |
|--|-------------------|-------|---------|----------|----------------------|---------------|
| | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | No opinion |
|--|-------------------|-------|---------|----------|----------------------|---------------|

Comments:

What did you enjoy most about this episode of the immunomovie?

A generally more enjoyable experience compared to a book or notes.

Please make any additional comments here.

I heard a friend say that it was “too political” for him, but it did not bother me.

Questionnaire 6

Your feedback is important in helping us to increase the quality of these animations.
Please send your evaluations to katherine.brown@utsouthwestern.edu

Instructions: Please mark the square that corresponds to your level of agreement with the statement to the left. Additional comments may be added after each statement.

Which computer platform did you view the case study (Mac, PC, etc)?

Which operating system did you use (OSX, Windows XP, etc)?

Which browser did you use (Explorer, Netscape, Safari, etc)?

| | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | No opinion |
|---|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| Course Presentation | | | | | | |
| The narration was easy to understand | X | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Comments: | | | | | | |
| You would watch this episode again for studying purposes | <input type="checkbox"/> 1 | X2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Comments: | | | | | | |
| These animations would be a more effective teaching tool if it had an interactive component. | X1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Comments: | | | | | | |
| The graphics of this episode (the characters, cells, background, ect) meshed well with the graphics in the previous movie | X1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Comments: | | | | | | |

| | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | No opinion |
|---|----------------|----------------------------|----------------------------|----------------------------|----------------------------|------------------------------|
| Course Objectives | | | | | | |
| The Immunology was accurately portrayed in this episode. Comments: | X1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Scenes that list cellular actions along with the narration are effective for learning. Comments: | X1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Scenes showing the cellular actions through animations are effective for learning. Comments: | X1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| You prefer scenes with animations to scenes with lists of cellular interaction. Comments: | X1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | 6 <input type="checkbox"/> 5 |
| This episode was a good transition from the last movie. Comments: | X1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| The animation was clear and easy to understand Comments: | X1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Visualizing scientific information via animations is an effective way to retain this information. | X1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |

| | | | | | | |
|--|-------------------|-------|---------|----------|----------------------|---------------|
| | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | No opinion |
|--|-------------------|-------|---------|----------|----------------------|---------------|

Comments:

What did you enjoy most about this episode of the immunomovie?

I like the color choices and the use of silhouette.

Please make any additional comments here.

Questionnaire 7

Your feedback is important in helping us to increase the quality of these animations.
Please send your evaluations to katherine.brown@utsouthwestern.edu

Instructions: Please mark the square that corresponds to your level of agreement with the statement to the left. Additional comments may be added after each statement.

Which computer platform did you view the case study (Mac, PC, etc)? PC

Which operating system did you use (OSX, Windows XP, etc)? Windows

Which browser did you use (Explorer, Netscape, Safari, etc)? explorer

| | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | No opinion |
|---|----------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| Course Presentation | | | | | | |
| The narration was easy to understand | X | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Comments: | | | | | | |
| You would watch this episode again for studying purposes | X1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Comments: | | | | | | |
| These animations would be a more effective teaching tool if it had an interactive component. | X1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Comments: | | | | | | |
| The graphics of this episode (the characters, cells, background, ect) meshed well with the graphics in the previous movie | X1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |

| | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | No opinion |
|--|----------------|-------|---------|----------|-------------------|------------|
|--|----------------|-------|---------|----------|-------------------|------------|

Comments:

Course Objectives

The Immunology was accurately portrayed in this episode.

X1 ☐2 ☐3 ☐4 ☐5 ☐6

Comments:

Scenes that list cellular actions along with the narration are effective for learning.

X1 ☐2 ☐3 ☐4 ☐5 ☐6

Comments:

Scenes showing the cellular actions through animations are effective for learning.

X1 ☐2 ☐3 ☐4 ☐5 ☐6

Comments:

You prefer scenes with animations to scenes with lists of cellular interaction.

X1 ☐2 ☐3 ☐4 ☐5 6☐5

Comments:

This episode was a good transition from the last movie.

X1 ☐2 ☐3 ☐4 ☐5 ☐6

Comments:

The animation was clear and easy to understand

X1 ☐2 ☐3 ☐4 ☐5 ☐6

Comments:

Visualizing scientific information via animations is an effective way to retain

X1 ☐2 ☐3 ☐4 ☐5 ☐6

| | | | | | | |
|--|-------------------|-------|---------|----------|----------------------|---------------|
| | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | No opinion |
|--|-------------------|-------|---------|----------|----------------------|---------------|

this information.

Comments:

What did you enjoy most about this episode of the immunomovie?

The drawings! They were clever, cute and funny not to mention an effective teaching tool.

Please make any additional comments here.

Questionnaire 8

Your feedback is important in helping us to increase the quality of these animations.
Please send your evaluations to katherine.brown@utsouthwestern.edu

Instructions: Please mark the square that corresponds to your level of agreement with the statement to the left. Additional comments may be added after each statement.

