IREC Imaging Platform (2IP): annual report- 2018

The 2IP multi-user platform was created in 2011 thanks to the sharing of imaging equipment present among the IREC research groups. 2IP gradually acquires new equipment and is recognized as a UCLouvain platform. 2IP is composed of two research logisticians (Caroline Bouzin and Guillaume Courtoy) and two technicians (Aurélie Daumerie and Michele de Beukelaer).

2IP offers access to:

- **Sample preparation services:**
  - Paraffin & cryo-sectioning
  - Histological stainings
  - Immunostainings (chromogenic-fluorescence-TSA multiplex)

- **Image acquisition:**
  - Slide digitalization in brightfield with a 384 slides capacity scanner (Leica SCN400)
  - Structured illumination fluorescence microscopy (Zeiss AxioImager.z1 + ApoTome1 module) which allows optical sections and 3D reconstruction
  - Polarized light microscope (Zeiss AxioPlan)

- **Image analysis:**
  - Oncotopix (Visiopharm)
  - TissueIA (Leica)
  - ImageJ support

**Contact:**
Caroline Bouzin
Université catholique de Louvain-IREC Imaging Platform
Avenue Hippocrate, 55 bte B1.55.20
1200 Bruxelles
caroline.bouzin@uclouvain.be
Tel : 02/764.55.98

2IP staff in 2018

Aurélie Daumerie succeeded to Chantal Fregimilicka who enjoys a well-deserved retirement. Together with Michele de Beukelaer, she is part of the technician team. A Fonds de Recherche Clinique (FRC) has been attributed to Guillaume Courtoy who joined 2IP as a research logistician in January 2019 for a project centered on fibrosis analysis tools.

2IP equipment use in 2018

Based on the online booking system, the use of the equipment in 2018 has been analyzed and the main trends are detailed here below.

- The use of the **SCN400 scanner** is stable as compared to the last three years, reaching saturation of the system (~2000 hours/year). This device is shared by multidisciplinary users (25 poles from different research institutes - 86% of them being part of IREC - and external universities). 13 poles scanned on a regular basis (more than 40h in 2018). The server hosting the scans and the data management system (DIH) has to be changed (end of maintenance). In order to prevent recurrent scanner failures, all carriers have been tested and those improperly taken or returned have been discarded. This proved to be successful.
• After three years of decreasing booking, the AxioImager has been used more frequently in 2018. User diversity has raised in 2018 (24 poles, among which 8 poles imaging in a regular basis, versus 75% of the use concentrated in 3 research poles in 2017). This increase testifies to the big interest in fluorescence microscopy. Of note, several current needs (mainly linked to cell imaging) cannot be met. An ApoTome module has been kindly lent by JM Vanderwinden (ULB) to replace our demagnetized one.

![Zeiss AxioImager/ApoTome](image_url)

• A Zeiss AxioPlan is available for imaging with polarized light, used for fibrosis assessment on Sirius red-stained sections.

• The Axioskop40 and AxiovertS100 being more useful in the culture room of FATH (owner of these devices), these microscopes are no longer part of 2IP.

• The Light-CT scanner is out of order due to PC crash and will not be repaired due to lack of projects and too expensive quotation of the company for the PC and software replacement.

• The 2 microtomes of the platform were used in 2018 by researchers coming from 24 research poles, mainly from IREC (among which 8 poles used them more than 40h).
Bookings are increasing since 2015 and are in line with the increasing technical services proposed by 2IP. The knife holder of the older microtome (~ 20 years old) is damaged and has to be replaced.

- **Cryostat** bookings represent 20% of those of the microtome. It is however also shared by different research groups (7 poles used it more than 20h in 2018). Since the implementation of tyramide technology allowing immunofluorescent stainings with improved signal-to-noise ratio on paraffin sections, histology preservation of FFPE tissue is increasingly preferred over cryopreservation.

