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LIVESTOCK BIOTECHNOLOGY WHY AND HOW?

Simon Lillico

Centre for Tropical Livestock Genetics and Health

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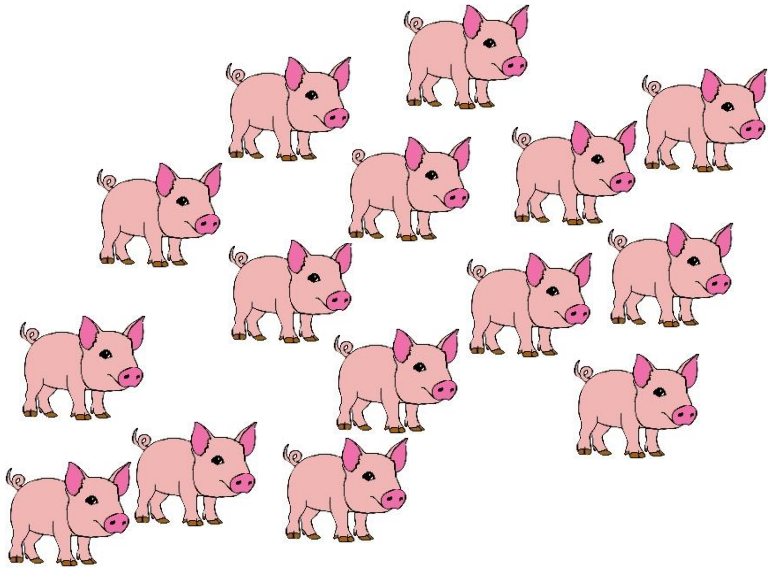
Selective breeding

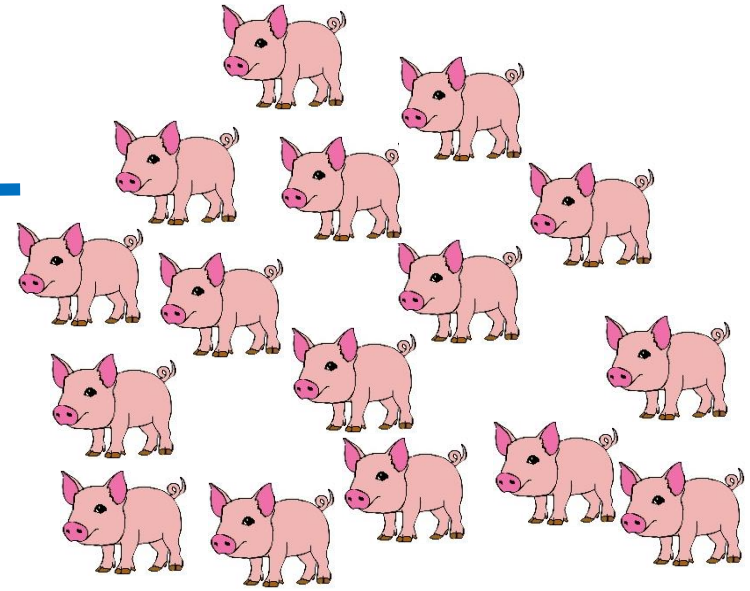
Genomic selection



Associate SNP profile with phenotype

Thousands of SNPs
Thousands of phenotypes

Generate prediction equation



Gather SNP profiles
Apply prediction equation
Generate EBV

Breed best animals

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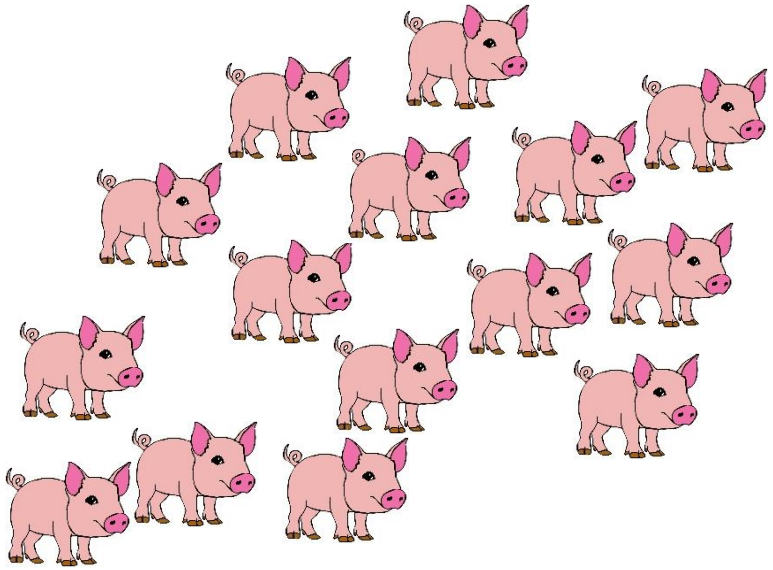
Genomic selection



