Applying aseptic conditions in rodent surgeries : yes we can !

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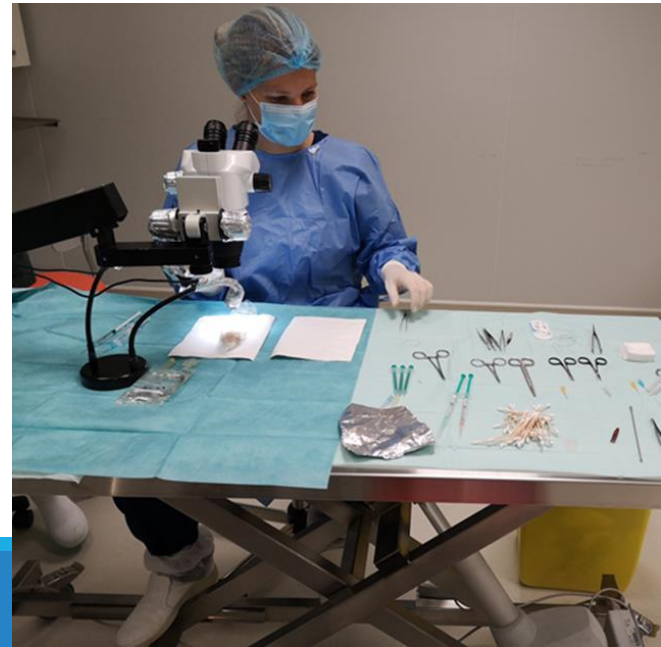
Summary

- Aseptic conditions history at a glance
- Any good reason to apply aseptic conditions for human, large animals, pet animals surgeries and not to laboratory rodent surgeries?
- And yet… current laboratory rodent surgery aseptic conditions situation
- You still need to be convinced (seriously ☺) ?
- Now that it is clear that it worth it… how to proceed ! The key actions for :
  -animals
  -surgeons
  -equipment/consumables/instruments
  -environment
- How to build your own improvement action plan, if needed



Aseptic conditions history at a glance

At the end of the 19th century, microorganisms were identified and their role in post-operative infection started to be studied and understood

By the late **1890s** Joseph Lister's antiseptic methods led to aseptic surgery and the introduction of sterile instruments in operating theatres

Based on Koch's research, the German surgeon Gustav Neuber was the **first to establish** sterilization and **aseptic methods** in his operating room.

Aseptic surgery went farther, creating surgical conditions *without* germs. Thus aseptic surgery led **to sterilizing instruments; swabbing down patients; robing, masking, and gloving surgeons; and dressing wounds with sterile dressings**

Such procedures began in the 1880s, and by the early 1900s were becoming more and more standard

Figure 794. Showing Ounce Package of Sterilized Cotton.

Figure 795. Showing a Layer Roll of Absorbent Cotton.

Aseptic conditions and animal species

Surgical aseptic conditions strategies (=protection from any bacteria coming from the environment) are different from basic hygienic measures (=protection against pathogens)

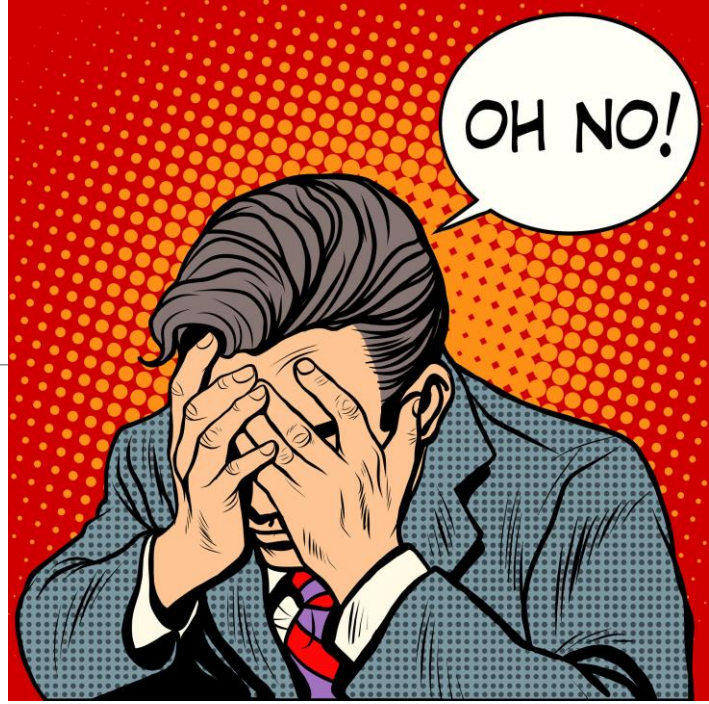
Is the subcutaneous tissue of dogs/rats sterile ? Is the abdominal cavity of human/mice sterile ? Is the thoracic cavity of non human primates/mice sterile ?

