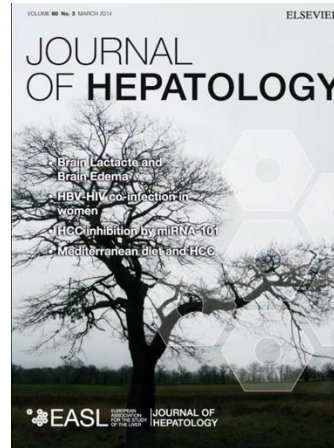


A new look at liver anatomy 10 years later

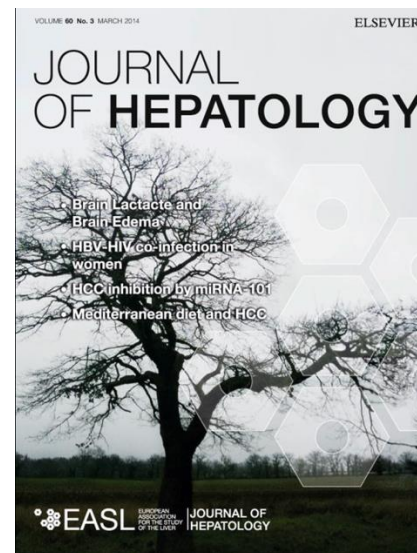
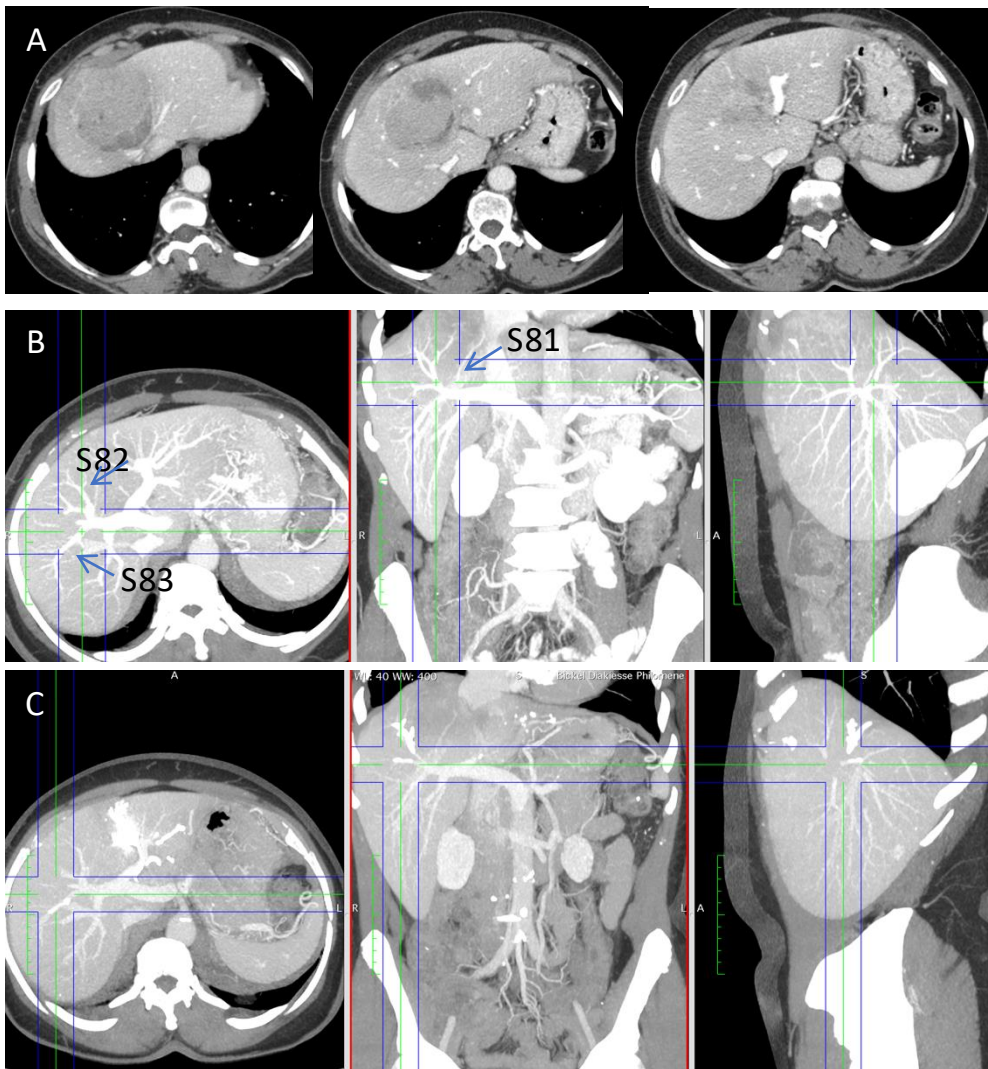
Are we ready to make sense of it?



Ente Ospedaliero Cantonale

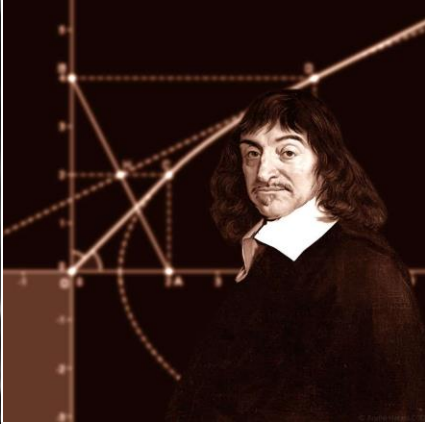
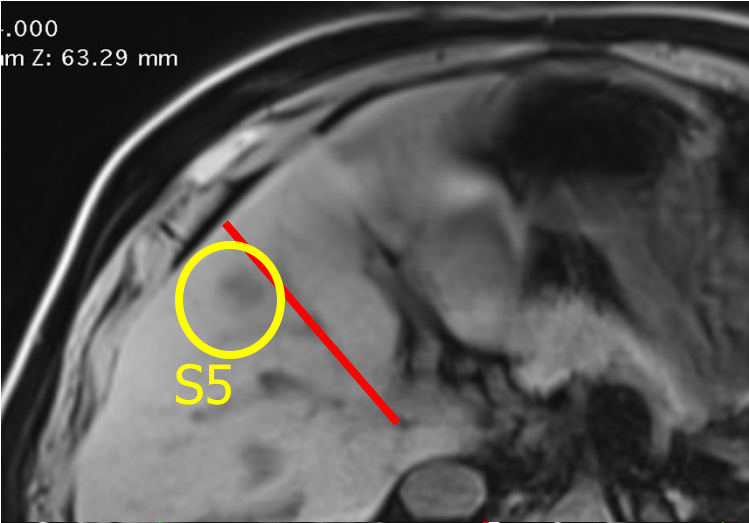
Unità EPB, Servizio di Chirurgia viscerale, Ospedale di Lugano
Facoltà di Scienze biomediche, Università della Svizzera Italiana



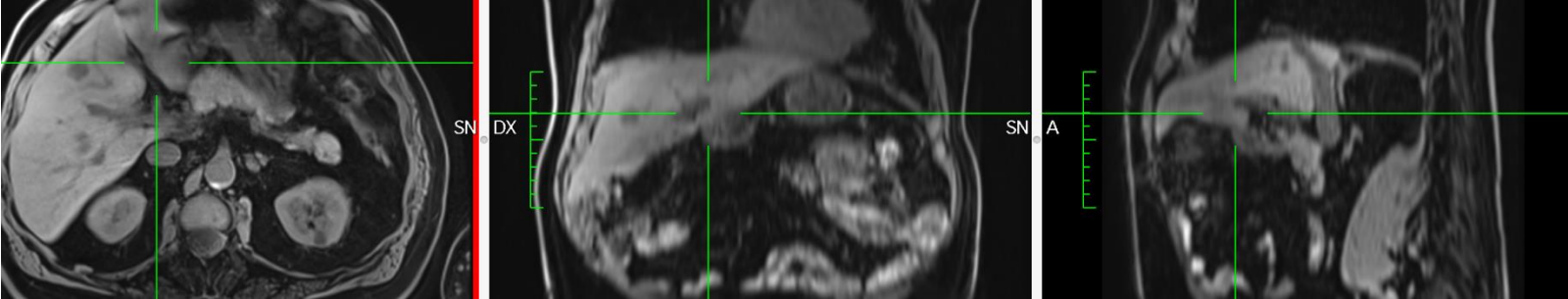


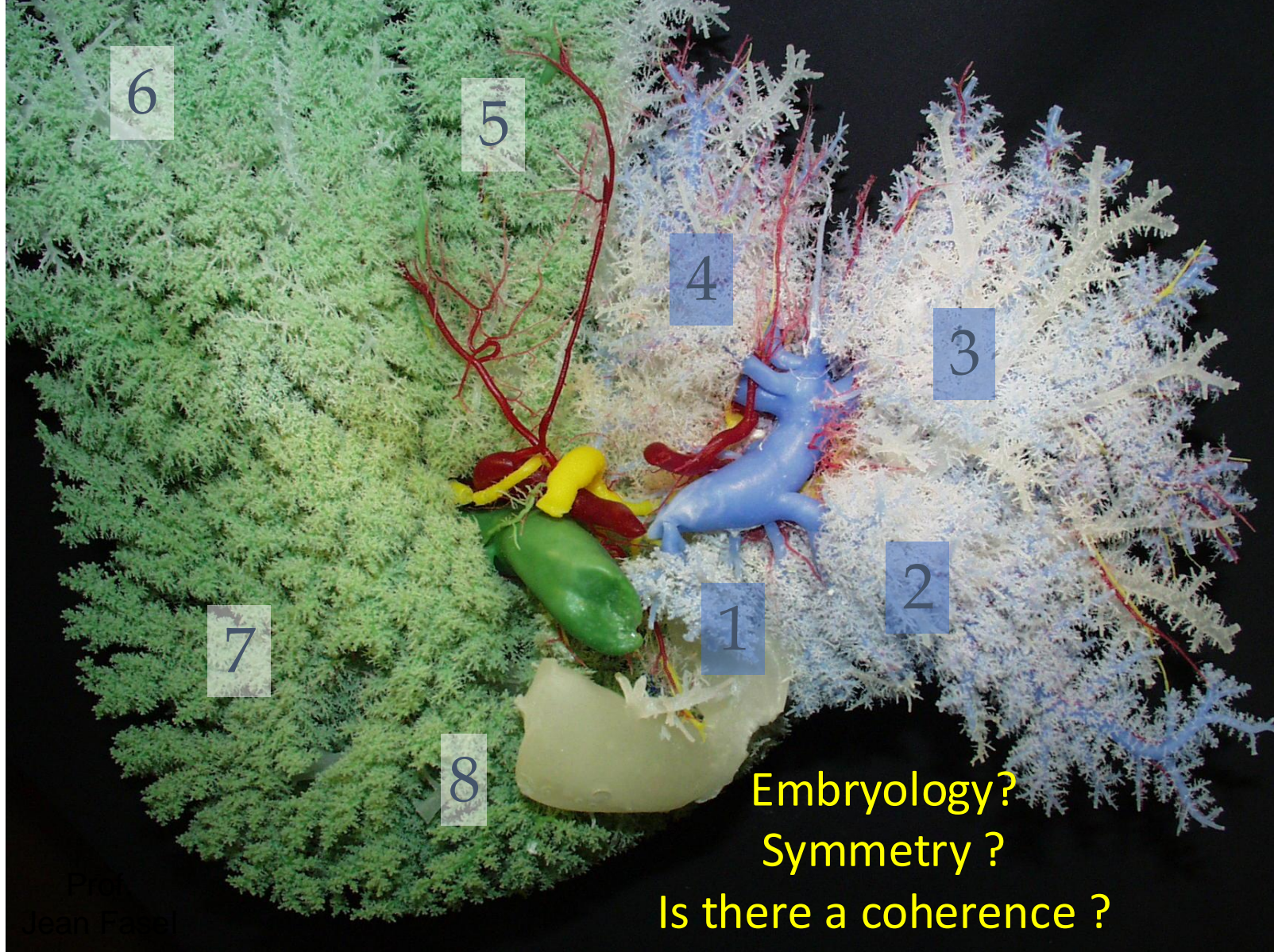
No need to make sense of the portal anatomy, just learn how to use it in the specific patient.