- Our expertise in **image analysis** using the Oncotopix analysis tool from Visiopharm developed initially to quantify tumor immune infiltration in lung cancer biopsies was
extended to other tumor projects and adapted to other research fields such as fibrosis, cardiac hypertrophy,... Compared to 2017, the 2 licenses were used to a lesser extent in 2018 (mainly decreased overnight analyses) but the user repartition is more homogeneous (16 research poles among which 12 for > 100h versus 76% used by one research group in 2017).

**2IP services in 2018**

The Histo-lab is accessible to researchers either through 2IP services or in “self-service”. 2IP services implies that the two technicians of 2IP (Aurélie Daumerie and Michele de Beukelaer) perform the sectioning or stainings. In the "self-service" option, any researcher can have access to the lab and we provide the solutions required for the (immuno)-stainings (except for primary antibodies).

More than 13 000 sections (paraffin & cryo), 6000 stainings and 2600 immunostainings were performed in 2018 (for more than 20 research poles).

The internal Histo-shop, aiming at centralizing products related to histology and rationalizing costs at the level of the institute is still available.
Communication tools

Beside support for sample preparation, acquisition and analysis, 2IP also promotes communication with and between users through:

- a website providing information about equipment and services, technical tips, validations,…
- an online booking system (~200 2IP users),
- a diffusion mailing list (“IREChelpme”: 260 members),
- dissemination of methodological innovation through technological seminars and demos organization:
  Workshop Marie Curie – Transmit (26-27/10/2018)
  Imaging tools for cells and tissue sections
  Sample preparation - image acquisition - image analysis
  (general topics + focus on mitochondria/hypoxia)

2IP acquisitions in 2018

A coverslipper has been acquired thanks to an EOS funding granted to Marie-Madeleine Dolmans. Olivier Feron and Fadel Tissir obtained an FNRS GEQ grant for a lightsheet fluorescence microscope that will enrich the platform soon and allow researchers to address new questions.
2IP management

The management committee evaluated the 2IP usage statistics and financial report for 2018. The minutes of this meeting* are summarized here:

(A) Financial aspects:
- The 2018 balance sheet is positive for all devices and services.
- Tarification has been adapted to distinguish (1) equipment use by researchers, (2) user training, (3) equipment use by the platform staff (service). Fees include maintenance costs, insurance, depreciation and consumables, and are balanced by the mean booking hours of the three last years. Contribution to manpower is included for users outside IREC (with different rates for users from UCLouvain, academic partners or industrial partners). Overhead of the university is also integrated for users outside UCLouvain. These fees are listed in annex 1 and will be applied from 07-2019 to 12-2020.
- In order to encourage archiving old scans, additional fees will be asked for scans older than 5 years according to the occupied space.
- During the warranty period, the use of new equipment will be free of charge for PIs entrusting the management of this equipment to the platform staff.

(B) Organizational aspects
- For adequate equipment use, trainings focusing on the general technological aspects will be organized at regular intervals and accessible to all researchers. They will be complemented by personalized trainings on the microscopes (fees in annex 1) for researchers planning to use the device at least 5h in the year following the training. For quality purposes, the platform staff will take care of the image acquisition for occasional users.
- Signature of a charter relative to the objectives, organization and duties of the platform and of the users is now asked to each user (annex 2).
- Upon arrival, the platform staff will have exclusive access to new equipment for some weeks to learn using it adequately, configure it, write user guide,... A call for samples will be addressed to users during this period.
C) Current needs

Equipments
- Considering the acute need for confocal technology and the repetitive failure to obtain FNRS grant for this technology, the IREC board decided to grant this device on its own funds.
- A new microtome will be acquired by 2IP to replace the old one (> 20 years old, damaged knife holder) which will be dedicated to training of new users.
- According to a recent survey (June 2019, 42 participants from 14 research poles), the most requested devices are (1) a high throughput fluorescence & brightfield scanner, (2) an additional Visiopharm license, (3) autostainers for IHC and for histological stainings.

Considering the acute need for an additional fluorescent slide scanner (overbooking of the 2 scanners available on the campus, repetitive breakdowns of the brightfield scanner SCN400), an application to an FNRS EQP will be introduced in July 2019.
- Solutions for data management, sharing, storage (and archiving) of large files (lightsheet acquisitions, scans, confocal time-lapse,...) are currently under investigation.

Services
- Until now, no primary antibodies were available at 2IP because of the diversity of antibodies requested. We now propose IHC-P (including primary antibodies) for some recurrent antigens for which antibodies have been successfully tested (annex3).
- In order to optimize lightsheet imaging, we propose to fine tune sample clearing (test of 3-4 protocols). Adequate protocols will then be transmitted to the users.
- We propose image analysis services for punctual needs and algorithms fine tuning/advices for more intensive use.
- Currently, paraffin embedding (VIP-MORF) and fluorescence scanning (GECE) are not part of the services provided by 2IP.

Resources
As the requests for services are increasing, so are also the operational delays. An additional technician would be welcome.
- In 2018 (and beginning of 2019), 5 devices were tested in demos: (1) Ultramicroscopell (Lavision), (2) Lightsheet.z1 (Zeiss), (3) MuVi SPIM (Luxendo), (4) Combistainer (VWR), (5) Coverslipper (Sakura).
- Caroline Bouzin is now the representative of the scientific community (CORSCI) at the “commission d’instruction disciplinaire”.
- Invitation to join the user committee has been sent to: G Courtoy (2IP), F Huaux (LTAP), F Tissir (IoNS), P Cani (LDRI), C Pierreux (successor of MC Many, histology teaching), C Galant (successor of A Mourin, anapath).
- A workshop dedicated to “Imaging tools for cells and tissue sections: Sample preparation - image acquisition - image analysis” will be scheduled in 2019-2020 for PhD students.
- A technological seminar on tissue clearing will be scheduled in 2019-2020.
- Through sustained collaborations, 2IP has been involved in the many projects, valorized in publications listed in annex 4. This recognition of the platform is sincerely appreciated.
## Annex 1: 2IP fees 2019-2020

### 2019-2020 fees (€/h, VATexc)

<table>
<thead>
<tr>
<th>Equipment</th>
<th>2IP</th>
<th>UCLouvain</th>
<th>academic partners</th>
<th>industrial partners</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Data scanner: SNNWO [Leica]</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>with</em> access to storage, data management (DIH) and image analysis software (TissueAI)*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>trained user</td>
<td>14</td>
<td>18</td>
<td>21.5</td>
<td>26.5</td>
</tr>
<tr>
<td>imaging by 2IP staff</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>40.5</td>
</tr>
<tr>
<td>imaging (F €/h/year)*</td>
<td>-</td>
<td>-</td>
<td>60</td>
<td>112.5</td>
</tr>
<tr>
<td><strong>without</strong> access to data management (DIH) and image analysis software (TissueAI)*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>trained user</td>
<td>9.5</td>
<td>12</td>
<td>14.5</td>
<td>18</td>
</tr>
<tr>
<td>imaging by 2IP staff</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>27.5</td>
</tr>
<tr>
<td>imaging (F €/h/year)*</td>
<td>-</td>
<td>-</td>
<td>40</td>
<td>75</td>
</tr>
<tr>
<td>storage on server + access to DIH and TissueAI**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IB/year</td>
<td>560</td>
<td>700</td>
<td>840</td>
<td>1090</td>
</tr>
<tr>
<td><strong>Fluorescence microscopy AxioImager.z1-ApoTome module (Zeiss)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>trained user</td>
<td>8.5</td>
<td>11</td>
<td>12</td>
<td>16</td>
</tr>
<tr>
<td>imaging by 2IP staff</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>25.5</td>
</tr>
<tr>
<td>training (if &gt;5h/year)*</td>
<td>-</td>
<td>-</td>
<td>45</td>
<td>80.5</td>
</tr>
<tr>
<td><strong>Confocal</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>trained user</td>
<td>22.5</td>
<td>28.5</td>
<td>34</td>
<td>42.5</td>
</tr>
<tr>
<td>imaging by 2IP staff</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>60.5</td>
</tr>
<tr>
<td>imaging (F €/h/year)*</td>
<td>-</td>
<td>-</td>
<td>90</td>
<td>149</td>
</tr>
<tr>
<td><strong>Lightsheet</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>trained user</td>
<td>7.5</td>
<td>9.5</td>
<td>11.5</td>
<td>14.5</td>
</tr>
<tr>
<td>imaging by 2IP staff</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>28.5</td>
</tr>
<tr>
<td>imaging (F €/h/year)*</td>
<td>-</td>
<td>-</td>
<td>30</td>
<td>56.5</td>
</tr>
<tr>
<td><strong>VIP (Sakura)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>trained user</td>
<td>2</td>
<td>2.5</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>imaging by 2IP staff</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>13.5</td>
</tr>
<tr>
<td>training (if &gt;5h/year)*</td>
<td>-</td>
<td>-</td>
<td>150</td>
<td>281.5</td>
</tr>
<tr>
<td><strong>Image analysis</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Histology (tissueform)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>trained user</td>
<td>2</td>
<td>2.5</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>imaging by 2IP staff</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>13.5</td>
</tr>
<tr>
<td>training (F €/h/year)*</td>
<td>-</td>
<td>-</td>
<td>150</td>
<td>281.5</td>
</tr>
<tr>
<td><strong>Sample preparation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inclusion-sectioning</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>paraffin embedding</td>
<td>1.6</td>
<td>1.8</td>
<td>2.1</td>
<td>2.5</td>
</tr>
<tr>
<td>paraffin sections (microtome not included)</td>
<td>0.3</td>
<td>0.4</td>
<td>0.6</td>
<td>0.6</td>
</tr>
<tr>
<td>cryosections (cryostat not included)</td>
<td>0.3</td>
<td>0.4</td>
<td>0.6</td>
<td>0.6</td>
</tr>
<tr>
<td><strong>Histological stainings</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HE</td>
<td>1.1</td>
<td>1.2</td>
<td>1.3</td>
<td>1.4</td>
</tr>
<tr>
<td>HE</td>
<td>1.4</td>
<td>1.6</td>
<td>1.9</td>
<td>2.7</td>
</tr>
<tr>
<td>uric acid</td>
<td>0.9</td>
<td>1.0</td>
<td>1.1</td>
<td>1.6</td>
</tr>
<tr>
<td>Masson trichrome (blue)</td>
<td>1.4</td>
<td>1.5</td>
<td>1.8</td>
<td>2.7</td>
</tr>
<tr>
<td>Sirius red-aladin blue-Miller trichrome</td>
<td>2.7</td>
<td>3.1</td>
<td>3.7</td>
<td>5.4</td>
</tr>
<tr>
<td>birefr</td>
<td>1.3</td>
<td>1.5</td>
<td>1.7</td>
<td>2.5</td>
</tr>
<tr>
<td>alcian blue</td>
<td>1.8</td>
<td>2.1</td>
<td>2.5</td>
<td>3.6</td>
</tr>
<tr>
<td>von Kossa</td>
<td>1.4</td>
<td>1.6</td>
<td>1.9</td>
<td>2.7</td>
</tr>
<tr>
<td>PAS</td>
<td>0.9</td>
<td>1.0</td>
<td>1.2</td>
<td>1.7</td>
</tr>
<tr>
<td>Oil red O</td>
<td>2.2</td>
<td>2.5</td>
<td>3.0</td>
<td>4.3</td>
</tr>
<tr>
<td>Sudan IV</td>
<td>1.8</td>
<td>2.0</td>
<td>2.4</td>
<td>3.5</td>
</tr>
<tr>
<td><strong>Immunostainings (primary antibodies not included except for listed antigens)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Hemagglutination</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IHC-DAB (secondary Ab provided by the user)</td>
<td>2.4</td>
<td>2.7</td>
<td>3.2</td>
<td>4.6</td>
</tr>
<tr>
<td>IHC Envision mouse/rabbit - DAB</td>
<td>3.7</td>
<td>4.5</td>
<td>7.8</td>
<td>11.4</td>
</tr>
<tr>
<td><strong>Fluorescent IHC</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IF-frozen (primary and secondary Ab provided by the user)</td>
<td>1.7</td>
<td>2.0</td>
<td>2.4</td>
<td>3.4</td>
</tr>
<tr>
<td>IF-TSA (1 Ab)</td>
<td>7.5</td>
<td>8.5</td>
<td>10.2</td>
<td>14.5</td>
</tr>
<tr>
<td>IF-TSA (additional Ab)</td>
<td>5.8</td>
<td>6.5</td>
<td>7.8</td>
<td>11.4</td>
</tr>
<tr>
<td><strong>Coverslipper (Sakura)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IB/year</td>
<td>0.5</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
</tr>
</tbody>
</table>

* 5h booking pre-paid
** import of external scans or long-term storage (>5years)
Annex 2: Charter of IREC's Imaging and Cytometry Technology Platforms

A. Objectives of the platforms

- Sharing of the material available within the research teams.
- Acquisition of new equipment according to common needs and technological advances.
- Costs optimization.
- Optimal use of equipment through the training and supervision of researchers for the use of these equipment by the platform logistician.
- Exchange of technical and scientific information between researchers.

B. Organization and duties of the platforms towards the users:

1. The platforms are managed daily by a logistician assisted by technicians and administrative staff. The roles of this logistician are:
   - to advise researchers for:
     o the choice of the most appropriate technological approach,
     o the conception and design of the experiments,
     o the analysis and interpretation of data;
   - to train and supervise researchers to use equipment with "free" access;
   - to ensure the optimal functioning of the equipment;
   - to conduct experiments for researchers (particular expertise or sophisticated equipment);
   - to disseminate technological information to researchers (discussions, seminars, ...);
   - to ensure a technology watch;
   - to contribute to the writing of grant requests;
   - to choose new equipment taking into account the technical specificities required for the needs of the greatest number and, in collaboration with the purchasing department, draft the appropriate documents for their acquisition (public market, ...);
   - to contribute to the writing of the technical part of the scientific publications;
   - to establish pricing for the use of equipment and services.

2. The equipments are either
   - directly accessible to scientists, according to clearly defined procedures in point B;
   - used exclusively by platform staff who carry out experiments for researchers if the equipment requires special expertise.

3. The equipment (together with their features and user guides) are listed on the website https://uclouvain.be/en/research-institutes/irec/plateformes.html.

4. The devices are booked via http://www.fath.ucl.ac.be/reservation/login.php, whose access is managed by Caroline Bouzin.

5. The information concerning the equipment (possible breakdowns, maintenance, ...) is communicated via the mailing list "IREChelpme".

6. The platforms are open to all academic and private sector scientists. Requests are processed in the order of their arrival, without prioritization.
7. The operating mode of the platforms and the services provided are subject to an annual evaluation by a management committee and by a user committee.

8. The services provided and the use of the equipment of the platforms are invoiced according to established fees accessible on the website, or are the subject of a preliminary quote.

C. Duties of users towards the platform

1. Each user contacts the logistician before the first use of a device to receive training and access to the online booking site.
2. Users book online equipment with their own name and respect the schedules.
3. In case of cancellation or modification of a reservation, the user immediately informs the following person on the reservation list. Failure to comply with this rule will result in the billing of the initially reserved time slot.
4. The last user of the day turns off the equipment and locks the door of the room. The user who cancels the last reservation of the day ensures that this is done correctly.
5. Users respect the equipment as well as the rules for the use of equipment and leave a tidy room before leaving. In particular, for the Flow Cytometry platform, the waste tanks must be discarded and fluidics tanks refilled with FACSFlow at the last session of the day.
6. Any problem encountered, failure, handling error ... is reported to the logistician and indicated in the dedicated notebook.
7. Potentially hazardous samples (human samples not fixed, samples infected with pathogens requiring containment (eg HIV), radioactive samples):
   - are not allowed on the imaging equipment
   - must be fixed before the analysis with the cytometers and reported to the logistician.
8. Training and service requests are scheduled in advance (min 2 days).
9. Service requests are clearly detailed (number of samples, analyses required,...), ideally via e-mail.
10. The data stored on the computers and/or servers of the platforms are archived as soon as possible according to the recommendations for each device. Each user pays particular attention to this at the end of his contract.
11. The platform is mentioned in the publications.
Annex 3: Proposed IHC-P catalog