Which computer platform did you view the case study (Mac, PC, etc)? Mac

Which operating system did you use (OSX, Windows XP, etc)? OSX

Which browser did you use (Explorer, Netscape, Safari, etc)? Safari

| | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | No opinion |
|---|---------------------------------------|---------------------------------------|----------------------------|---------------------------------------|----------------------------|----------------------------|
| Course Presentation | | | | | | |
| The narration was easy to understand | <input type="checkbox"/> | <input checked="" type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Comments: The T-cell, B-cell will always be confusing to me, but it got very clear near the end, right around "the mucus incarcerates the worm" | | | | | | |
| You would watch this episode again for studying purposes | <input type="checkbox"/> 1 | <input checked="" type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Comments: If I thought I would need to know the T-cell stuff and cytokines, I would make good use of the chapter select buttons. | | | | | | |
| These animations would be a more effective teaching tool if it had an interactive component. | <input type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input checked="" type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Comments: Not needed | | | | | | |
| The graphics of this episode (the characters, cells, background, ect) meshed well with the | <input checked="" type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |

| | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | No opinion |
|--|----------------|-------|---------|----------|-------------------|------------|
|--|----------------|-------|---------|----------|-------------------|------------|

graphics in the previous movie

Comments: They were better!

Course Objectives

The Immunology was accurately portrayed in this episode.

Comments:

Scenes that list cellular actions along with the narration are effective for learning.

Comments: It was a lot more clear to see the words.

Scenes showing the cellular actions through animations are effective for learning.

Comments: Loved the part where the cytokines makes the lumen wall more appropriate for the Ig molecules to go through – made so much more sense visually

You prefer scenes with animations to scenes with lists of cellular interaction.

Comments:

This episode was a good transition from the last movie.

Comments: Well, it was a little distracting that this movie was much more interesting

The animation was clear and easy to understand

☒1 ☐2 ☐3 ☐4 ☐5 ☐6

☒1 ☐2 ☐3 ☐4 ☐5 ☐6

☒1 ☐2 ☐3 ☐4 ☐5 ☐6

☒1 ☐2 ☐3 ☐4 ☐5 ☐6

☒1 ☐2 ☐3 ☐4 ☐5 ☐6

☒1 ☐2 ☐3 ☐4 ☐5 ☐6

| | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | No opinion |
|--|-------------------|-------|---------|----------|----------------------|---------------|
|--|-------------------|-------|---------|----------|----------------------|---------------|

Comments:

Visualizing scientific
information via
animations is an
effective way to retain
this information.

☐ 1

☒ 2

☐ 3

☐ 4

☐ 5

☐ 6

Comments: As with anything, the concepts are easier to understand than the details. This animation did an excellent job of showing the big picture, and I know where to click to if I need to refresh the details in my mind.

What did you enjoy most about this episode of the immunomovie?

THE PICTURE AT THE END WITH ALL THE WORMS COMING OUT THAT GUY'S BUTT – GROSS AND FUNNY!

Questionnaire 9

Your feedback is important in helping us to increase the quality of these animations.
Please send your evaluations to katherine.brown@utsouthwestern.edu

Instructions: Please mark the square that corresponds to your level of agreement with the statement to the left. Additional comments may be added after each statement.

Which computer platform did you view the case study (Mac, PC, etc)? PC

Which operating system did you use (OSX, Windows XP, etc)? Windows XP

Which browser did you use (Explorer, Netscape, Safari, etc)? Explorer

| | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | No opinion |
|---|------------------------------|------------------------------|------------------------------|----------------------------|----------------------------|----------------------------|
| Course Presentation | | | | | | |
| The narration was easy to understand | X <input type="checkbox"/> | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Comments: | | | | | | |
| You would watch this episode again for studying purposes | <input type="checkbox"/> 1 | X <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Comments: | | | | | | |
| These animations would be a more effective teaching tool if it had an interactive component. | <input type="checkbox"/> 1 | <input type="checkbox"/> 2 | X <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Comments: | | | | | | |
| The graphics of this episode (the characters, cells, background, ect) meshed well with the graphics in the previous movie | X <input type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Comments: | | | | | | |

| | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | No opinion |
|---|------------------------------|------------------------------|------------------------------|----------------------------|----------------------------|------------------------------|
| Course Objectives | | | | | | |
| The Immunology was accurately portrayed in this episode. Comments: | X <input type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Scenes that list cellular actions along with the narration are effective for learning. Comments: | <input type="checkbox"/> 1 | X <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Scenes showing the cellular actions through animations are effective for learning. Comments: | <input type="checkbox"/> 1 | X <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| You prefer scenes with animations to scenes with lists of cellular interaction. Comments: | <input type="checkbox"/> 1 | <input type="checkbox"/> 2 | X <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | 6 <input type="checkbox"/> 5 |
| This episode was a good transition from the last movie. Comments: | X <input type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| The animation was clear and easy to understand Comments: | X <input type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Visualizing scientific information via animations is an effective way to retain this information. | <input type="checkbox"/> 1 | X <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |

| | | | | | | |
|--|-------------------|-------|---------|----------|----------------------|---------------|
| | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | No opinion |
|--|-------------------|-------|---------|----------|----------------------|---------------|

Comments:

What did you enjoy most about this episode of the immunomovie?