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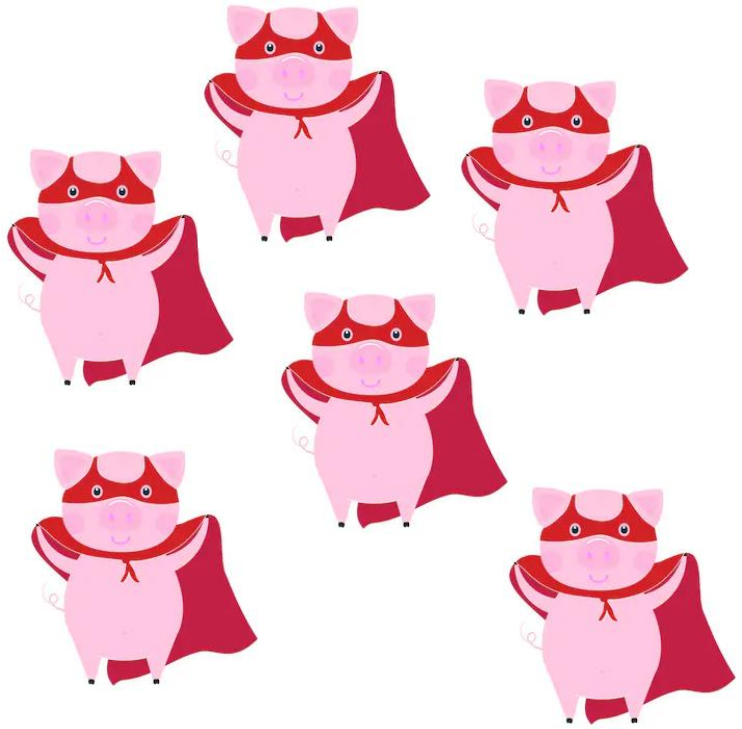

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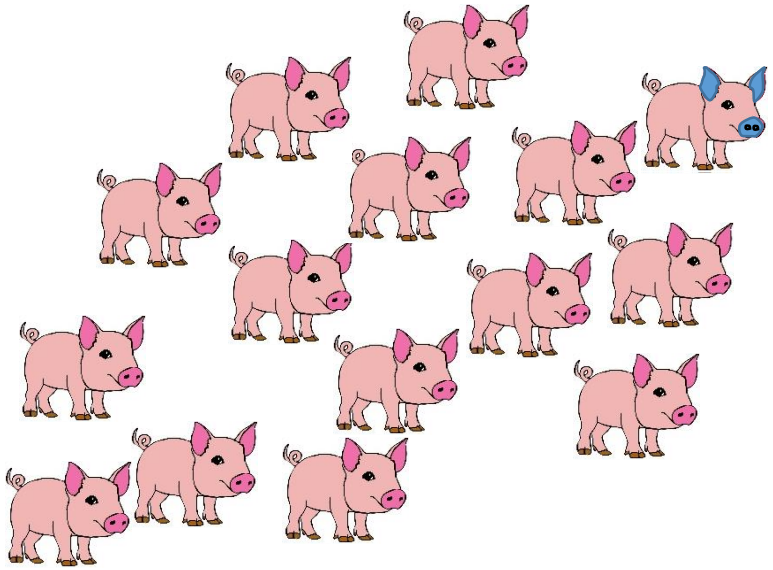

