BioMight

The Might of Biological Simulations

Functional Specification

Draft Version 0.1

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1. Introduction

BioMight is an internet-based biological animation engine that allows subscribers to build detailed, interactive 3D models of the human body. The animations are customizable and storable, allowing one to build models that reflect the attributes of particular individuals. BioMight provides all the components you need to build a biological world, and then provides the tools to travel through and explore it.

For the *patient* subscriber, **BioMight** will serve up a 3D model of the individual based on their biological data ranging from blood pressure, to ion concentrations in the heart, to platelet levels in the blood, and even cholesterol uptake in the intestines. As the user drills into the model, they configure each component, and BioMight renders it into an interactive X3D model that can be taken to a physician's office or hospital when medical attention is desired, as their entire medical record can be brought forward and visualized.

For the *educator*, **BioMight** will compliment classroom life sciences coursework in K-12 and academia. Educational subscribers will be able to take their students into the inner workings of the human body. With BioMight, they can dive into the skeletal, digestive, and muscular systems, test the efficiency of a muscle's output by varying the number of mitochondria in the tissues, or decrease the blood flow to unsustainable levels so that the virtual avatar passes out.

Scientists and *Researchers* will take advantage of **BioMight** to elucidate their offerings to the public, providing them with the tools for constructing eye-catching virtual reality presentations. Stagnant PowerPoint slides that barely address the task of showcasing the discoveries realized in the lab will go the path of antiquity. Cell barriers, SNPs, and bacterium will 'come alive' in their presentations and keep their audiences attentive and interested.

Release 1.0 of **BioMight** will be scaled in scope so that a marketable product can be developed and released in a suitable timeframe (18 months). At the very least, it must provide a complete anatomical model comparable to that found in a commercial product like Visible Body, and then

exceed that product's feature set.

2.

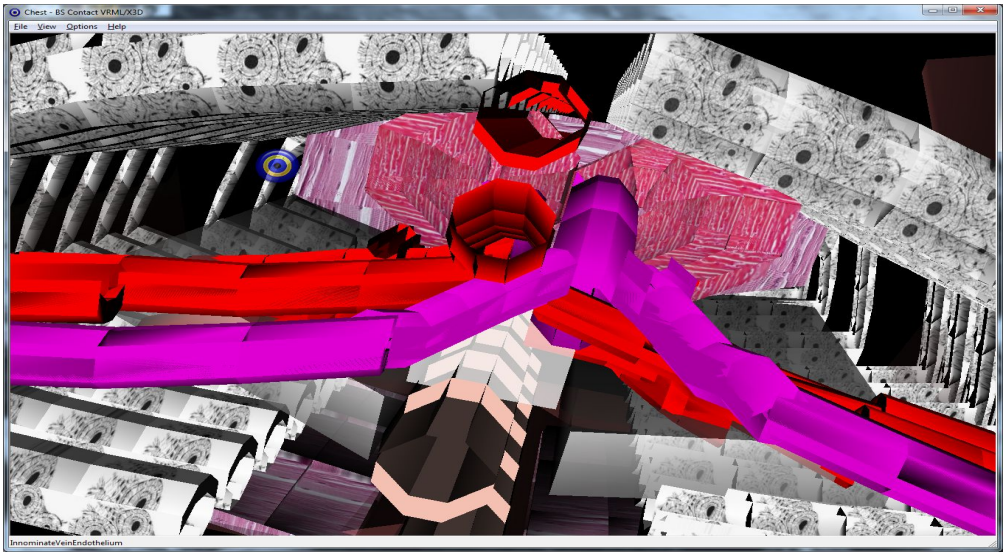
BioMight Models

2.1 3D Anatomical Reference Model

BioMight covers the core features currently found in competitive products. For this measure, BioMight shall have representations for every muscle, bone, organs, and gland in the human body, both male and female. Through the visual interface, the user will be able to enable/disable the viewing of each component. When the user moves their mouse over a component, its label with annotations will appear.

The user will be able to rotate, move, and zoom in/zoom out of the model. The model should allow the user to move in and around each component. Please note that competition's current offering does not allow the user to enter the vascular system, the system of ducts, the respiratory tract, etc. In competitive models, when the user crosses the boundary of the organ, blood vessel, etc, the visual interface presents blank space.

BioMight will offer with release 1.0, the ability to move in and out of each anatomical component. The interior features of organs and glands will be visible and accessible as shown in the screen capture below. As in competitive products, the basic model should also switchable between genders, with the female model having a lighter bone structure, and child-bearing features.



2.2 Fly-Throughs

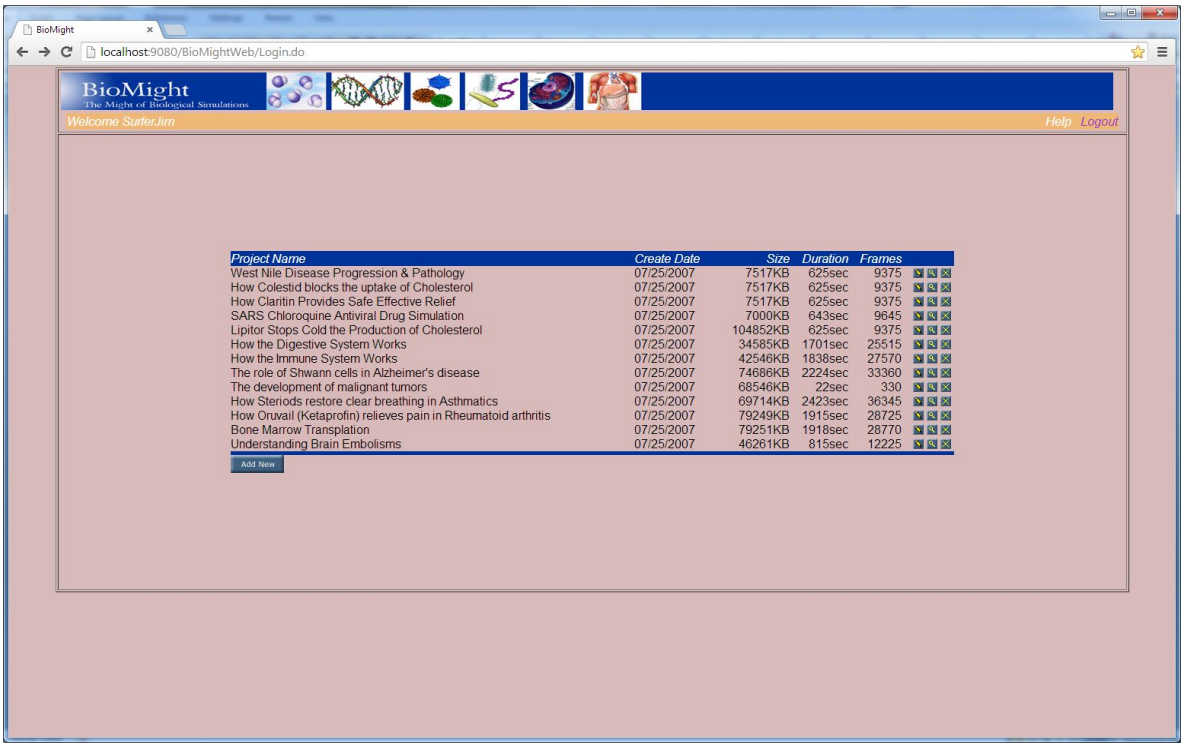
BioMight release 1.0 also comes with several pre-programmed template animations that are staged across the Digestive, Respiratory, Vascular, Immune and other biosystems. These templates may be adapted to create custom animations in minutes, or just viewed in classroom

setting for educational instruction.

3. BioMight Projects

One creates **BioMight** animations through the projects page. Here, the user is able to create and store their custom animations. The amount of storage and number of projects that a subscriber is allowed to setup is based on their subscription. Clicking the 'Add' button will allow the user to set up a new animation project. There are options for editing the project text, and options for editing an existing project. To edit the existing project, the user will click on the magnifying glass icon.

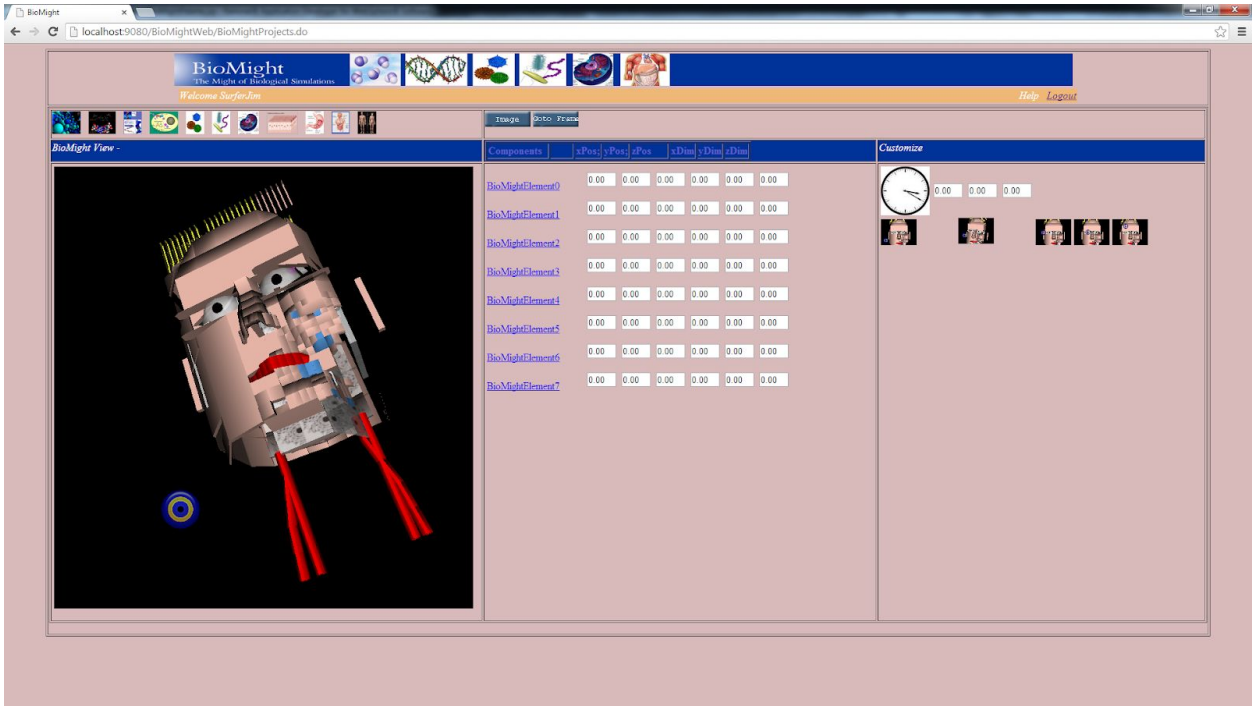
The subscription limits, associated with the user or group account, are applied in this web page to manage the account. A corporate account will allow projects to be created under several individual accounts keeping the client's data properly segregated and organized.



4.

BioMight Palette

The **BioMight** Palette is where the user assembles the 3D components from the BioMight libraries and instructs them to interact like actors on a stage. Here, one can adjust the position and scale of each object relative to each other. In reality, one cannot yet view a virus with the naked eye, but through **BioMight** the virus can be viewed being hoisted up the nostril of a breathing human 3D model by scaling and orienting the objects into the desired configurations.



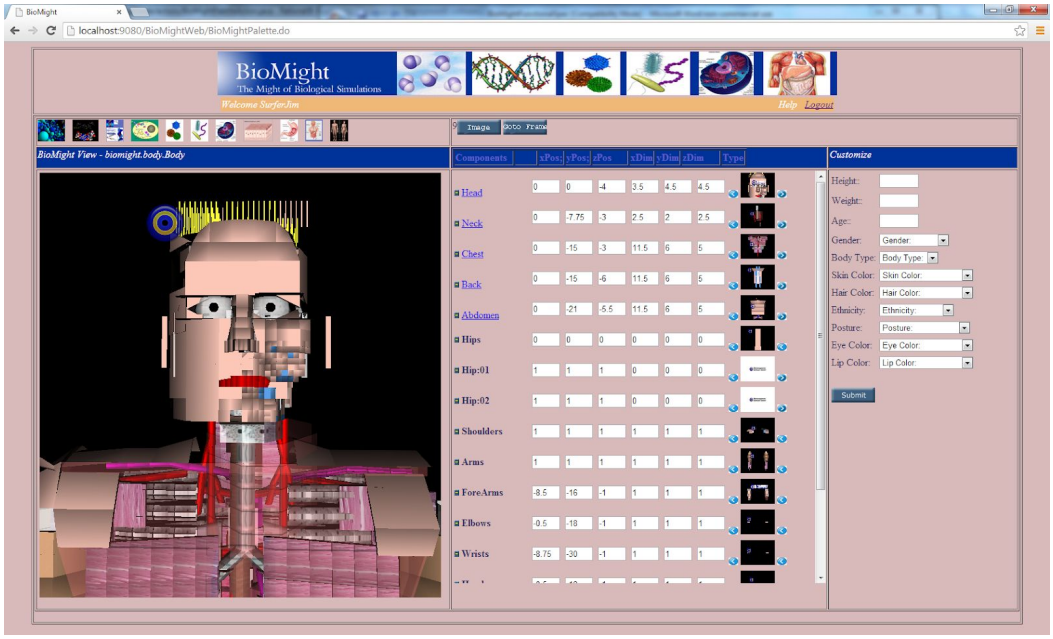
In the right pane is where the user controls the sequences of the animation in respect to time. The user selects the component, and then tells BioMight what to do with that object over the given stretch of time. These time settings are written into the X3D model by the BioMight engine for each participating actor. A placeholder image of each scene appears under the clock and allows for easy selection of each timed interval. Fade-in and Fade-outs can be inter-layered between scenes allowing for smooth, visually appealing transitions.

In the middle pane appears a list of each of the components appearing in the palette. A special entry for the camera is added so that it can be programmed to follow and capture the action. For each step in the path, the camera can be moved, angled, and aligned with the background to capture that ‘perfect shot’.

When the configurations have been completed, **BioMight** will assemble the time-sequenced based animations to produce a portable self running X3D file that can be viewed across a variety of mobile devices. For the user, the animations may be activated upon startup, by mouse click, or by distance sensors that are placed within the virtual world.

5. BioMight Viewer

BioMight components are available through the BioMight view page. This web page allows the user to view components, set their characteristics, and instruct them to carry out actions. Appearing just above the 3D object are a set of icons that take the user to the various libraries; *Body, Systems, Organs, Tissues, Cells, Bacteria, Viruses, Pathways, DNA, Chemistry,* and *Elements*.



5.1 X3D View

In the left pane appears the X3D rendered object. The user can invoke a full screen view from within the X3D viewer allowing for more aesthetic viewing. Controls are provided for movement through the virtual world.

5.2 Component Properties

The center pane allows the user to set the size, shape, and configuration of each of the components. It also allows the user to drill into each component, right down to the molecular level.

5.3 Component Actions

The right pane allows the user to invoke actions in the model, such as walk, chew, set eye color, hair color, etc.

6. Digestive System

BioMight's release 1.0 offers a working digestive system that supports a number of capabilities. The mouth can chew, swallow and excrete saliva. The muscles in the esophagus display movement as food moves through it, the stomach excretes gastric juice during digestive processing.

