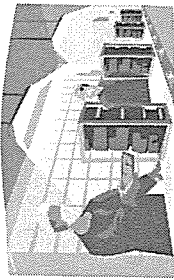


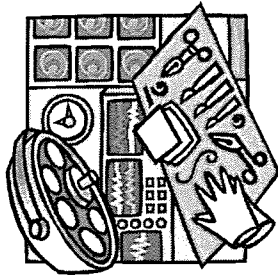
# 医療安全・訓練センター構想

## リサーチ

医療事故分析と  
事故回避・安全技術の研究・開発  
(シミュレータの活用)

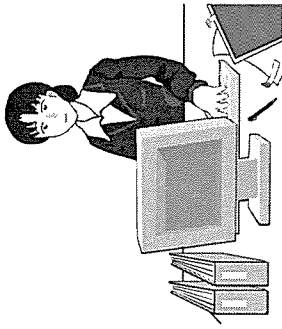


医療事故事例の情報収集

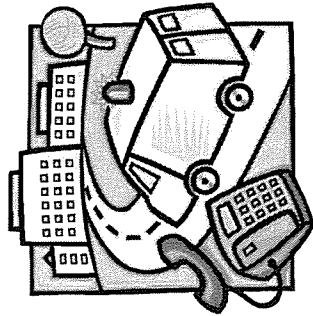


## インフォメーション

高度先進医療技術の情報発信  
医療従事者向け  
一般市民向け



医療安全情報の発信



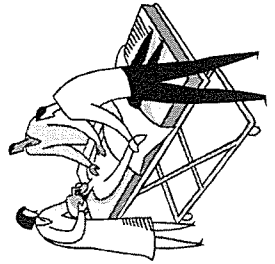
## 医療安全・訓練センター

手術シミュレータを用いた  
高度先進手術技術の習得



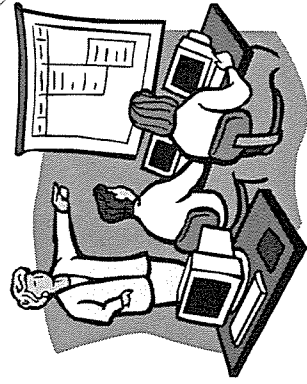
## トレーニング

患者ロボットを用いた  
高度先進医療技術の習得



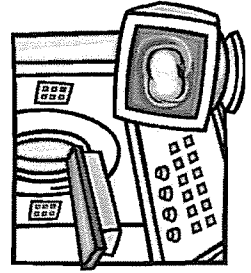
遠隔授業

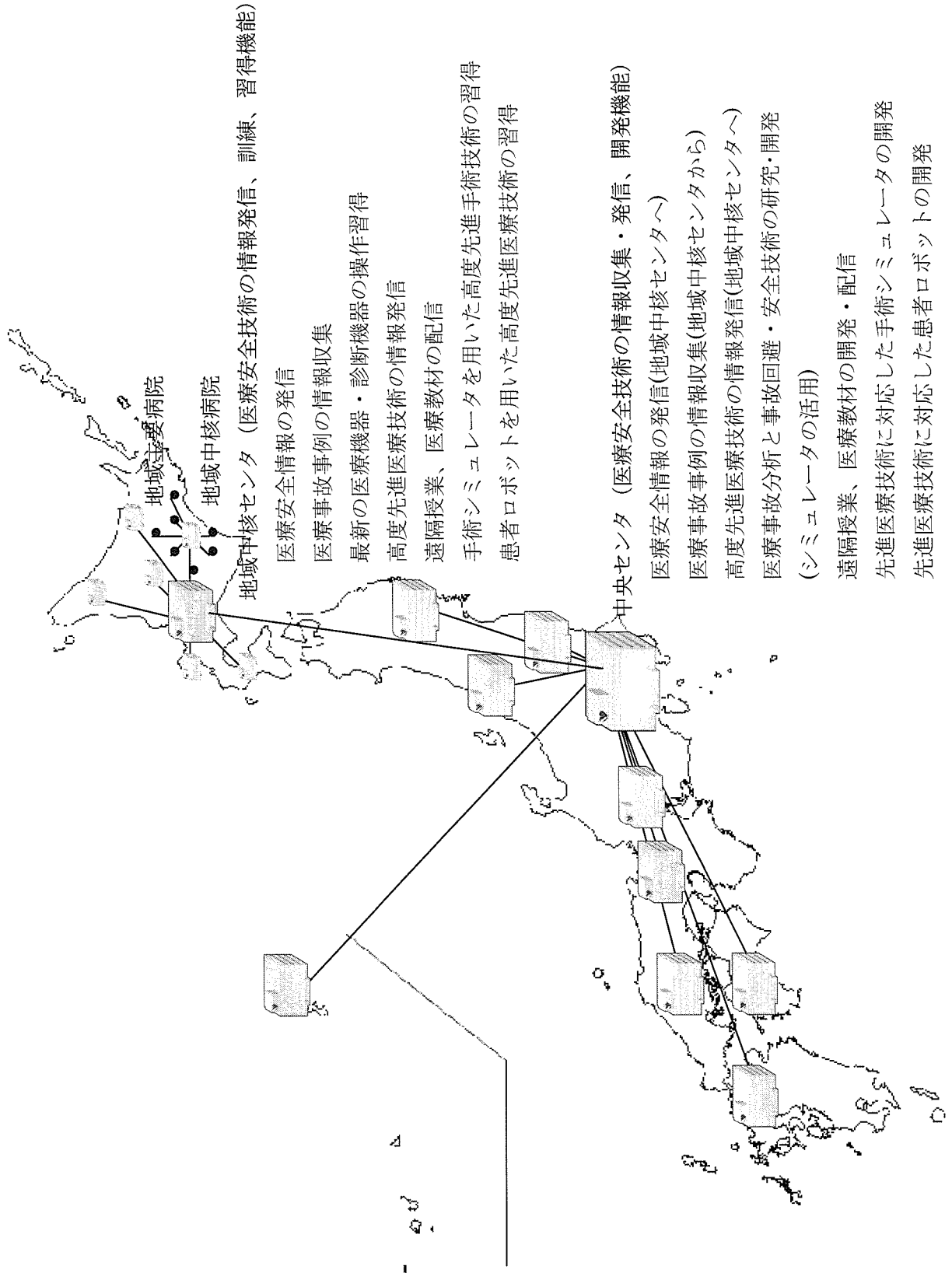
医療教材の開発・配信



## ラーニング

最新の医療機器・診断機器の操作習得  
(メーカーより提供の最新機器を使用)





**Surgical Science** develops high-quality tools for the Assessment, Training and future Certification of medical professionals.