Couinaud will stay: admirable cartesian esperanto to communicate the location of liver lesions

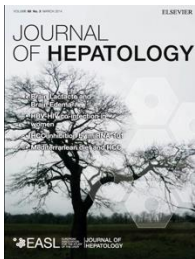


N=8 (9?)
Franco Filipponi





Embryology?
Symmetry ?
Is there a coherence ?



LIVER

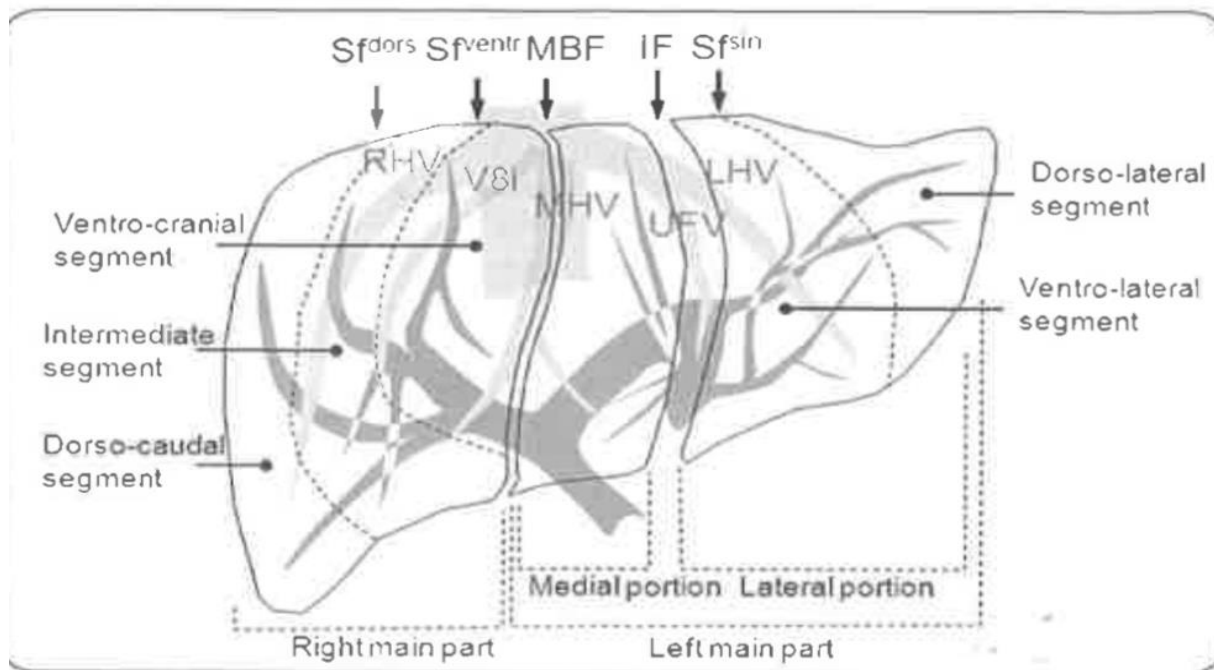
Hidden Symmetry in Asymmetric Morphology: Significance of Hjortsjo's Anatomical Model in Liver Surgery

Junichi Shindoh, Shoichi Satou, Taku Aoki, Yoshifumi Beck, Kiyoshi Hasegawa, Yasuhiko Sugawara and Norihiro Kokudo

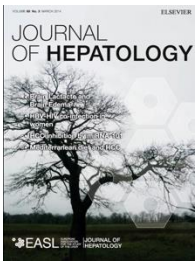
Hepato-Biliary-Pancreatic Surgery Division, Department of Surgery,
Graduate School of Medicine, University of Tokyo

Corresponding author: Norihiro Kokudo, MD, PhD, Hepato-Biliary-Pancreatic Surgery Division, Department of Surgery,
Graduate School of Medicine, University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo, 113-8655, Japan;
E-mail: kokudo-2S@

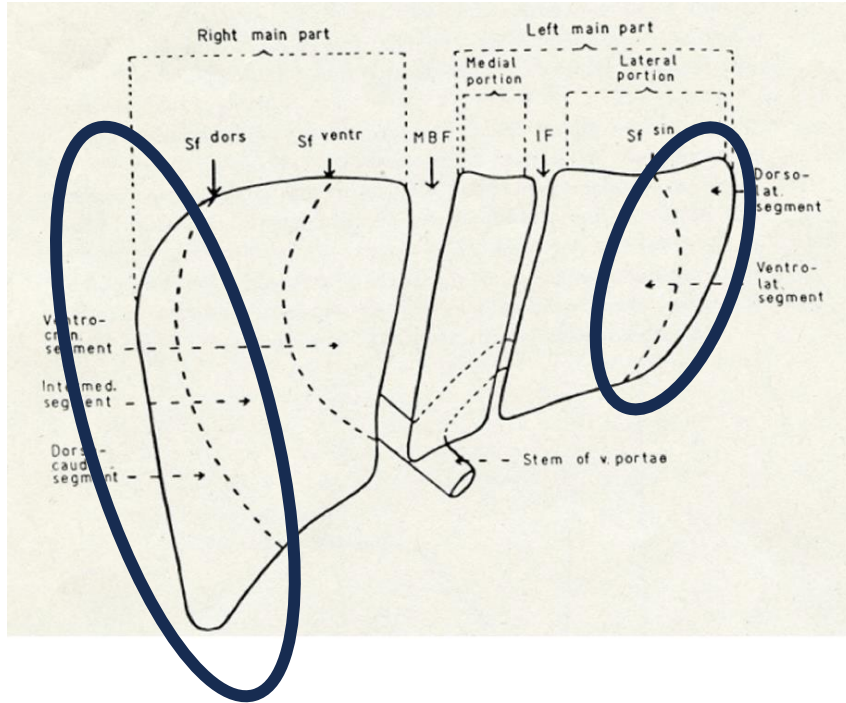
Hepatogastroenterology 2012



Junichi Shindoh
(Hasegawa
Kokudo)



Hjortsjö: the symmetry in 4 sectors



Two lateral sectors

Carl-Herman Hjortsjö



Carl-Herman Hjortsjö né le 8 décembre 1914 à Malmö en Suède et mort le 3 juillet 1978 à Varberg, est un anatomiste suédois connu pour ses travaux sur l'expression faciale. Ses travaux ont influencé Freitas-Magalhães and Paul Ekman dans ses recherches.

[Wikipédia](#)

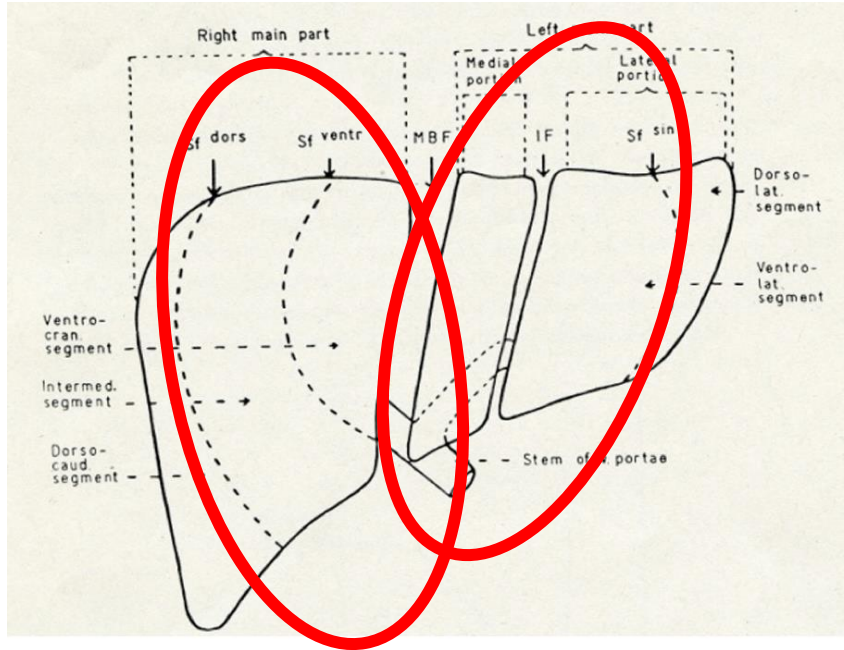
Date de naissance : 8 décembre 1914

Date et lieu de décès : 3 juillet 1978, [Suède](#)

Livres : [The Human Skull: A Technical Construction and Schematic Interpretation](#)

Commentaires

Hjortsjö: the symmetry in 4 sectors



Two median sectors

Carl-Herman Hjortsjö



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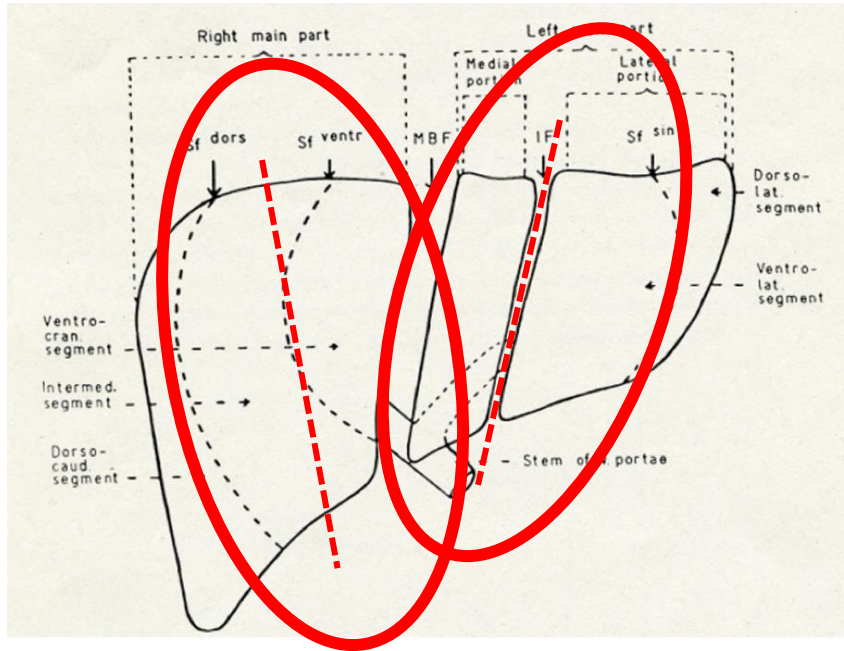
[Wikipédia](#)

Date de naissance : 8 décembre 1914

Date et lieu de décès : 3 juillet 1978, [Suède](#)

Livres : [The Human Skull: A Technical Construction and Schematic Interpretation](#)

Hjortsjö: the symmetry in 4 sectors



Two median sectors
Divided longitudinally

Carl-Herman Hjortsjö



Carl-Herman Hjortsjö né le 8 décembre 1914 à Malmö en Suède et mort le 3 juillet 1978 à Varberg, est un anatomiste suédois connu pour ses travaux sur l'expression faciale. Ses travaux ont influencé Freitas-Magalhães and Paul Ekman dans ses recherches.

