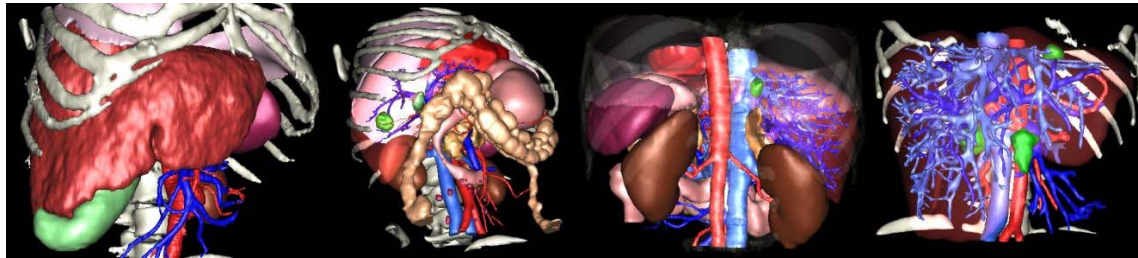


PASSPORT

PASSPORT: PATient-Specific Simulation and PreOperative Realistic Training for liver surgery

We will present several results of the PASSPORT project through:

- **Live demonstration** of patient-specific surgical planning software
- **Videos** of intraoperative use of the computer-assisted surgical software



Patient-specific geometrical modelling: image segmentation followed by 3D mesh generation.

About PASSPORT

Short summary:

In 2006, over 45,000 European citizens died of cirrhosis of the liver and 44,000 additional citizens of liver cancer, knowing that the same year 48,700 new liver cancer cases were declared. Surgical procedures remain the options that offer the foremost success rate against such pathologies. Regrettably, surgery is not so frequent due to several limitations. Indeed, eligibility for liver surgery is based on anatomical and biological parameters that vary over time and from one patient to another. PASSPORT for Liver Surgery aims at increasing surgical eligibility by offering preoperative surgical simulation based on patient-specific modelling that combines anatomical, mechanical, appearance and biological preoperative modelled information. PASSPORT also aims at developing software allowing to use these models for hepatic surgical planning and education.

Main Outcomes

PASSPORT aims at offering the first patient-specific modelling that combines anatomical, mechanical, appearance and biological preoperative modelled information in a unified model of the patient so as to propose the first complete "Virtual Liver". To reach this objective, **PASSPORT** will:

- o develop an innovative open-source and multi-level patient-specific model combining anatomical, mechanical, functional and biological liver properties,
- o develop novel dynamic modelling, integrating predictive liver regeneration, organ motion and deformation and providing the patient-specific minimal safety standardized Future Liver Remain,
- o generate a highly realistic simulation environment for liver surgery planning and training,
- o validate all simulation models with internationally renowned medical experts.

Technological Impact:

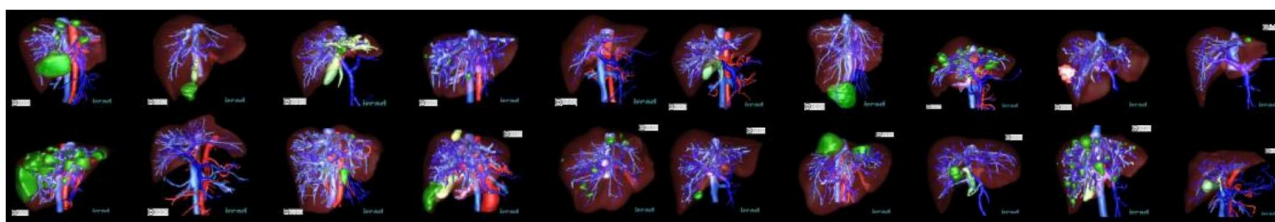
Eligibility for surgical resection is not only based on geometrical information (total liver volume) or topological information (vascular networks), but also on the physiological and biological state of patients (due to chemotherapy or pathology such as fibrosis). The resulting minimal safety standardized Future Liver Remain is therefore a dynamic patient-specific value. The current evaluation of this value remains approximate and is very generic, reducing surgical eligibility. **PASSPORT** proposes to solve this complex limitation by developing the first patient-specific virtual liver, which will be composed of several integrated models providing all required information: anatomy, mechanics, appearance, and biology (cells modelling and tumour classification).

Societal and economic Impact:

By integrating these models in a unified virtual liver, PASSPORT allows patient-specific preoperative surgical planning and simulation including resection and post-operative liver regeneration based on physiological and biological modelling. Moreover, thanks to this modelling, PASSPORT has permitted the development of a new liver functional anatomy based on a topological ontology. Validated on 50 medical images of patients, it avoids the current mistakes of Couinaud's segmentation described by Couinaud himself in an article published in 2002 where he demonstrated that the standard 8 anatomical segments delimitation was correct in only 40% of cases. These results contribute to realize safe, controlled and predictable liver surgeries with a better post-operative knowledge of the liver regeneration. The current multicentric clinical validation will confirm an increased rate of operative solutions which will heal and save patients with serious liver diseases. PASSPORT also helps reinforcing the European competitiveness and market perspectives. Indeed, the international market in surgical simulation is currently changing due to the involvement of the surgical industry. PASSPORT will offer Europe's

leading company in surgical instrumentation a real and efficient competitive tool on the surgical market against its international competitors.