Using cutting-edge simulation technology and wide-ranging knowledge of the needs of the medical community, we are committed to developing tools that will help train safer surgeons faster. Systems that build skills that actually transfer into the operating room.

Based in Göteborg, Sweden, we maintain close ties to the Göteborg University. Through ongoing research and close cooperation with the medical community, we will continue to provide professionals worldwide with the means to improve surgical training and practice.

OUR MISSION IS  
**SAFER  
SURGEONS  
FASTER**

**surgicalscience**

Haraldsgatan 5, SE 413 14 Göteborg, Sweden. Phone +46 31 741 65 60. [info@surgical-science.com](mailto:info@surgical-science.com). [WWW.SURGICAL-SCIENCE.COM](http://WWW.SURGICAL-SCIENCE.COM)

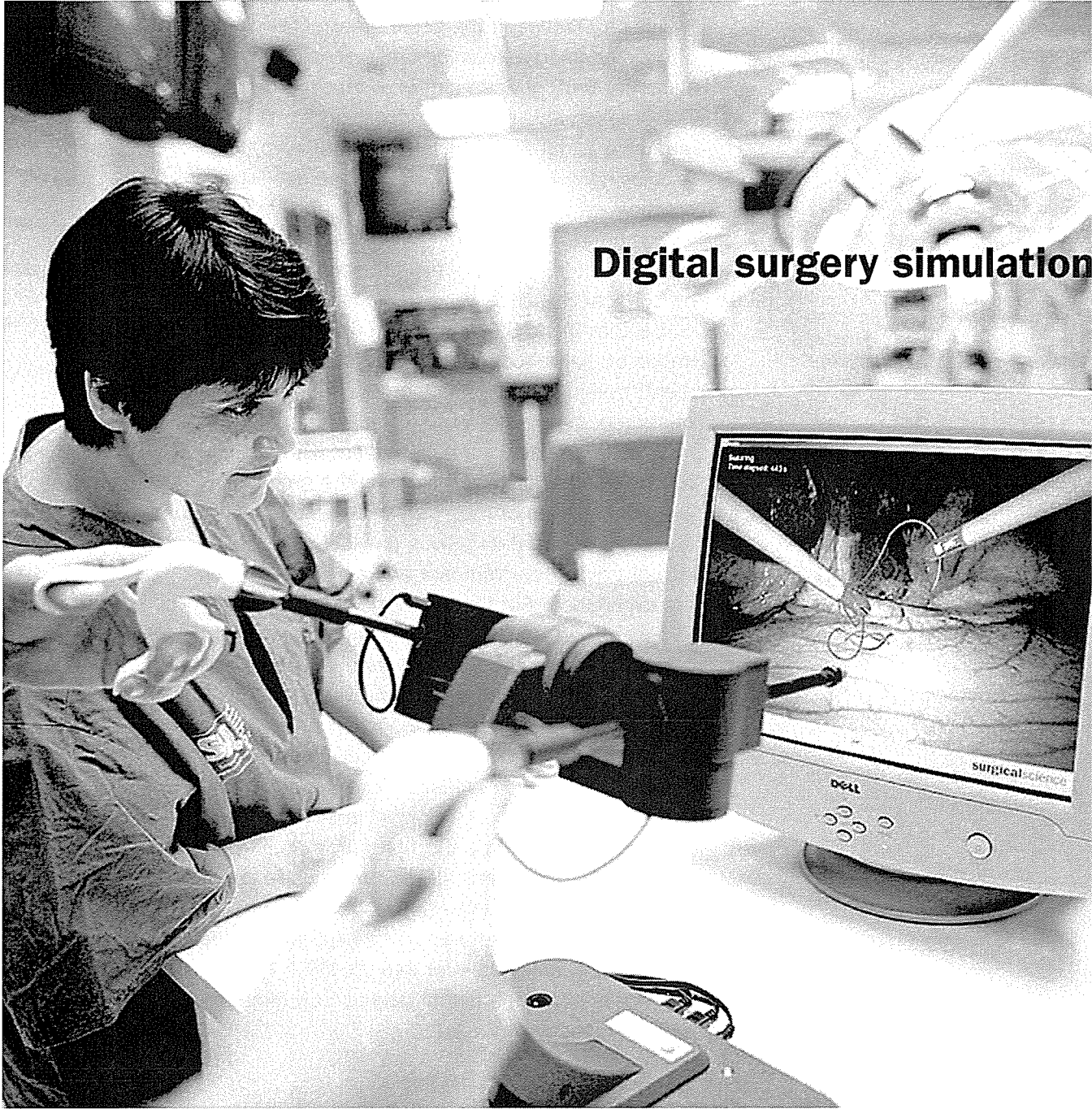
## Enhancing surgical skills without cutting skin.



|                        |        |
|------------------------|--------|
| time (s)               | 57,0   |
| misses (%)             | 0      |
| path (m)               | 0,57   |
| drift (mm)             | 1,32   |
| tissue damage (#)      | 0      |
| max damage (mm)        | 0      |
| angular path (degrees) | 221,83 |

passed

**surgiscience**  
LapSim® Basic Skills



**has come of age.**

Hands-on practice in the OR is an effective way of building and maintaining laparoscopic surgery skills, for both novices and experienced surgeons. The problem is: with a live patient on the table, learning by trial-and-error is simply not an option. And, using animal models may not be desirable or practical either, for a number of possible reasons.

Fortunately, now there's a safe and effective alternative. It's called LapSim® by Surgical Science.

LapSim Basic Skills is the first of a series of digital tools for the assessment, training and possible certification of surgeons.

It replaces the vulnerable patient with expendable pixels. By digitally recreating the procedures and environment of minimally invasive abdominal surgery, LapSim Basic Skills provides a realistic virtual training environment and an effective learning experience. But that's not all.

Extensive task and course-tailoring functions, along with advanced features for the recording and processing of training results, provide a means of benchmarking surgical skills against a set of standards. With LapSim Basic Skills, certified laparoscopy training is just around the corner.

LapSim is not the first digital laparoscopy trainer on the market. But it's the first fully mature system of its kind, both technically and practically. LapSim really works, and studies support our claims. Novice surgeons who train using LapSim develop skills that actually transfer into the OR.<sup>1</sup>

With LapSim, the digital laparoscopy simulation system has come of age.

OUR MISSION IS  
**SAFER  
SURGEONS  
FASTER**

<sup>1</sup>Surgical Endoscopy (2002) 16:1324-1328.

# A cost-effective tool for assessment, training and future certification.

LapSim provides the means to dramatically increase the amount of training and practice time available to both the aspiring surgeon and the experienced professional needing to keep his or her skills current. Using state-of-the-art 3D virtual reality technology, including interactive digitized video, LapSim will enable more surgeons to put in more training and practice time in a supremely cost-effective way. It will also allow assessment of a surgeon's skill, as well as provide a basis for future certified laparoscopy training.