Even though each component of the system can be individually accessed, here the system can be programmed to act as a unified whole. The model will allow implements from the library to enter through the mouth and proceed through all the digestive steps until excretion.

6.1

Digestive System Scenario

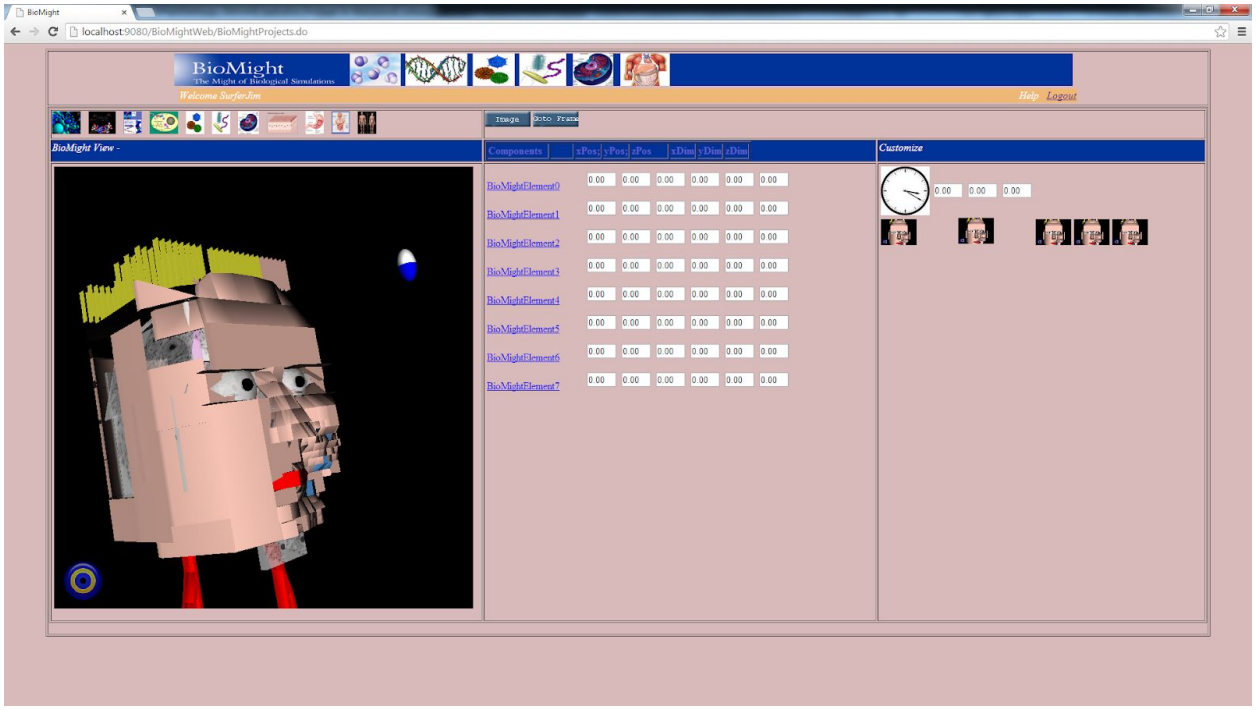
A pharmaceutical marketing director wishes to create a custom animation for a new drug his company is developing. It will be placed on the corporate web site and when visitors view the page, the animation will play educating them on its aspects. The drug is designed to be absorbed through the intestine.

6.1.1 Design the medication

The director decides to use **BioMight** and begins by designing the virtual medication, albeit a tablet, pill, capsule, gummy or liquid in form. Using BioMight's medications library, he chooses a capsule that will be orally ingested and sets the size, shape, color, and theme of the capsule. He then accesses BioMight's molecule library and composes a string of a chemical compounds that make his company's product unique (later, these will break out of the capsule at the point of absorption). On the palette, he positions the compounds inside the capsule and tells **BioMight** to group them together.

6.1.2 Customize the model

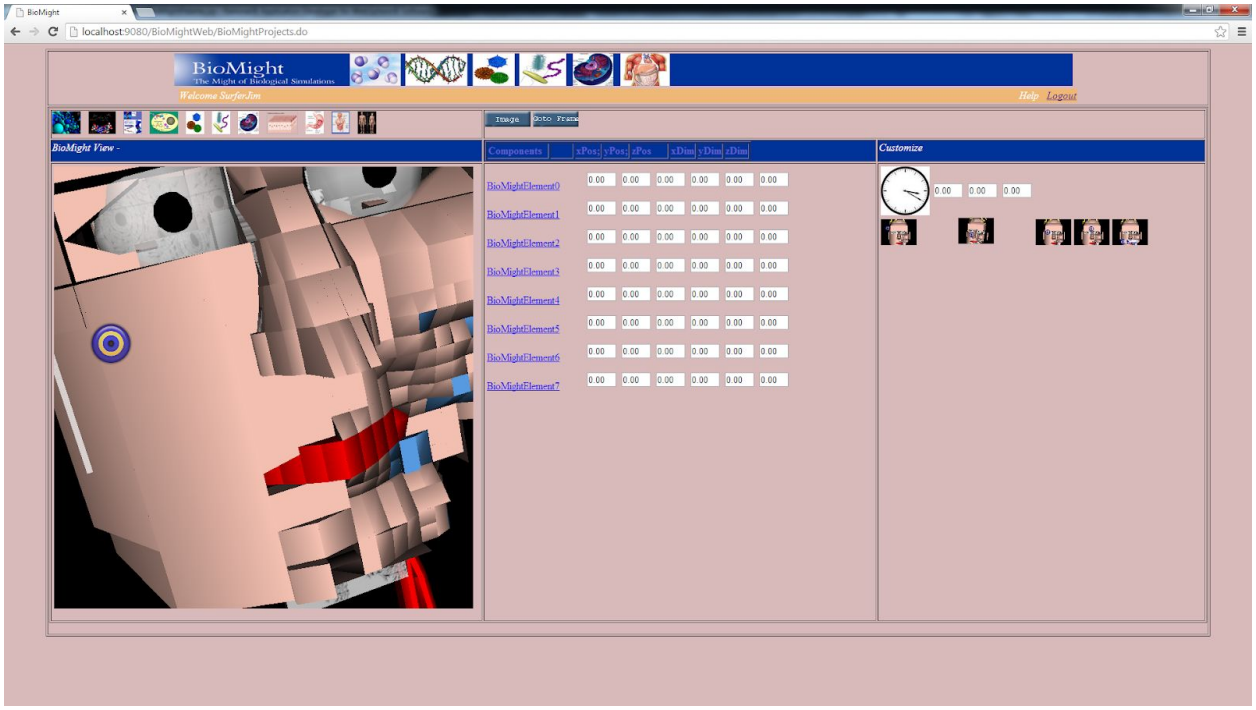
After the medication has been put together, the user selects a male subject, sets the hair style, the hair color, the eye color, and the skin tone. The capsule is then added into the virtual world alongside the human model. The start position and orientation is specified. Some portions of the body are set to be transparent so that the viewer can see the effects going inside the body as the medication passes through. As each component is customized, the user adds them to the BioMight palette, as this is the stage where the actors act out the animation sequence.



6.1.3 Choose Medicine's Path

The director wishes to have the medication trek through the digestive tract. Through the palette, he will be able to adjust and tune these parameters so that the timing meets his needs. For instance; spend 3 seconds in the mouth, 4 seconds moving through the esophagus, 7 seconds in the stomach, and then a span 5 seconds to the selected target area in the jejunum.

The director begins building the animation by selecting the medication from the middle pane, and then choosing the span of time on the clock. He selects 2 seconds, and enters the start and end position. BioMight offers the option for taking a straight path, curved, or elliptical paths to reach the destination. This time information is then sent to the **BioMight** engine and it builds this time sequence into the component so that when the animation is run, in real time, every component knows where and what it is supposed to be doing at a given point in time.


BioMight
The Might of Biological Simulations
Welcome SurferJim
Help Logout
BioMight View -
Components
xPos
yPos
zPos
xDim
yDim
zDim
Customize
BioMightElement0
BioMightElement1
BioMightElement2
BioMightElement3
BioMightElement4
BioMightElement5
BioMightElement6
BioMightElement7

6.1.4 Configure Actors and Actions

The **BioMight** model will be capable of basic chewing action, and swallowing capability. The amount of time the BioMight model chews or swallows will be configurable by the user. Each component in BioMight, as in real-life, has properties and actions. For instance, the esophagus will squeeze food down its channel. The esophagus will also release secretions as the food travels along. Through the interface, the user will choose whether or not these actions take place in the animation they are building.

In addition to specifying the pathway, and the time spent traversing the path, the user will be able to set the color and skins of the various interacting components. They can also set the number and frequency of the various components that appear in the biological animation they are constructing. As the path is customized, the 3D human model is configured to behave the way the animator intends.

At this point, the pill has come close to the mouth, so the director will instruct **BioMight** to open the 3D mouth so that the medication may be ingested. The user drills into the *Body* model, and accesses the *Head*, and then accesses the *mouth*. He chooses *"Eat"* from the methods menu and sets values that determine how long it takes for the mouth to open, how long it stays open, and when it closes. These actions will now be affixed to the timeline of the current project.

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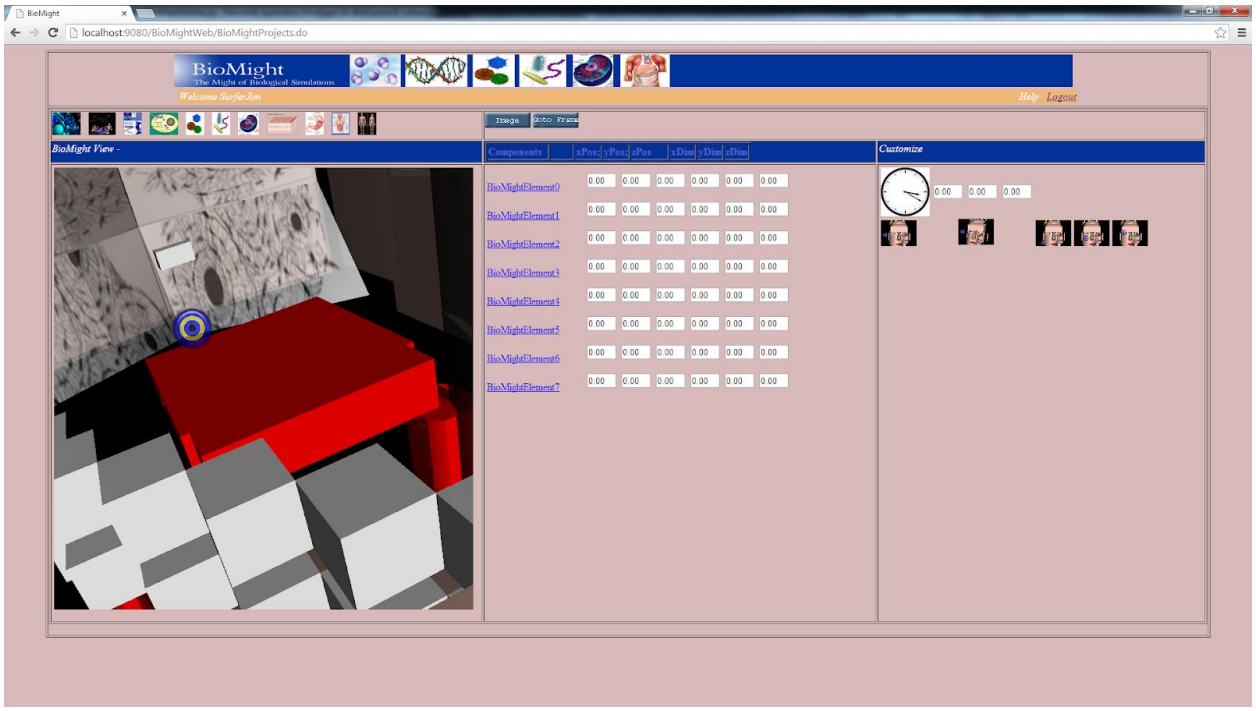
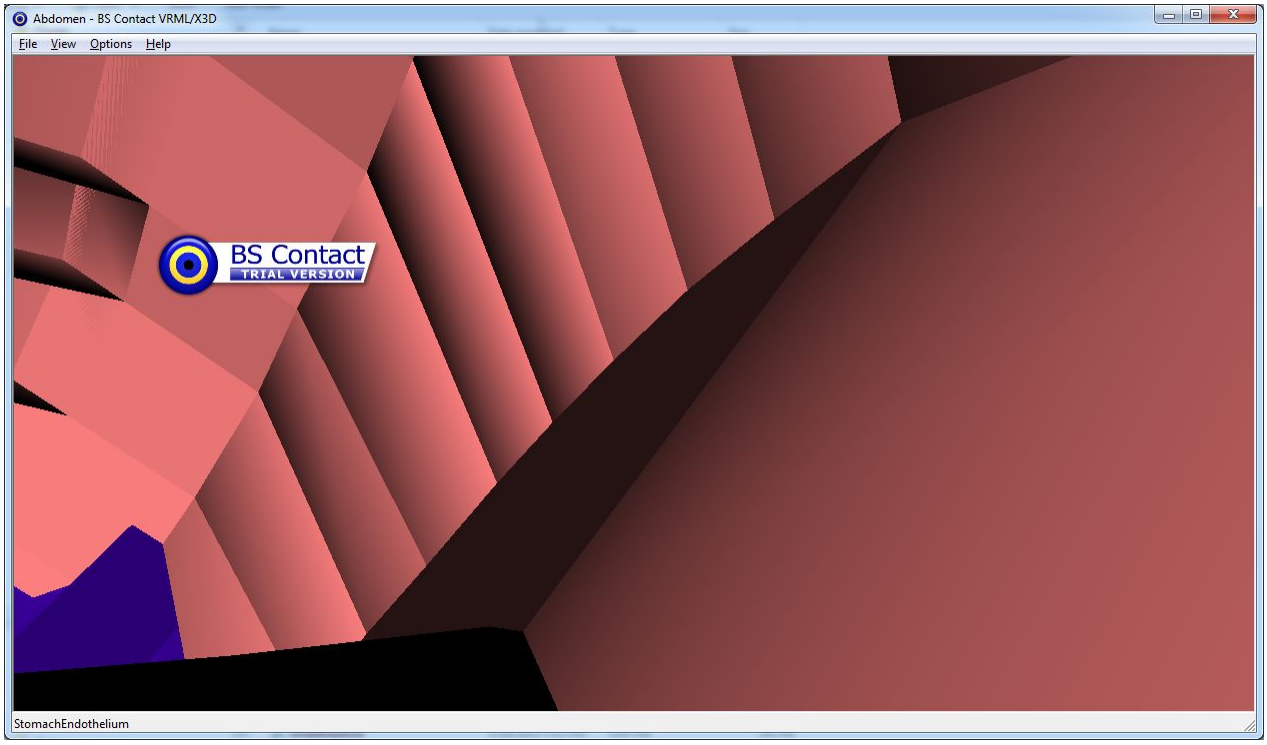


6.1.5 Setup Camera

Using the palette, the animator instructs the camera to follow the medication into the mouth using a start and end position that is pre-calculated based upon the user's chosen path. The user has the option to customize the camera's direct route. When the capsule is swallowed, the camera will follow the medication it as it is pushed through the esophagus.