<table>
<thead>
<tr>
<th>IHC-P</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Human</td>
<td>Ki67</td>
</tr>
<tr>
<td></td>
<td>CD3</td>
</tr>
<tr>
<td></td>
<td>CD8</td>
</tr>
<tr>
<td>Mouse</td>
<td>Ki67</td>
</tr>
<tr>
<td></td>
<td>CD31</td>
</tr>
<tr>
<td></td>
<td>F4/80</td>
</tr>
<tr>
<td></td>
<td>GFP</td>
</tr>
<tr>
<td>Rat</td>
<td>Ki67</td>
</tr>
</tbody>
</table>
Annex 4: 2IP publications and collaborations in 2018

Increased IgA Expression in Lung Lymphoid Follicles in Severe COPD.  
Am J Respir Crit Care Med. 2018 Oct 19  

Porcine pulmonary valve decellularization with NaOH-based vs detergent process: preliminary in vitro and in vivo assessments.  
vан Steenberghe M, Schubert T, Gerelli S, Bouzin C, Guiot Y, Xhma D, Bollen X, Abdelhamid K, Gianello P.

Inulin Improves Postprandial Hypertriglyceridemia by Modulating Gene Expression in the Small Intestine.  
Nutrients. 2018 Apr 25;10(5)  
Hiel S, Neyrinck AM, Rodriguez J, Pachikian BD, Bouzin C, Thissen JP, Cani PD, Bindels LB, Delzenne NM.

Imaging markers of response to combined BRAF and MEK inhibition in BRAF mutated vemurafenib-sensitive and resistant melanomas.  
Oncotarget. 2018 Mar 30;9(24):16832-16846  
Acciardo S, Mignon L, Joudiou N, Bouzin C, Baurain JF, Gallez B, Jordan BF.

Perfusion-decellularization of human ear grafts enables ECM-based scaffolds for auricular vascularized composite tissue engineering.  

Bronchial Epithelial IgA Secretion Is Impaired in Asthma. Role of IL-4/IL-13.  
Am J Respir Crit Care Med. 2018 Jun 1;197(11):1396-1409  

Enhanced Vascular Biocompatibility and Remodeling of Decellularized and Secured Xenogeneic/Allogeneic Matrices in a Porcine Model.  
Eur Surg Res. 2018;59(1-2):58-71  
vан Steenberghe M, Schubert T, Bouzin C, Caravaggio C, Guiot Y, Xhma D, Gianello P.

Wheat-derived arabinoxylan oligosaccharides with bifidogenic properties abolishes metabolic disorders induced by western diet in mice.  
Nutr Diabetes. 2018 Mar 7;8(1):15  
Neyrinck AM, Hiel S, Bouzin C, Campayo VG, Cani PD, Bindels LB, Delzenne NM.

vан Steenberghe M, Schubert T, Bouzin C, Caravaggio C, Guiot Y, Xhma D, Gianello P.

Immune cell infiltration in head and neck squamous cell carcinoma and patient outcome: a retrospective study.  
Acta Oncol. 2018 Sep;57(9):1165-1172  
Schneider K, Marbaix E, Bouzin C, Hamoir M, Mahy P, Bol V, Grégoire V.

Enhanced vascular regeneration with chemically/physically treated bovine/human pericardium in rodents.  
vан Steenberghe M, Schubert T, Xhma D, Bouzin C, Guiot Y, Duisit J, Abdelhamid K, Gianello P.
Cardiac myocyte β3-adrenergic receptors prevent myocardial fibrosis by modulating oxidant stress-dependent paracrine signaling.
Eur Heart J. 2018 Mar 7;39(10):888-898

EPR monitoring of wound oxygenation as a biomarker of response to gene therapy encoding hCAP-18/LL37 peptide.

Targeting the gut microbiota with inulin-type fructans: preclinical demonstration of a novel approach in the management of endothelial dysfunction.
Gut. 2018 Feb;67(2):271-283