With LapSim 2.0, the system reaches new heights of realism and flexibility. Featuring numerous tweaks, detail improvements and new features, as well as a new training module, the latest version expands the scope, as well as the training value, of LapSim considerably.

## An expanding modular system

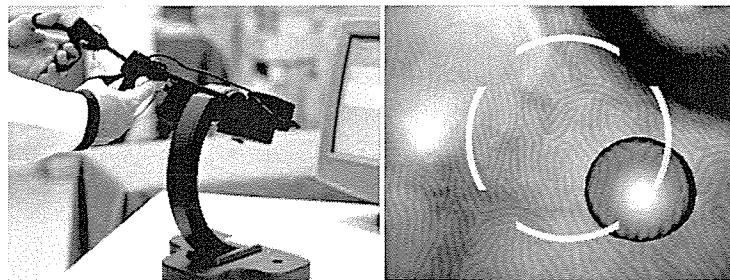
LapSim 2.0 contains eight training tasks, from basic camera navigation to suturing. Additional game-style navigation exercises provide added incentive for practice. As a modular system, LapSim is continuously being expanded and improved. Further upgrades featuring more tasks are continually in the pipeline. Surgical Science is committed to providing training tools that allow surgeons at all levels gain practical experience in a safe way. LapSim Basic Skills 2.0 is an important step in this progression.

The on-screen surgical instruments are manipulated using an instrument rig designed and manufactured by Immersion Inc., CA, USA. Essentially a specialized "joystick", the rig emulates the look and feel of real laparoscopic instruments. The system runs comfortably on a current standard PC (please refer to the system specifications on page 9). Pending the availability of suitable hardware, LapSim will incorporate force-feedback functions to further increase training realism.

## Tailoring courses and tracking results

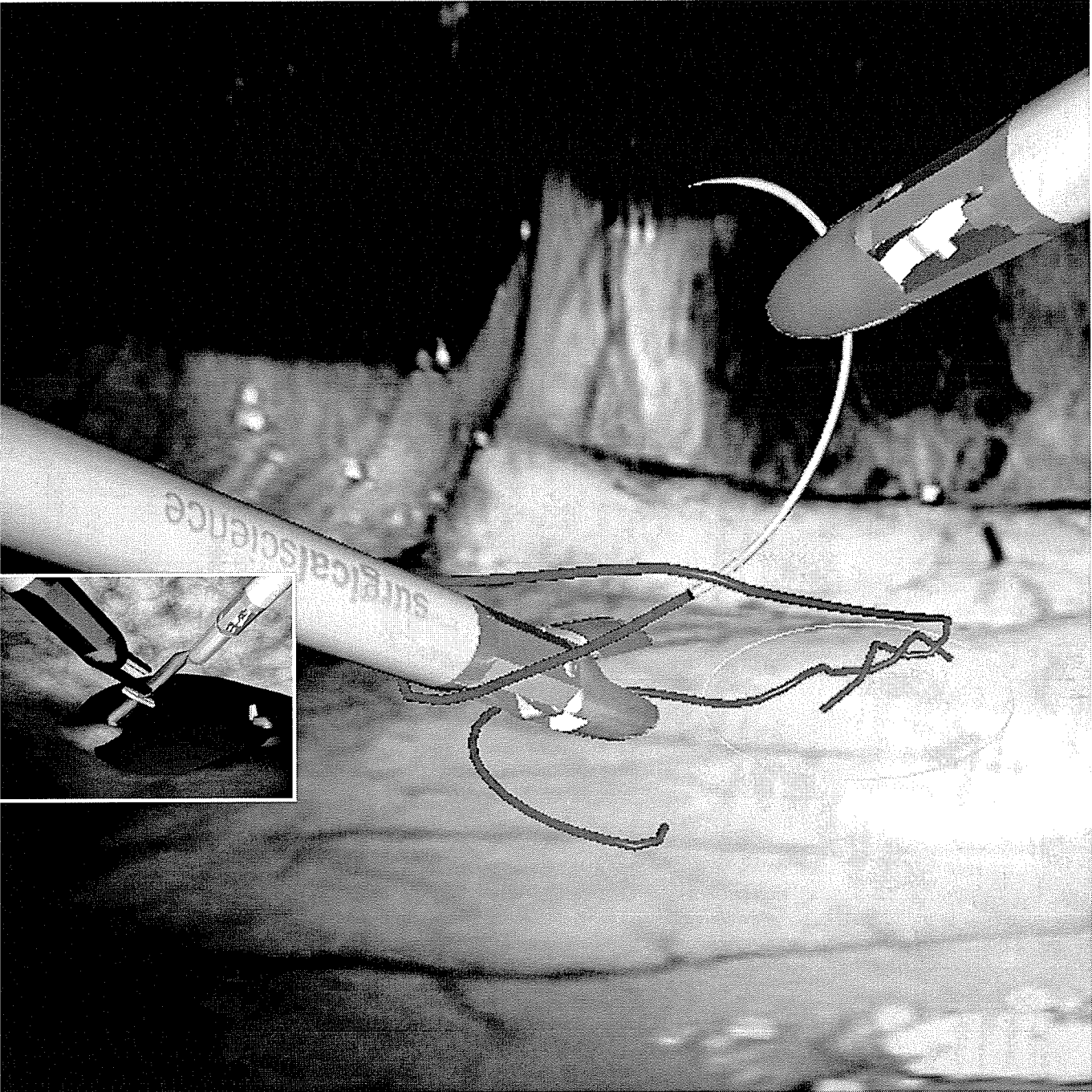
An important and unique feature of LapSim is its open-ended system for task and course customization and administration. Each training task can be edited in minute detail to provide each user with exactly the right challenge to suit his or her proficiency level. In the same way, courses consisting of a series of tasks may be tailored to the specific needs of a group of students or users. In LapSim 2.0, courses and curriculums may also be saved, exported and imported, facilitating course sharing between educators and institutions.

The particulars of each user and group of users are entered into a database. The training and examination results of each are entered into the database as the course progresses, providing the basis for accurate benchmark assessment of each surgeon's skill and ability.



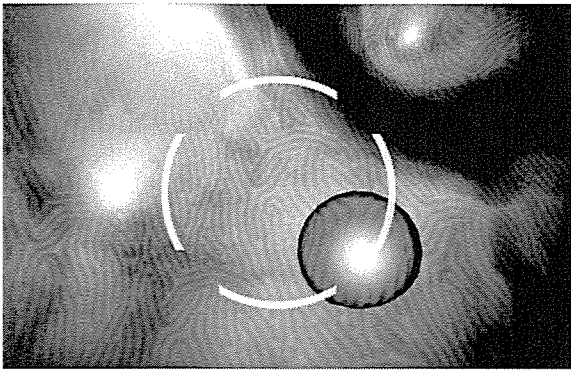
## LapSim really works!