Knowing that :

- rats and mice, like any other species, carry on their skin many bacteria that do not cause any problem as long as they are “on the good side” of their skin and mucosa barriers
- rats and mice are largely used as model of infection! https://pubmed.ncbi.nlm.nih.gov/?term=rodent+infection+model

= > Does it make sense to consider that aseptic conditions are not of interest in these species (and only these ones) ???

Current situation in EU



More than 95% of large laboratory animals surgeons* are working under « state of the art » aseptic conditions (sterile gloves sterile drapes, autoclaved instruments, etc.)

Less than 15% of laboratory rodent surgeons* are working under such conditions, most of the others are working under « grey » techniques

**estimation based on Dr Bouard's observations between 2009 and 2021 among approximately 120 EU laboratory animal teams (public institutions, biotechs, pharma companies)*

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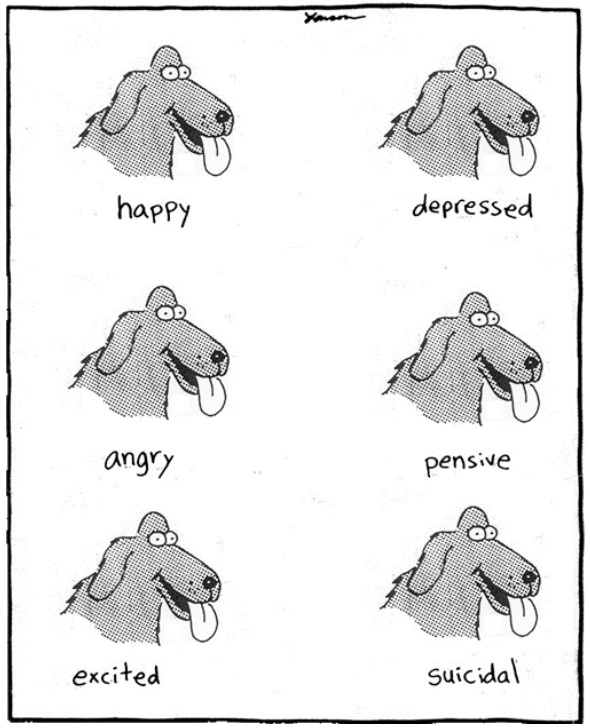
What could we improve with better aseptic conditions ?

Survival is not the point… and sometimes clinical signs of infection are difficult to detect

« *Survival alone is not a valid criterion for judgment of acceptability of a rodent surgical technique, but rather, the criterion for acceptability should be the presence of untoward, unplanned alteration of physiological functions or behavior due to perioperative infection* » Cunliffe-Beamer 1993



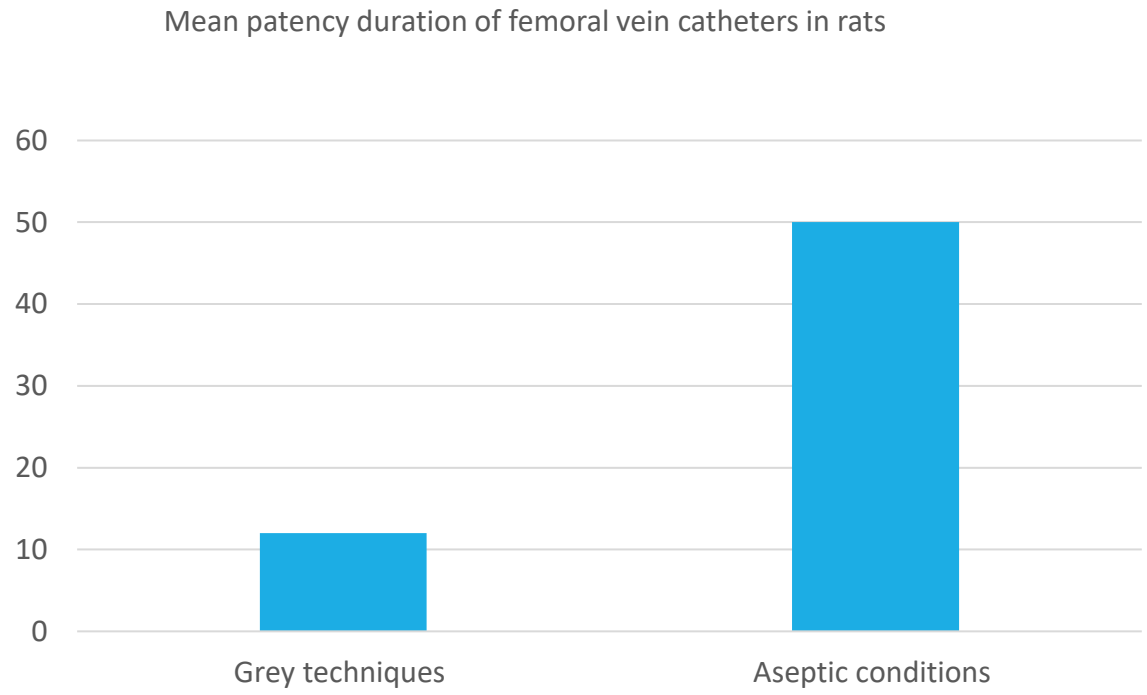
Nowadays, a large part of :