[Wikipédia](#)

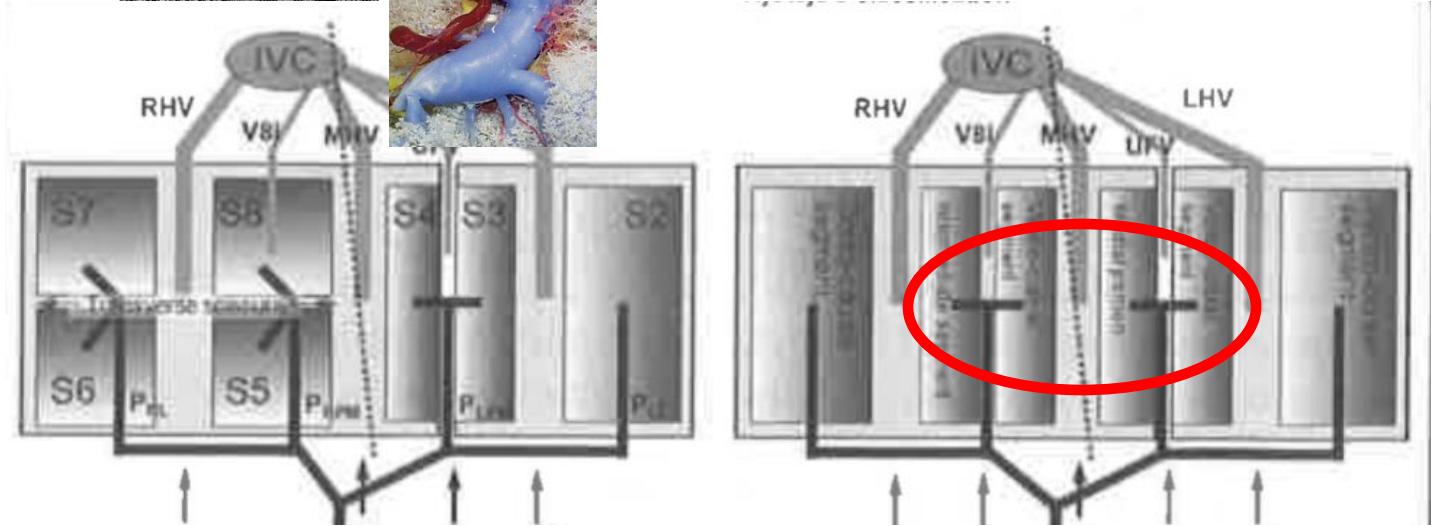
Date de naissance : 8 décembre 1914

Date et lieu de décès : 3 juillet 1978, [Suède](#)

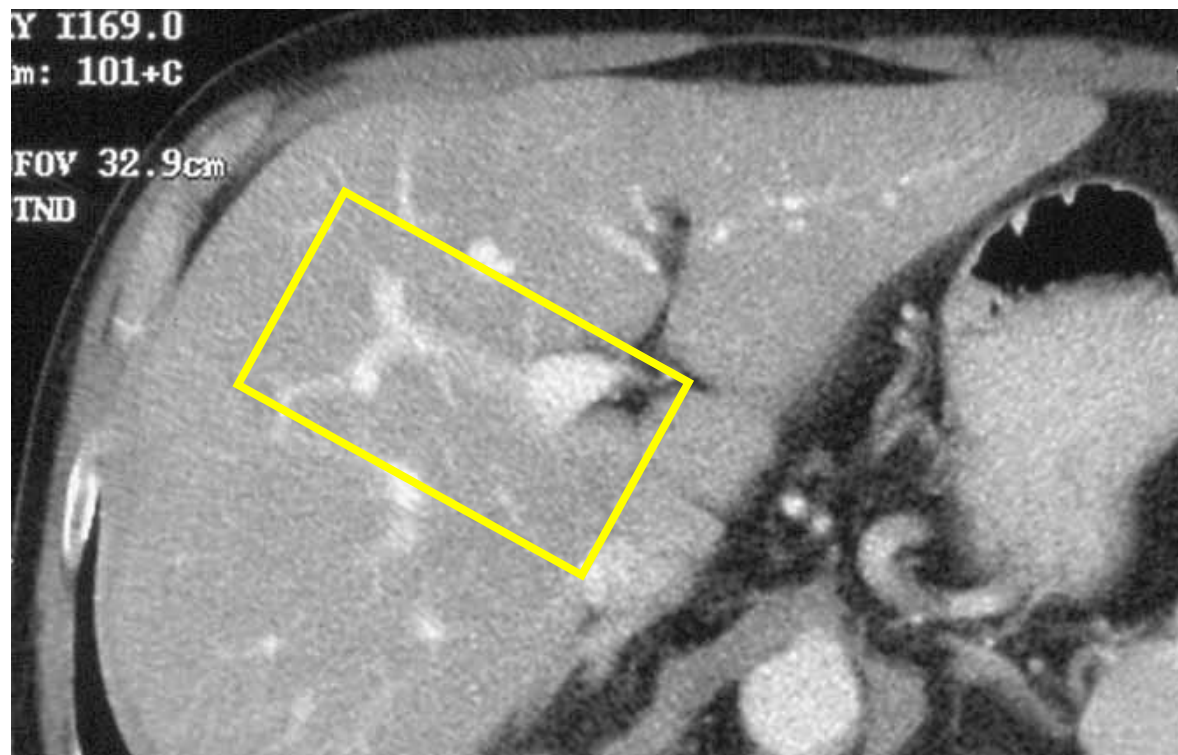
Livres : [The Human Skull: A Technical Construction and Schematic Interpretation](#)

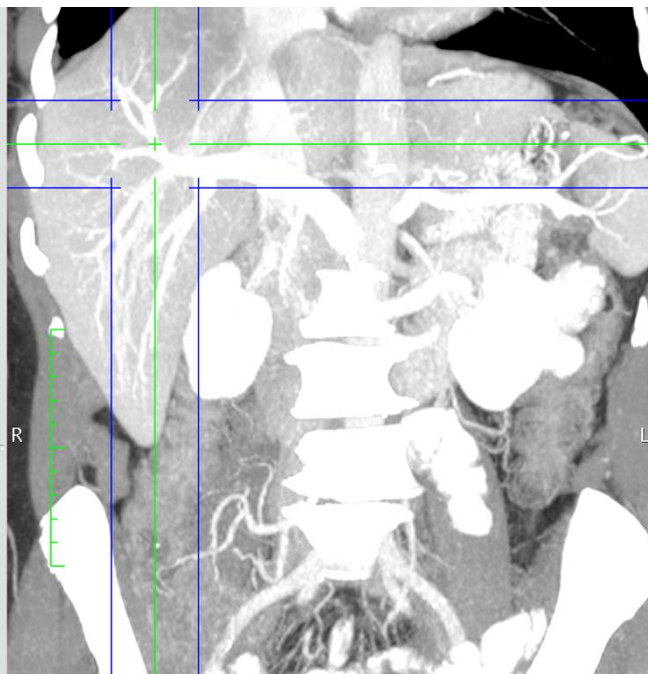
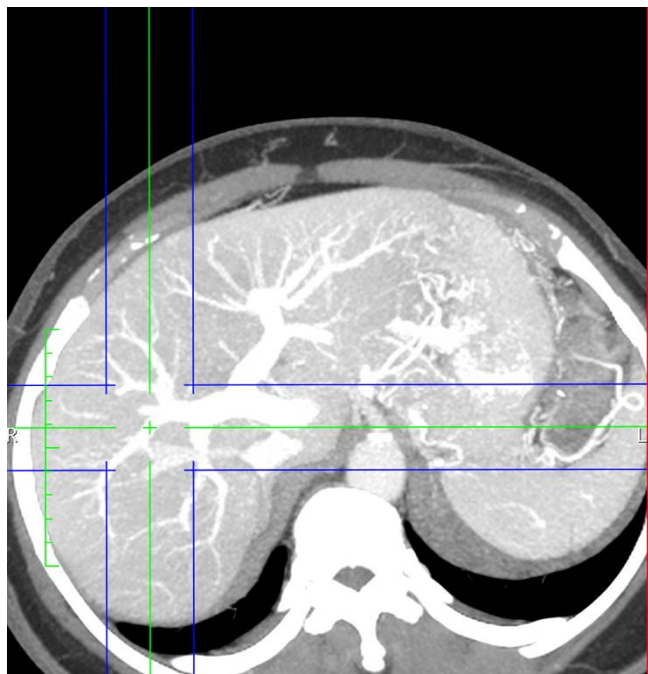


The synthesis



The right anterior sectorial pedicle is the « pendant » of the left (umbilical) portal pedicle