And most importantly, LapSim really does the job it was designed to do. Validation studies show that junior surgeons trained with LapSim are more proficient in the OR compared to those trained using conventional methods. Please read on for study abstracts.





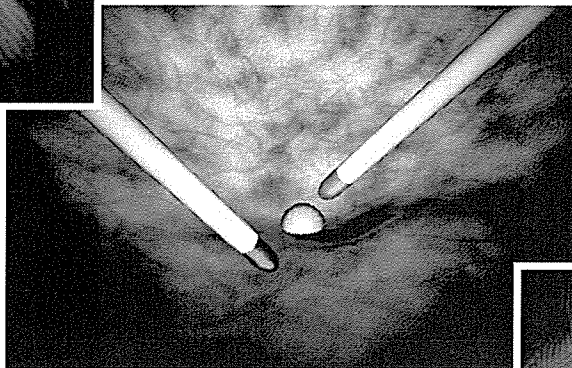
# Current LapSim® Basic Skills training modules



## Camera Navigation

Handling the camera is the first skill the aspiring surgeon has to master. Basic navigational skills and an initial feeling for how laparoscopic instruments are handled are developed.

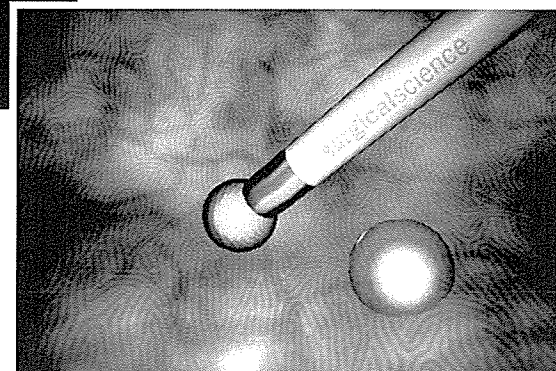
The camera is the left instrument. The object is to find the red ball on the tissue surface, zoom up to it and match its size to the on-screen circle. The camera is then held steady until the ball disappears. The next ball appears, and the exercise is repeated.



## Instrument Navigation

This module provides a safe environment in which to begin acquiring the skill of moving two instruments through three dimensions guided by a two-dimensional image.

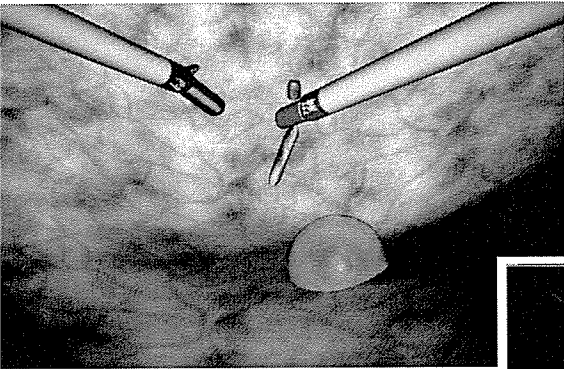
The camera is computer-controlled. The colors of the instruments correspond to the colors of the balls. When a ball appears, it is touched with the tip of the relevant instrument. The ball disappears, another appears, and the exercise is repeated.



## Coordination

Using both hands in a coordinated manner is an essential skill for the laparoscopic surgeon. In this exercise, one hand controls the camera, the other an instrument. The object is to use the instrument while simultaneously moving the camera to monitor the process.

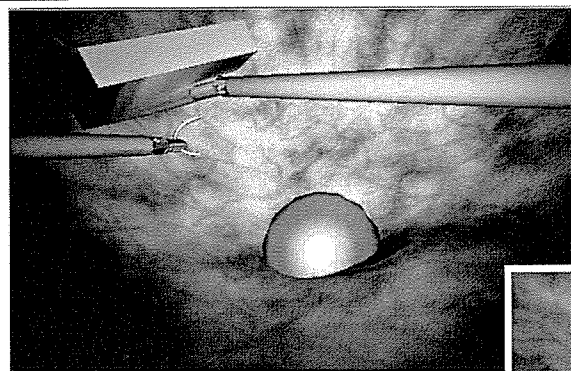
The appearing balls are picked up with the instrument and moved to a target with the camera following. When a ball is held completely inside the target, it disappears, and another ball appears.



## Grasping

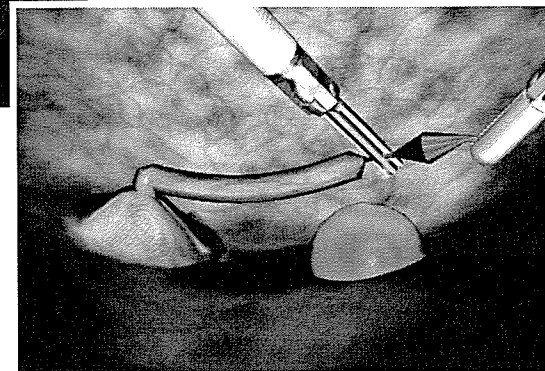
Here, the objective is to grasp, stretch and move blood vessels, using grasper instruments.

Red vessels must be grasped with the left grasper, green vessels with the right one. A vessel is grasped and moved towards the blue hemispherical target. When it is held still within the target area, the target changes color. The vessel is released and then disappears. Another vessel appears and the exercise is repeated.



## Lifting & Grasping

This module combines two tasks. First, one instrument is used to lift a generic object off the underlying tissue surface. It has to be lifted correctly in order for it not to slip off the instrument. Inserting the instrument too far will result in tissue damage. Once the covering object is held securely, the other instrument is used to grasp another small object previously hidden underneath. The final step is moving the retrieved object into a target area and releasing it.

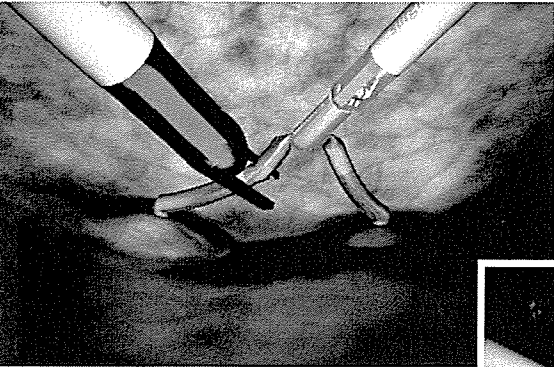


## Cutting

This module introduces the student to cutting, using ultrasonic scissors or forceps. Accordingly, it features a third manipulation device: a foot pedal used to trigger the cutting instrument.