- **surgically induced models failure** (ex : catheter blockage, cement dehiscence)
- **results heterogenicity between batches** (ex: heterogeneous cells graft success rates)

could be **significantly reduced through aseptic techniques improvement**

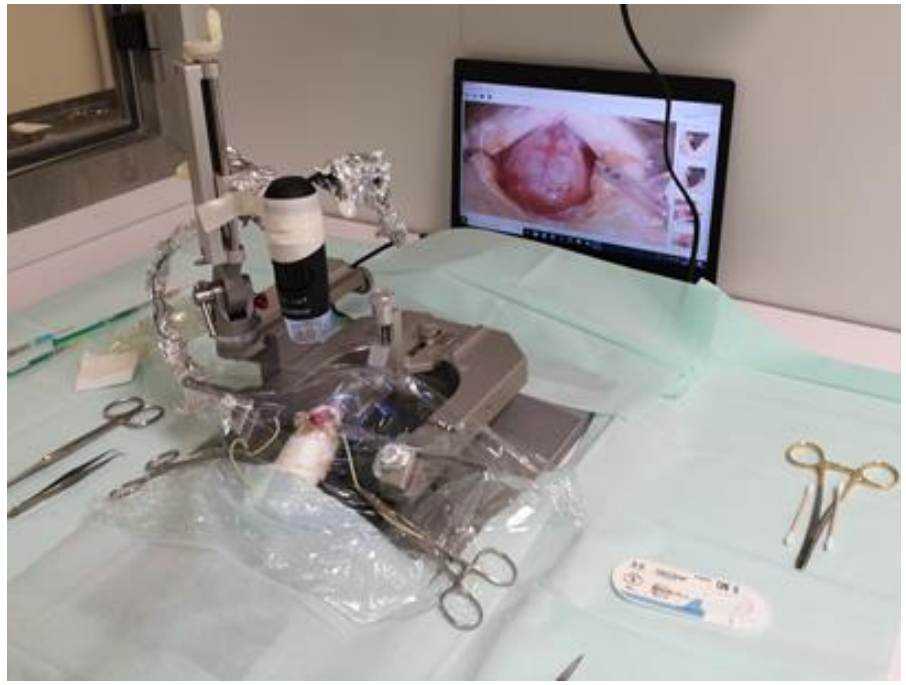
Still need to be convinced ? Results example

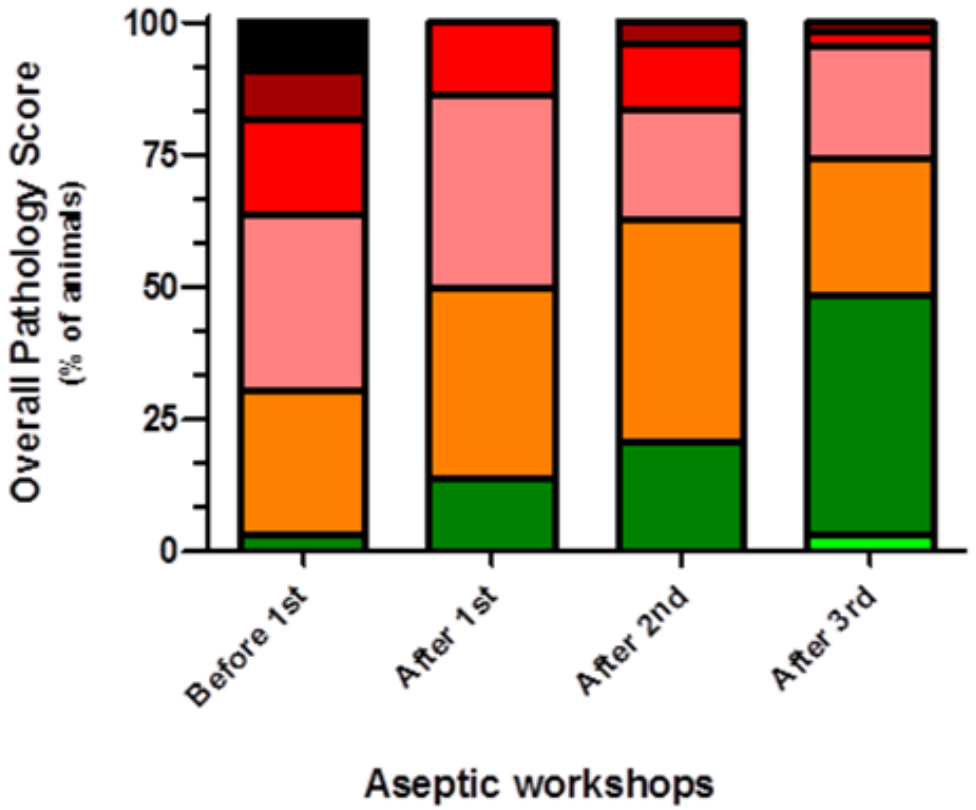
Vascular catheterization in rats with and without strict aseptic conditions



Still need to be convinced ? Results example (2)

Brain cannulation in mice before and after implementation of strict aseptic conditions





Key actions !

Animals

Environnement

Instruments/cunsumables

Surgeon

Surgeons key points

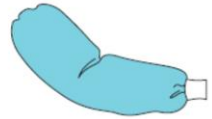
Strict aseptic conditions	Acceptable compromises	Not acceptable
-Proper surgeon hand washing -Sterile gloves, eventually doubled or changed on a very regular basis -Sterile gown changed in-between each animal	-Hand disinfection with hand gel -Sterile gloves changed on a regular basis -Sterile sleeves	-No hand disinfection -Jewelry -Examination gloves -No forearm protection

1/ Get read of your hand jewelry !

2/ Wash your hands thoroughly *(after 40-90 minutes surgeries, approx. 15% of gloves are microperforated !)*

3/ Wear sterile gowns, or at least sterile sleeves for rodent surgeries

4/ Wear sterile gloves



Surgeons (cont'd)

It is definitely feasible for a rodent surgeon to get properly prepared with hand gel, sterile gloves and sterile gown

Total cost : less than 10€ per surgery day

Total time for the initial prep : approximately 5 minutes

Infect Control Hosp Epidemiol. 2013 Mar;34(3):245-50. doi: 10.1086/669528. Epub 2013 Jan 18.

Modified World Health Organization hand rub formulations comply with European efficacy requirements for preoperative surgical hand preparations.

Suchomel M[1], Kundi M, Pittet D, Rotter ML.

Animals : key points

Strict aseptic conditions	Acceptable compromises	Not acceptable
-Shaving -Proper skin disinfection -Draping with barrier drapes + films	-Shaving -Proper skin disinfection -Basic draping with barrier drapes	-No shaving -No skin disinfection - No draping or draping with non barrier items

1/ Shave (but away from the surgery area, and with a good shaver !)

2/ Disinfect the skin

3/ Drape the animal

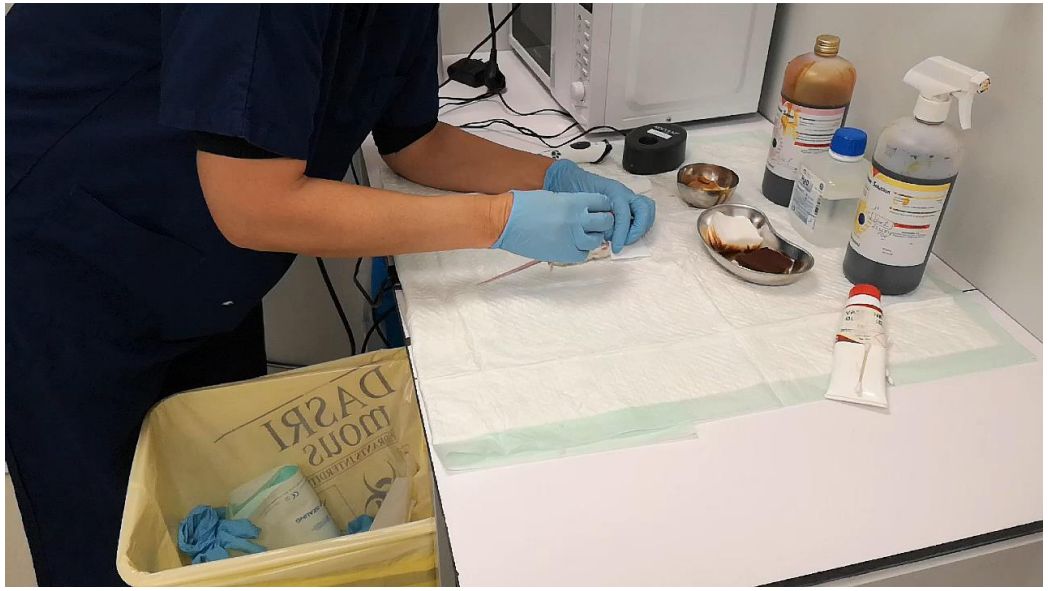
Animals: skin disinfection

The « go-forward» principle and the 3 steps :

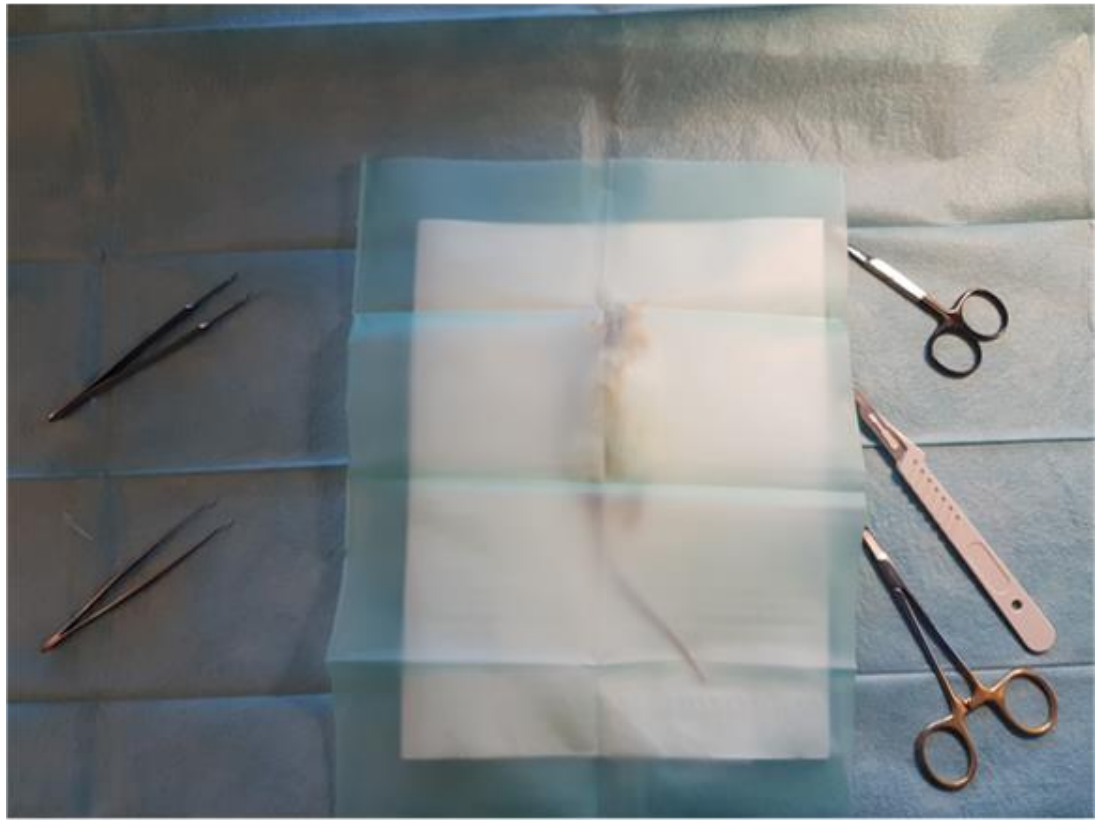
1/ Cleansing with a soap

2/ Rinsing with water

3/ Applying a solution



Animals : draping



Animal : draping (cont'd)

Picture : courtesy of Charles River surgery team

Environnement key points

Strict aseptic conditions	Acceptable compromises	Not acceptable
-Dedicated rooms (preparation, surgery, recovery) -Dedicated teams -Very clean and “empty” surgery room	-Dedicated spaces with clear separation between « clean » and « dirty » areas -Dedicated teams for surgeries in series -Clean and “empty” bench	-Animal preparation and surgery performed at the same station -Dirty and clean tasks performed by the same persons -”Busy” rooms with a lot of non surgical equipment

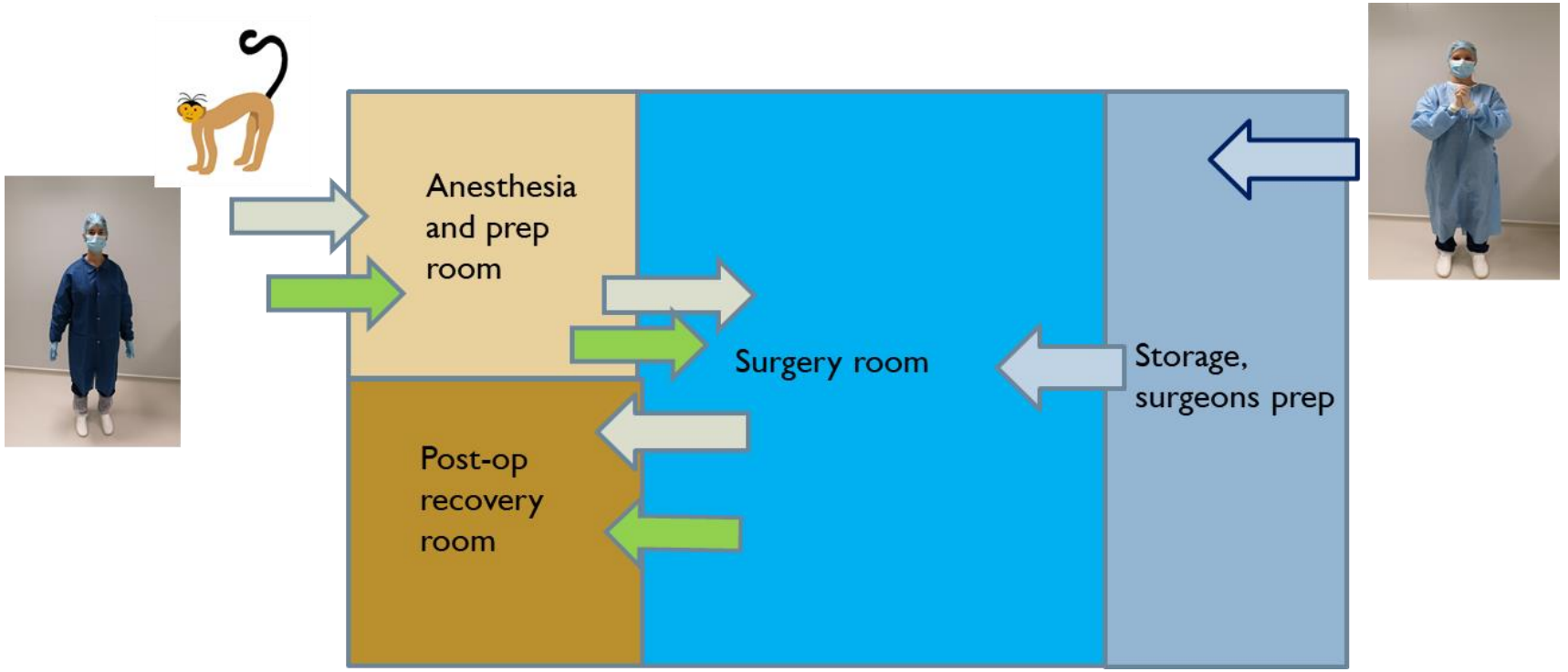
1/ Separate clean form “dirty” area (separated rooms are ideal)

2/ Keep clean area clean !

3/ Protect non sterile equipment close to your surgical area

4/ Try to remove “dangerous” equipment from the room (ex : fridges!) and eventually check ventilation systems

