



# PHYSIOME SCIENCES, INC.

SUN SERVERS HELP ENABLE PHYSIOME SCIENCES TO SUPPORT BIOLOGICAL MODELS THAT IMPROVE DRUG SELECTION AND APPROVAL PROCESS

## KEY HIGHLIGHTS

### Company

Physiome Sciences, Inc.

### Industry/Market

Biological Model Development

### Applications/Solutions

Develop biological models using proprietary software tools to speed drug discovery

### Products/Services

- Sun Enterprise™ 3500 server
- Sun Enterprise™ 4500 server
- Sun 420R™ application server
- Sun Solaris™ 7 Operating Environment
- Sun Ultra™ 5 workstations
- Oracle Relational Database Management System, version 8

### Key Business Solutions

- Generates insight into the disease process, thereby decreasing the time to clinical trials
- Improves decision-making during the drug discovery process
- Eliminates unnecessary experiments (animal and human trials)
- Increases database management for data used in modeling and simulation of biological processes
- Helps enable cost-effective scalability to meet exponential growth in complex medical data

*“Physiome Sciences can take advantage of all the information coming from the Human Genome Project without delay, and Sun is an important part of this success. We’ve had great, great technical synergy with Sun.”*

*Dr. Jeremy Levin  
President and CEO  
Physiome Sciences, Inc.*

To support biological modeling, Physiome Sciences has developed a comprehensive simulation platform, including software tools and complex databases, which runs on a powerful underlying Sun architecture. These tools can be licensed to drug developers who wish to enhance Physiome Sciences’s models or create their own.

Physiome Sciences, a privately held Princeton-based company, is a leader in the commercial development of biological models and software tools needed for simulating biological processes. Physiome Sciences also develops its own proprietary databases and web applications. Its technology is used to model pathways, cells, tissues, organs, and living systems in a virtual setting, enabling scientists to generate predictive information using their own data.

For example, drug developers use Physiome Sciences’s software and models to predict the effects of specific drugs on animals and humans. These predictions enable rational selection of targets and drugs for subsequent testing, eliminate unnecessary experiments, and generate insight into basic biology as well as the disease process. Overall, Physiome Sciences’s goal is to help pharmaceutical and biotechnology companies develop better drugs faster through the use of biological simulations.

Pharmaceutical and biotechnology companies are struggling to find technologies that can integrate, simulate, store, and visualize tremendous amounts of complex biological data. “There’s a wide-spread need for a way to deal with the tremendous amount of complex data that is emerging in the post-sequencing phase of the genome project. This data includes how a protein is expressed and interacts with other proteins in pathways, how these proteins effect cellular behavior and how diseased cells interact,” explains Dr. Jeremy Levin, president and CEO of Physiome Sciences, Inc.

“Over the past 10 years an ever-increasing amount of data about gene expressions, pathways, tissues, and cells has been collected. This data has reached a critical mass that is sufficient for building innovative, predictive models. Physiome Sciences is committed to discovering the emergent properties uncovered when this diverse data set is captured in biological models. To develop these models, we start by describing biochemical pathways. Then, we assemble this data into cells, tissues, and ultimately entire systems. This particular approach is very different from what has been done before and allows scientists to evaluate the role of numerous biological targets or the effects of drugs,” explains Levin.

Physiome Sciences began by developing an environment where its scientists built and stored portions of completed models or portions of pathways or cells. These portions became the framework for other models. The final models can be stored, shipped across the web, and merged to make models of higher complexity with collaborators at pharmaceutical companies or academic centers enabled with Physiome Sciences technology. Physiome Sciences turned to Sun Microsystems and Oracle for the capability to store and offer this technology.

**“Java technology has been instrumental in creating these technologies. Because of Java’s “Write Once, Run Anywhere” technology, we’ve been able to run the same software on PCs and supercomputers.”**

*G. Scott Lett, Ph.D.  
Scientific Computationalist  
Physiome Sciences, Inc.*

### **Sun Enterprise Servers Provide Backbone for Physiome Sciences’s Database Management**

Physiome Sciences’s approach includes looking for the best and most scalable database for its models and biological data. Scalability is crucial to Physiome Sciences considering the large amounts of data that will need to be stored and manipulated in the near future.