Why I like it

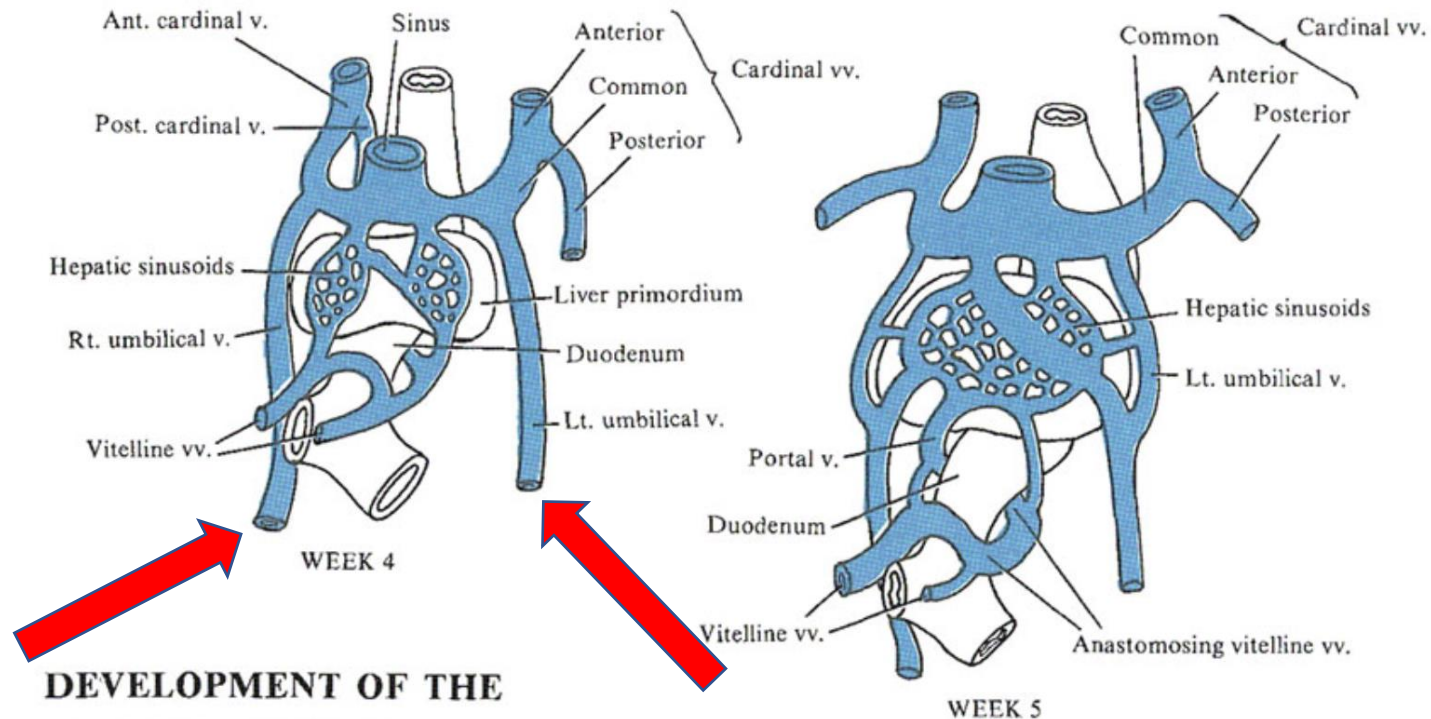


Ente Ospedaliero Cantonale



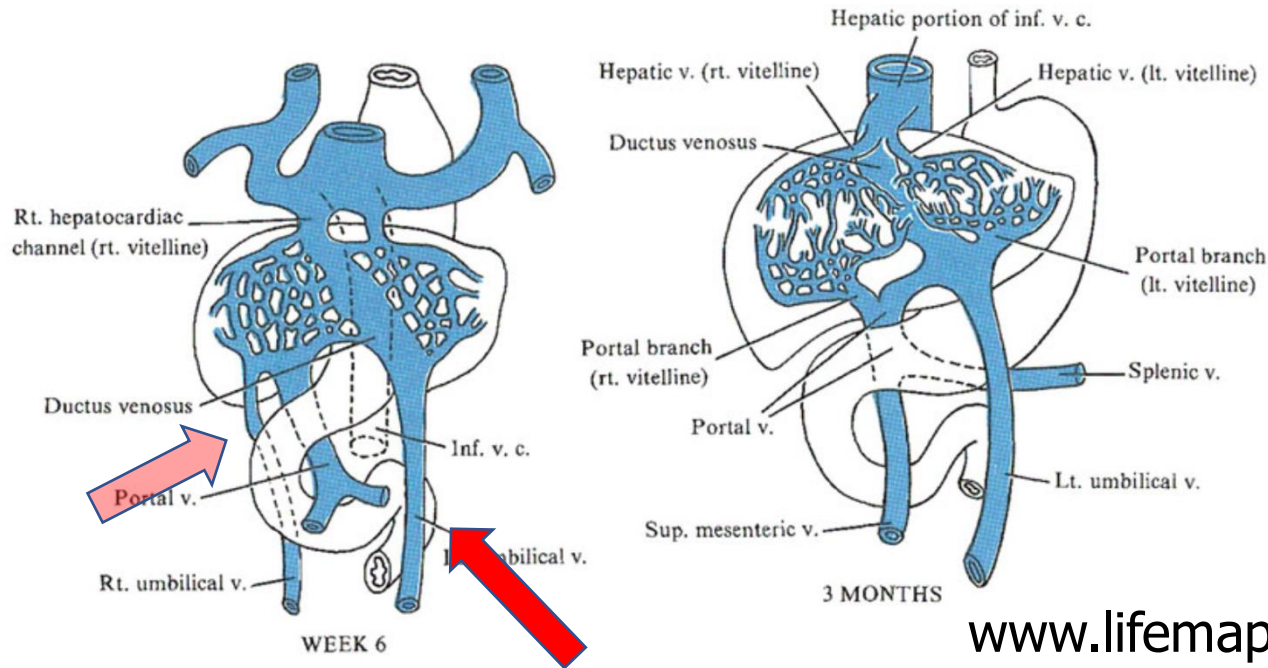
Embryology is highly compatible with Hjortsjö

We have two umbilical veins (for a while)



**DEVELOPMENT OF THE
PORTAL SYSTEM**

The left umbilical vein is kept open for oxygenated blood in Arantius'shunt (2)

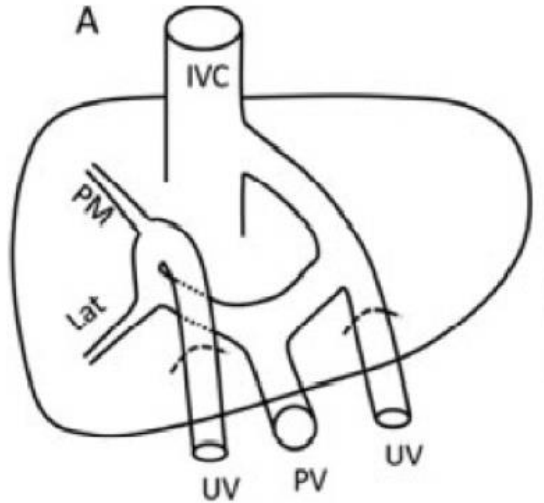


www.lifemaps.com

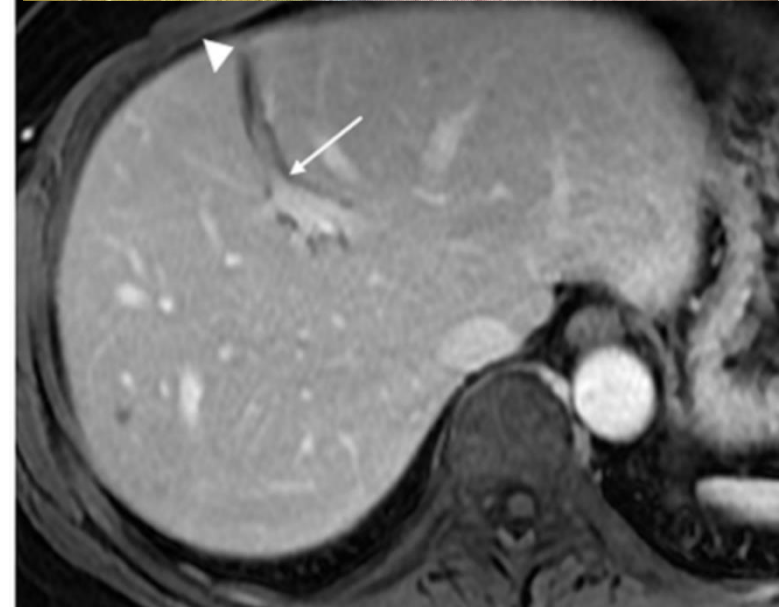
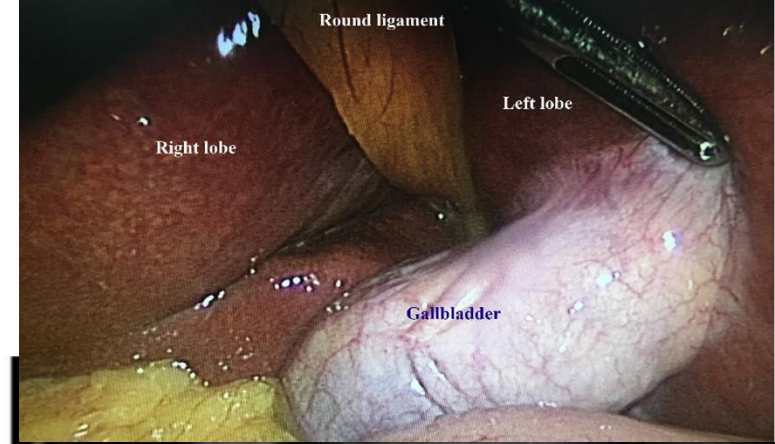
On the right, the shunt and UV go away, and the liver is free to grow large

Two umbilical veins: The symmetry pointed out by a mistake:

Sometimes the embryo gets mixed up and underlines the symmetry: **right umbilical vein**



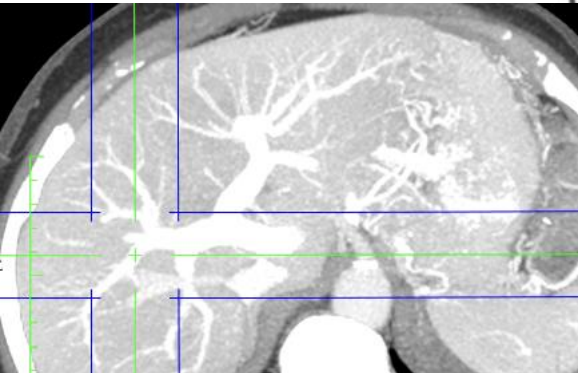
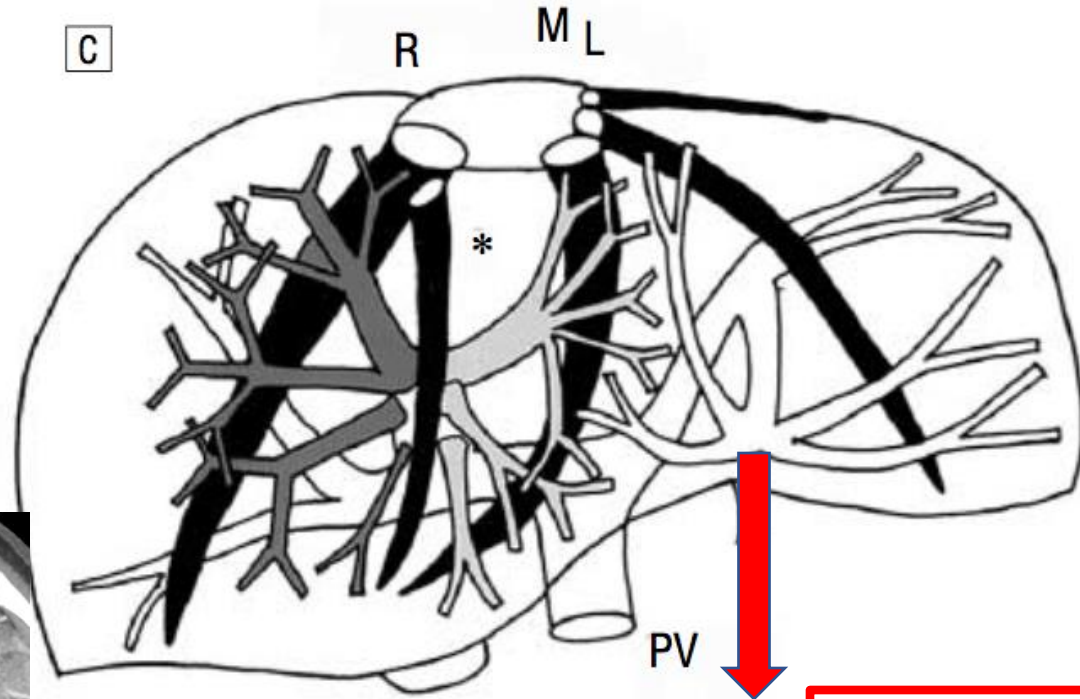
Makuuchi Ann Surg 2013



Lin, *Insights Imaging* 9, 955–960 (2018)

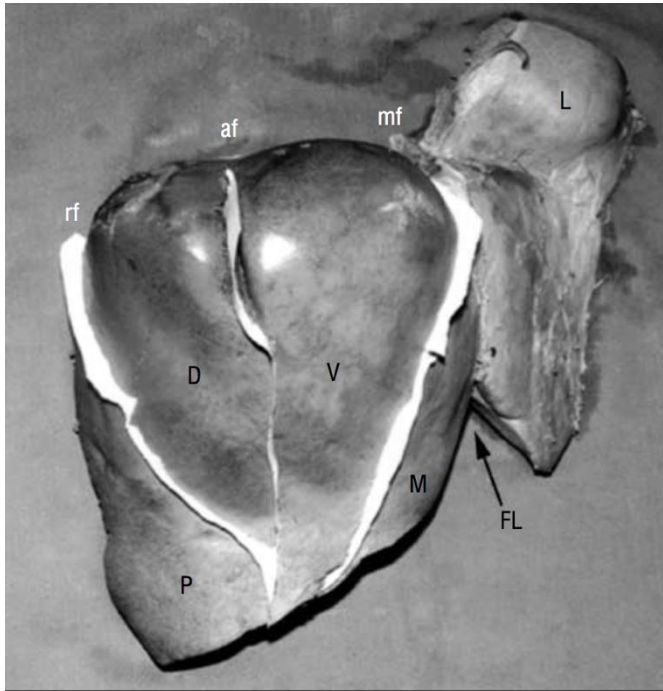
Why is the symmetry difficult to see?