Ultrasonic scissors or forceps are selected on-screen. The second instrument is a grasper.

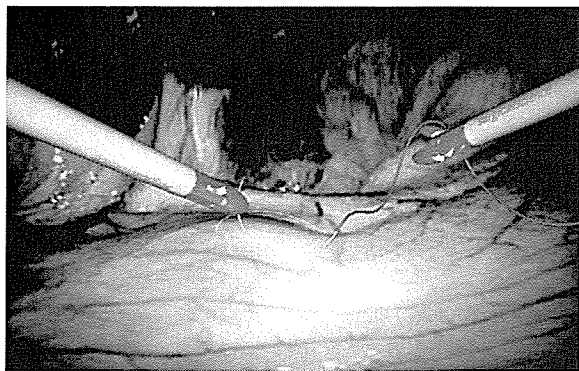
A vessel is grasped inside the green area. It is stretched until a blue segment becomes visible. The vessel is then cut through the blue area. The grasper is used to move the excised vessel section into a hemispherical "target".



## Clip Applying

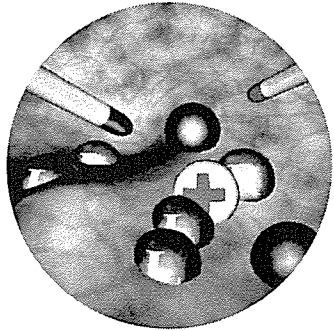
This module involves using multiple instruments, as well as increased elements of risk and stress. The instruments are clip instrument, grasper, scissors, and a suction device.

A vessel is grasped and a clip applied across the green area. The vessel is lifted, and scissors are used to cut it. An incorrectly applied clip, misguided cut, or vessel overstretching will result in bleeding, which must be stopped using the clip instrument, grasper and suction device. Any bleeding in excess of 2 litres indicates a failed exercise.



## Suturing

Suturing is the most advanced basic laparoscopic skill featured in v 2.0. The module includes a realistic graphic environment, based on actual video recordings. In this exercise, the needle must be grasped correctly and inserted into the designated area. The thread is pulled through, and must then be tied twice in the correct manner. The digitized video "tissue" reacts realistically to the manipulations of the needle. The correct knot-tying procedure may be chosen to conform with national practices.



## Precision & Speed

A light-hearted module with a serious intent. It puts precision and speed practice into a game-like context, complete with progressively more difficult "levels", scoring, time bonuses, etc.

The instruments used are two generic "pointers". The targets are red and green balls, indicating which instrument should be used to hit them. Blue targets must be hit with both instruments, gray ones avoided. Red cross-balls clear the level. As the game progresses, the tasks become more demanding with more targets, moving targets, etc.

## ...and more to follow.

LapSim's architecture allows for the progressive addition of new training modules. And since we are committed to ongoing expansion of the system, new modules are already under development.

# Course and student administration and monitoring

LapSim Basic Skills is much more than a surgical procedure simulator. With LapSim, it is possible to build complete training curriculums. The software offers extensive functions for student administration and course preparation. LapSim keeps track of each student's progress, for the benefit of both teacher and students.

These functions set LapSim apart from other surgical simulators, and they form the basis of the accurate skill assessment and benchmarking that enable LapSim Basic Skills to be a tool for future certification of surgical ability.

## Teacher functions

Each student's personal particulars are entered into LapSim's database, including name, login, date of birth, and handedness, an important factor when designing tasks. Training and examination results are recorded and displayed graphically for easy viewing. Each student's results may be viewed in minute detail, and by exporting them into standard spreadsheet formats, comparisons and evaluations can be made against a reference group.

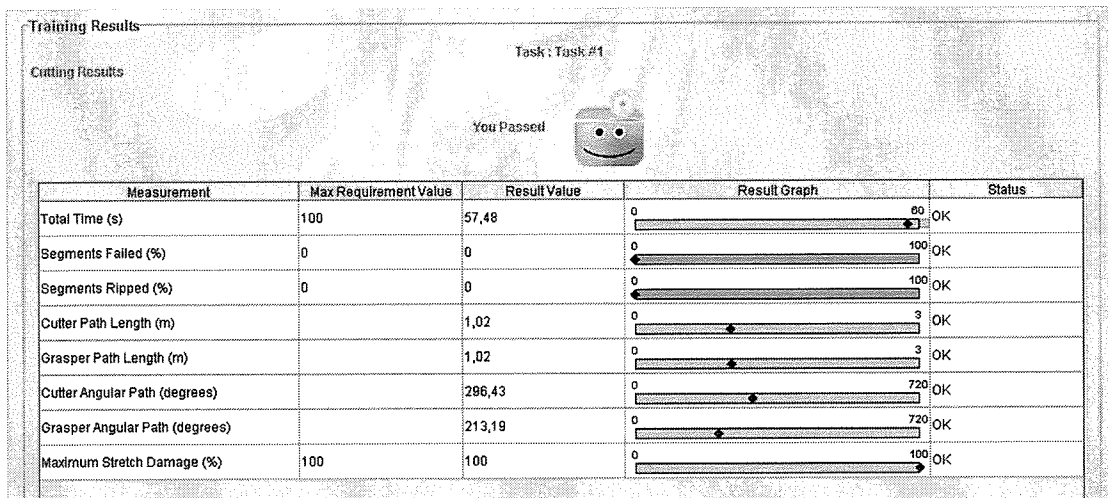
Students may be divided into classes or groups. Complete study courses can be designed for each student

individually, or for a group of students. Courses consist of tasks chosen and customized by the teacher, and are prepared using a simple, intuitive point-and-click interface. Course import-export functions make course and curriculum sharing simple and practical.

LapSim Basic Skills can be adapted to offer exactly the right level of challenge to each student, at each stage of the course. This means that the same exercise can be repeated at advancing difficulty levels as the student's proficiency increases.

## Student functions

The student database is also accessible to the students using LapSim Basic Skills. By logging into the system using a personal login name and password, the student gains access to detailed information about his or her results and progress. The data is displayed in clear and simple graphics, and can be broken down into different parameters, including time spent on exercise, hit percentage, accuracy, tissue damage, etc. "Failed" or "passed" results are clearly displayed, allowing the student to concentrate on improving weak points.



The results of each training session and examination are displayed in detail, both numerically and graphically, along with an overall "grade" of pass or fail.

# Validating LapSim® – does it improve skills in the OR?

At Surgical Science, we are anxious to validate the effectiveness of training with LapSim Basic Skills.

Currently, our system is undergoing a number of studies. So far, results are available from a study conducted by the Dept. of Surgery at the Sahlgrenska University Hospital in collaboration with the Man-Machine Dept. of the Chalmers University of Technology. The study shows that novice surgeons having trained with LapSim are more proficient when evaluated in a porcine model than those who have not. In other words, LapSim builds skills than can be transferred into the OR.

