Peter is fleeing Rome. Outside the city he meets the risen Jesus and asks him:

“Domine, *quo vadis*?“
“Lord, *where are you going*?”

Jesus replies:
"I am going to Rome to be *crucified again*".
Lymphology
Quo Vadis?

Part-1

The fate of lymphology

Lymphatic system teaching

Lymphatic system history

Borislav Penchev - Unitec NZ
Shamim Shaikh - Unitec NZ
We asked old school MRTs

- Where is the LS going to?
- Is the LS relevant to the Medical Imaging practice?

An NZ MRT role model, researcher and educator stated: “We performed lymphangiograms in the dark ages...alas”

To learn more, we decided to:
Content

1) Survey the current LS teaching

2) History of the LS exploration
1. CURRENT ANATOMY TEACHING OF LS

Survey – conducted between 2012 and 2017

Methods – personal contacts, phone calls and emails
– questionnaire completed in class

Participants – students and staff from various tertiary providers, but predominantly from Unitec NZ
Student N = 321; staff N = 11

Survey carried out and analysed by the authors
<table>
<thead>
<tr>
<th>Provider</th>
<th>LS anatomy teaching time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unitec: MI, Nursing, Osteopathy</td>
<td>10-20 minutes</td>
</tr>
<tr>
<td>Fiji Med School</td>
<td>20 minutes</td>
</tr>
<tr>
<td>Auckland Med School</td>
<td>30 minutes</td>
</tr>
<tr>
<td>New Zealand College of Chiropractic</td>
<td>4 hours</td>
</tr>
<tr>
<td>Otago Med School</td>
<td>4-5 hours</td>
</tr>
</tbody>
</table>

Disproportionate influx of “soft social” subjects deprived “hard” scientific topics from adequate teaching time.

Staff & students from the above institutions

“Curriculum time dedicated to anatomy is decreasing” (Patel & Moxham, 2008)

“Anatomy teaching is in the midst of a downward spiral” (Older, 2004)
QUESTIONNAIRE

Q1: List four anatomical elements of the LS

Q2: List two principle functions of the LS

Q3: To study, or not to study the LS?

Q4: If “YES”, how many hours?

Q5: If “NOT”, why not?
## Results

<table>
<thead>
<tr>
<th>Participants from Unitec</th>
<th>Year</th>
<th>Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osteopathy students</td>
<td>1, 2 &amp; 3</td>
<td>47</td>
</tr>
<tr>
<td>Nursing student</td>
<td>2 &amp; 3</td>
<td>59</td>
</tr>
<tr>
<td>Med. Imaging students</td>
<td>1, 2 &amp; 3</td>
<td>215</td>
</tr>
</tbody>
</table>

### Q1: List four anatomical elements of the LS

- **59 Nursing students**: 4 students listed 3 elements, 15 students listed 4 elements<br>\[32\%\]  
- **47 Osteopathy students**: 6 students listed 3 elements<br>\[12\%\]  
- **215 Med. imaging students**: 18 listed 3 elements, 9 listed 4 elements<br>\[12.5\%\]
Interesting answers

Q1: List four anatomical elements of the LS

And the winner is:
“System of nerves, which send signals from face to other organs”
Results

Q3: To study, or not to study the LS?

To study the LS system - 296 students = 92.22%

Not to study the LS - 25 students = 7.78%
Results

- Not to study the LS - 25 students = 7.78%

Not to study the LS because:
- Not applicable
- Too difficult to show on radiographic images
- Not required for radiographic interpretation
- Does not help us take images
- Lymphatics can’t be seen on an X-ray
- MRTs don’t need it
- Only CT, MRI, sonographers and mammographers need it
- Knowledge is not assessed academically
- We can’t assess or detect the LS in an image

Medical imaging 22=10.23%
Nursing 2 =3%
Osteopathy 1=2%
Recently an *year-2 MI student* shared:

“I don’t see what it has to do with bones and radiography.

I have never seen any knowledge of the LS been used in the clinical practice”
Results

TO STUDY the LS system - 296 students = **92.22%**

These students suggested an average of **3.64 hours**

<table>
<thead>
<tr>
<th>Provider</th>
<th>Teaching time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unitec</td>
<td>0 to 15-20 minutes</td>
</tr>
<tr>
<td>Fiji Medical School</td>
<td>very similar</td>
</tr>
<tr>
<td>Auckland Medical School</td>
<td>20-30 minutes</td>
</tr>
<tr>
<td>NZ College of Chiropractic</td>
<td>4 hours</td>
</tr>
<tr>
<td>Otago Medical School</td>
<td>4- 5 hours</td>
</tr>
</tbody>
</table>
Content

1) Survey the current LS teaching

2) History of the LS exploration
2. History of lymphology - five periods

19th AD - Today - “Modern”
- Immunology and molecular imaging of LS
- Sappey, Poirier, Cuneo - French

17th - 18th AD - “Renaissance”
- Integrating system of the body - Rudbeck
- Cysterna chyli - Percquet (1622-1674), Bartholomeus Eustachius (1500-1574)
- Thoracic duct - Eustachius
- Watery channels - Glisson (1597-1677) (Forrester, 1996)
- Milky veins - Aselli (1581-1626) (Choi, 2012)
- Lymphha - “Clear spring water”

16th - 17th AD - “Awakening”
- Vesalius (1514-1564) - founder of modern anatomy
  “De humani corporis fabrica” - 1543 - Padua

1st BC - 16th AD - 1700 “Fruitless” years partially due to Galen’s doctrine

5th - 1st BC - “Fruitful”
- Chyle - “juice”, “Peri Adenon” - Hippocrates (Grotte, 1979)
- “white veins” - Herophilus & Erasistratus (Lord, 1958)
- “… liquid “other than blood”” (Chilky, 1987)
The 16th - 17th “Golden age”
Gaspar Aselli (1581-1626) - Italian

In 1622, while performing a vivisection on a well fed dog, Aselli rediscovered the lacteal vessels.