It's a good way to review since it keeps you engaged more than reading a book would.

Please make any additional comments here.

Questionnaire 10

Your feedback is important in helping us to increase the quality of these animations.
Please send your evaluations to katherine.brown@utsouthwestern.edu

Instructions: Please mark the square that corresponds to your level of agreement with the statement to the left. Additional comments may be added after each statement.

Which computer platform did you view the case study (Mac, PC, etc)? Mac

Which operating system did you use (OSX, Windows XP, etc)? OSX

Which browser did you use (Explorer, Netscape, Safari, etc)? Safari

| | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | No opinion |
|--|-------------------|-------|---------|----------|----------------------|---------------|
|--|-------------------|-------|---------|----------|----------------------|---------------|

Course Presentation

The narration was easy to understand ☐ ☒2 ☐3 ☐4 ☐5 ☐6

Comments: At times, the narration was choppy making it a little hard to follow.

You would watch this episode again for studying purposes ☒1 ☐2 ☐3 ☐4 ☐5 ☐6

Comments: For a complicated subject such as immunology, I think being able to visualize the process is very helpful not only for learning but also for reviewing the material.

These animations would be a more effective teaching tool if it had an interactive component. ☒1 ☐2 ☐3 ☐4 ☐5 ☐6

Comments: I think an interactive component such as multiple choice questions would force the viewer to actively learn the material instead of just sitting back and watching.

The graphics of this episode (the characters, cells, background, ect) meshed well with the ☒1 ☐2 ☐3 ☐4 ☐5 ☐6

| | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | No opinion |
|---|---------------------------------------|---------------------------------------|----------------------------|----------------------------|----------------------------|------------------------------|
| graphics in the previous movie | | | | | | |
| Comments: | | | | | | |
| Course Objectives | | | | | | |
| The Immunology was accurately portrayed in this episode. | <input checked="" type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Comments: | | | | | | |
| Scenes that list cellular actions along with the narration are effective for learning. | <input checked="" type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Comments: | | | | | | |
| Scenes showing the cellular actions through animations are effective for learning. | <input checked="" type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Comments: | | | | | | |
| You prefer scenes with animations to scenes with lists of cellular interaction. | <input checked="" type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | 6 <input type="checkbox"/> 5 |
| Comments: Being able to visualize these interactions is much easier to learn than through memorizing lists. | | | | | | |
| This episode was a good transition from the last movie. | <input checked="" type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Comments: | | | | | | |
| The animation was clear and easy to understand | <input type="checkbox"/> 1 | <input checked="" type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |
| Comments: | | | | | | |
| Visualizing scientific | <input checked="" type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 |

| | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | No opinion |
|--|-------------------|-------|---------|----------|----------------------|---------------|
|--|-------------------|-------|---------|----------|----------------------|---------------|

information via
animations is an
effective way to retain
this information.

Comments:

What did you enjoy most about this episode of the immunomovie?

I enjoyed the story. It was entertaining yet informative at the same time and the animations did an excellent job of portraying this story and the actions of the immune system in fighting off parasitic infections.

Please make any additional comments here.

Overall the immunomovie was excellent. Immunology can be a very difficult subject to grasp especially when faced with lists of non-descript items such as all the interleukins or the integrins. Visualizing their interactions through this animation is an extremely valuable tool for the med student to learn and review the material that is presented in the syllabus. The animations were very well done. They were not only accurate but also entertaining.

BIBLIOGRAPHY

Despommier, Gwadz, Khirsch, Hotez, *Parasitic Diseases Fifth Edition*, New York, NY, Apple Tree Production, 2005

Drywer, Frank, *Visual Aids in Instruction and Their Relation to Student Achievement*, www.ed.psu.edu/news/visualaids.asp. Accessed 2006.

Immunology Survey, Dr. Vitetta (August 2006)

AJ Dessein, WL Parker, SL James and JR David, *IgE Antibody and resistance to infection. Selective suppression to the IgE antibody response in rats diminishes the resistance and the eosinophil response to Trichinella spiralis*, <http://intl.jem.org/cgi/content/abstract/153/2/423>. Accessed 2005

Medical Student Questionnaire

Vitetta, Ellen. *Immunology Core Principles I 2006 Syllabus*. Dallas: UTSouthwestern Web Curriculum, 2006.

VITAE

Katherine Michelle Brown was born in Cape Fear, NC, on April 9, 1980, the daughter of Donald and Hwa Yong Brown. After completing her work at Hilton Head high school in Hilton Head, SC in 1998, she entered the University of Georgia. She received her BFA in Scientific Illustration in May 2003; then moved to Manhattan, NY to work on her portfolio at The Art Institute of New York. Katherine Brown continued her education at the University of Texas Southwestern Medical Center in BioMedical Communications. In January 2007 she received her graduate degree of Master of Arts in Biomedical Communications.