A «pendant», but tethered by the round ligament...



This is why the LPV points towards us and up in CTs

This is confirmed in quantitative studies

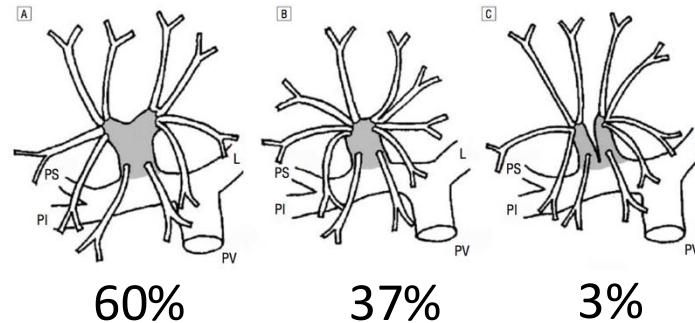


ORIGINAL ARTICLE

Reproposal for Hjortsjo's Segmental Anatomy on the Anterior Segment in Human Liver

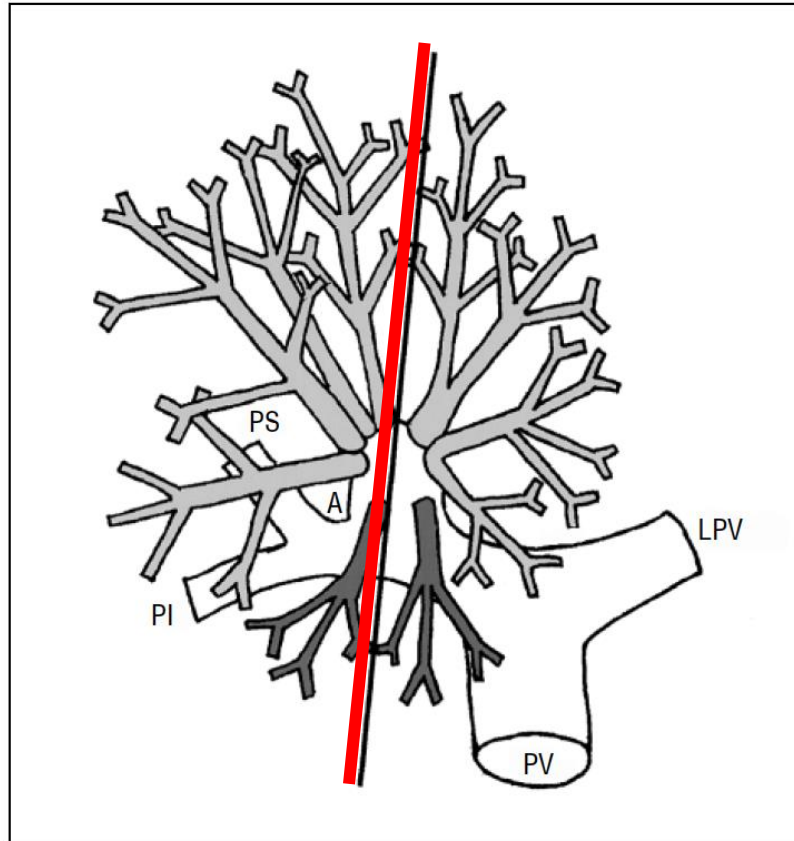
Kimitaka Kogure, MD, PhD; Hiroyuki Kuwano, MD, PhD; Noboru Fujimaki, MD, PhD; Harunori Ishikawa, MD, PhD; Kuniaki Takada, PhD

Kogure Arch Surg 2002



65 livers dissected

3rd order branches: in **all** livers there is a vertical separation, in **none** a horizontal separation



Clear vertical plane
(separation)

No clear horizontal plane
(intermingling)

Kogure Arch Surg 2002

Hidden Symmetry in Asymmetric Morphology: Significance of Hjortsjö's Anatomical Model in Liver Surgery

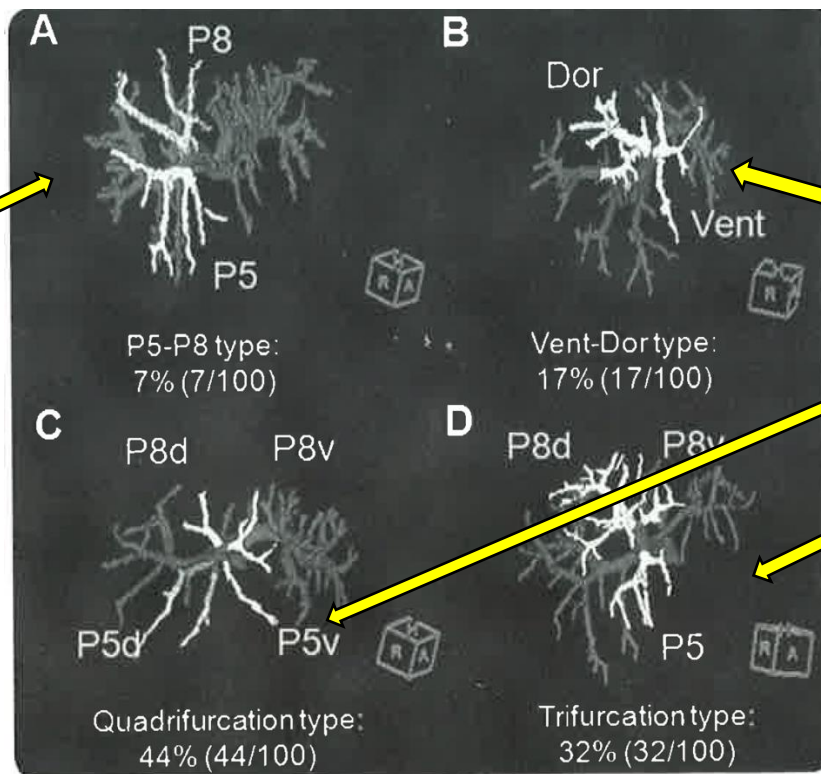
Junichi Shindoh, Shoichi Satou, Taku Aoki, Yoshifumi Beck, Kiyoshi Hasegawa, Yasuhiro Sugawara and Norihiro Kokudo

Hepato-Biliary-Pancreatic Surgery Division, Department of Surgery,
Graduate School of Medicine, University of Tokyo

Corresponding author: Norihiro Kokudo, MD, PhD, Hepato-Biliary-Pancreatic Surgery Division, Department of Surgery,
Graduate School of Medicine, University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo, 113-8655, Japan;
E-mail: kokudo-2SU@h.u-tokyo.ac.jp

Radiological confirmation (100 livers):

Hepatogastroenterology 2012

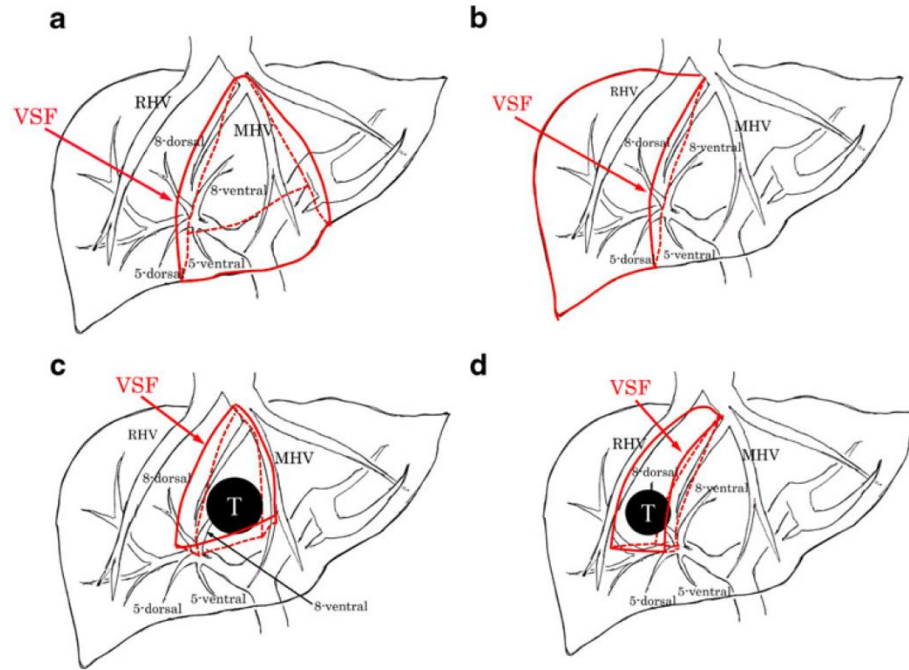


Hjortsjö beats
Couinaud 93/7



For the anterior sector
Hjortsjö beats Couinaud
93/7

Does this matter in practice?



New hepatectomies become easily conceivable,
for the anterior and posterior sector

Brustia et al. HPB 2024

Extended Resection

Ok*

Segment V

SUPER ET

ANTONIO SKÁRMETA
IL POSTINO DI NERUDA

“Facciamo della poesia senza saperlo...”