These remained unnoticed for:
- 18 centuries since described by Herophilus and Erasistratus
- 14 centuries since last reported by Galen

Aselli published “De lactibus sive Lacteis venis…” in 1627
Aselli’s publication may well be the first to use coloured illustrations for better scientific clarity.
During Aselli’s time - early 17th century digestion was seen as:

Aselli thought, that the “milky veins” empty into the liver.
Francis Glisson (1597-1677) - English
Published “De Rachitide” in 1650 & “Anatomy of the liver” in 1665,
And described the “Watery channels and hepatic lymphatics”
Jean Percquet (1622-1674) - French

In 1651, he published the discovery of:

**Chyli receptaculum**  
= cisterna chyli  
= cisterna of Percquet

**Thoracic duct**, which drains into the venous system at the jugular-subclavian union


https://en.wikipedia.org/wiki/Jean_Percquet


https://en.wikipedia.org/wiki/Jean_Percquet
Thomas Bartholin (1616-1680)-Dutch

In 1952, he described **cisterna chyli & thoracic duct** in his book “Circulation via the lymphatic vessels”. 
Olaus (Olof) Rudbeck (1630-1702) - Swedish
Drew the entire LS

Diagram by Rudbeck - 1656
Rudbeck suggested, that similarly to the nervous and the endocrine systems, the LS is an integrating system of the entire body.

(Forster, 1996)
By 1650 it was known that:

Cisterna chyli is located:
- at level T12 - L2
- between aorta and IVC

The cisterna receives
- two lumbar trunks
- intestinal trunks
- descending thoracic and hepatic trunks
- renal & suprarenal trunks

Thoracic duct:
- length - 38 to 45 cm, diameter - 3-5 mm
- through aortic hiatus ascends in the posterior mediastinum between aorta and azygos vein
- from T5 gradually inclines to the left
- runs posterior to the left subclavian artery
- joins the left subclavian / jugular vein with a valve

What was not clear yet was the LS of
Niels Steensen (1638-1686) - Danish

Founder of modern geology

A bishop

Why not an anatomists too?

https://en.wikipedia.org/wiki/Nicolas_Steno

Right lymphatic duct

History of lymphology

- 19th AD - Today “Modern”
  - Injecting of mercury into lymphatics: P. Mascagni (1755-1815), Cruikshank
  - LS in the university curriculum: W. Hunter (1715-1783) and A. Monroe (1733-1817)

- 17th-18th AD - “Renaissance”
  - LS in the university curriculum: W. Hunter (1715-1783) and A. Monroe (1733-1817)

- 16th - 17th AD - “Awakening”

- 1st BC - 15th AD - 1500 “Fruitless” years

- 5th - 1st BC - “Fruitful”

- To 5th BC - “Prehistoric”
The LS gained popularity, when two famous 18th century anatomists included the **LS in the curriculum of the universities** they worked for.

**English - William Hunter** (1715-1783)  **Scotish - Alexander Monro Jr.** (1733-1817)

**The Hunter-Monro controversy**
Paolo Mascagni - (1755 - 1815) - Italian

In 1771, Mascagni introduced the dyeing of lymphatics with mercury.

This technique enabled him to determine, that:

- lymphatics are related to absorption
- lymphatics originate from interstitial space & serous cavities

Mascagni mapped, named and described ALL principal lymphatic vessels and nodes.

Published by Pazzini Carli, Siena, 1787
In the same 1787 year Cruikshank located the breast - axilla l. pathway using mercury.

But, once again, the LS was forgotten for almost a century until 1874, when M. Ph. C. Sappey (1810-1896) published the mercury based superficial lymphatic drainage of the torso.
Cutaneous lymphatics by Sappey

Surgical cutaneous incisions to be parallel to the lymphatic vessels

Watershed L2


https://www.researchgate.net/publication/304358392_Lymphosome_Concept_Anatomical_study_of_the_lymphatic_system_Lymphosome_Concept
19th AD - Today - “Modern”

- Immunology & molecular imaging
- Sappey, Poirier, Cuneo – all French

Poirier & Cuneo

A 1903 diagram of the breast lymphatics by Poirier & Cuneo as seen in the Gray’s Anatomy.

By the end of the 19th - beginning of 20th century the LS mapping was completed on a macroscopic level.
EMBRYOLOGICAL DEVELOPMENT

Starts at 5\textsuperscript{th} week
(Heart beats at 3\textsuperscript{rd} week)

- Jugular lymphatic sacs
- Cisterna chyli
- Mesenteric lymphatic sac
- Iliac lymphatic sacs
This theoretical basis is used for injection of dye and/or isotope for sentinel node mapping and biopsy.
Lymphology
Quo Vadis?

Your current teaching needs updating
REFERENCES: