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Skingineering: Fetal tissue engineering

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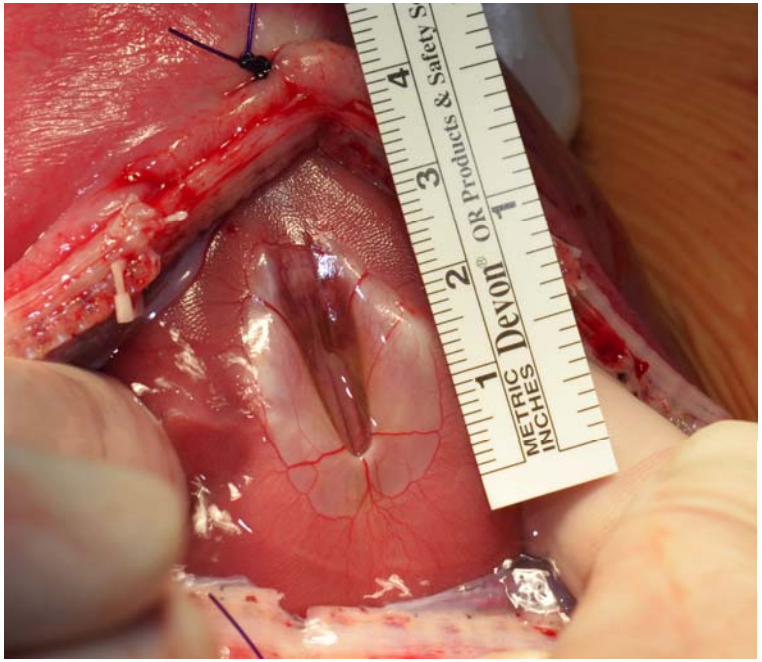
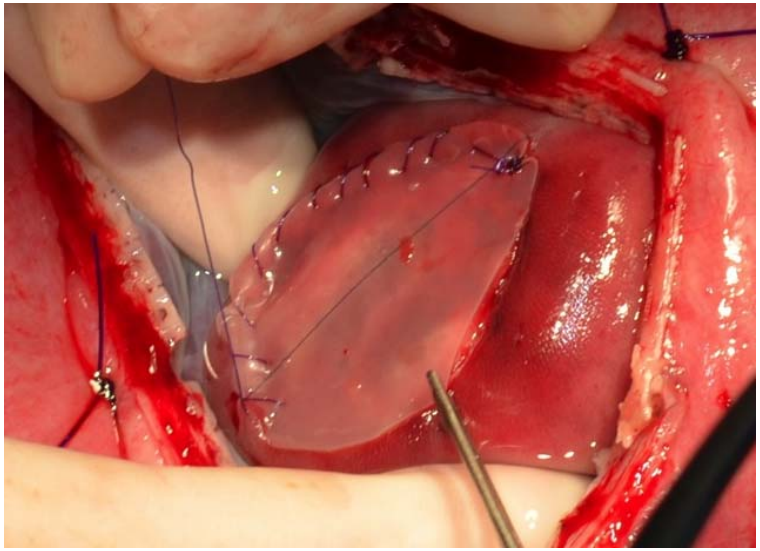
Some defects are too large...

- CHOP: 20/100 (20%)→ Alloderm
- Zurich: 4/17 (23%) → Integra





Meuli M, et al: Premiere use of Integra artificial skin to close an extensive fetal skin defect during open in utero repair of myelomeningocele. Pediatr Surg Int 29:1321-1326, 2013