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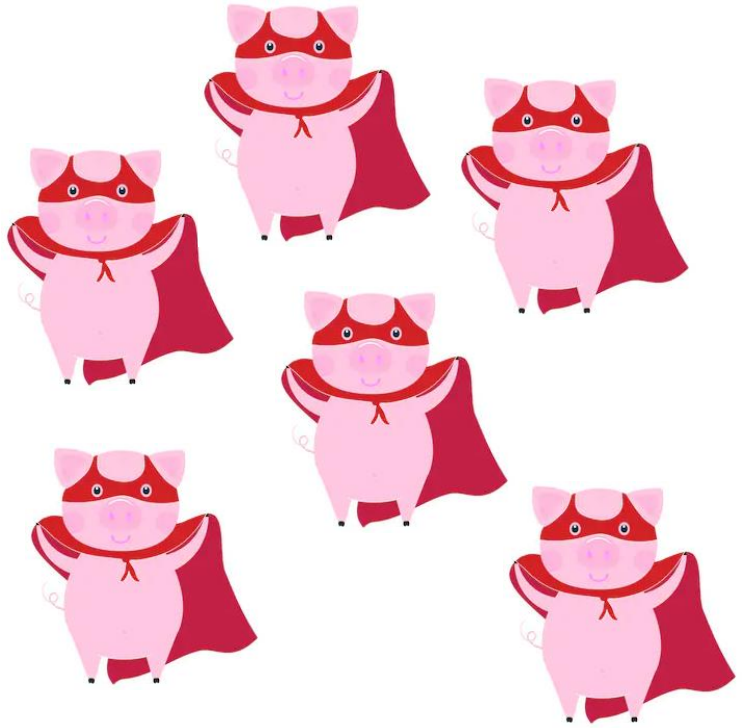

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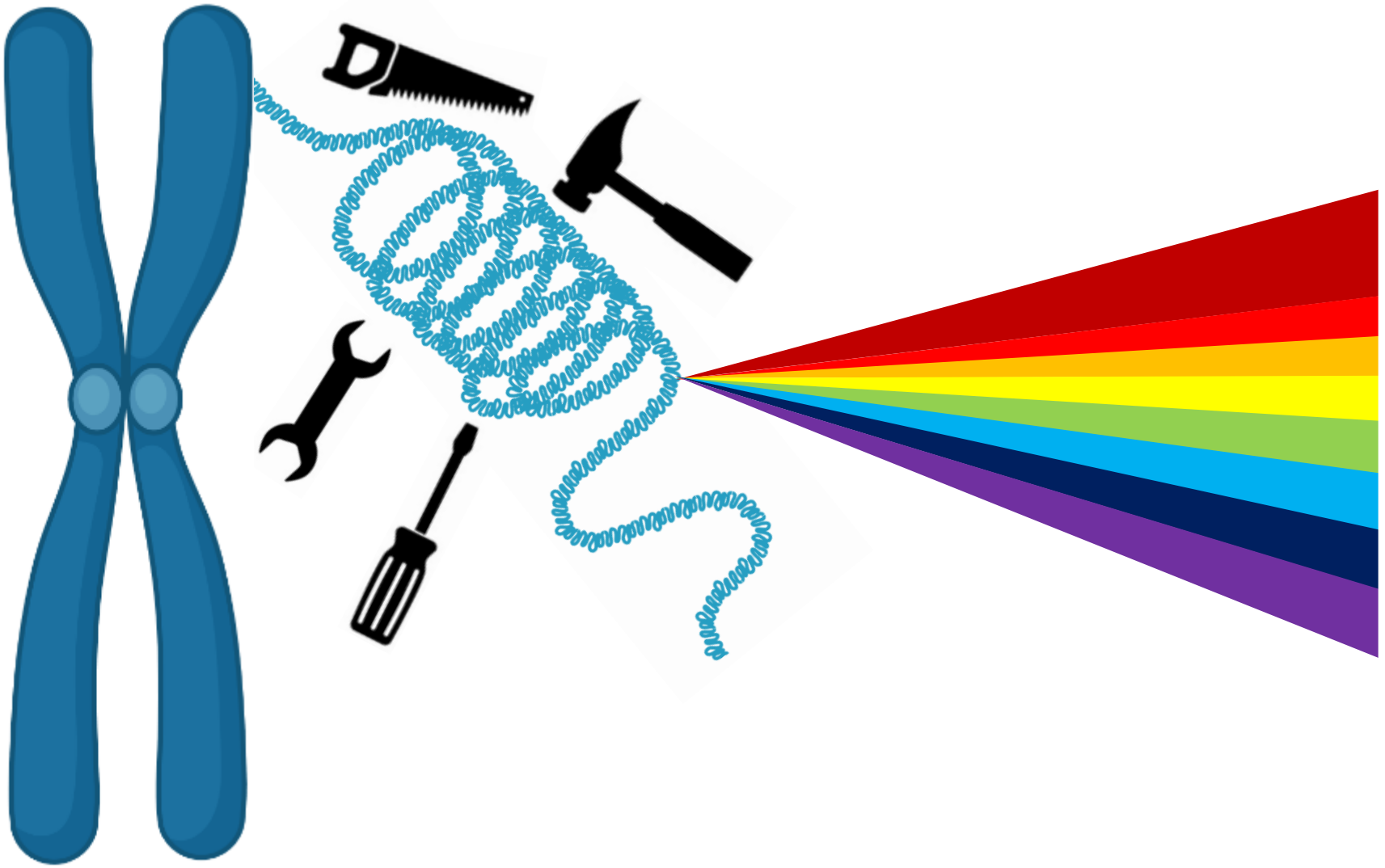
Biotechnology