The ideal set-up



Separating clean from dirty : team work and dedicated spaces

« Dirty » activities

Pre operative care

Anesthesia

Shaving

Disinfection

Post-operative care

Cleansing, maintenance

Activities to be performed under aseptic conditions

Sterile cunsumables preparation

Sterile material manipulation

Surgical area set up

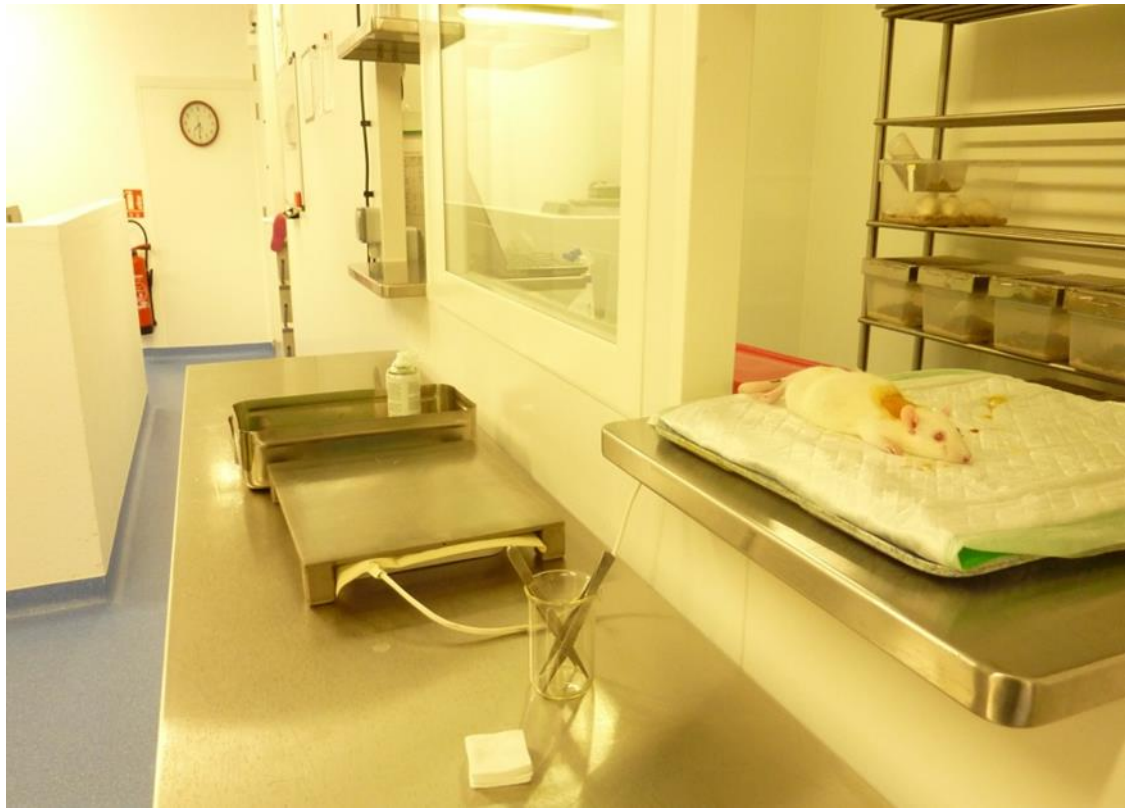
Surgeries

Animal transfer

« Dirty nurses »
Preparation area

Surgeons
Surgery area

Transfer bench for rodents



Picture : courtesy of Charles River surgery team

Instruments and cunsumables keypoints

Strict aseptic conditions	Acceptable compromises	Not acceptable
-One set of sterile instruments per animal -Sterile consumables only	-One set or two sets of sterile instrument, decontaminated between each animals with a head bead sterilizer or a cold sterilant -Sterile consumables only	-Non sterile instruments or use of the same set for several animals without decontamination -Non sterile consumables

1/ Work only with sterile instruments and consumables : everything that enters in contact with your animals cavity should be sterile !

2/ Anything you have to touch during the surgery that can’t be sterilized should be covered with something sterile

Different classical sterilization processes and what you can sterilize with it

Autoclave
Stainless steal Instruments
Glass pots
Cotton tips
Gauze
Silicone tubing
Aluminum foil

Dry heat
Stainless steal instruments
Glass pots
Aluminum foil

Cold sterilant
Stainless steal instruments
Hamilton syringes
Telemetry implants
Brain cannula
Injectors

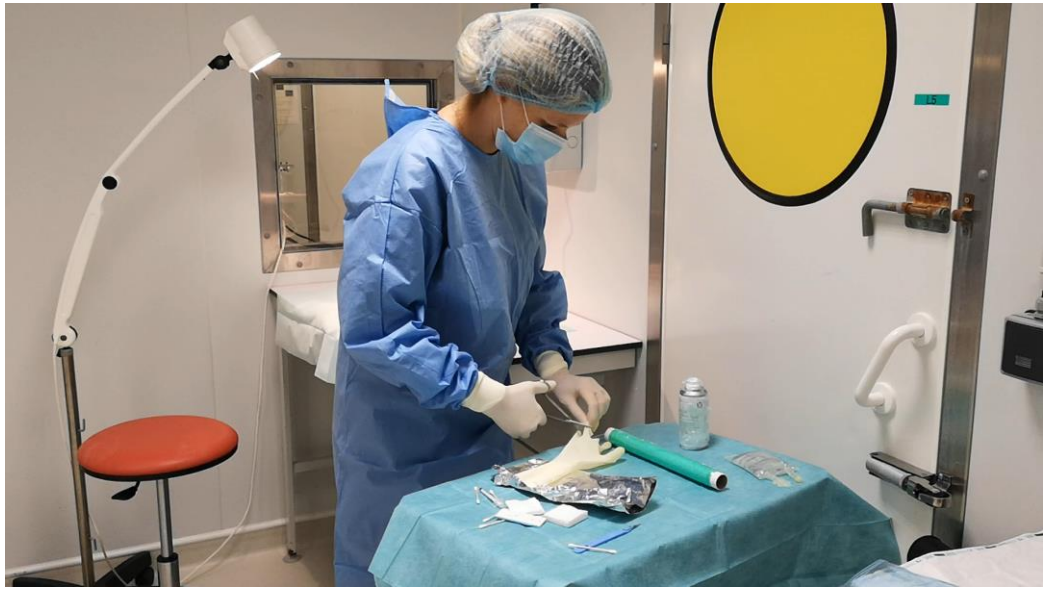
Gamma irradiation
Everything !! Including food film, PU tubing…