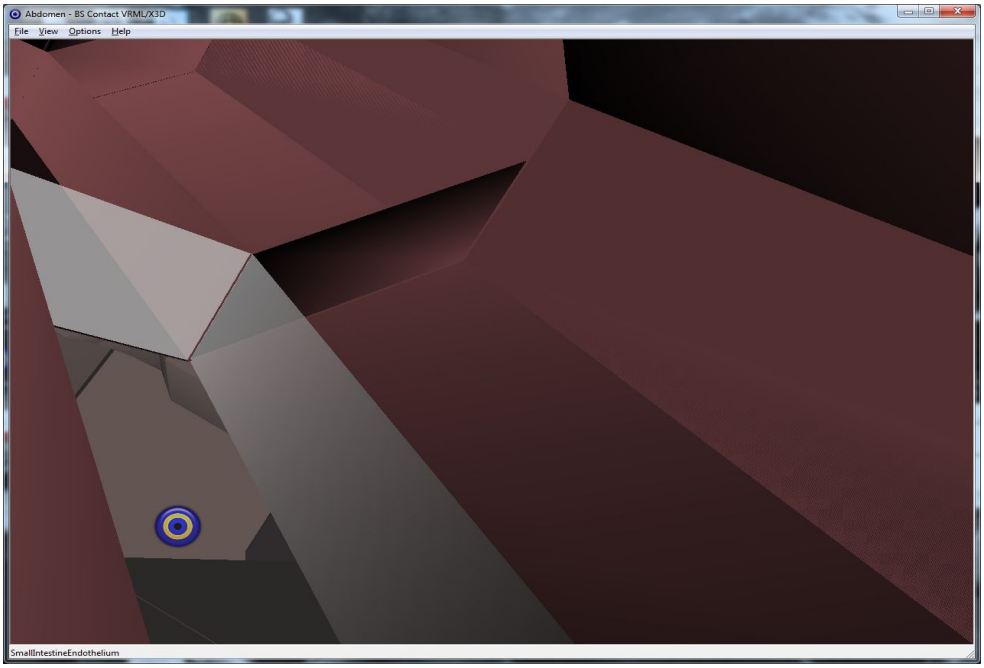
When it reaches the stomach, the camera will swing to outside of the stomach wall and then film the scene as the capsule swishes through the gastric juices of digestive chamber. This is done by moving the camera from inside the chamber of the stomach to just outside it, where the action can be viewed. The director drills down into the Body model and chooses the *Stomach*. He then uses the method list to set the color of the whole stomach to translucent. This allows the camera to capture the inner workings of the stomach as it unleashes its digestive enzymes on the capsule.



6.1.6 Target Delivery

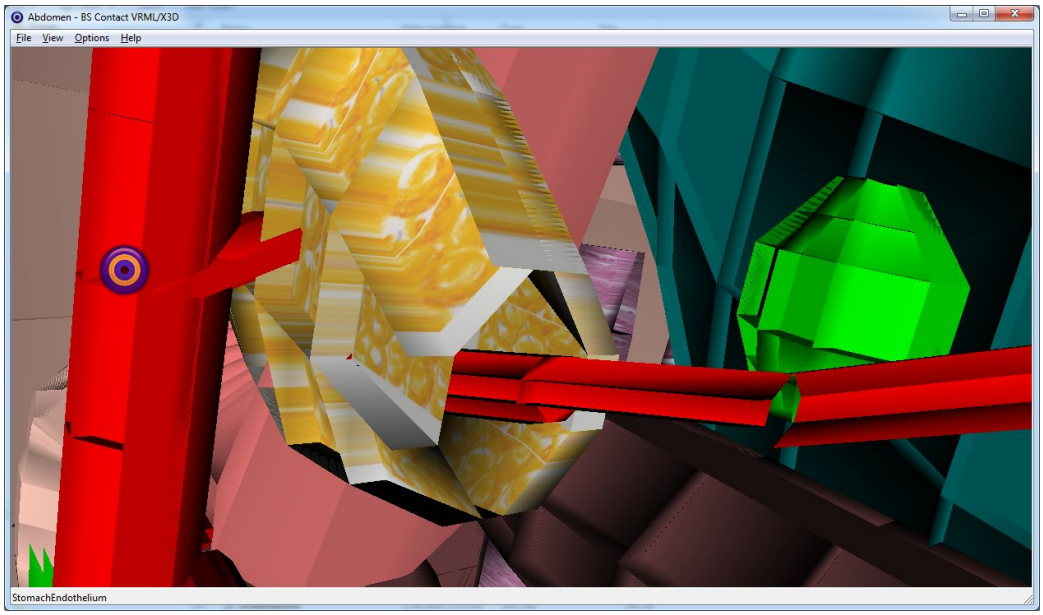
The marketing director then instructs the camera to once again, to follow the medication as it travels through the intestinal tract where it observes the capsule breaking apart from the secreted enzymes. When the medication arrives at the intestinal lumen, the camera will zoom into the layers of the intestinal wall; the submucosa, serosa, the muscular layer, and finally reach the target of this drug, the mucosa.

Using the modeler, the user will be able to select a set of cells and embellish or highlight them such that they can be readily seen and allow the compounds to dispense and absorb into the surrounding tissues. Below, we see the layer of the intestinal wall has been made transparent and molecules of the drug are seen flowing across the boundary, completing the animation scene.



7. Vascular System

BioMight's release 1.0 offers a working vascular system that can animate the movement of blood and constituent components through it. It contains representations for the heart and major vessels. BioMight provides five preprogrammed paths through the model; the respiratory loop, the hepatic loop, the lower extremities, the upper extremities, and a complete body route. The routes can be traveled by blood cells, viruses, as well as bacteria.



7.1 Vascular System Scenario

A medical liaison at the World Health Organization needs to inform the public about a new immunization via their website. The immunization protects the population from the recent strain of flu that has been transmitted in other areas of the globe.

7.1.1 Design the Medication

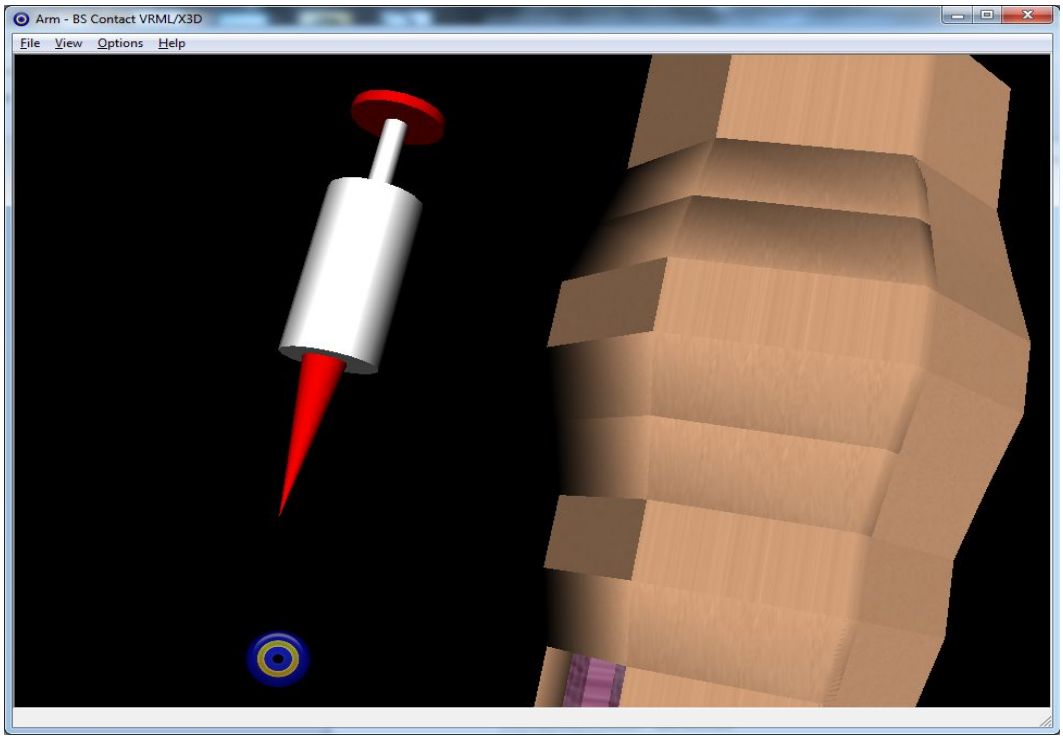
She starts by selecting a syringe from the medical tools library, and customizing it to her liking. Then she decides on the point of injection. From the BioMight palette, she dives into the body model and configures an arm that fits the aesthetics' of her website. She positions the objects on the palette, and then proceeds to set up the animation.

7.1.2

Pick the Injection Site

She configures **BioMight** to administer the shot into the right arm. There is no desire for a full body view, only a fly-in to the bicep, where the medication will be administered. Upon selection from the tools library, the syringe appears in virtual world alongside the human model, and she scales and positions the objects.

The user will set the starting position and then choose the path and speed at which the syringe moves to the target, the angle of injection, and delivery of the contents. She instructs the camera to follow behind the syringe, and then swing and dive into the needle, following the contents into the vein.

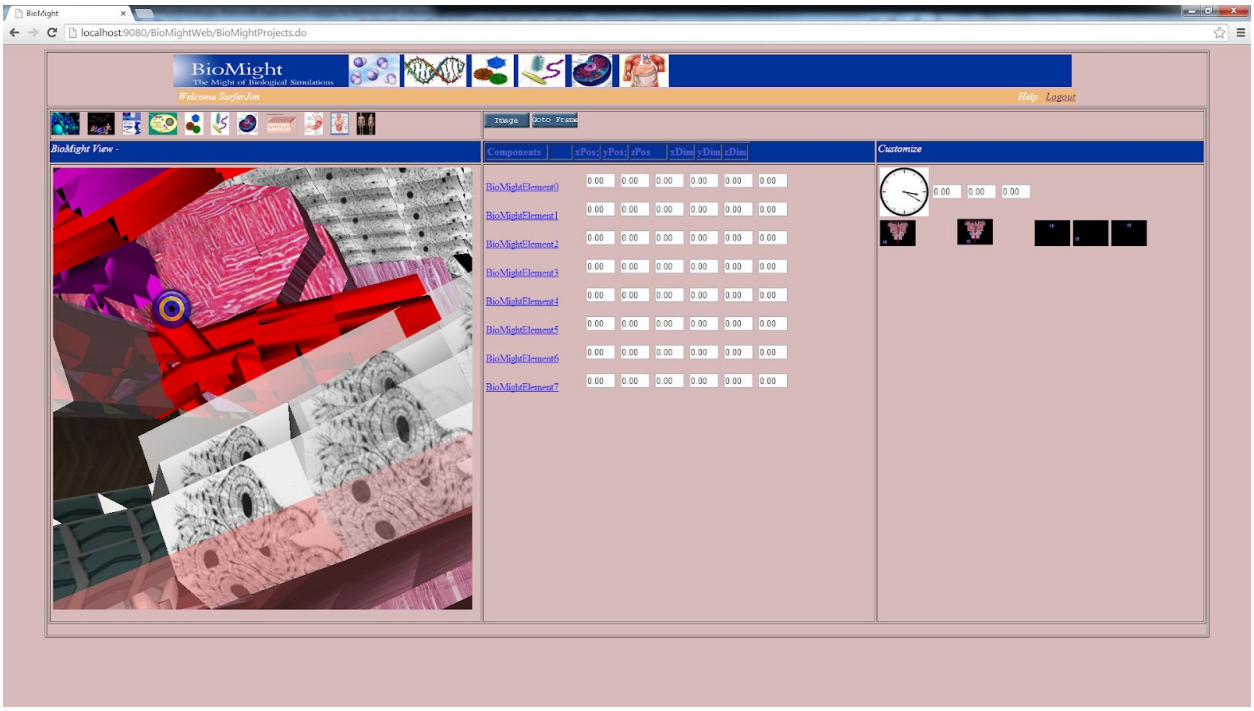


7.1.3 Travel the Bloodstream

The camera is programmed by the medial liaison to follow the medication as it gets caught up in the flow of the blood stream. BioMight has a nearly complete representation of the circulatory system and can send the camera into any one of the arteries, veins, or tributaries of a capillary.

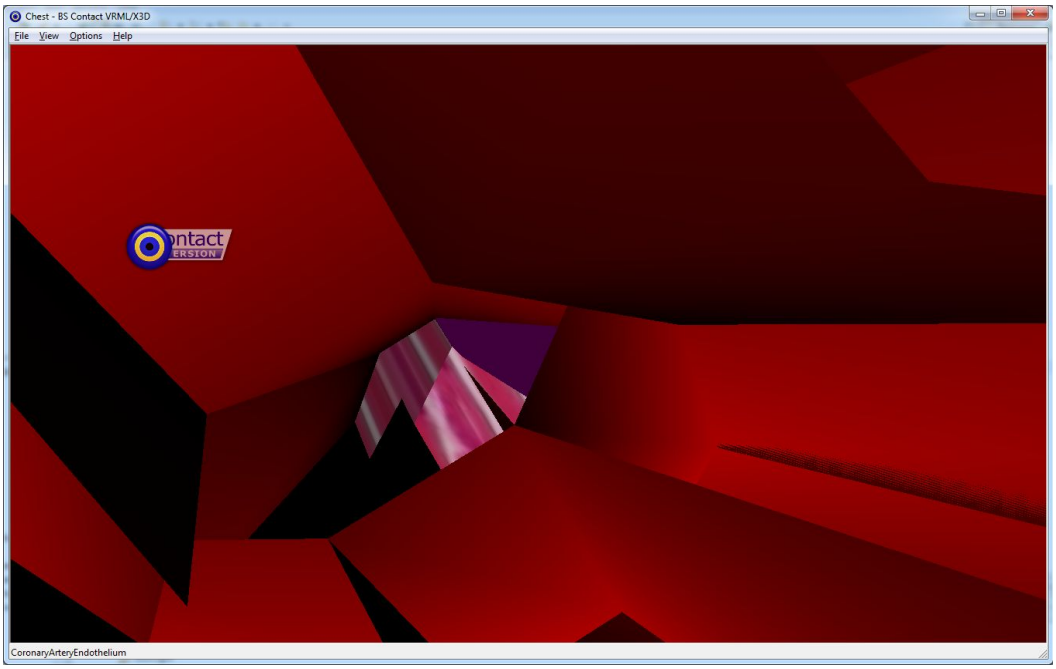
The liaison decides that the medication will travel through the brachial vein, through the Subclavian vein, into the Innominate, and lastly hover above the chamber of the heart in the Aorta. Using the palette, sections of time are selected from the clock, the BioMight component is selected, and the position and orientation information is specified.

A section of the brachial vein within the bicep is selected as the starting juncture, and a section of the aorta artery is selected as the destination. Using this data, **BioMight** presents the default route map. The user has the option to extend or customize the chosen path as needed.