Transgenic

Expression cassette

Targeted transgene

Targeted insertion

Small sequence exchange

Targeted deletion

Targeted indel

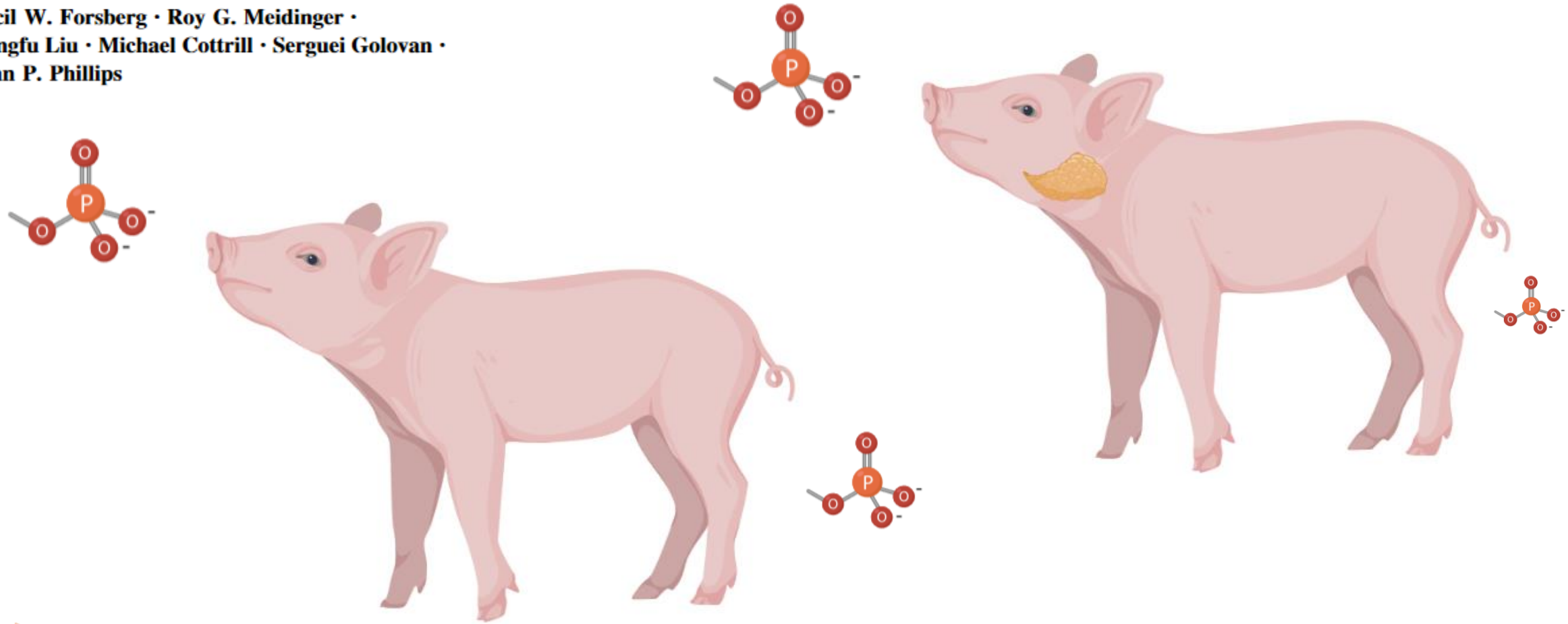
Single nucleotide change

Edited

Transgenesis

Integration, stability and expression of the *E. coli* phytase transgene in the Cassie line of Yorkshire Enviropig™