The ideal skin substitute

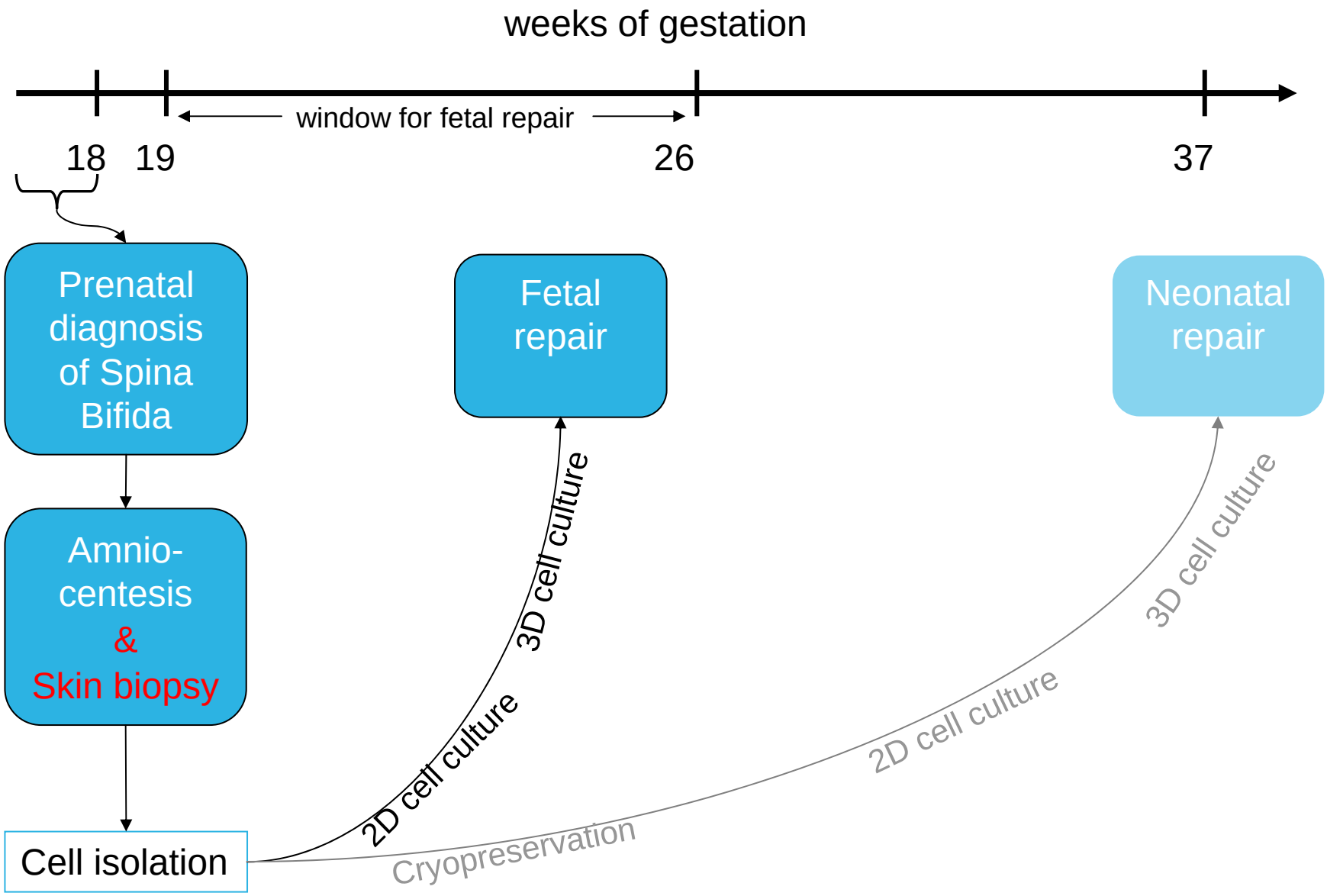
- Watertight
- Functional
- Definitive

- Usefull for a less invasive and earlier approach