## Systematic simulator training improves performance in laparoscopic surgical procedures<sup>1</sup>

A. Hyltander, P. Rhodin, E. Liljegren, H Lonroth Dept. of Surgery Sahlgrenska Univ Hospital, Chalmers Univ of Technology, Surgical Science Ltd, Gothenburg, Sweden

### Hypothesis

To evaluate whether systematic simulator training of basic skills in laparoscopy improves performance in Minimally Invasive Surgery.

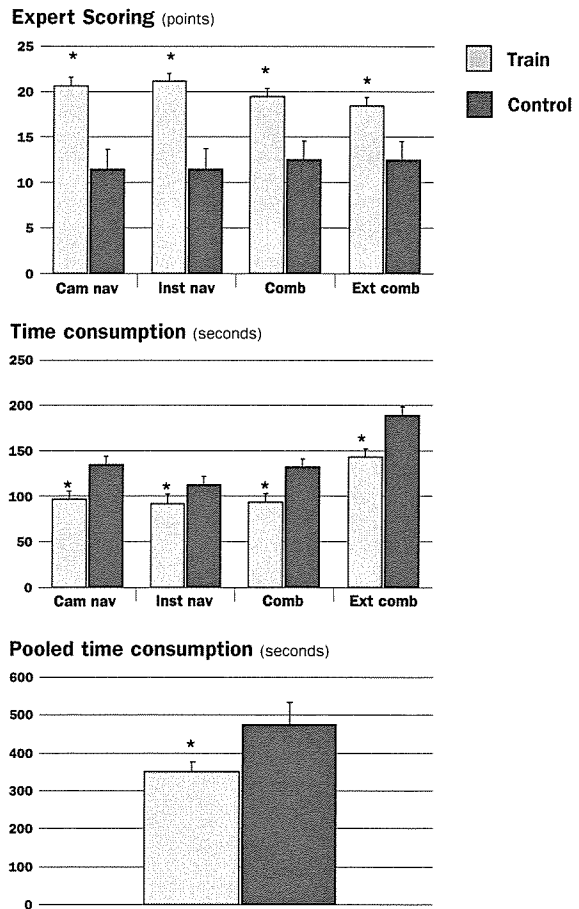
### Method

The study was prospective and randomized. A total of 24 students were included, 12 in the group training with LapSim and 12 in a control group. The groups were well balanced, according to the stratification variables. The junior surgeons trained for 2 hours per week for a period of 5 weeks. Evaluation was conducted in a porcine model.

### Evaluation

Results were evaluated using time registration, continuous video recording, as well as blind evaluation by independent experts.

<sup>1</sup>Surgical Endoscopy (2002) 16:1324-1328.



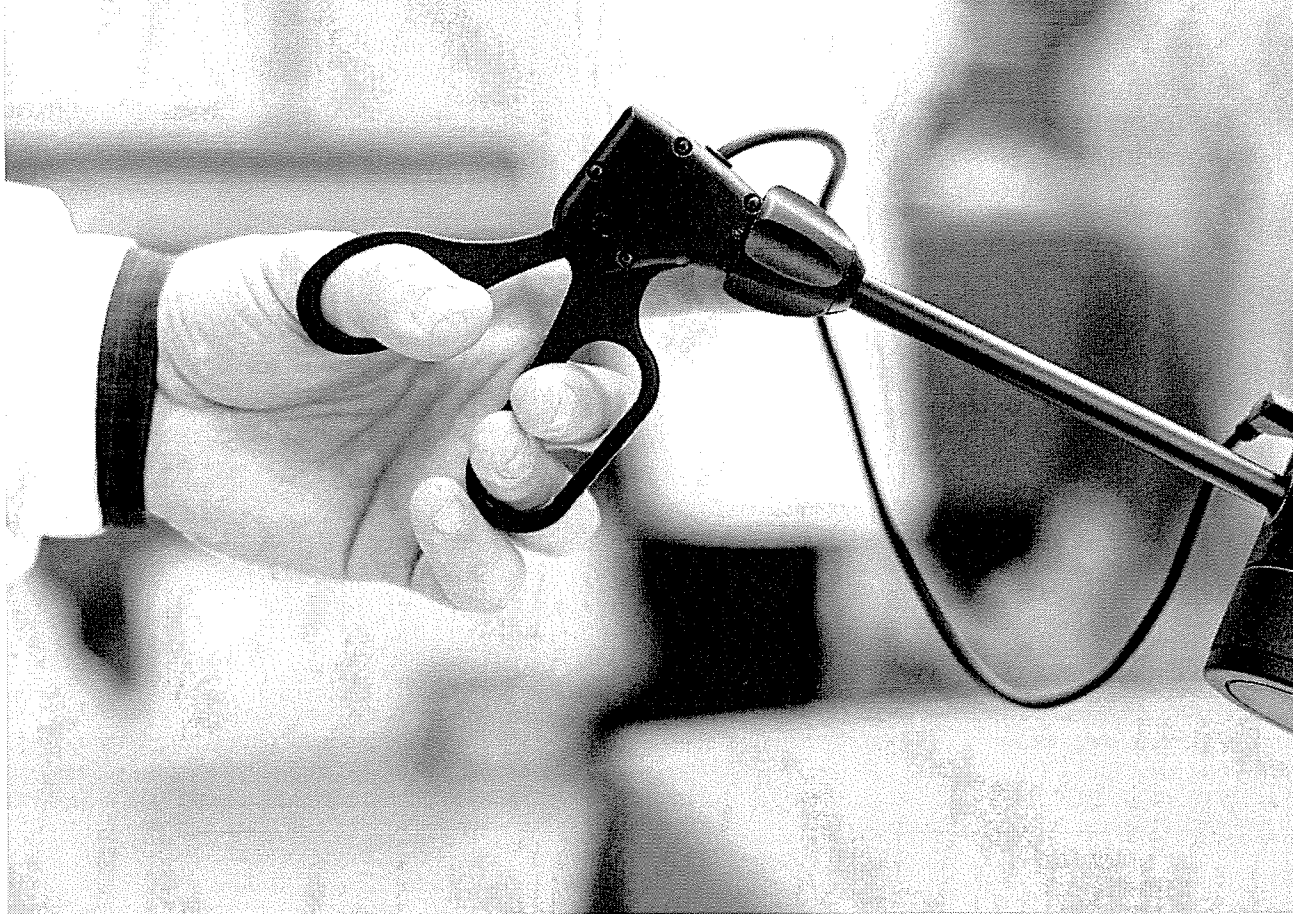
### Conclusion

Systematic training with LapSim Basic Skills in surgically inexperienced students undertaking defined basic laparoscopic procedures in a porcine model results in a significantly improved performance rate and reduced time consumption.



|                    |      |
|--------------------|------|
| time (s)           | 57.0 |
| misses (%)         | 0    |
| path (m)           | 0.57 |
| drift (mm)         | 1.32 |
| tissue damage (%)  | 0    |
| max damage (mm)    | 0    |
| angular path (deg) | 0    |

**passed**



# Technical Specifications

The LapSim system can be freely scaled to suit the client's requirements, ranging from a single software license to complete multi-user systems including VLIs, server and network solutions.