Cecil W. Forsberg · Roy G. Meidinger · Mingfu Liu · Michael Cottrill · Serguei Golovan · John P. Phillips



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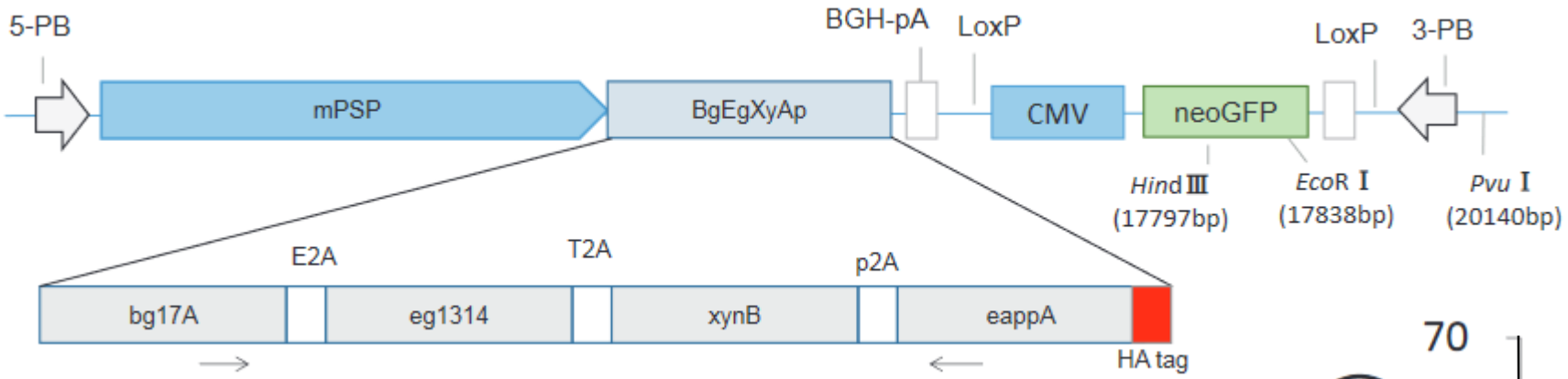
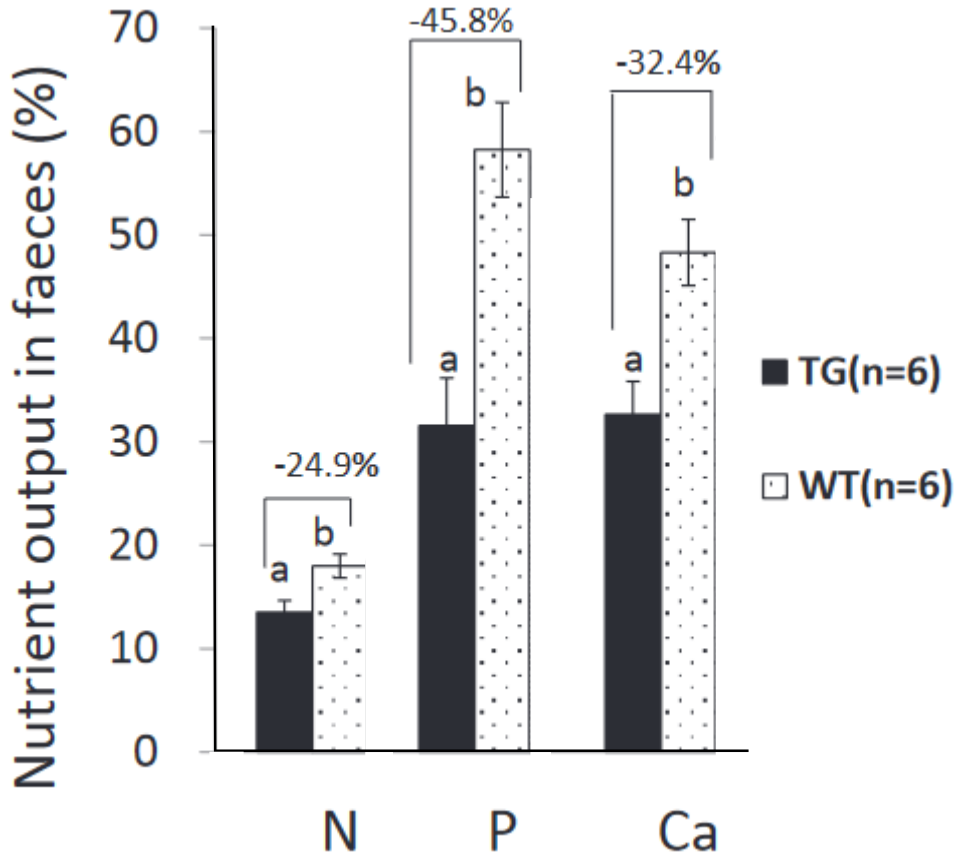
Transgenesis