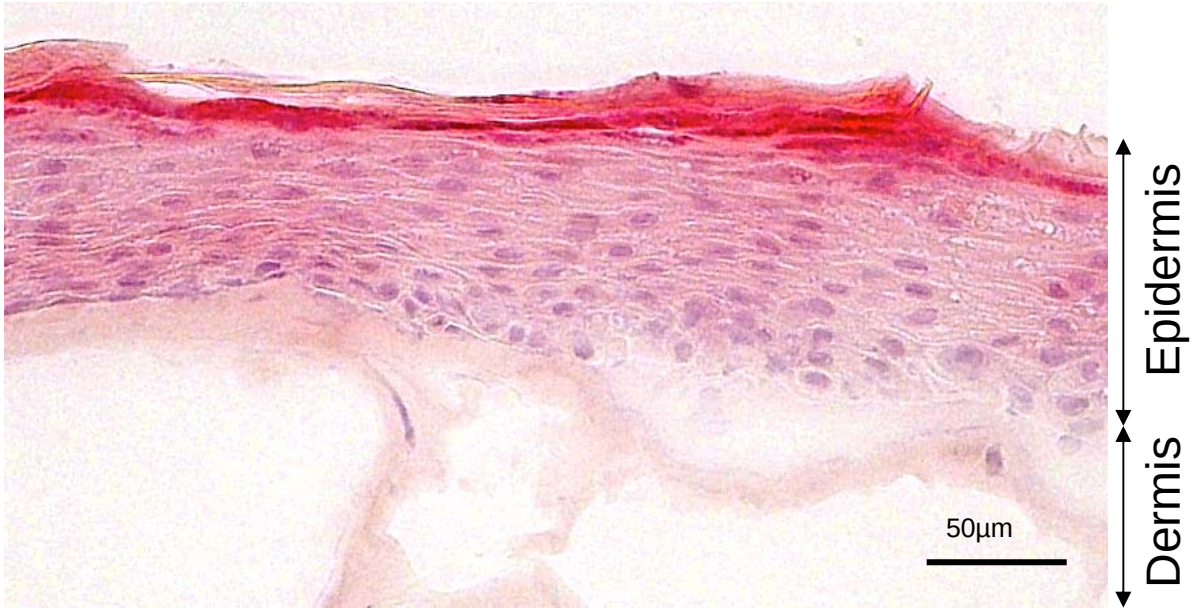
Autologous

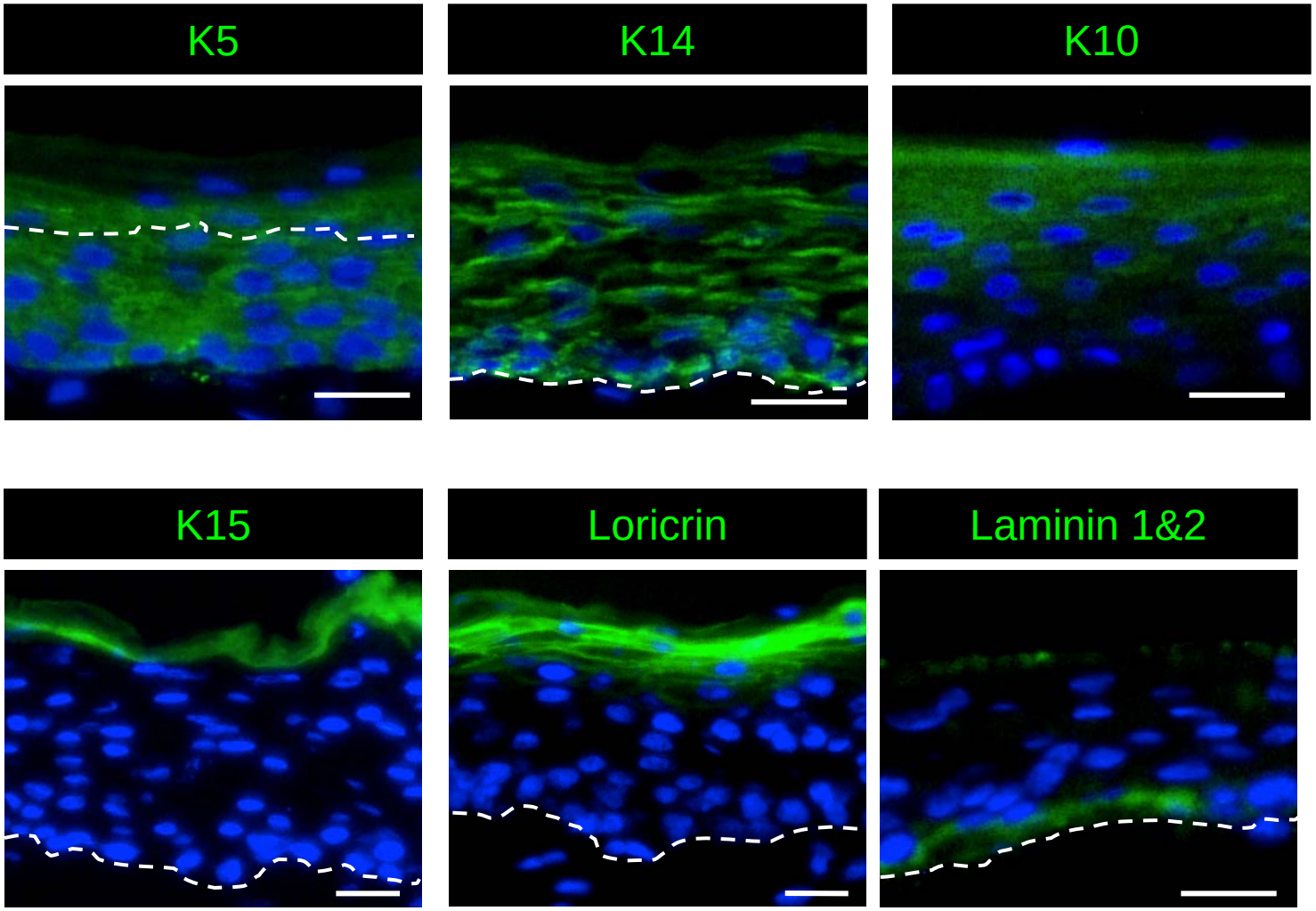
laboratory grown (out of the shelf)