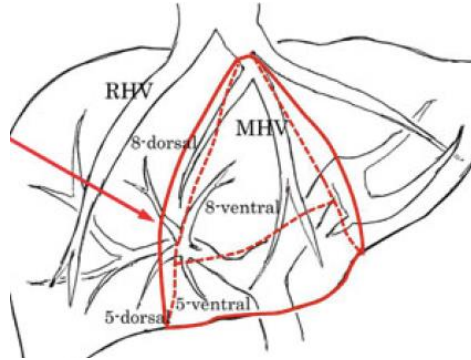
R0 = Lymph

Aloia, HPB 2015

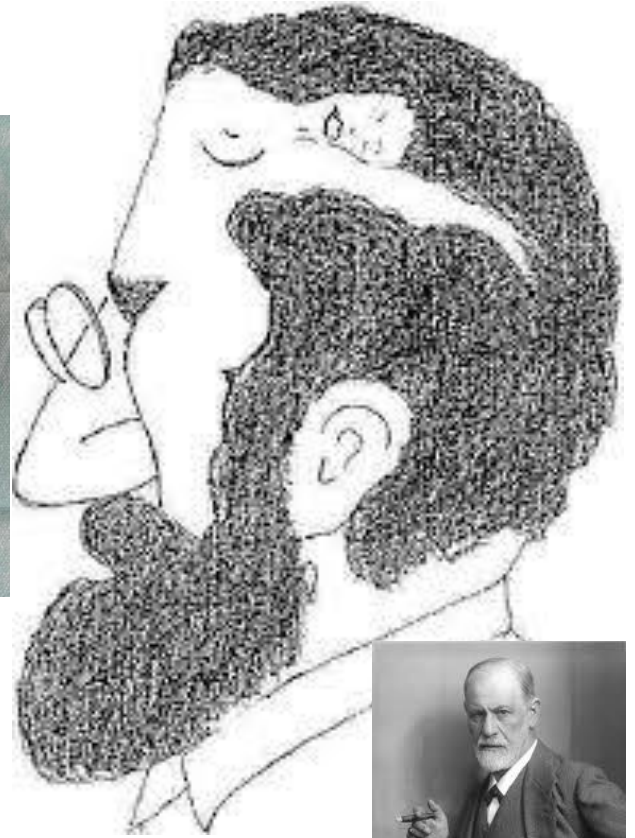
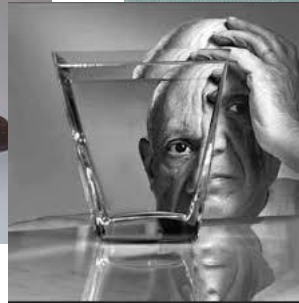
et al. J Hepatobiliary Pancreat Sci. 20

Central hepatectomy for angiomyolipoma

Preserving the “lateral” anterior and the posterior sector

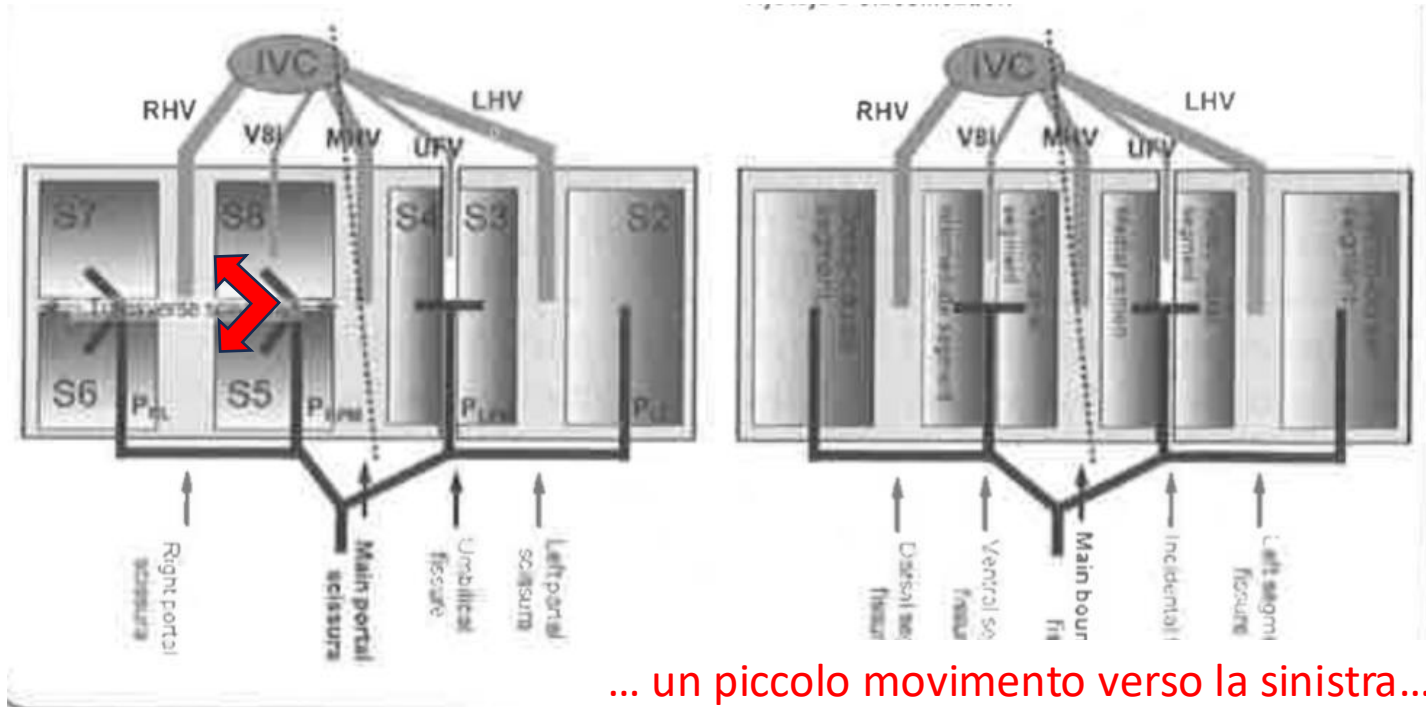


With understanding a new look is possible...





In the end, not a big revolution:
to give sense to the portal
segmentation...



Is it the same as the Cone Unit resection concept?

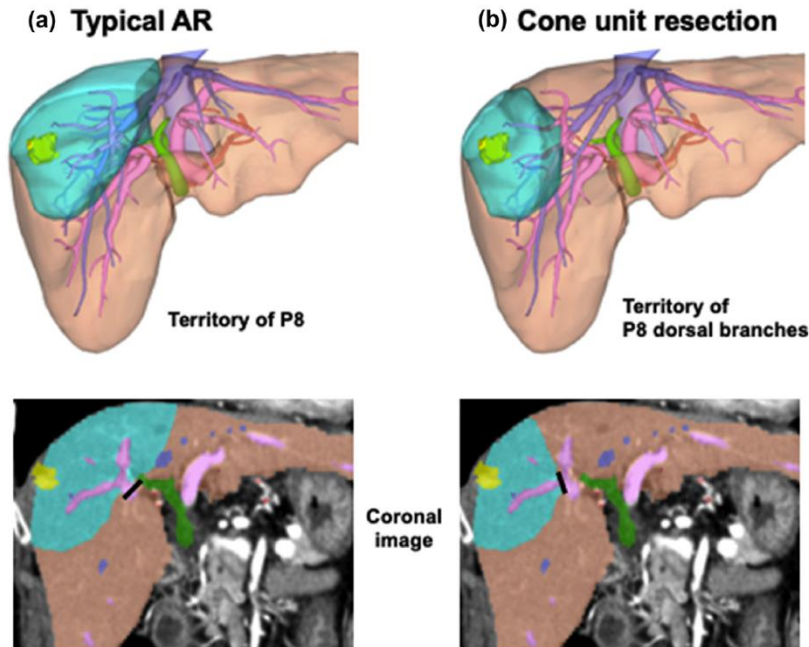


Figure 1 Simulation image by portal segmentation. (a) **Typical AR**: Couinaud's segment 8 visualized as the territory of P8, (b) **Cone unit resection**: small segment visualized as the territory of some P8 dorsal branches

Highly compatible!

- Acknowledges the high and variable number of portal territories
- Does not try to systematise them into a conceptual framework

Is it the same as Takasaki's representation?

K. Takasaki: Glissonean pedicle transection

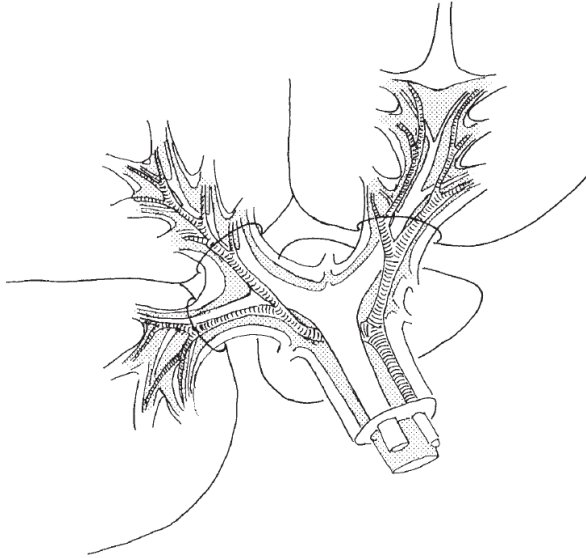


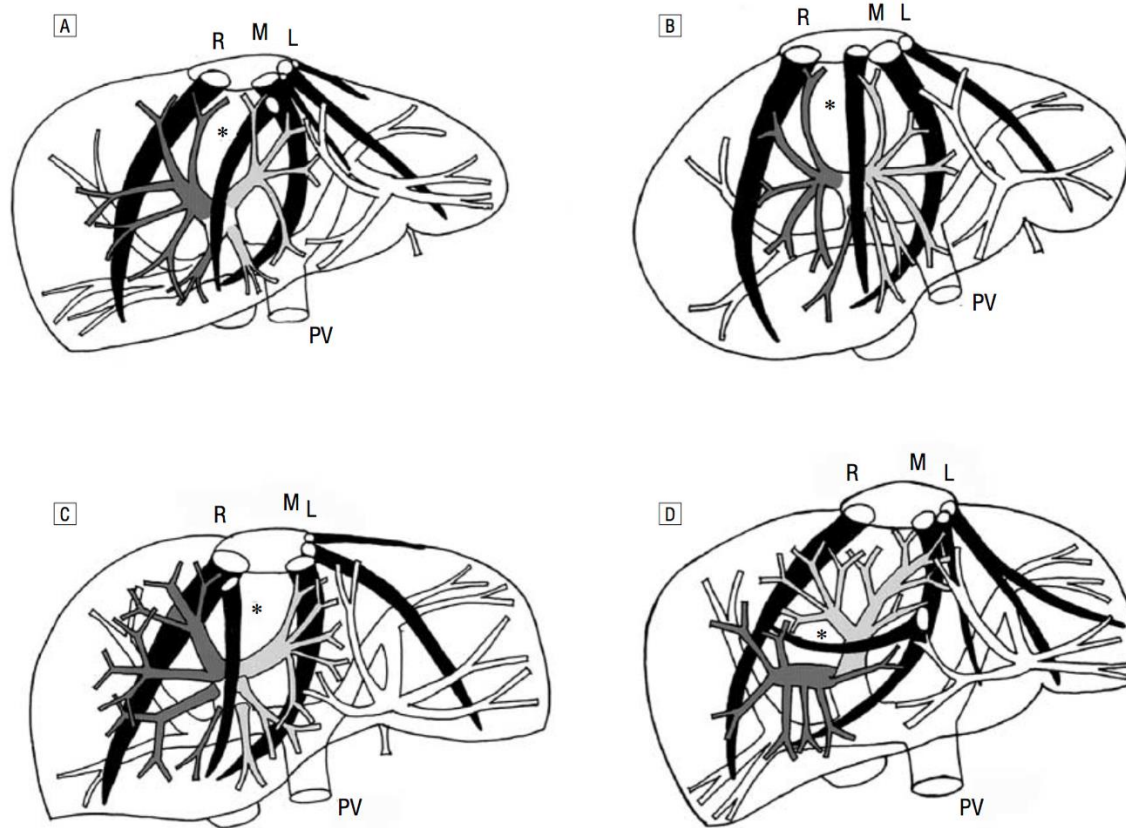
Fig. 1. The trees of the Glissonean pedicle. Three components, artery, vein and bile duct, wrapped with connective tissue and anatomically the same structure, extend into the liver