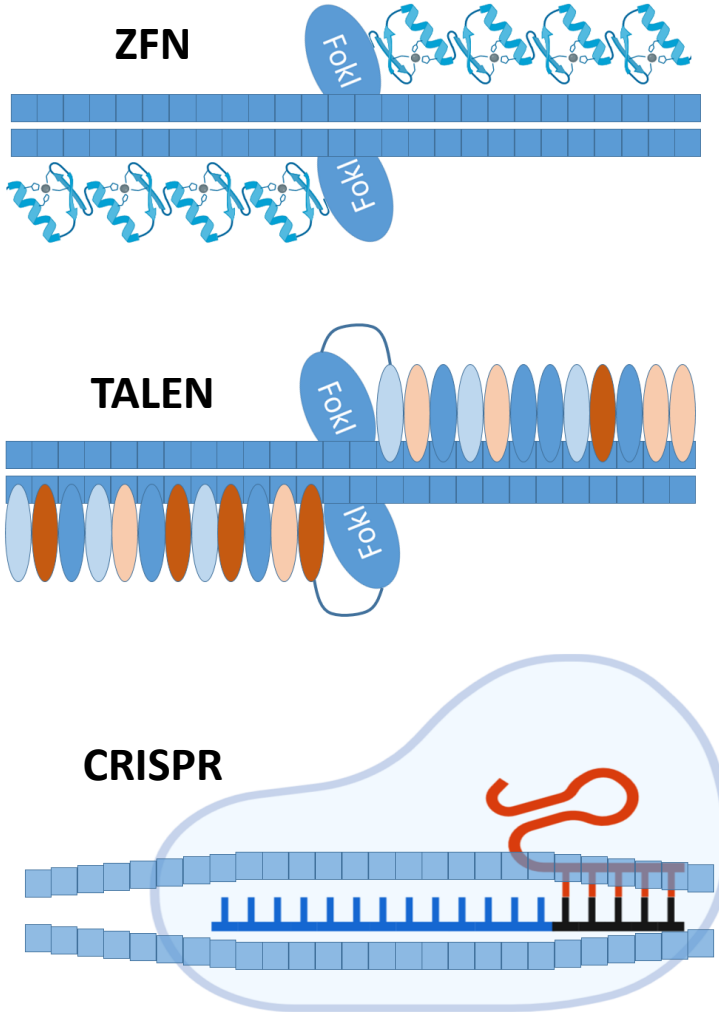
eLIFE
elifesciences.org

Novel transgenic pigs with enhanced growth and reduced environmental impact

Xianwei Zhang[1,2†], Zicong Li[1†], Huaqiang Yang[1,2], Dewu Liu[1], Gengyuan Cai[1,2], Guoling Li[1], Jianxin Mo[1], Dehua Wang[1], Cuili Zhong[1], Haoqiang Wang[1], Yue Sun[1], Junsong Shi[2], Enqin Zheng[1], Fanming Meng[1], Mao Zhang[1], Xiaoyan He[1,2], Rong Zhou[2], Jian Zhang[2], Miaorong Huang[1], Ran Zhang[3], Ning Li[3], Mingzhe Fan[4], Jinzeng Yang[5], Zhenfang Wu[1,2*]