fetal dermo-epidermal skin substitute

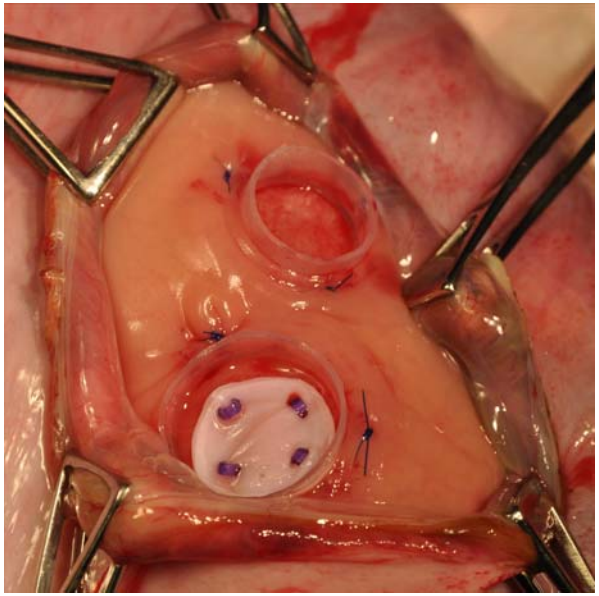

weeks of gestation
window for fetal repair
18
19
26
37
Prenatal diagnosis of Spina Bifida
Amnio-centesis & Skin biopsy
Cell isolation
Fetal repair
Neonatal repair
2D cell culture
3D cell culture
Cryopreservation
2D cell culture
3D cell culture