## Computer

Dual PIII 500, 128 MB RAM, 20 GB HD  
Gfx card: NVIDIA GeForce 2, 3 or 4  
Windows 2000  
Network interface card

Single PIII 1GHz, 128 MB RAM, 20 GB HD  
Gfx card: NVIDIA GeForce 2, 3 or 4  
Windows 2000  
Network interface card

Dell Inspiron 8100 Laptop  
Gfx card: NVIDIA GeForce2Go/GeForce4Go 32 MB  
Windows 2000  
Network interface card

For more information, please contact  
support@surgical-science.com.

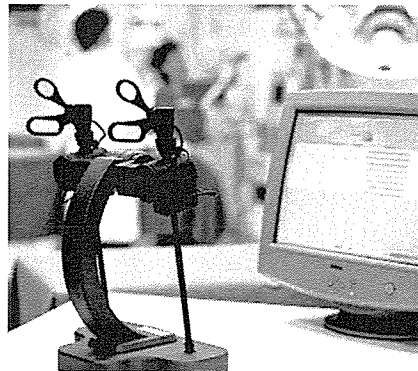
## System Features

- Standard PC and Windows compatibility
- Simple, intuitive user interface
- Highly realistic 3D graphics
- Interactive digitized video background
- Expandable, modular architecture
- 8 customizable training tasks (v 2.0)
  - Camera navigation
  - Instrument navigation
  - Coordination
  - Grasping
  - Lifting & Grasping
  - Cutting
  - Clip applying
  - Suturing

- Game-style Precision & Speed training module
- Student and course database
- Extensive student administration functions
- Course creation and administration
- Course and curriculum export and import
- Detailed training and examination results, accessible by both teacher and students
- Result statistics with graphic display
- Customizable Excel format results export

## External Hardware

Virtual Laparoscopic Interface (VLI) and/or Surgical Workstation by Immersion Inc.



**The Immersion Virtual Laparoscopic Interface tracks the motion of a pair of surgical instruments through three-dimensional space. The surgical tools pivot about their insertion points, insertion and retraction are tracked, and each instrument can spin about its insertion axis. The open-close motion of the tool handle is also tracked.**

**Seeing is believing.**  
**Watch the LapSim demo.**



# LAP Mentor™

Practice Surgery on a Virtual Patient



As a world leader in the field of medical education and simulation technology, Simbionix offers the most comprehensive medical training experience available, using the latest software and hardware technology.

## Where virtual reality comes to life

The LAP Mentor™ is specifically designed to provide comprehensive training in the field of laparoscopic surgery.

Simbionix has developed a unique technique for realistic visualization of the human anatomy and anatomy behavior. The LAP Mentor™ takes advantage of this cutting-edge technology to provide realistic hand-on training that mimics the look and feel of an actual surgical procedure.



**Simbi nix**

## **The LAP Mentor Assessments System**

The system features a built-in independent tool for managing groups or individual trainees. It easily keeps track and manages workshops, skill labs and courses.

The system provides a large number of quantitative and comprehensive performance parameters, allowing objective trainee performance assessments and running extensive performance statistics on an individual or a group. It serves as a useful and efficient tool for studies and future certification.

The LAP Mentor performance metrics provide assessment of basic laparoscopic skills, as well as performance measurement of full laparoscopic procedure!

### **The LAP Mentor™ system meets all of your laparoscopic surgery training needs**

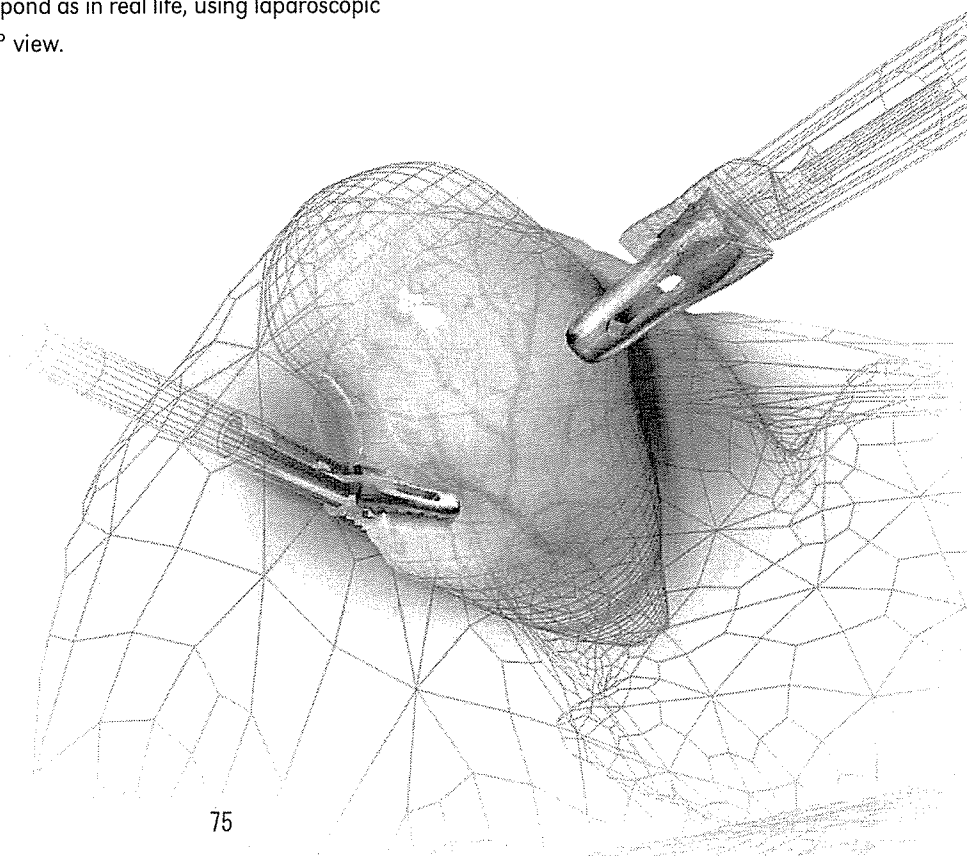
The system is aimed at enhancing operational and medical decision making, improving medical training, and expanding physiological and medical knowledge

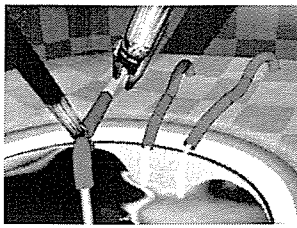
#### **Growing library of modules**

The LAP Mentor training system has been developed in collaboration with medical experts from around the world. It incorporates a variety of practice opportunities and provides a laparoscopic training curriculum made up of basic skills, tutorial procedural tasks and simulation of a full procedure. This cost effective design achieves the goal of a simulator that can accommodate on-going development including the addition of new laparoscopic procedures.

