Chapter 11

Development of an Interactive Virtual 3-D Model of the Human Testis Using the Second Life Platform

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ABSTRACT

One of the strengths of a virtual environment is the ability to immerse the occupant into an environment that would otherwise be impossible. The primary focus of the author’s project in Second Life is to take advantage of this opportunity to explore novel approaches to medical education. Second Life can be used to model doctor-patient interaction, clinical diagnosis skills, and three dimensional molecular and cellular modeling of objects from individual molecules to whole organ systems, both healthy and diseased. Using the powerful building and scripting tools of the Second Life platform, the author has created a model of the human testis that students can fly through and interact with to understand how the anatomy and physiology of the testis work together to regulate sperm production. The anatomical and physiological interactions occurring during these processes are described in accompanying audio and text. The development of educational tools within the Second Life context is in its infancy. As the technology matures, the opportunities for education within Second Life will continue to expand as an important adjunct to traditional pedagogical approaches.

INTRODUCTION

Data from several sources suggest that approximately 65% - 80% of adults are “visual learners”, with the remainder distributed between auditory learners and kinesthetic/tactile learners (Felder & Silverman, 1988; Felder, 1993; Valkoss, 2005). Educational theory also suggests the advantages of active learning and participation in small groups over traditional lecture based approaches (Bonwell & Eison, 1991; Mayer, 2004). One of the strengths of virtual worlds such as Second Life is the abil-

DOI: 10.4018/978-1-4666-1770-4.ch011
ity to immerse the occupant into an environment that would otherwise be impossible. The ability to interact in learning spaces that do not and cannot exist in the real world offers unique educational opportunities. It was with these concepts in mind that we began to explore the possibilities of using Immersive Learning Environments for medical education.

The use of Second Life for medical and healthcare education has been well documented (Boulos et al., 2007; Boulos et al., 2008; Gorini et al., 2008). Second Life has been used for a wide variety of educational activities, and there are currently several hundred educational institutions using Second Life for teaching and learning (Kemp, 2009). Medical and healthcare education is especially well represented, and Second Life has been used for disaster simulation (Boulos et al., 2008), nursing training (Skiba, 2009), nutrition education (Second Life Nutrition Game, 2009), etc., much of which is referenced by one of the primary in-world sources of healthcare information – HealthInfo Island (Perryman, 2009; Second Life HealthInfo Island, 2009) funded by the National Library of Medicine. In addition to these clinical healthcare education resources, there are several basic medical and biological simulations in Second Life. Genome Island (Clark, 2008) is a richly developed resource for genetic and molecular biological information, and other simulations such as Biome (Greenwood, 2009) and Second Nature (Scott, 2009) provide innovative approaches to exploring biology and nature in a virtual environment. In contrast, due to the inherent difficulty in creating accurate and realistic biological models using the tools available, there are relatively few anatomical simulations in Second Life. As such, our goal in building the virtual testis was not to attempt to re-create an accurate anatomical representation of the testis, but rather to explore novel ways in which we could examine the relationships between the anatomy and physiology to describe various aspects of testicular function.

We chose to model the testis in SL for several reasons: 1) there are key concepts in testicular physiology, such as the blood-testis barrier that lend themselves to a visual explanation of the process, 2) the testis has “moving parts” that could be animated and scripted, and 3) the students could progress through the various parts of the testis and follow a logical progression of how the anatomy and physiology work together to regulate sperm production. We considered other aspects of the reproductive system, including the ovary and uterus, but ultimately decided that the testis was best suited for the opportunities afforded by the Second Life platform (Danforth, 2008).

Design and Development

The Virtual Testis is located above the Ohio State University College of Medicine Island in Second Life; OSU Medicine (Danforth, 2009). It was built in three parts in reverse order, although there was significant overlap during the construction process. One of our primary goals was to make the model large enough so that visitors could “fly into” the testis and see how the testis functions from a “sperm’s eye view”.

It immediately became clear that the normal building tools available in Second Life would be inadequate for a project of this scale. All objects in Second Life are created from standard building shapes, such as blocks, spheres, tubes, etc. and are called primitives or “prims”. Normal objects are limited to a maximum size of 10 meters (m) x 10 m x 10 m. The testis model required objects as large as 150m x 150m x 150m so “giant prim” or “megaprim” were used. However, working with objects of this size was problematic on several levels. First, these giant prims only existed in a few predefined sizes and could not be resized. As such we were limited to the sizes that already existed in-world at the time.

To get around the limitations of using giant prims various other options were explored, including geodesic dome makers, the creation of giant