Editors allow us to re-write the genome



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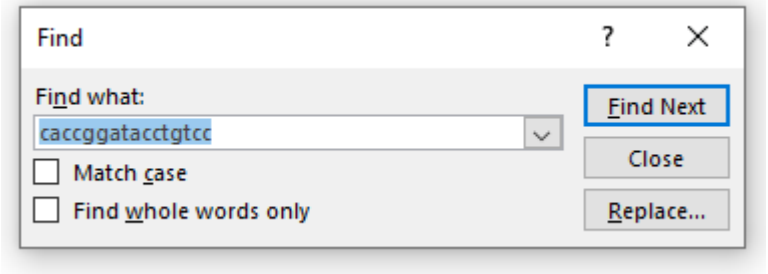
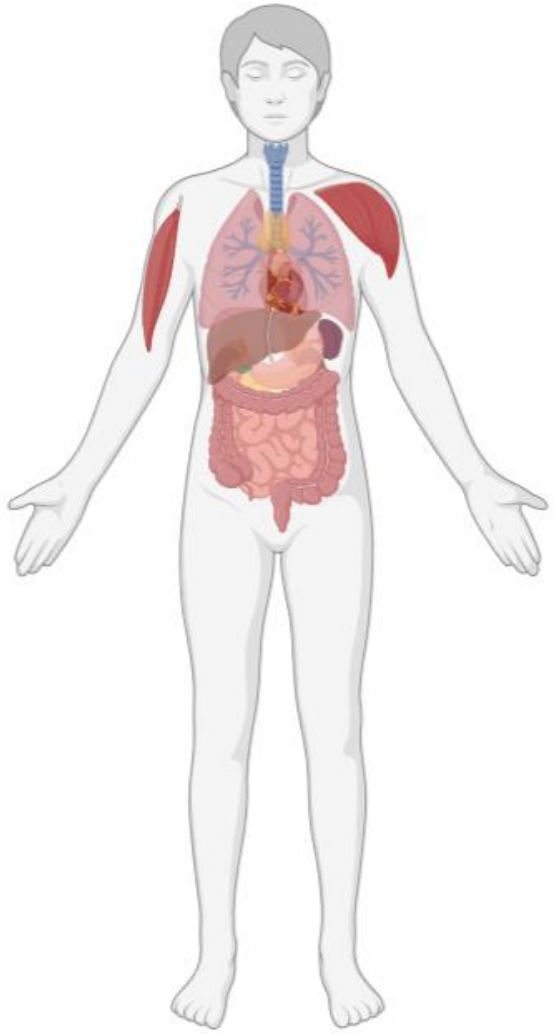
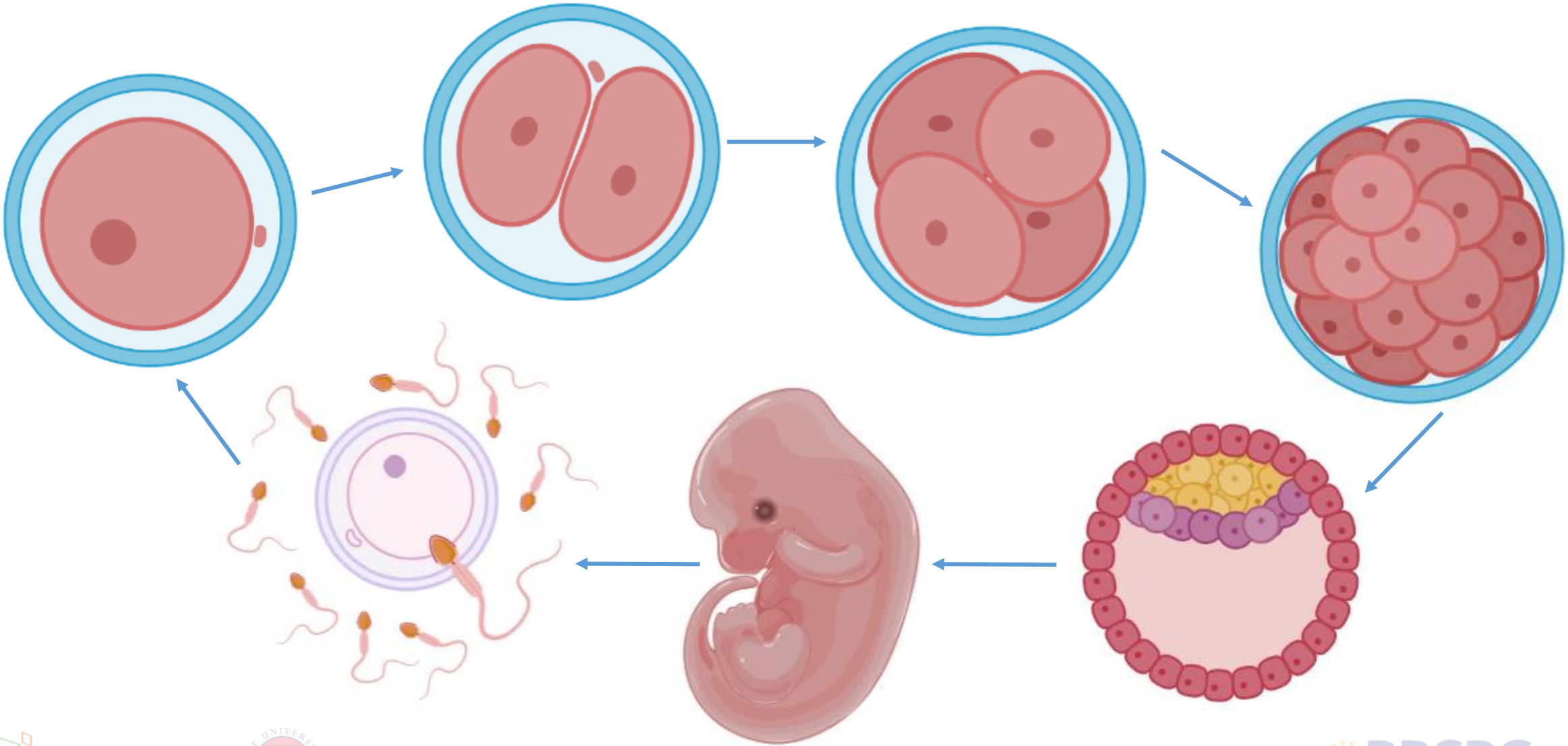