Scalability, the ability to easily and cost-effectively grow with no interruptions, led Physiome Sciences to choose Sun Enterprise™ 3500 and 4500 servers, running the Solaris™ Operating Environment 7, for its mission-critical database management. Physiome Sciences runs Oracle Relational Database Management System. The structure of this database can be individualized based on customer need, and it is fully searchable using the power of Oracle’s advanced scripts and relational entities.

“There are four key reasons we chose Sun Enterprise servers to support the database that maintains all our models,” says Peter Brooks, VP of Product Development and Operations at Physiome Sciences. “First, we seek products that are reliable. This is crucial to us. Second, we require that the servers work well with an Oracle database. Next, we require scalability. Since we know that the amount of information will grow

exponentially, we need to cost-effectively and easily expand to meet that growth. Finally, we need servers that work well within our environment as well as the environment of the partner pharmaceutical companies,” concluded Brooks. “The Sun/Oracle solution meets our criteria wonderfully.”

As an example of how Physiome Sciences is growing quickly, Levin described their innovative Physiome Academic Centers of Excellence Program (PACE™ program). “The PACE™ program provides academic collaborators with technology and biological model building capabilities so that they can simulate complex processes. Currently, there are several specialized PACE™ programs, but many centers are planned.” The sheer amount of data and models is expected to grow exponentially.

“Data management becomes a crucial IT infrastructure issue. Right now, with the physiological information emerging from the discovery of new genes, the data backing up the models are in the gigabyte or possibly terabyte range,” says Levin. “But once we have the data generated by PACE centers using Physiome Sciences software, the amount of data involved will be tremendous. We will be modeling, storing, and visualizing data at the petabyte level!”

### **Physiome Sciences Uses Java™ Technology, Enabling Seamless Collaboration Worldwide**

One reason Physiome Sciences chose Sun Microsystems to provide key database management infrastructure is because of Physiome Sciences’s familiarity with Sun software development tools. Physiome Sciences has used Java software in designing all of its software tools included in the Physiome Sciences modeling environments.

“The Physiome Sciences platform combines many technologies to bring biological data and mathematical modeling together in an environment that is accessible to biological scientists involved in drug discovery on their desktop computers,” explains G. Scott Lett, Ph.D. Scientific Computationalist at Physiome Sciences. “Java technology has been instrumental in creating these technologies. Because of Java’s “Write Once, Run Anywhere” technology, we’ve been able to run the same software on PCs and supercomputers.”

In addition, Java technology helps enable Physiome Sciences's software engineers to add worldwide web connectivity, database access, scientific data visualization, data security, and XML data portability very quickly. "Java native interface (JNI) and CORBA support enable us to link seamlessly with non-Java legacy software that does high-performance computing tasks," adds Lett. "Without Java, we'd still be in the process of developing the software we're already using."

### **Sun and Physiome Sciences Work Together in Consortium Establishing Standards**

In January 2001, Sun helped start the Interoperable Informatics Infrastructure Consortium (I3C), chartered with the mission of proposing and maintaining an open platform to support data interoperability across all life science and establishing common protocols toward the goal of accelerating discovery. Sun's background in the Extensible Markup Language (XML), which it invented, is part of the expertise it brings to the consortium. The main purpose of I3C is to develop and encourage computing standards.

Along these lines, Physiome Sciences, with the Bioengineering Research Group at the University of Auckland's Department of Engineering Science and affiliated research groups, developed the CellML™ modeling language. The purpose of the CellML™ modeling language, an XML-based markup language, is to store and exchange computer-based biological models. It also enables scientists to reuse components from one model in another, thereby accelerating model building. Additional information can be obtained by visiting the CellML website at <http://www.cellml.org>.