7.1.4 Set up Vaccination Interplay

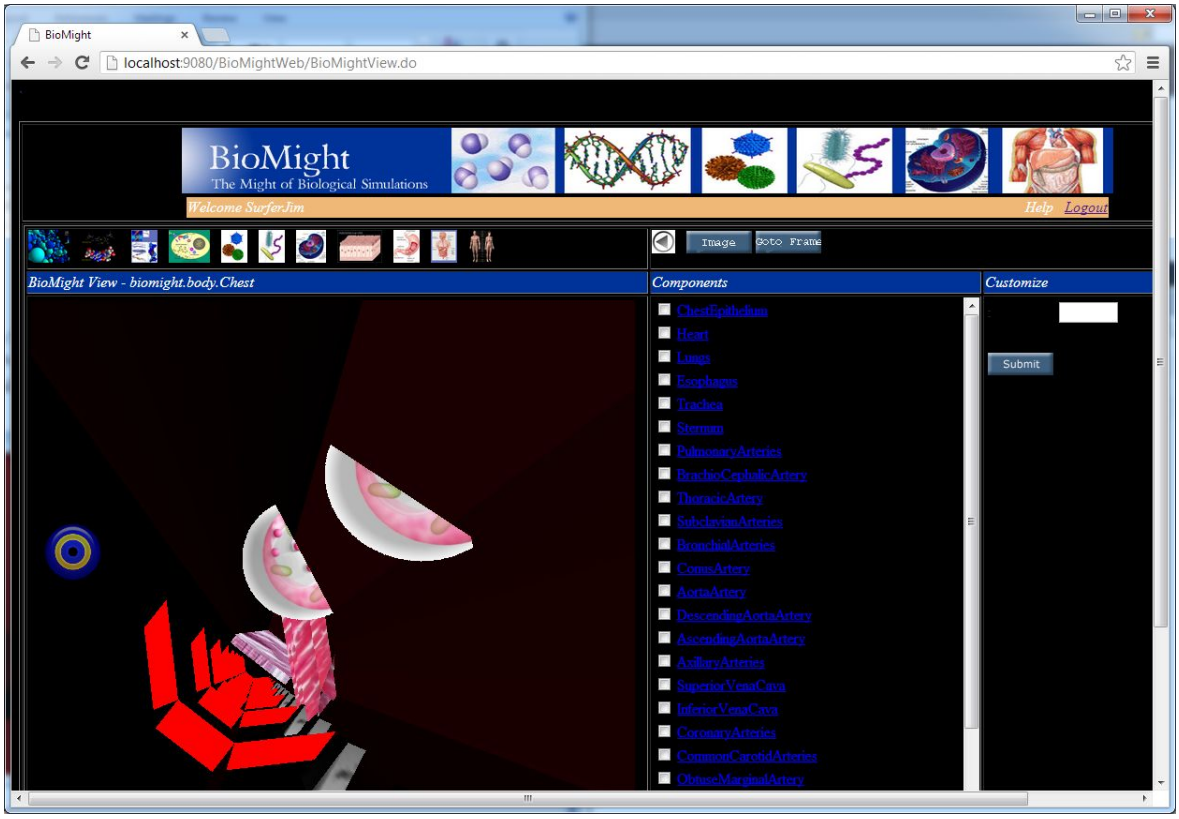
As the medication travels the blood stream, the camera follows, taking it into a junction near a chamber of the heart. Here, the medication will contact B1 cells and a cell-mediated immunity biochemical dance will take place.



7.1.5

Vaccination Delivery

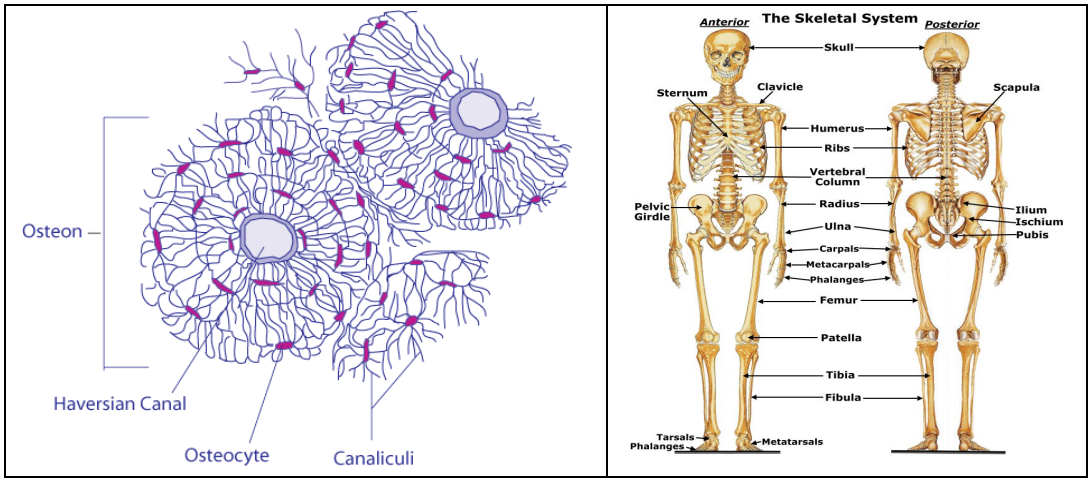
Drilling into the Aorta artery, the user instructs BioMight to compose the blood. The blood's composition, concentration, and ratios between the various elements are configured. B1 cells are added as show in the screen capture below. Once BioMight has been customized and the virtual model has been described, one simply sends the camera through the model make the 3D interactive animation complete.



8.

Skeletal System

The first version of **BioMight** will contain all the bones in the adult human female and male models. Embryonic and child development models will be added in a future release. Through the BioMight interface, one can view all the bones, drill into individual bones, and dive into the composite elements such as osteons and canaliculi.

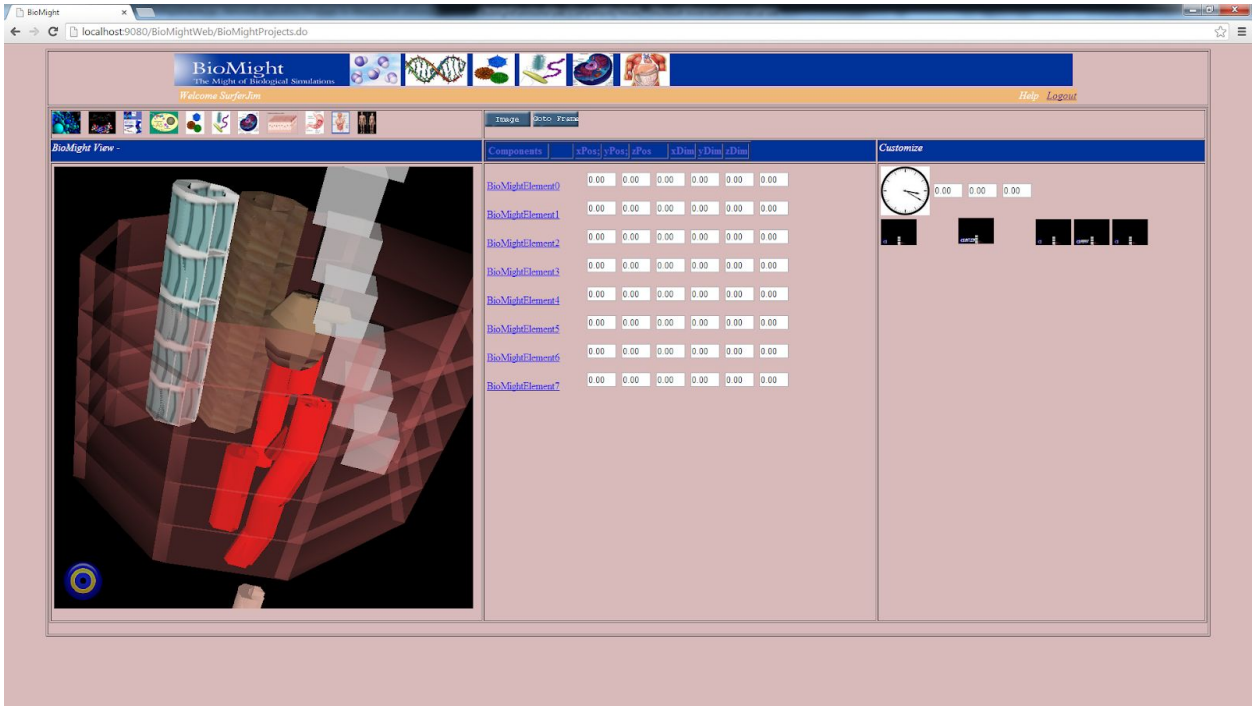


8.1 Skeletal System Scenario

A spinal surgeon is attempting to repair a few crushed cervical vertebrae in a patient that has been in an accident. Although x-rays serve as an excellent clinical medium, ***BioMight*** *can assist the process by allowing the patient and surgeon to review the details of the surgery pre-op. The surgeon takes the patient on virtual tour using the patient's body data in the process.*

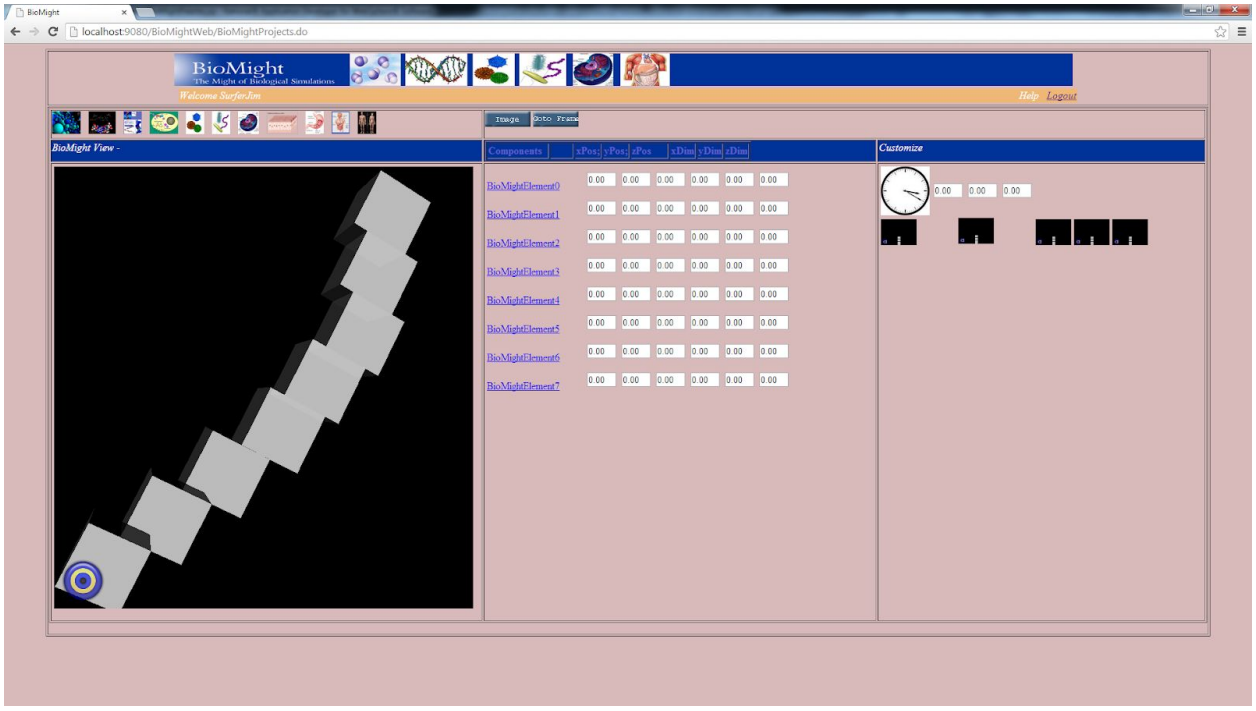
8.1.1 Setup the Stage

Using **BioMight**, the surgeon drills into the 4th and 5th cervical vertebra and shows the patient the blood vessels, nerves and other tissues that will be affected by the operation. We see the thyroid, trachea and esophagus all nearby. The surgeon then selects the injured vertebrae and applies the *"Crack Bone"* method. A number of fracture-types are available in scrollable *3Dicons*. The fracture is applied, and the individual fragments are added to the palette. BioMight is configured to show the shattered bone fragments dispersed into the surrounding tissues.



8.1.2 Setup Actors and Actions

After the surgeon has set up the model with the patient's information, she configures BioMight to replicate the reconstruction effort by moving the broken shards of bone back into their near original position. After the surgery, the new data can then be exported and loaded into the patients personal X3D model updating their body's model based on the surgical procedure.



Note: *In a future release, BioMight will have the capability to import the x-ray data directly into its database. For release 1.0, the user will have the option of disfiguring a bone, cracking a bone, and inflicting disease through the selection of skins and the applying dimensional changes to the 3D composite.*

9.

Respiratory System

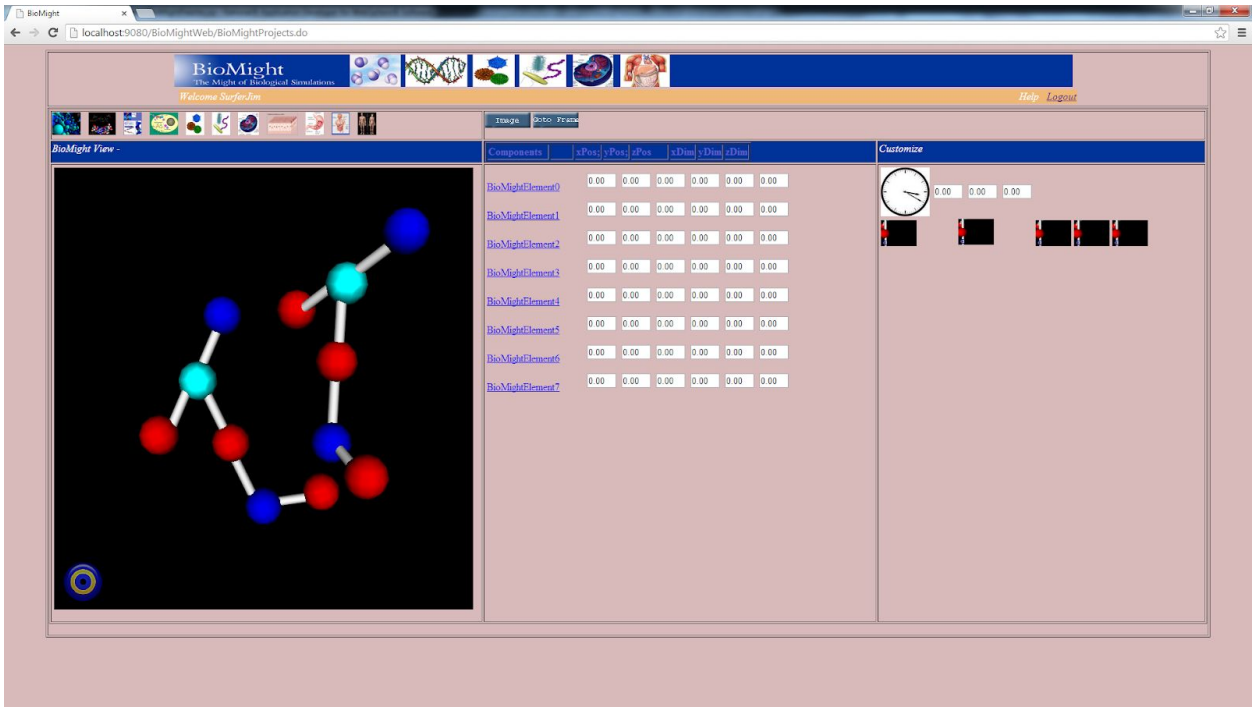
Release 1.0 of **BioMight** will contain a nearly complete model of the *Respiratory System*. It allows inhalants, viruses, and other bacterial to enter and travel its pathways. It contains a working nose, trachea, bronchi, bronchioles, and alveoli. The user will even be able to view the exchange of gases at the cellular membrane level, providing for a wide range of animations.