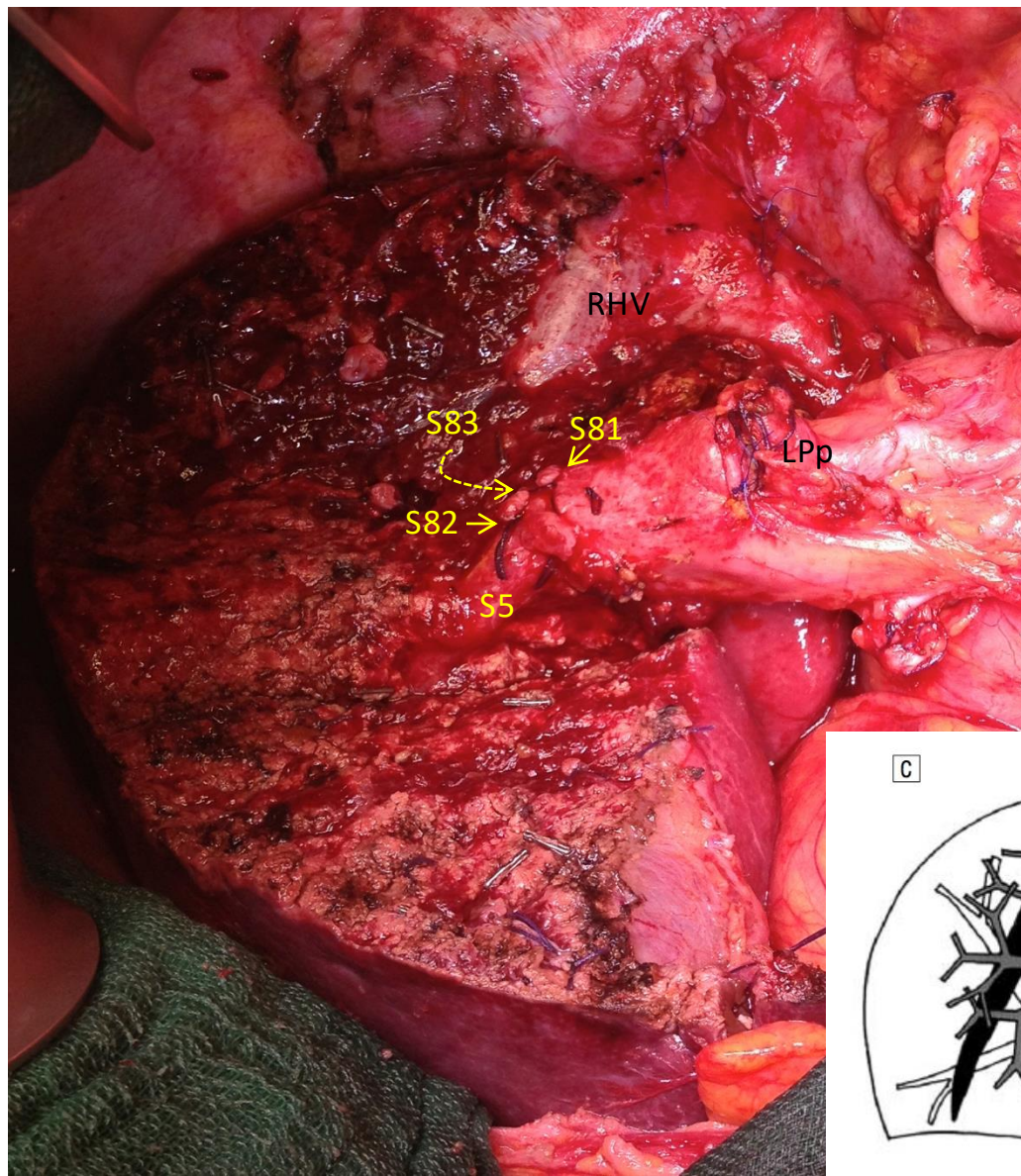
No!

No account for

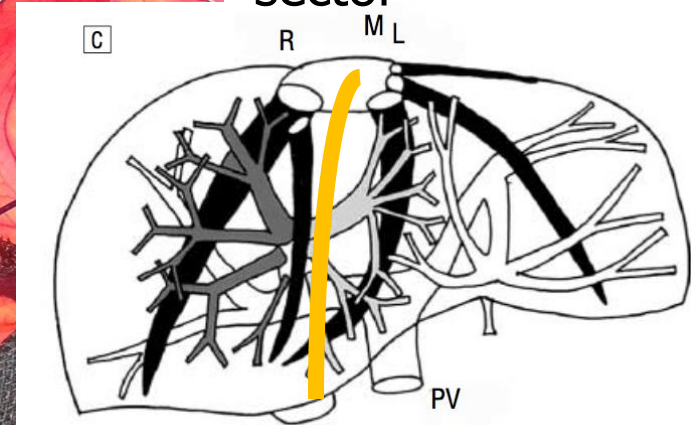
- symmetry
- embryology

A new view of central hepatectomy

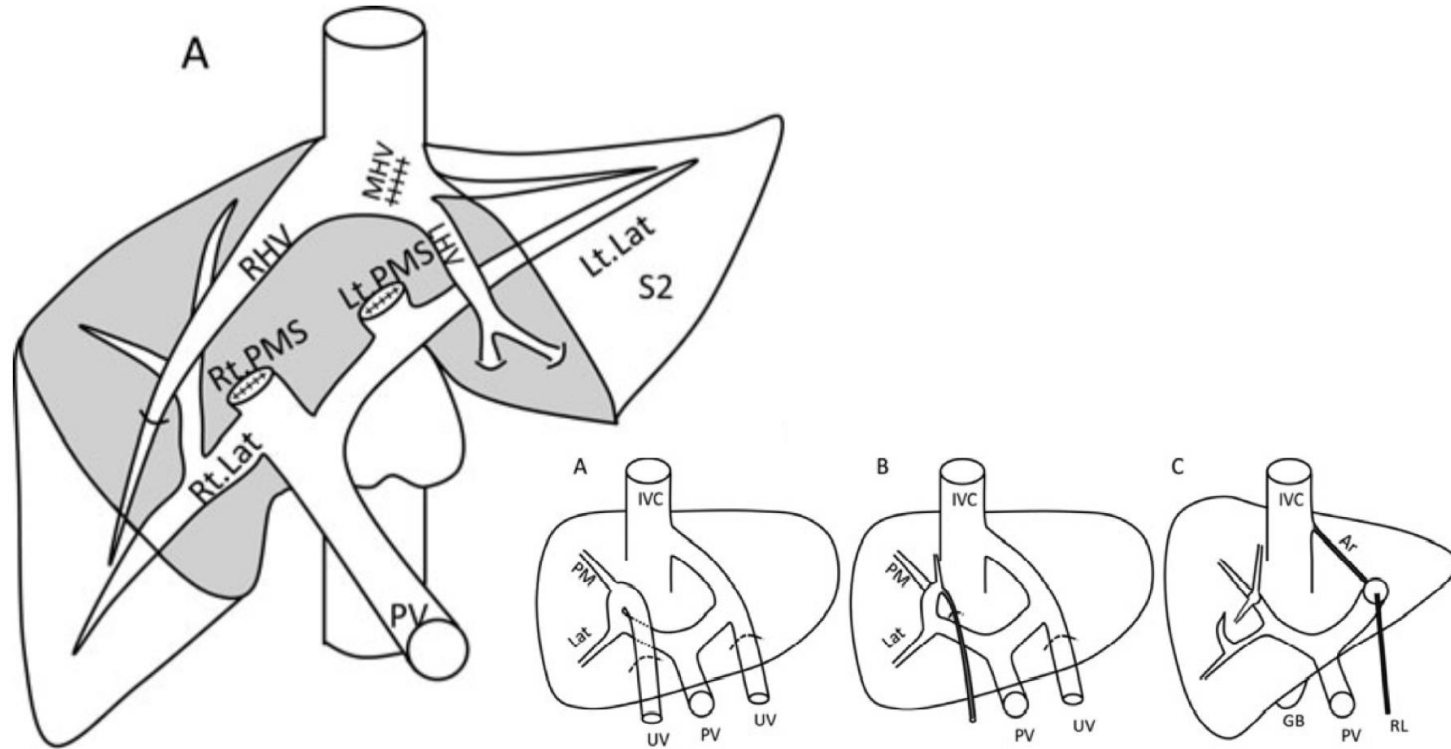




Left hepatectomy +
medial R anterior
sector



A second revelation



Makuuchi Ann Surg 2013



Conclusions (1)

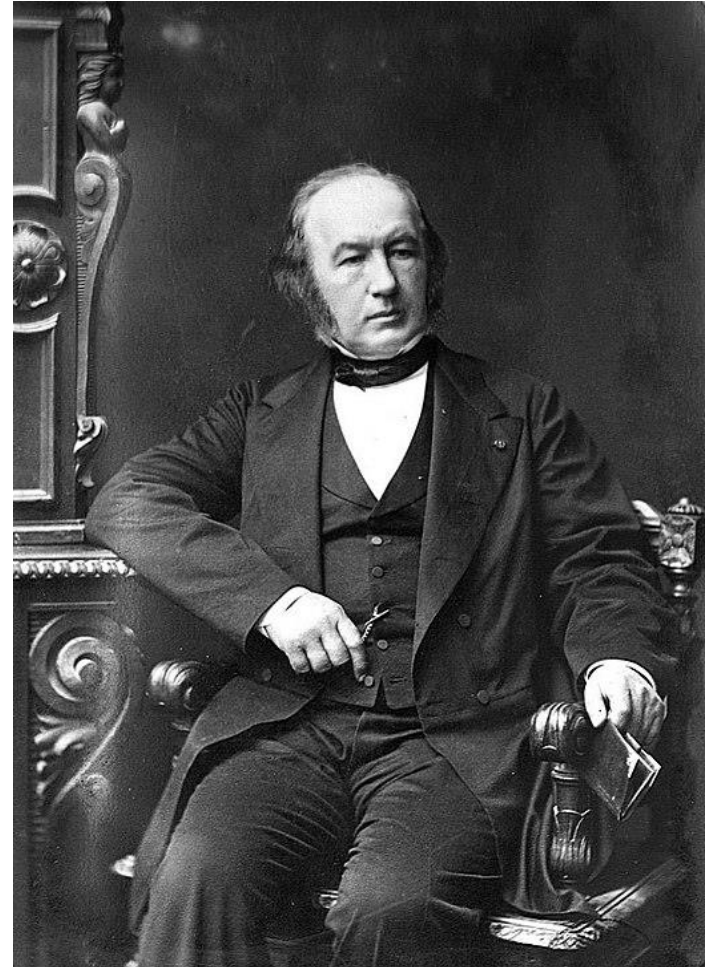
- Couinaud makes a beautiful three-dimensional frame to communicate on the place of liver lesions
- For advanced surgery, (especially central hepatectomies), give a chance to Hjortsjö, and you will be suprised

The first was a complex case



Claude Bernard:

- *«Ce qui est simple est toujours faux, ce qui est complexe est inutilisable»...*
- *A deadlock for a modern scientist*