in vitro tissue engineered dermo-epidermal skin substitute

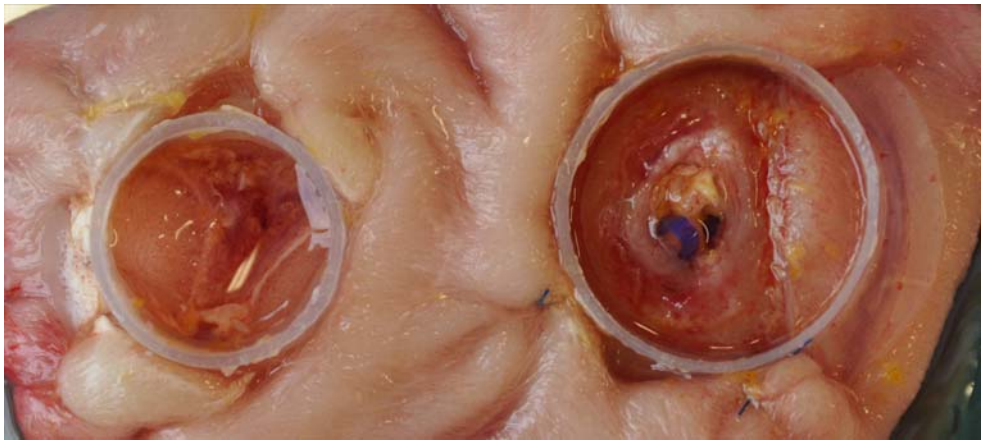



K5
K14
K10
K15
Loricrin
Laminin 1&2

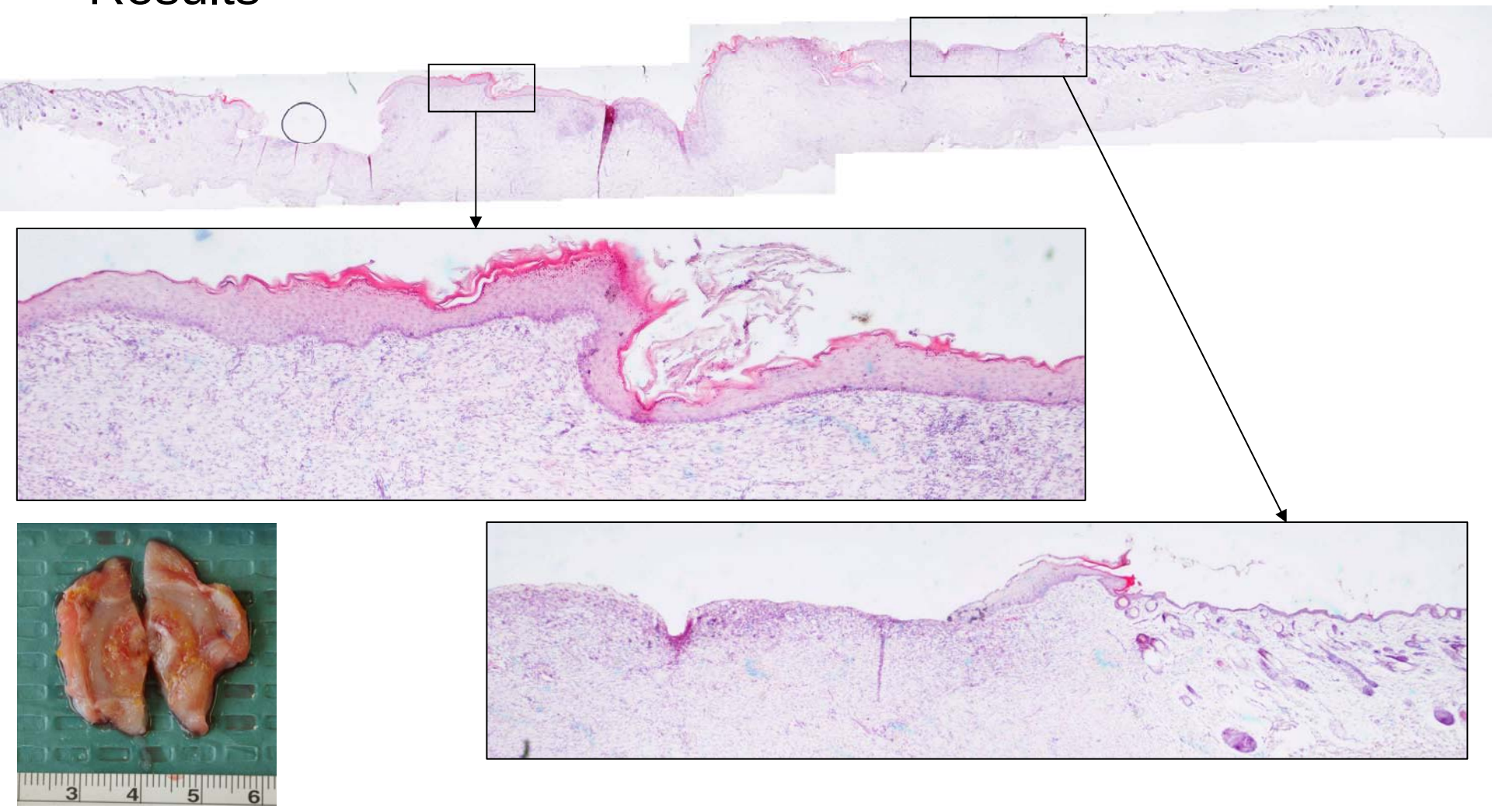
Results



4 wks
in-utero



Results



Conclusion

– Our experiments provide evidence that fetal cell-derived skin analogues with near normal anatomy can be engineered *in vitro*

– Intra-uterine autologous transplantation is possible

– The graft survives in-utero, keeping histologically its skin-like structure

Outlook

- Use of the autologous tissue engineered fetal skin analogue to close a fetal MMC in the fetal sheep model
- Tissue engineering of a fetal skin using human fetal skin cells (cell acquisition problematic)
- Use of amniotic stem cells for the tissue engineering of autologous skin