The CellML™ modeling language project is closely affiliated with two other XML-based projects currently underway at the University of Auckland in New Zealand. These languages, AnatML and FieldML, are aimed at exchanging information at the organ level and describing system biology, respectively. Combined, these three languages will provide a complete vocabulary for describing biological information ranging from the subcellular to organ level. The expectation is that these three languages will greatly increase the ability

to collaborate with scientists worldwide, thus speeding up the understanding of diseases and the drug discovery process.

### **Physiome Sciences Makes Human Genome Project Information Useful and Effective**

Physiome, Sun, and Oracle are providing pharmaceutical companies with a total solution for database management. "We now have the tools to organize and process the complex information from the Human Genome Project," says Levin.

This is excellent news for the decade-long, \$3 billion Human Genome Project. Recently, experts have been getting buried in information and have had a hard time efficiently organizing all of the information and extracting biological function. Drug and pharmaceutical companies can now bring one of Physiome Sciences technology platforms right into their own company and manipulate this public information and their own internal proprietary data with it. This greatly increases the ease and speed of analyzing and annotating genes, proteins, and subcellular pathways and networks. "Physiome Sciences can take advantage of all the information coming from the Human Genome Project without delay, and Sun is an important part of this success," added Dr. Levin. "We've had great, great technical synergy with Sun."

Physiome Sciences's timing is perfect for a great opportunity. Research and development at pharmaceutical companies has increased at a staggering rate. In 2000, pharmaceutical companies spent nearly \$23 billion, according to the Biotechnology Industry Organization. Even more amazing is the fact that only \$2.4 billion of that \$23 billion was spent on drugs that made it successfully through Food and Drug Administration clinical trials. Roughly one out of ten drugs makes it to the market.

Physiome Sciences's models, software tools, database management, and web applications drastically reduce the expense and time currently required in drug development. And more importantly, it saves many lives potentially lost during the lengthy drug development process. "It's incredibly flattering and a true privilege to be involved in developing tools that increase human insight into some of our most devastating diseases," concluded Dr. Levin.

## Business Advantages

- Scalability:** It is crucial to Physiome Sciences to have the ability to grow easily and cost-effectively to meet its exponential growth. Physiome Sciences should be able to add capacity quickly to meet growing needs by just turning on processors and memory and adding storage.
- Enhanced Performance:** The Sun/Oracle solution provides Physiome Sciences with a means to manage and share massive volumes of scientific data. Specifically, this solution provides the power to store annotation information about individual components, such as technical information about genes, proteins, subcellular pathways, and kinetics. In addition, this solution provides links to individual research works, other appropriate documentation, and external references in private or public databases. The database structure is customizable by each customer.
- Use of Java:** The "Write Once, Run Anywhere" technology helps enable Physiome Sciences's software tools to be run on various platforms, ranging from PCs to supercomputers. In addition, Java technologies help enable Physiome Sciences's software engineers to add worldwide web connectivity, database access, scientific data visualization, data security, and XML data portability, and they can do it quickly. All this greatly facilitates worldwide collaboration among scientists.
- Reliability:** The Sun/Oracle solution is designed to provide Physiome Sciences reliability 24 x 7 for its database management. The benefit is dependability and high confidence in its database management solution.

"There are four key reasons we chose Sun Enterprise servers to support the database that maintains all our models. First, we seek products that are reliable. This is crucial to us. Second, we require that the servers work well with an Oracle database. Next, we require scalability. Since we know that the amount of information will grow exponentially, we need to cost-effectively and easily expand to meet that growth. Finally, we need servers that work well within our environment as well as the environment of the partner pharmaceutical companies. The Sun/Oracle solution meets our criteria wonderfully."

*Peter Brooks, Vice President  
Product Development and Operations  
Physiome Sciences, Inc.*

**HEADQUARTERS SUN MICROSYSTEMS, INC.,** 901 SAN ANTONIO ROAD, PALO ALTO, CA 94303-4900 USA  
PHONE: 650 960-1300 FAX: 650 969-9131 INTERNET: [www.sun.com](http://www.sun.com)



## SALES OFFICES

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