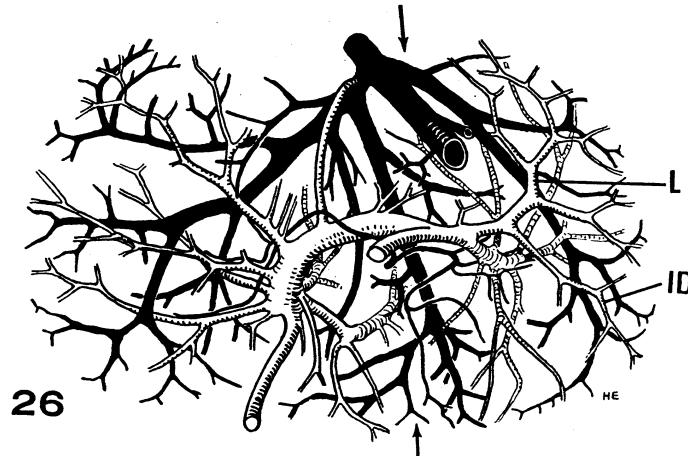


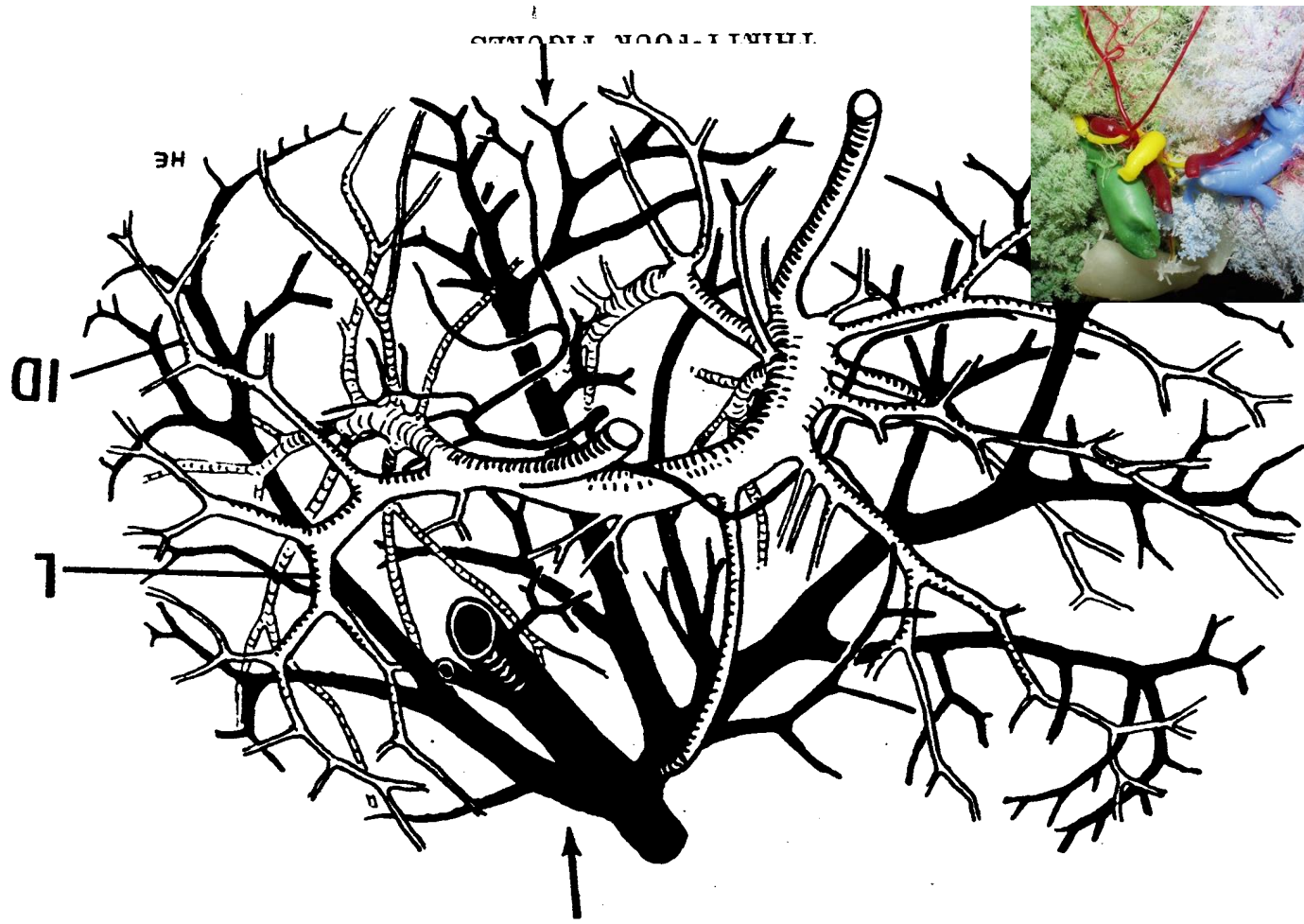
GROSS ANATOMY OF THE BLOOD VESSELS AND DUCTS WITHIN THE HUMAN LIVER

HANS ELIAS AND DAVID PETTY

*Department of Anatomy, Chicago Medical School; Department of Pathology and
Hektoen Institute for Medical Research, both of Cook County Hospital, and
Department of Pathology, Northwestern University, Chicago, Illinois*

THIRTY-FOUR FIGURES





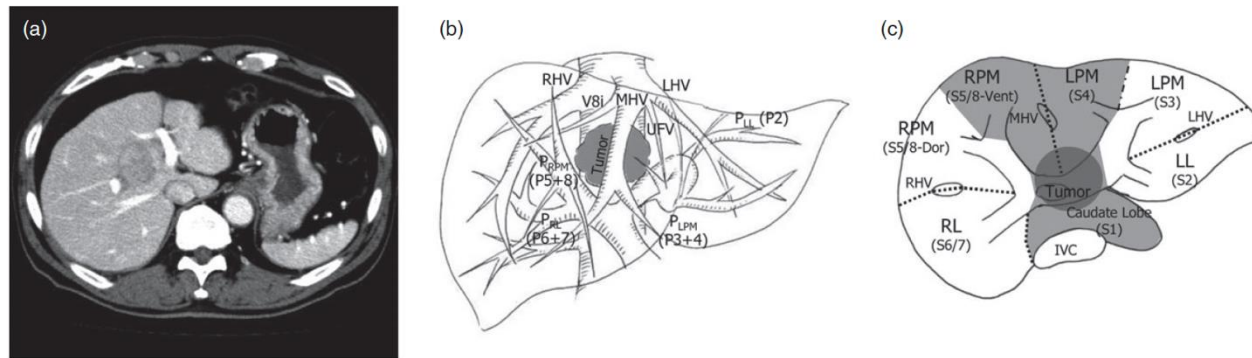


Fig. 1 Typical tumor location and surgical concept for the anatomic resection of the bilateral ventral part of the paramedian sectors of the liver. **(a)** Computed tomography; **(b)** frontal schema; **(c)** axial schema. IVC inferior vena cava, LHV left hepatic vein, LL left lateral sector, LPM left paramedian sector, MHV middle hepatic vein, RHV right hepatic vein, RL right lateral sector, RPM right paramedian sector

A



P6-P7 type:
46% (46/100)

B

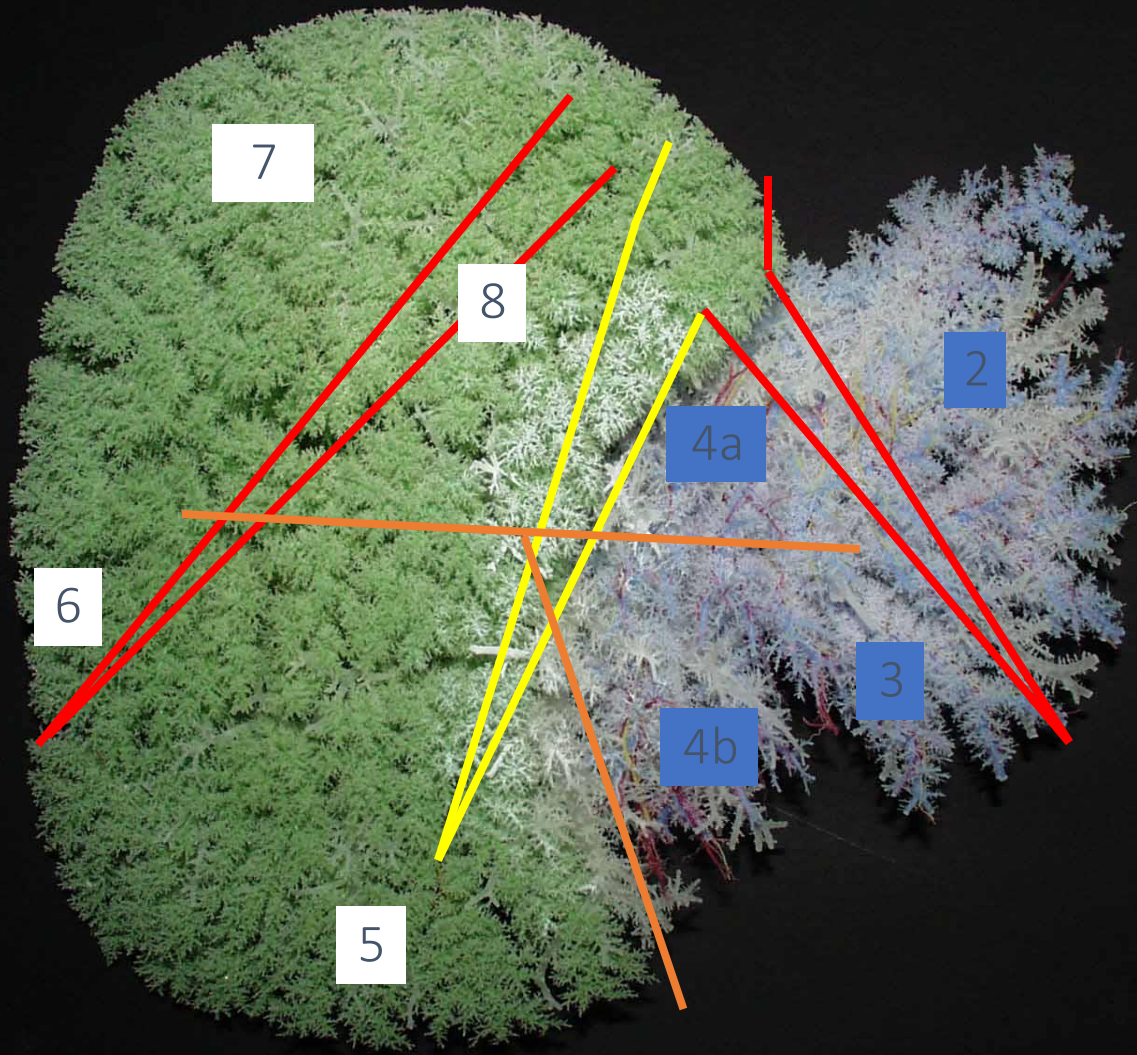


Arch type:
54% (54/100)

New hepatectomies become conceivable

In the Compagnons: initiation ritual to the anterior sector

- Rotate the division from horizontal to vertical
 - Fits with observation
 - Useful for central hepatectomies
 - Useful for sub-segmental S8 resections
 - Fits with embryology (re-establishes in your mind the symmetry of the right and the left liver)



They make the portal vein bifurcate in a horizontal plane