9.1 Respiratory System Scenario

A researcher has developed a new corticosteroid inhalant that does not require a nebulizer to deliver medication to young patients. The researcher wants to show how their product differs from the leading medication, and present to other researcher its effectiveness in delivery when compared to current methods.

9.1.1 Configure the Medication

The researcher begins by putting together the medication. She decides to show some chemical compounds interacting in the bronchial tubes. She selects BioMight's chemistry library and builds a ball and stick model (please ignore the inaccuracies in this molecular representation).

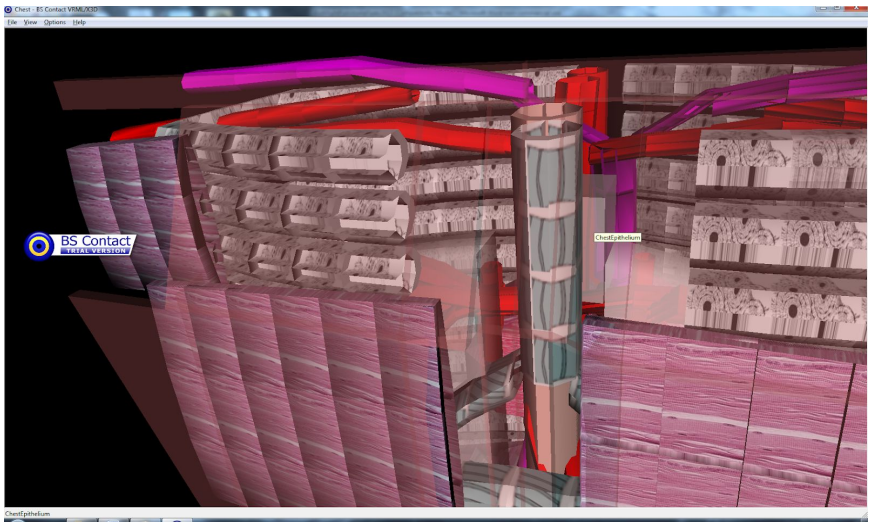


9.1.2 Set the Actors and Actions

After the medication is setup and added to the palette, the researcher selects the *Chest* body component.

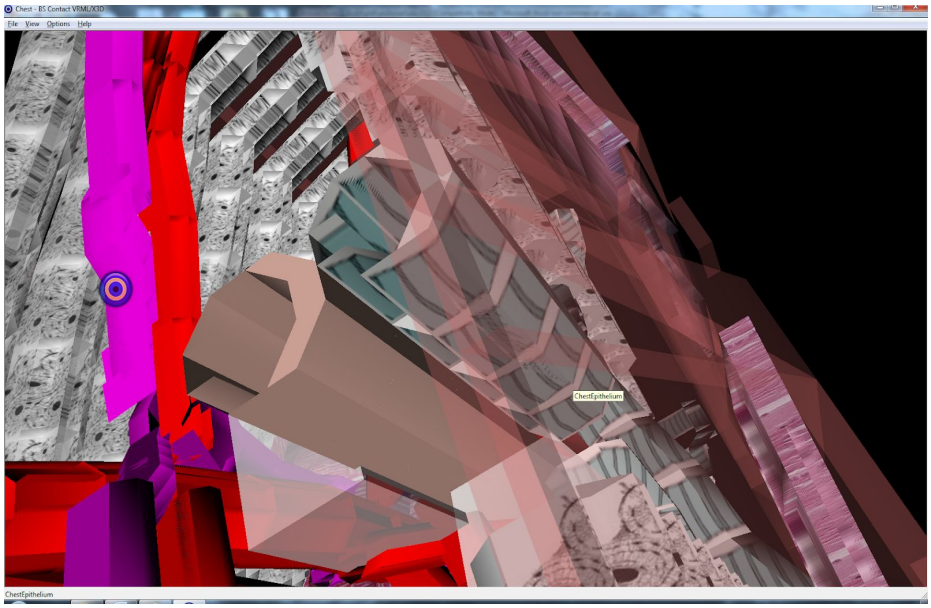
The researcher starts by positioning the medication in the lower trachea. The end position is selected and default path is generated by **BioMight**. The algorithm uses the current location, and creates a path through the air passage way. The user decides that this should take 5 seconds.

The camera starts off ten units from the center of the chest. The camera will drive straight forward through the central wall of the body until it intersects the trachea, and from there, it will follow the pathway down a branch of a bronchial tube until it the reaches the capillaries in the alveoli. It will be programmed to follow the molecular inhalant.



9.1.3 Drug Delivery

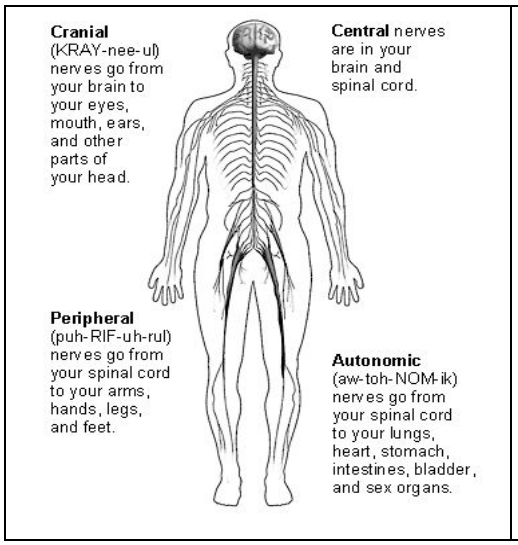
The camera follows the medicines journey through the air pathways. As shown, the researcher chooses the cross section view, allowing for maximum viewing of the target area.
Inside the Bronchial tube the camera will follow the tubule until it reaches the inflamed cilia
At the chosen destination, the chemical compound will be found coating the inside of the tubes, and opening the airways for clearer breathing.

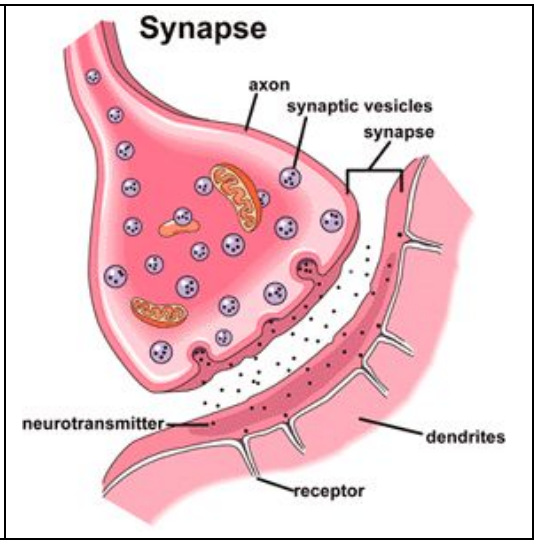


10. Nervous System

Release 1.0 of **BioMight** will offer a near complete representation of the *Nervous System*. It will allow users to explore a variety of nerves that span the human body. Template pathways will be preprogrammed to take the user on a strip through the nervous system if desired. The preprogrammed path will go from the brain stem to the end of each of the extremities.

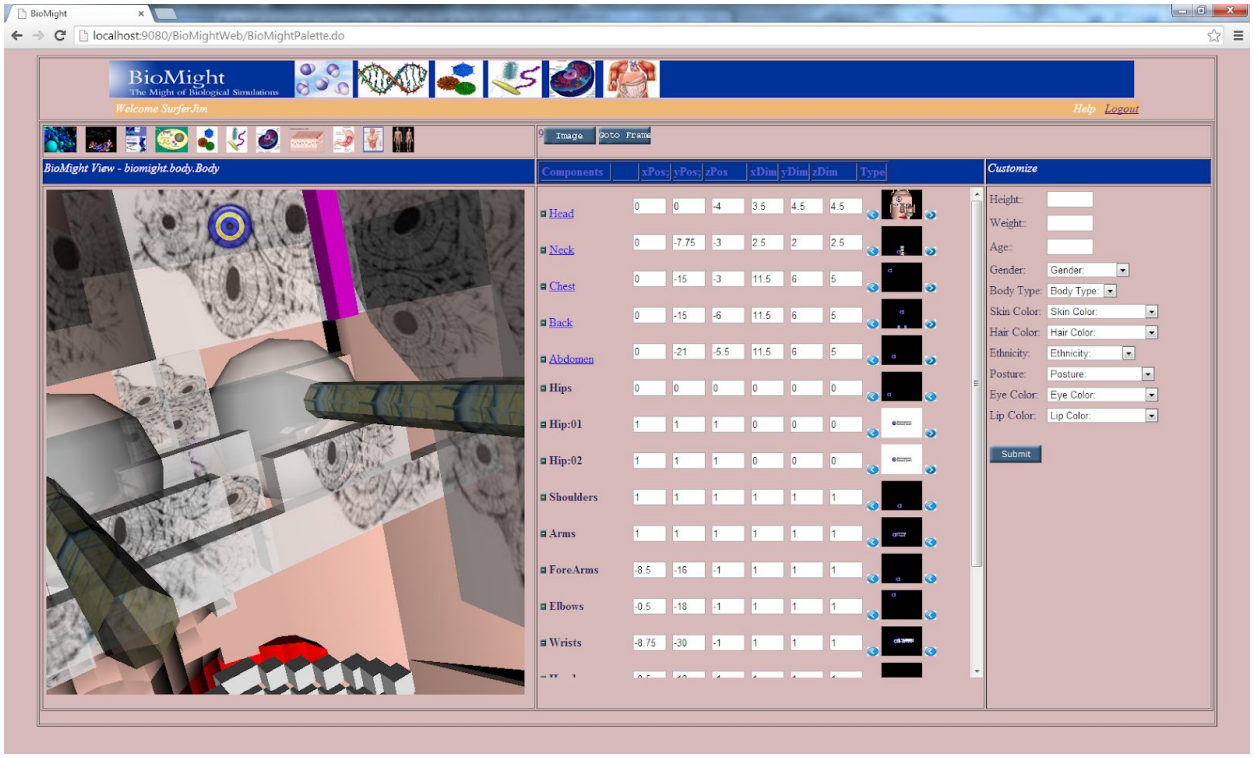
In addition, the nervous system models will allow one to dive into the internals and program the components to simulate vital processing. The Synaptic cleft and Synaptic vesicle are modeled after their real life counterparts allowing them to send electrochemical messages across the synapse.





10.1 Nervous System Scenario

An eye surgeon is interested in detailing a procedure for optic-nerve reattachment. The surgeon and client have a sit down to discuss the procedure and the pros/cons of the operation. Using the BioMight application, the surgeon sets up the model to resemble the patient's anatomy.

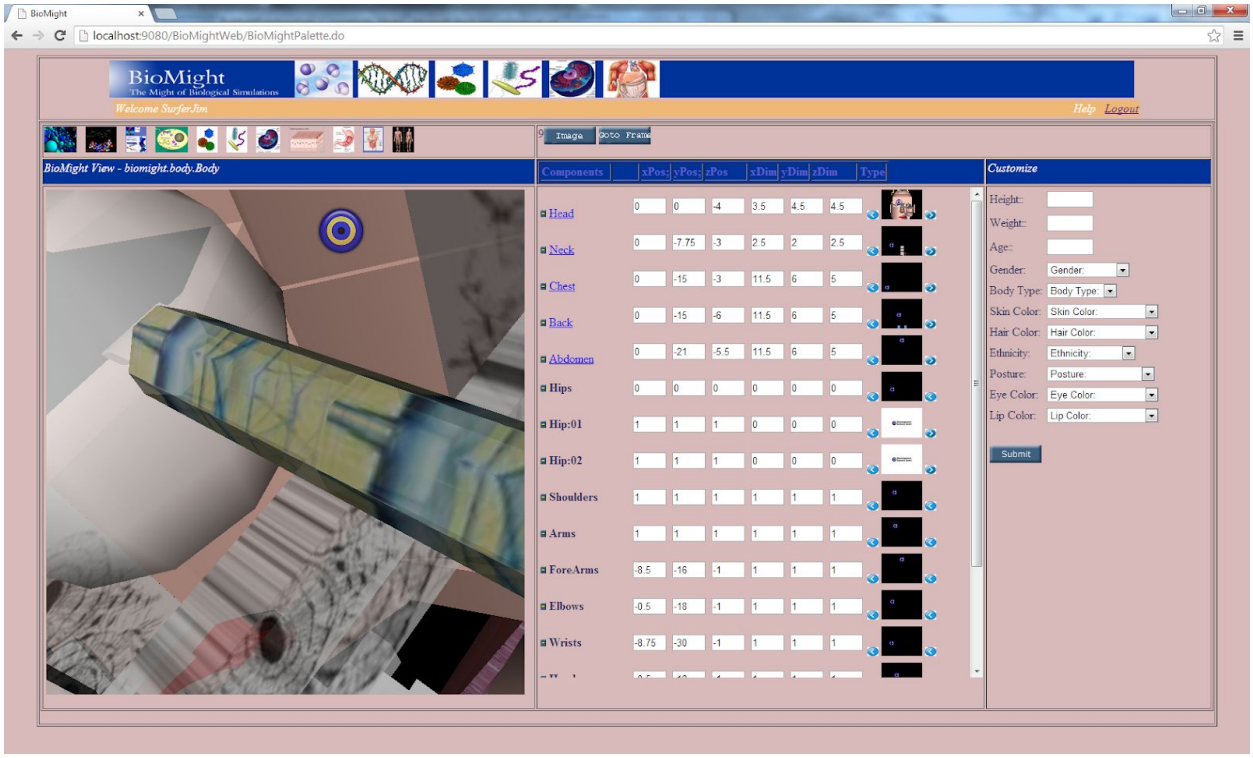


10.1.1 Set the Stage

Using the BioMight palette, the surgeon drills into the head model, and customizes it to match the patient's characteristics. He moves in behind the eyes and uses the display filter option to disable generation the pre-frontal lobe of the brain so that we get an unobstructed view of the detached retina. The x-ray and MRI data help the subscriber to replicate the injury at a granular level of detail.