Interesting sterilization tools

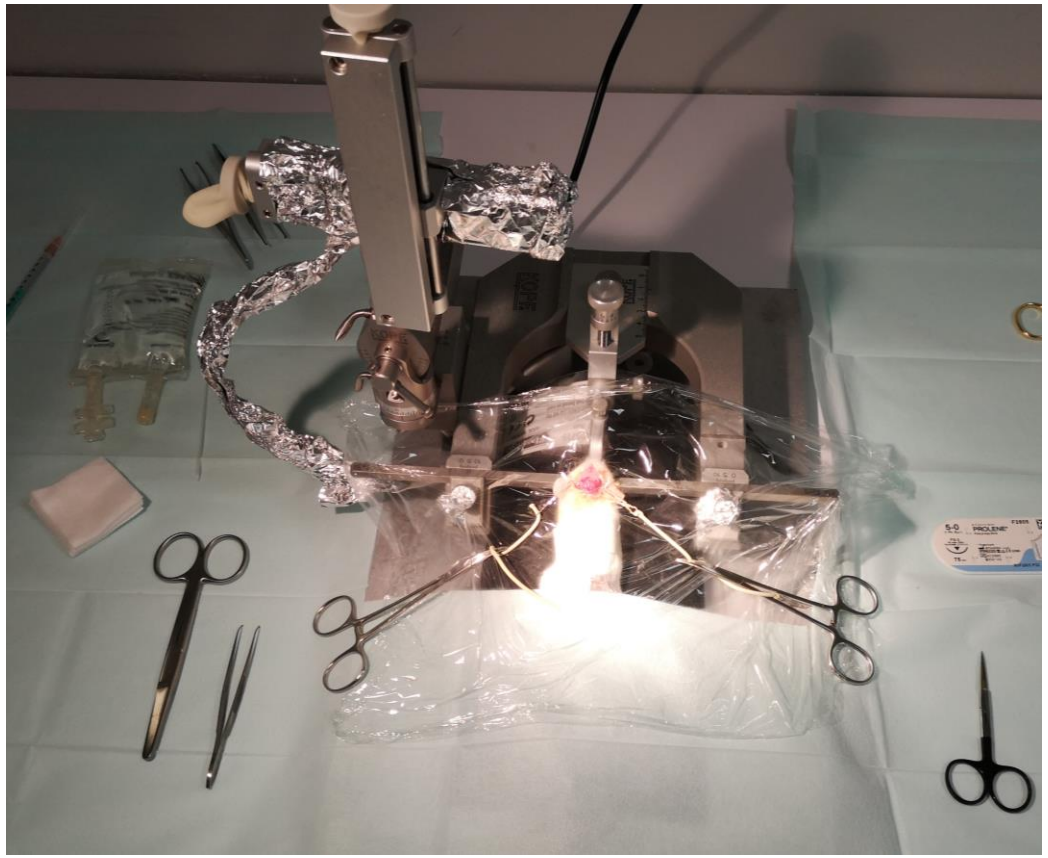
Enos S class B mini autoclave (approx 1500€)

Dry bead « sterilizer » (approx 500€)

Covering non sterile items : some tips and tricks



Covering non sterile items : some tips and tricks (cont'd)



Action ! Build your own improvement plan

1/ Buy basic consumables

Cost : 25+120+30+10+10+10+ 20 : 225€ for approximately 20 sessions

2/Spend ½ day working on your strategy

3/ Build and step by step improve your aseptic techniques routine

Ask the help of you local vets !

Conclusion and Q&A sessions !

Thanks a lot for your attention ☺