Simulation of full procedure modules incorporate a library of virtual patients based on realistic anatomies created from CT/MRI images of real patients. Each patient case, with anatomical variations and pathologies, includes a history complete with imaging and lab test results.

The simulator utilizes actual surgical instrumentation, allowing practice of laparoscopic instruments that respond as in real life, using laparoscopic cameras with a choice of 30° or 0° view.

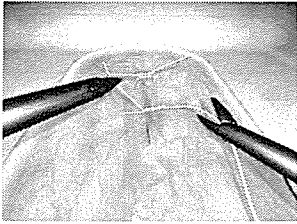




#### Basic Tasks Module

Didactic Laparoscopic skills for all fields of laparoscopic surgery in a non-anatomic setting.

In a relaxed environment outside of the OR, this module enables acquisition of basic-level skills that are essential to building confidence and ease with laparoscopic techniques. Tasks resemble those that are performed during surgery.



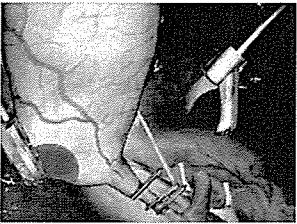
#### Suturing Modules

Simbionix suturing module consists of two unique modules, designed for all fields of laparoscopic surgery.

The suturing modules allow surgeons to gain proficiency in advanced suturing techniques, and provide a perfect training environment similar to real life practice.

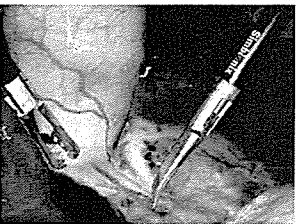
It features realistic tissue behavior and realistic simulation of surgical thread, and allows training of continuous or interrupted suture and different knots. Additionally, it allows training of needle insertion and suturing in challengeable suture line angles.

The tutorial tasks are accompanied by instructional videos to enhance the training process.



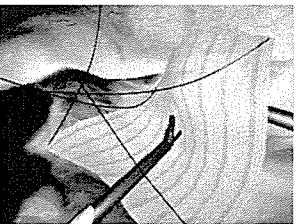
#### Lap Chole - Procedural Tasks Module

A step-by-step tutorial of didactic, tasks with each task focusing on one critical stage of the Lap Chole procedure. The tasks are in an anatomical setting with visual signs and instructions on how to perform a safe procedure. This module is aimed at learning the visual clues of traction-counter traction of tissue (using virtual tissue), and finding areas of weakness that require additional practice.



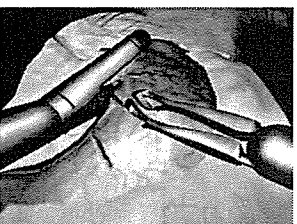
#### Lap Chole - Full Procedure Module

Virtual patient cases of complete Cholecystectomy procedures. Trainees can practice complete virtual Cholecystectomy procedures with life-like sensations that mimic the feel of an actual lap procedure. By using the new Simbionix's random anatomy engine – the same patient case will appear with various alterations to cystic duct and artery positions, mimicking real life in which each patient has a different anatomy. This module is aimed at developing judgment and learning interpretation of anatomical and operative findings. Trainees gain experience of different techniques and alternative approaches to LapChole, and acquire skills and know-how for safely coping with surgical complications.



#### Incisional hernia – Full Procedure Module.

A unique module that provides surgeons with life-like practice of laparoscopic incisional hernia, in a controlled and safe environment. The module aims at enhancing training techniques unique to laparoscopic incisional hernia repair, gaining an in-depth understanding of the abdominal anatomy, becoming skilled at carefully separating the adhesion to expose the hernia defect, appreciate potential complications, and practicing safe use of prosthetic mesh and devices used to fixate, suture and staple the mesh.



#### Gastric Bypass full procedure module – Soon to be released!

A unique module that provides surgeons with life-like practice of laparoscopic gastric bypass procedures. The module aims at practicing technical aspects of laparoscopic Roux-en Y creation and the jejunojunostomy, acquiring skills of gastrojejunal anastomosis creation and understanding intra-operative problems during Lap Bypass and how to avoid them.

The LAP Mentor utilizes several hardware interfaces, based on unique high-end haptic or tracking systems. The hardware technology allows using laparoscopic instruments that respond as in real life. The LAP Mentor is available with or without haptic sensation. All systems share the same software capabilities.

## Technical Specifications

### Measurements:

Height 66" (166 cm)

Width 47" (120 cm)

Depth 21" (54 cm)

Total weight < 200Kg

17" flat LCD touch screen

Two instruments with five degrees of freedom

High performance force feedback devices (haptic system only)

### One Endoscope:

Four degrees of freedom

Adjustable positioning

Freeze picture switch

Foot switch for activation of electrosurgical coagulation

### Simulation Processing Unit:

Intel Motherboard

CPU: Intel TM Pentium 4, 2.8GHz class or better

Operating System: Microsoft Windows XP

All components of the system are UL & CE marked

Simbionix reserves the right to change the LAP Mentor specifications with no prior notice

All trademarks are the property of their respected owners

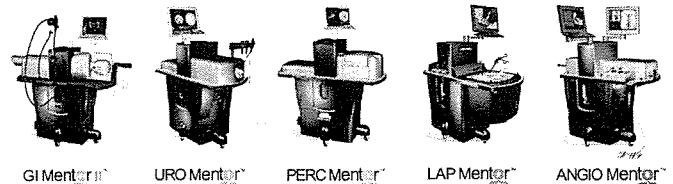
# Simbionix

## The SIMBIONIX Line of Medical Training Simulators

Simbionix is a multinational medical simulation company with headquarters in Cleveland, Ohio. The company has been developing and producing PC based training simulators for Minimally Invasive Surgery (MIS) since 1997. Today, with an impressive product line of simulators, the company is the leader in medical simulation for MIS.

The Simbionix team includes experts in 3D graphics, image processing and design engineering, coupled with a marketing and sales team with a customer-first orientation.

Visit our web site for more information on the company  
and our product line: [www.simbionix.com](http://www.simbionix.com)



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