10.1.2 Build Animation

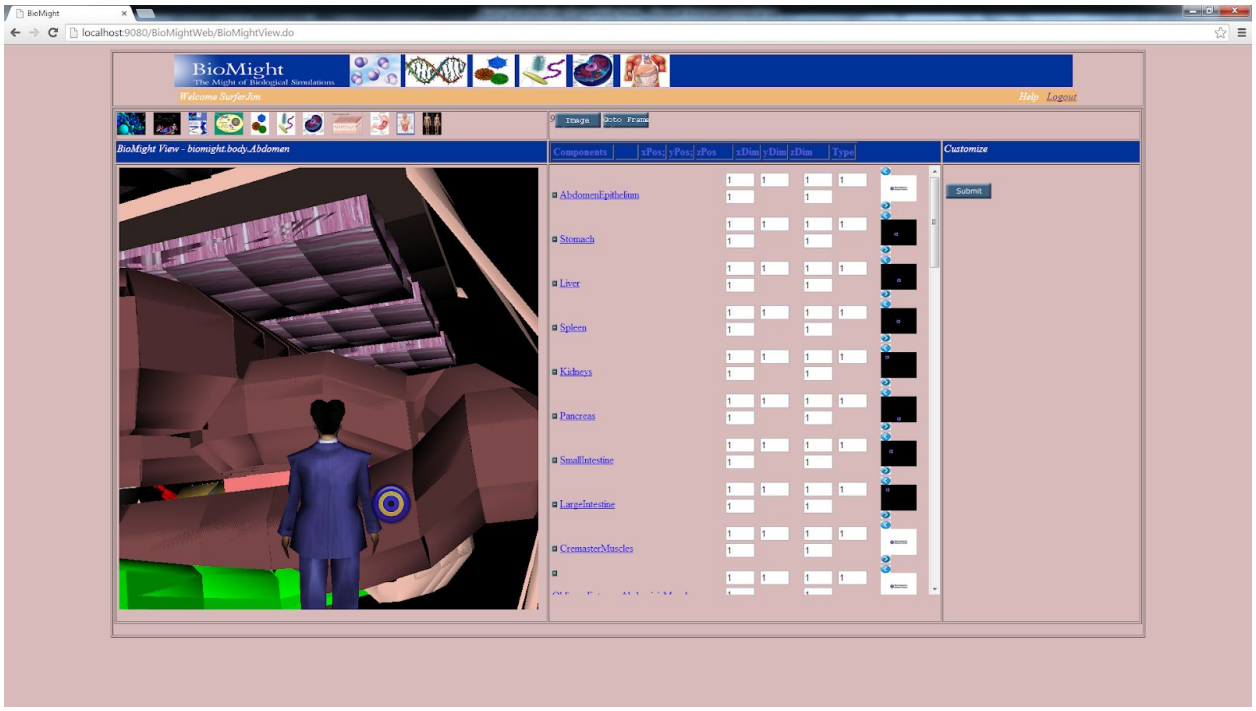
To animate the scene, the surgeon decides to drill into the optic nerve as he wants to show the dead connection. Using the palette, he sets the starting and ending position for the camera's opening scene. The camera will hover above the detached optic nerve and then dive infinitely close to it. When the camera covers ¾ of the screen with the nerve, the X3D inline-load option will be invoked to pull in higher resolution model. This takes us from the Tissue composition level to the Cellular level, and allows the broken neurons to be placed into the viewframe.



11. Muscular System

Release 1.0 of **BioMight** will offer a near complete representation of the *Muscular System*, containing representations for every muscle in the human body. Each of these muscles can be customized via its physical properties like size and shape, as well as appearance by applying variety of muscle-oriented skins (graphic textures).

The user will also be able to drill into the muscle tissue models and be able to manipulate the endomysium, perimysium and epimysium layers.



11.1 Muscle System Scenario

An orthopedic surgeon needs to prepare a paper on the reconditioning of muscles in the lower back to correct scoliosis.

11.1.1 Set up the Stage

Using the BioMight palette

11.1.2 Set up the Actors and Actions

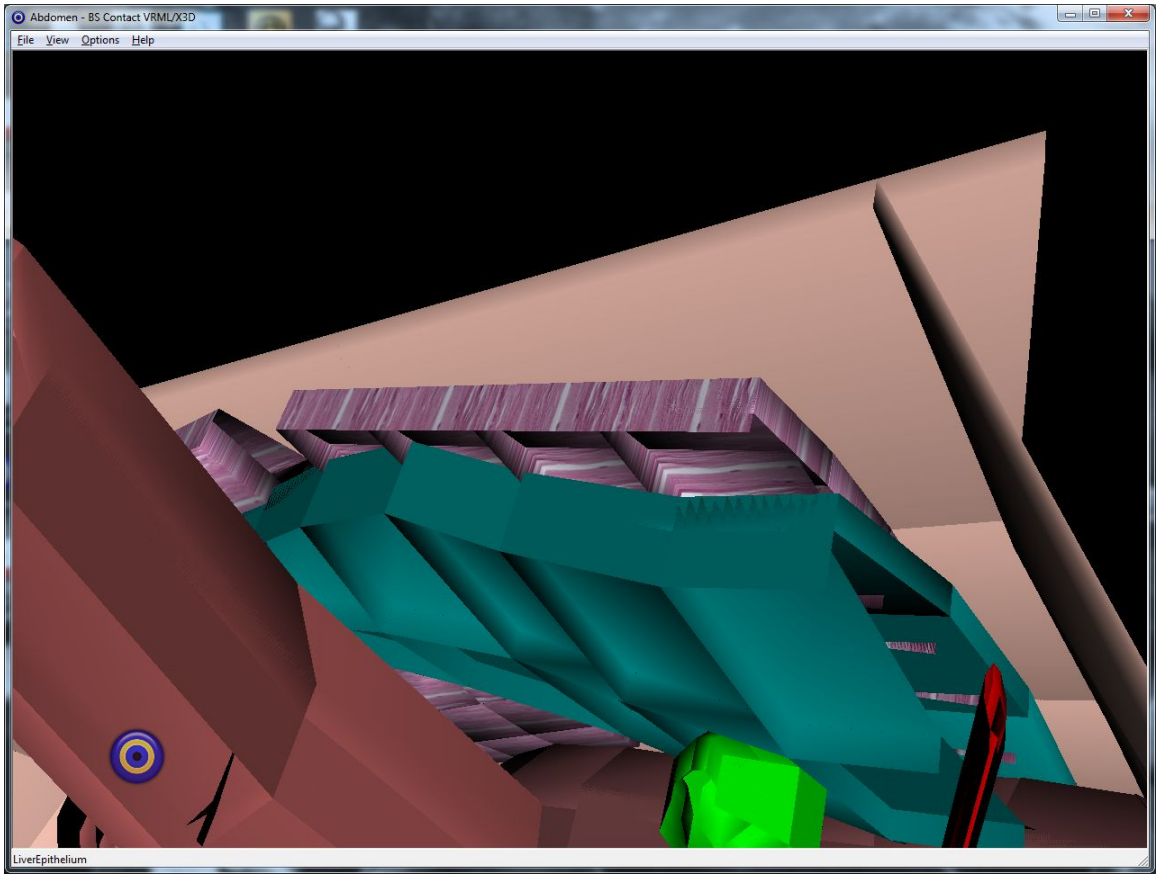
Using the BioMight palette

12. Endocrine System

Release 1.0 of **BioMight** will offer a near complete representation of the *Endocrine System*. Most parts of the endocrine system were covered through the creation of the individual glands and organs. From the system level, the units can be modeled as an integrated whole, with the user being able to set parameters that involve the pituitary gland sending chemokines to the Adrenal glands to produce adrenalin.

12.1 Endocrine System Scenario

An endocrine scientist is studying the effects of autoimmune hepatitis, wherein the body's immune system attacks healthy hepatic cells deeming them foreign invaders. The scientist wants to demonstrate the theoretical model to his peers. He makes use of BioMight to illustrate the process.



12.1.1 Set up the Stage

Using the BioMight palette the user sets up the stage for the animation chooing the components from the BioMight libraries.

12.1.2 Set up the Actors and Actions

After the components have been assembled, they are directed to carry out an animation sequence. The BioMight palette is used to position and size the objects. One can switch between the objects and make them carry out actions allowing for informative, detailed animations to be constructed for consumption by the web audience.

13.

Immune System

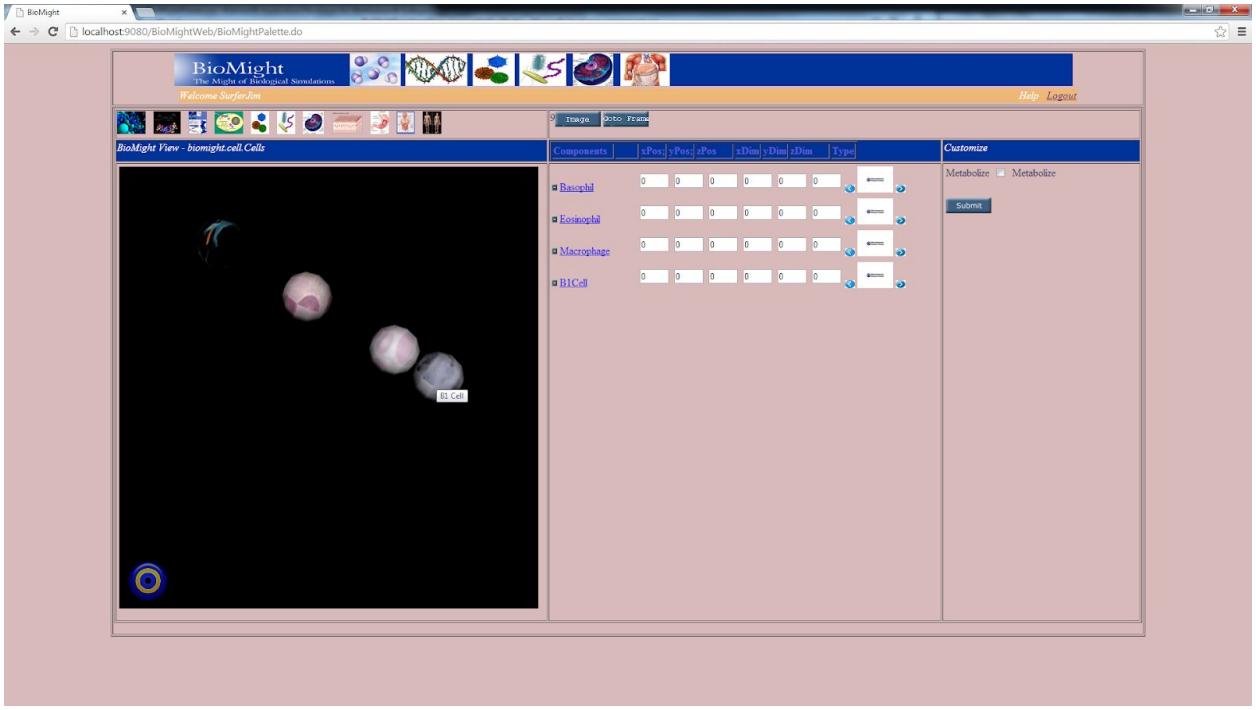
Release 1.0 of **BioMight** will offer a near complete representation of the *Immune System*. It will contain all the known cell types that comprise the human immunological system. From the library, one will be able to select white blood cells, macrophage, B1 Memory cells, Natural Killer cells, and design a variety of cell types by setting custom configurations through the BioMight engine.

13.1 Immune System Scenario

A professor of immunology wishes to illustrate the human body's natural immunity system. The professor starts by customizing the number of white blood cells and other components of the blood. Then she decides where she wants the interaction to take place and sets the stage at the center of the spleen, where numerous cells accumulate "waiting to get their mark."

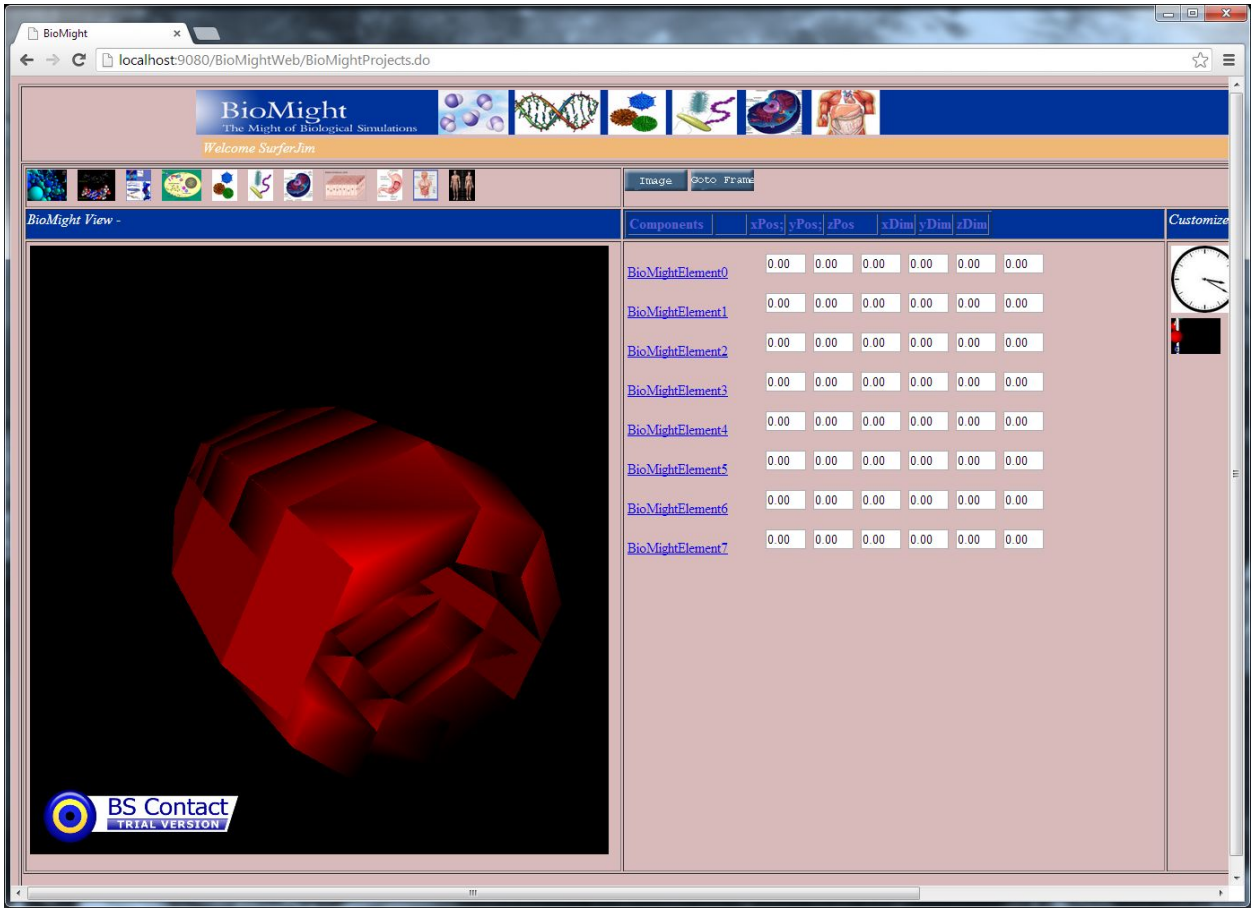
13.1.1 Set up the Stage

Using the BioMight palette, the user will drill into the Cells library and creates a collection of dendritic cells. These will be the cells that catch 'first scent' of the biological marker. The user then drills into the library and selects the spleen. The Splenic artery is added running though the pulp of the organ.



13.1.2 Setup the Actors and Actions

After the spleen and dendritic cells have been added to the palette, they are sized and placed into their starting locations. Using the clock and the location and orientation inputs, the animation is programmed. The Bacterial Cell will travel through the Splenic artery where it will touch off a dendritic cell that is hanging along the fibrin mesh.



13.1.3 Dendritic Cell Interaction

A dendritic cell will be the one that catches the first biological marker. After the interaction, the user adds a transition segment to the animated scene. A new scene is launched where now the micro details of the protein spikes on the surface membranes are center stage.