From our results, we have created an online service providing patient modelling to several associated European clinical teams. First results clearly demonstrate the cost effectiveness and the benefits of the resulting patient-specific surgical planning based on a more precise Future Liver Remain volumetry. The next step will now consist in commercializing such a service. This commercialization will represent a first step towards the routine clinical use of PASSPORT results, giving citizen access to those developments. Moreover, PASSPORT offers several open results to the scientific community such as two open source libraries dedicated to computer assisted surgical software development (the framework for software production line: <http://code.google.com/p/fw4spl>) and surgical simulation (Simulation Open Framework Architecture: <http://www.sofa-framework.org>). An open anonymous database of real clinical cases containing medical images in DICOM and 3D models of organs is also freely available on the PASSPORT website.



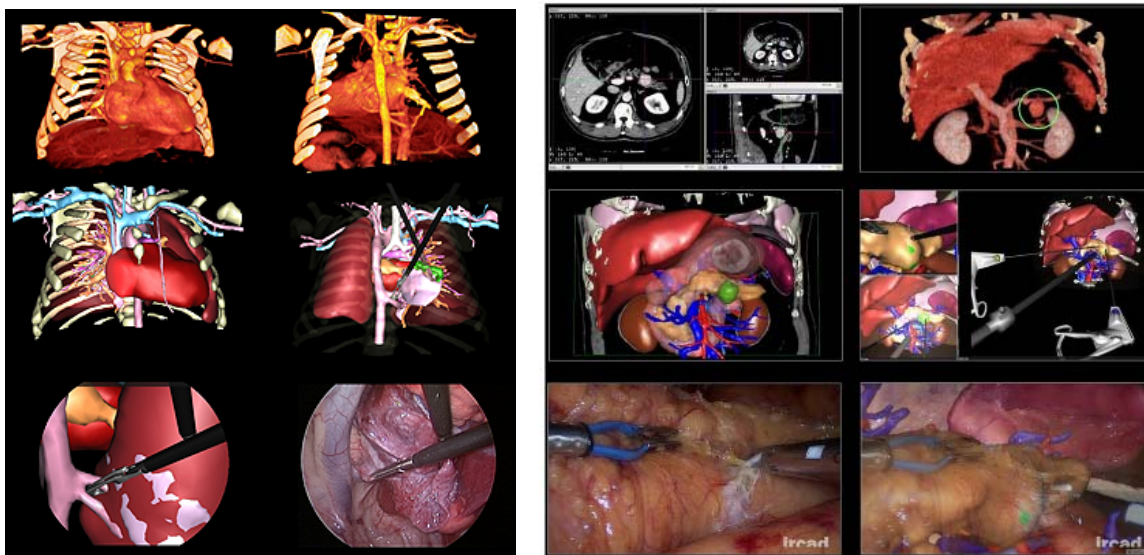
3D IRCADb 01: database containing 20 livers, including 3D models of patient.

In the news/Awards:

Media coverage broadcast both on television and an internet TV channel:

- ARTE: "Xenius", 13 April 2010 → European Communication in French and German
- Pratis-TV : "VR-Render : vos images scanner en 3D", 18 June 2009
- FRANCE 5 : "Le magazine de la santé ; 7 minutes pour une vie : l'IRCAD », 10 July 2008.

Award: First Prize for Best Biomedical Visualization 3D software in the medical field, awarded to IRCAD during the MICCAI 2008 (figure below, left) and 2009 (figure below, right) conference.



Link to video:

- [http://www.websurg.com/ref/Segment_III_hepatocellular_carcinoma_\(HCC\)_and_major_liver_cirrhosis%253A_laparoscopic_resection-vd01en2659_fr.htm](http://www.websurg.com/ref/Segment_III_hepatocellular_carcinoma_(HCC)_and_major_liver_cirrhosis%253A_laparoscopic_resection-vd01en2659_fr.htm)
- http://www.websurg.com/ref/Laparoscopic_resection_of_liver_segments_V_and_VIII_for_colorectal_metastasis-vd01en2689_fr.htm
- http://www.websurg.com/ref/Laparoscopic_hepatectomy_for_a_left_8cm_hepatocellular_carcinoma_after_embolization_for_bleeding-vd01en2889_fr.htm

Download the VR-Render software: <http://www.websurg.com/software/vr-render/>
 PASSPORT website: <http://www.passport-liver.eu/Homepage.html>



Exhibition Floor - EC booth n° 311 – Wednesday 11 May

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