13.1.4 Generate Animation

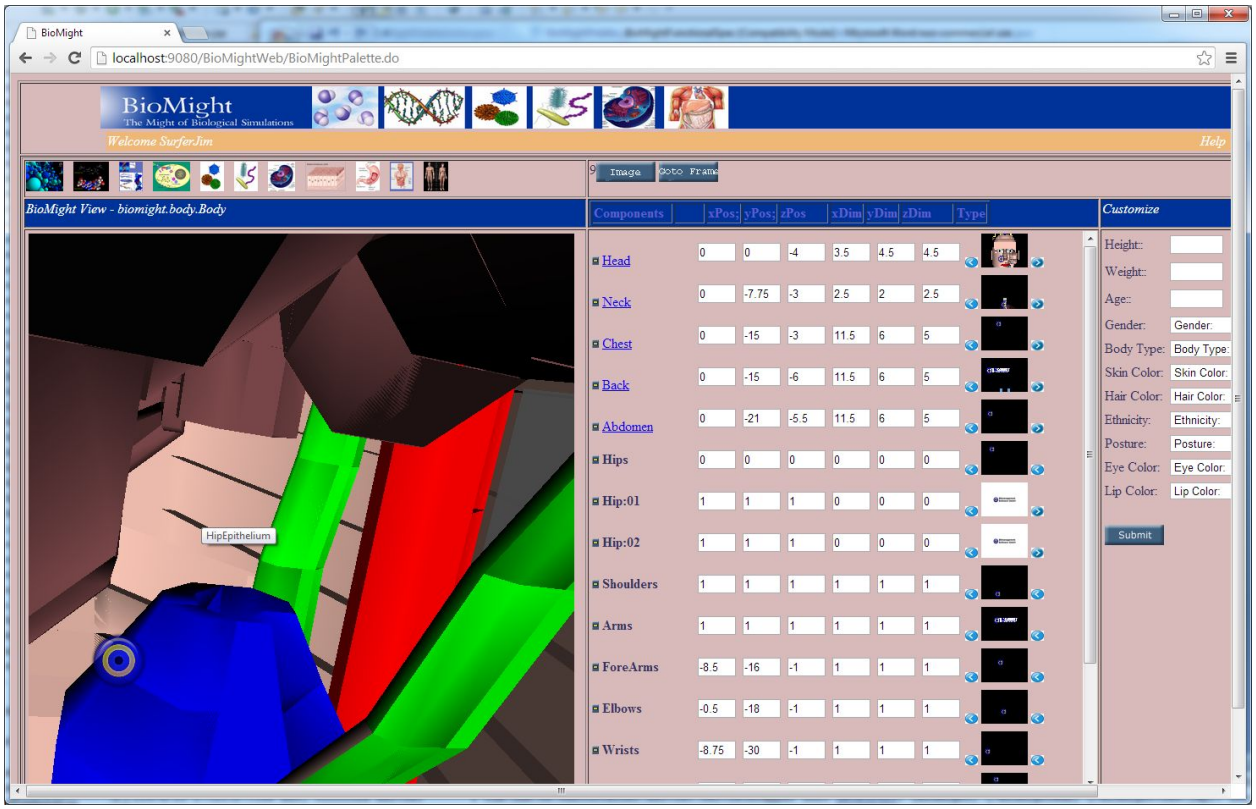
After all the components have been configured and setup, the X3D file is exported and deployed to the professor's laptop, where it will reside until presented to his class.

14. Organs

The organs of the human body are accessible from the Body, Systems, and Organs libraries. The Organs "view" allows one to easily drill down into Organ structures while not having the overhead of all the other body components.

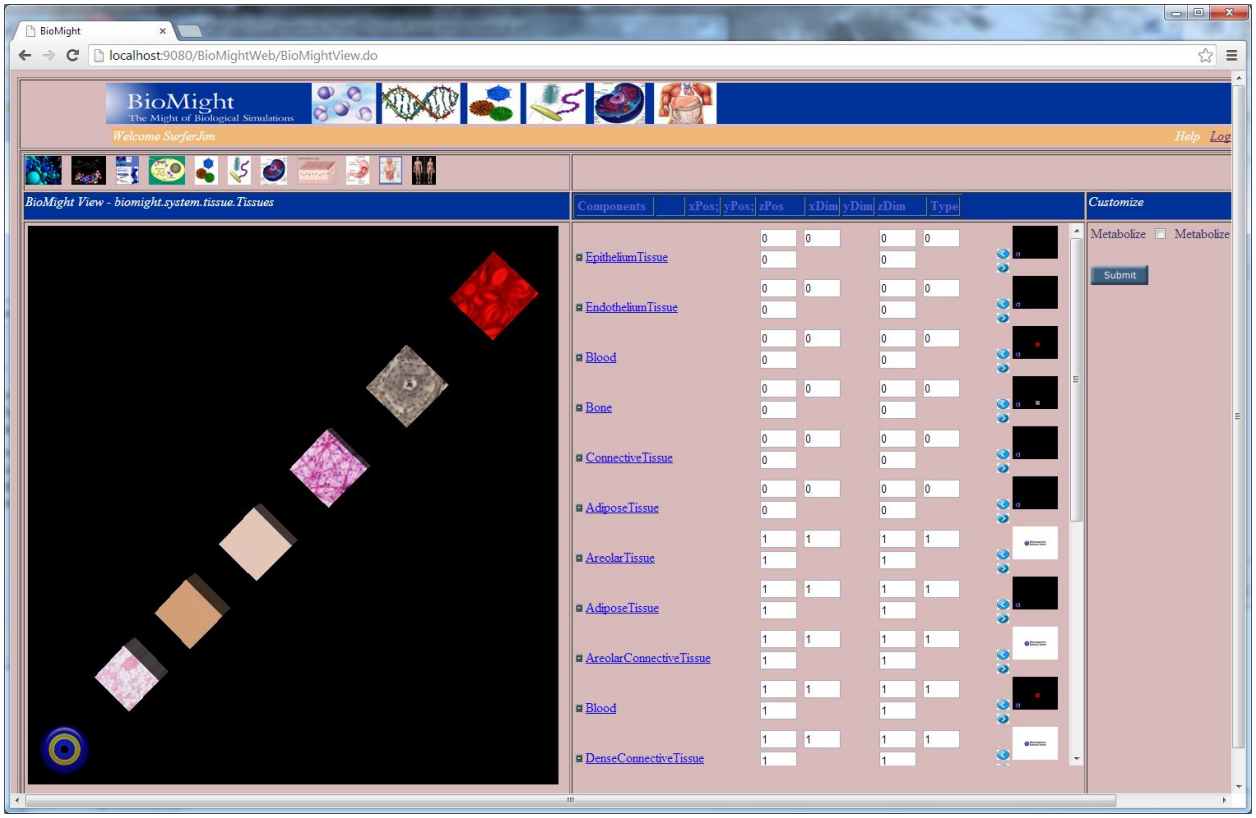
14.1 Organs Scenario

A K-12 teacher is interested in teaching her students about the digestive process. She wishes to show her students how the oyntic or parietal cells that are only found in the glands of the fundus secrete gastric acid into the stomach via active transport. She also wants to show how wastes are collected in the Kidneys are emptied into the bladder.



15. Tissues

The Tissue library allows the user to set up the various tissues that are part of the human body model. *Connective Tissue, Muscular Tissue, Nerve Tissue*, Bone, and *Blood* are represented in the BioMight Tissue library. Using BioMight, one can assemble tissues various tissue composites and customize them to represent their study, or natural conditions within the various tissue models.



15.1 Tissue System Scenario

A grad student is performing research in Tumor Tissue Lysates and their association to Heat Shock proteins and human dendritic cells. After expressing dendritic cells with Lysates he observed that the Dendritic cells undergo maturation. She wishes to make a presentation to his peers for review.

15.1.1 Set up the Stage

Using the BioMight palette, the she sets up a Tissue sample to explain the mechanics.

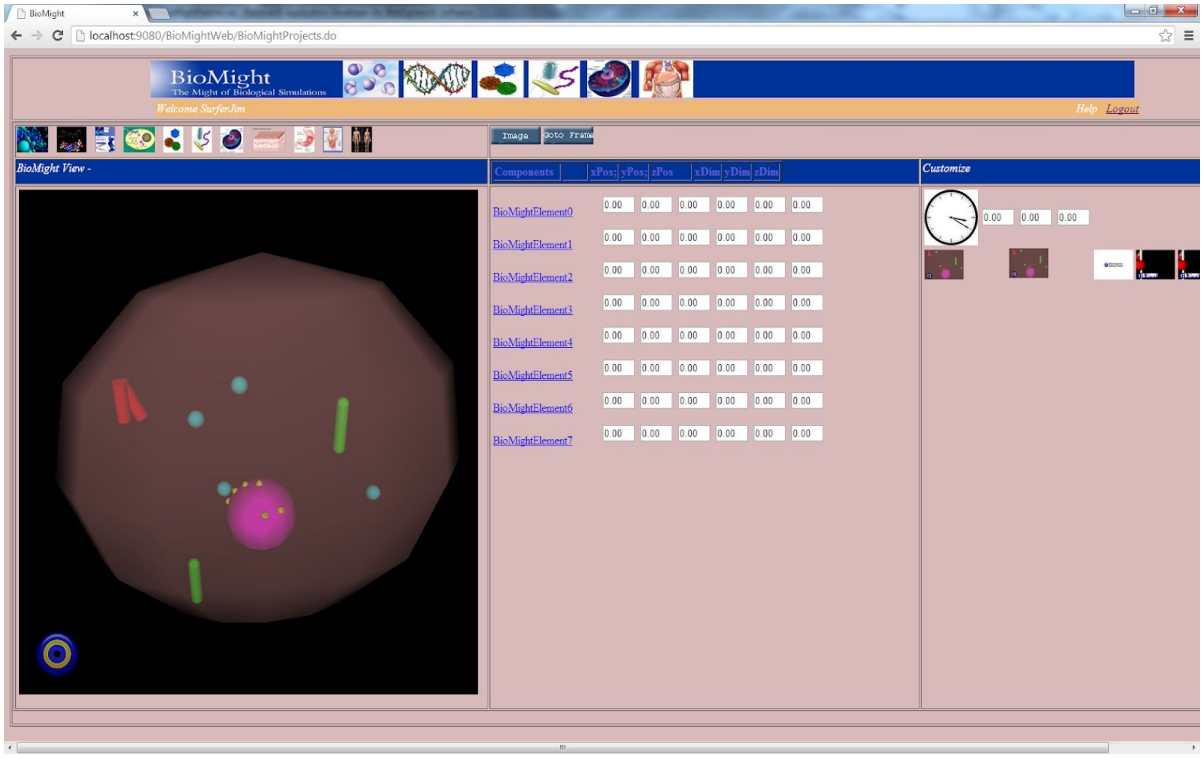
15.1.2 Setup the Actors & Actions

She uses the palette to assemble the actors for the animation.

16.

Cells

Release 1.0 of **BioMight** will offer a nearly complete representation of the *Cell* and its constituent components. Through **BioMight** the user will be able to set the position and number of endosomes, lysosymes, and the length and structure of the Golgi apparatus, even raise and lower the height on the endoplasmic reticulum. BioMight's Cell library also contains many different types of cells that are all customizable to meet the user's animation needs.

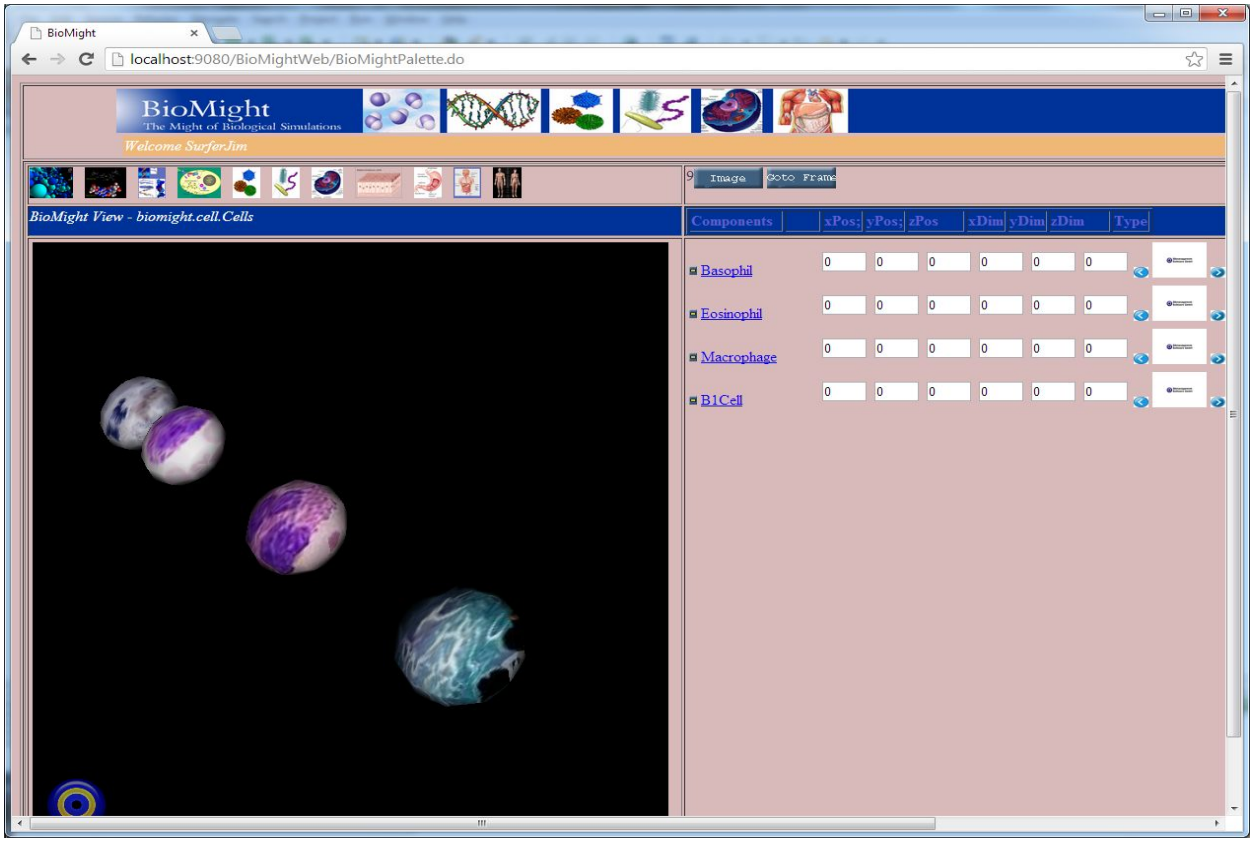


16.1 Cell System Scenario

A student wishes to explain basic eucaryote cellular composition to her high school science class. She wishes to design a animation where she flies through the cell wall, rides the channels of the endoplasmic reticulum, flies through an endosome, and then travels through the lipid layer of the cholesterol wall before breaking backing to the outside, and as she flies out into the distance, she observes calcium-ion pumps operating on the surface of the cell membrane.

16.1.1 Set up the Stage

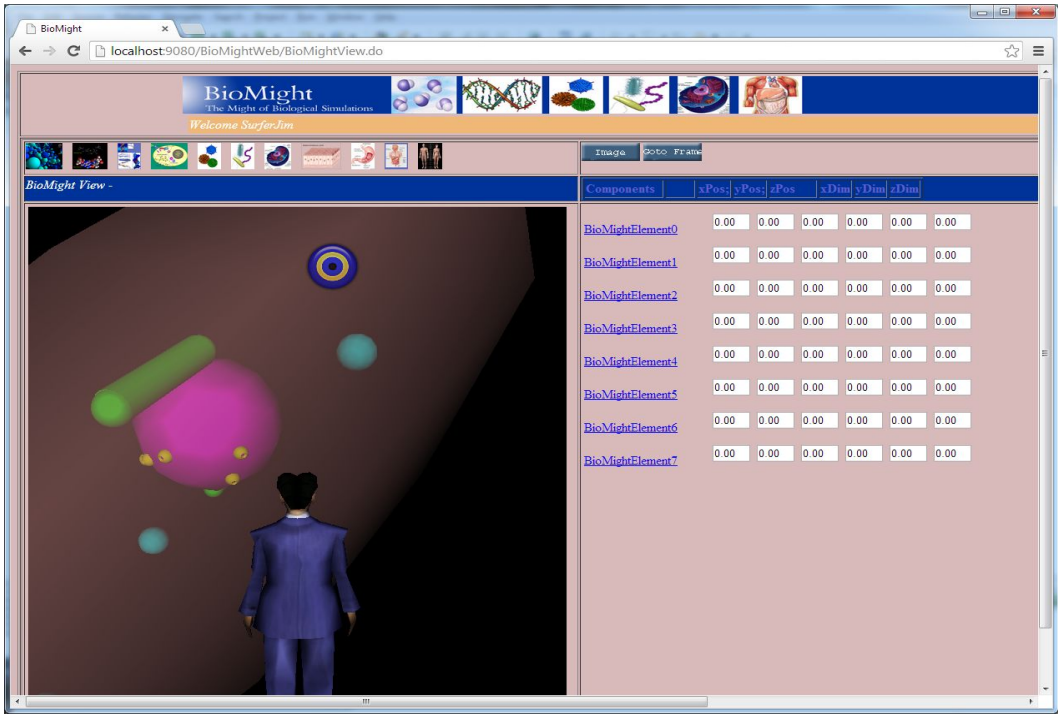
Using the **BioMight** palette, the student grabs a basic cell from BioMight's *Cells* library. Many different cell types are available; *dendritic, macrophage, B1, Duct cell, basophils, eosinophils, neuron,* etc. She selects her cell, configures it to her liking for the presentation, and places it on the palette.



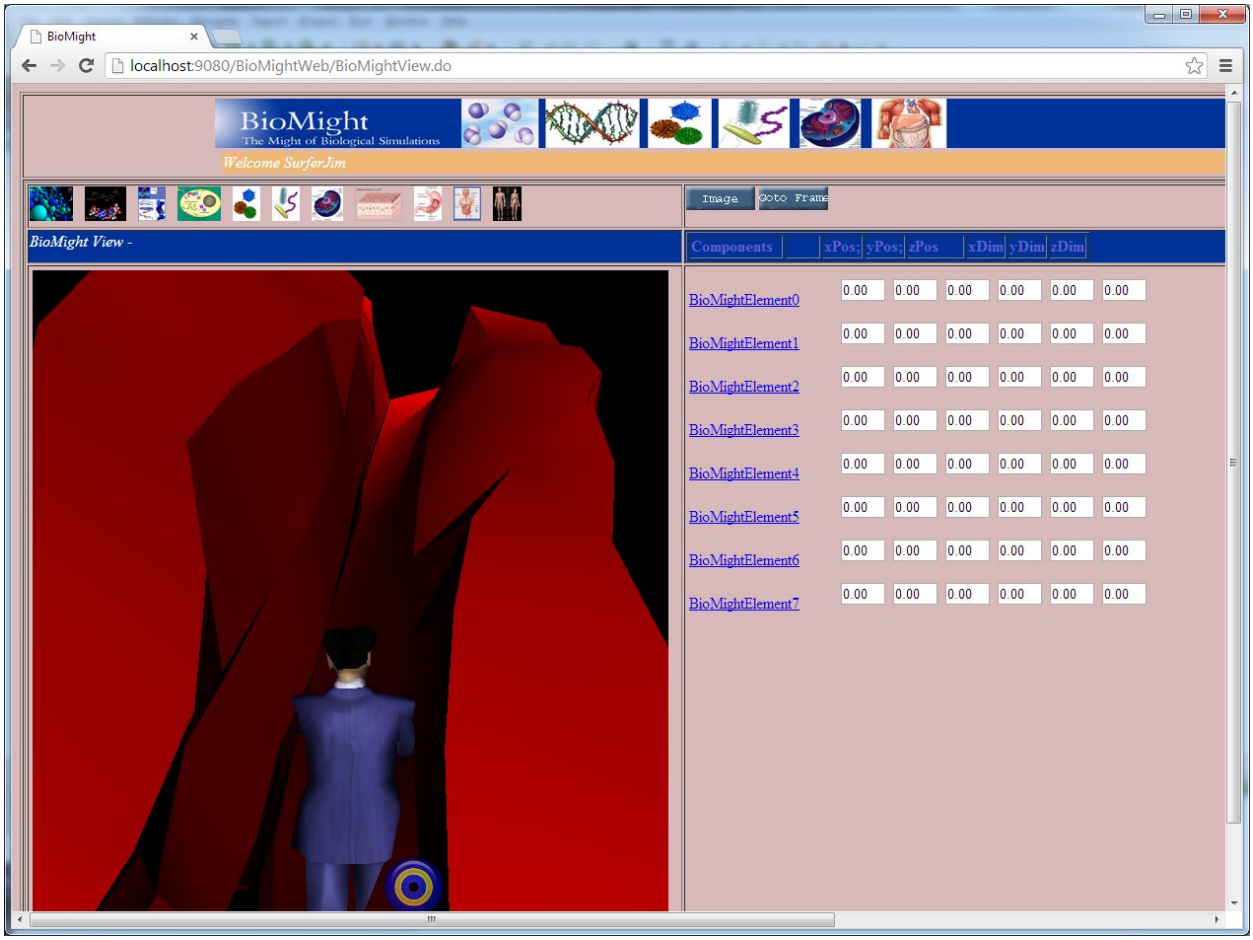
16.1.2 Setup the Actors & Actions

She decides to use an avatar for the journey, and creates a representation of herself using the BioMight engine. The BioMight avatar is a light-weight X3D model that allows for surface modifications. She sets the hair color, eye color, and facial features to match her own. She also sets the avatar to match her body specifications to her liking (BioMight offers twenty plus avatars for release 1.0 targeting a wide demographic thus providing a set of options for user selection and specialization.)

After the actors are on the stage, she sets up the initial animation by positioning them into their starting positions and setting their scale in perspective to one another. Then, she selects the first 5 seconds of time from the animation clock, and directs her avatar to zoom into the cellular model as described in the scenario above. After she breaks the barrier of the Cellular wall she heads straight towards the endoplasmic reticulum.

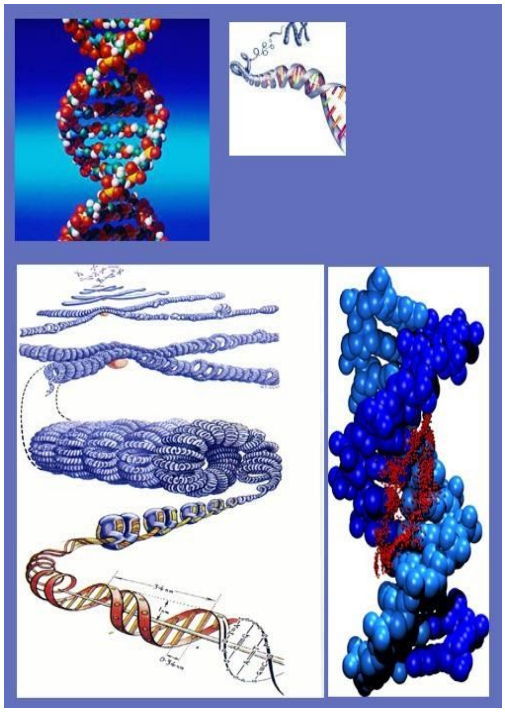


After reaching the Endoplasmic Reticulum, she decides to run through the cavern. In her class presentation, she will describe to the students the various components that comprise the cellular structure and how they function in the overall mechanics of the cell.



17. DNA

Release 1.0 of **BioMight** will offer a near complete representation of the *DNA* and its constituent components. One can view the classic ladder representation of the Helix model, and if desired create a virtual avatar that runs up the phosphate backbone pointing out the ACGT mathematical equations along the way.



17.1 DNA System Scenario

A biotech company executive wishes to convey how a new biomarker will assist hospitals and doctors in diagnosing prostate cancer. A radiated compound which attaches to errant prostate produced proteins (ligand), needs to be described such that insurance companies and hospitals understand the test and how to administer it.

17.1.1 Set up the Stage

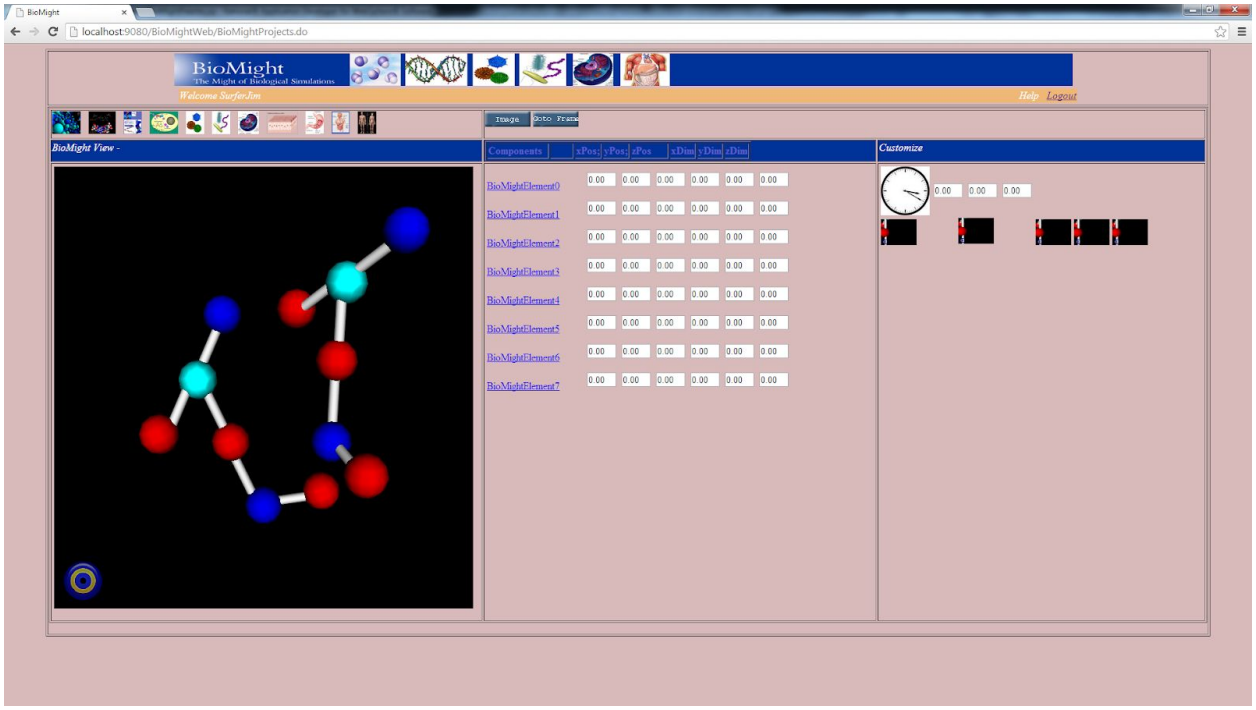
From the BioMight palette, the executive dives into the *Chemistry* library and constructs a representation of his company's newly created biomarker. When he has the look and feel that he wants to convey to his audience, he adds it to the BioMight palette. The user then moves into the DNA library and constructs a nucleotide chain that his biomarker will attach to. He then dives into BioMight's Organs library and selects the selects the prostate gland, customizes it, and adds it to the palette.

17.1.2 Setup the Actors and Actions

After the biomarker, the DNA chain, and the prostate are assembled on the stage, the user selects the time intervals from the clock and directs them through the sequence of the animation.

18. Chemical & Pharma

Release 1.0 of **BioMight** will offer a standard chemical and pharmaceutical library that contains a variety of well known organic compounds. In the library, one will find representations for amino acids, the sugars, carbohydrates, proteins, nucleic acids, and many more. Rather than storing that data internally, the BioMight engine reaches out and integrates with the Protein Data Bank and other well known repositories to get is molecular counterparts



18.1 Chemical & Pharma Scenario

A biotech company

18.1.1 Set up the Stage

From the BioMight palette, the user will dive into the Chemical & Pharma library and construct a representation of the biomarker. When completed, they will press the ‘add’to palette button and the object will be brought back the stage. The user will the jump into the DNA library and construct an nucleotide chain. They will add that to the palette using the ‘add’ button.

18.1.2 Setup the Actors and Actions

19.

Medical Library

Release 1.0 of **BioMight** will come with a basic medical library consisting of a standard set of devices and implements.

19.1 Medicines

BioMight will be able offer the ability to deliver medications via the following mediums; Pills, Capsules, Tablets, Gummy Chews, Liquid, or Injection. Injections can be intravenous or subcutaneous.

19.2 Tools

Release 1.0 of **BioMight** will offer a set of surgical and medical instrumentation that can be dropped onto the BioMight palette and manipulated. Using the tools to operate independently with built in actions will be a topic for a future release.

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20.

Account Management

Release 1.0 of **BioMight** will allow users to set up their accounts. These accounts will be stored in an LDAP enabled server.

20.1 Create Account

The user will visit the account screen to gain access to the **BioMight** software. On this page, the user will enter their username, name, address, payment, email, email verification, and choose a subscription type. Guest accounts will be allowed where the account will be given access for 60 days and then trimmed from the account servers. Emails will be sent to the guest notifying them that their account will be deleted and their information will not be used or stored elsewhere for any other purposes.

Type	tion Type	SD)
Corporate (Pharma/Advert)		
Corporate		
Corporate		
University		
University		
University		
Research Non-Profit		
Research Non-Profit		
Research Non-Profit		
Hospitals/Clinics		
Hospitals/Clinics		
Hospitals/Clinics		
Medical – Private/Group Practices		
Medical – Private/Group Practices		
Medical – Private/Group Practices		
K-12	5 user license)	
K-12	5 user license)	
K-12	5 user license)	
Consumer		
Consumer		
Consumer		

Guest	ect creation	

20.2 PWD Reset

PWD Reset will feature will allow the user to reset their account. It will use a three question scenario where if the user provides the information they will be given access. The reset option via email will also be available.

20.3 Account Payments

For release 1.0, **BioMight** will rely on a corporate based PayPal Account. PayPal will offer the validation and security checks needed to process the receivables but will extract their fee. As sales increase, a competitive, vendor-based solution will be sought.

21.

The Application

BioMight is J2EE compliant application, which is built enterprise strength, capable of supporting thousands of simultaneous users each building their own interactive worlds. It has a rich set of classes and methods, that when published, may set the standard for the Java Biological API.