Development of genome editors ongoing



Cancers
Duchenne muscular dystrophy
Thalassemia
Haemophilia
Transthyretin amyloidosis
Leber congenital amaurosis
HIV
Huntington’s disease
Cystic fibrosis

Livestock applications require alteration of the germline



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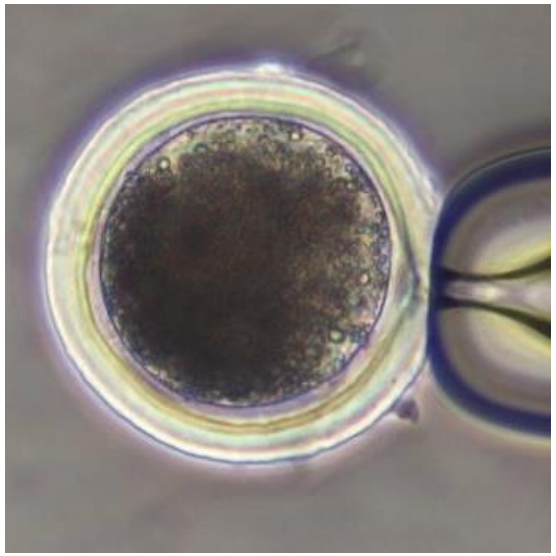
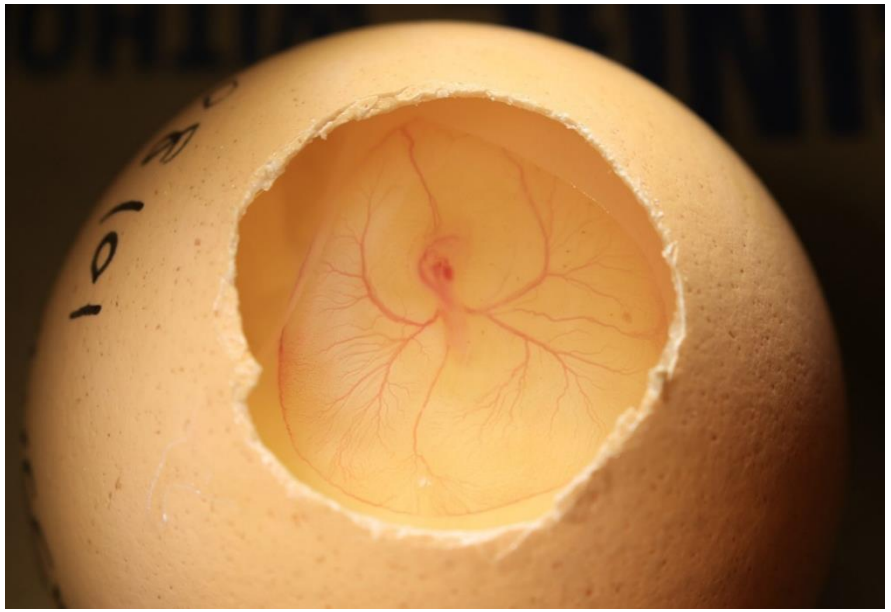
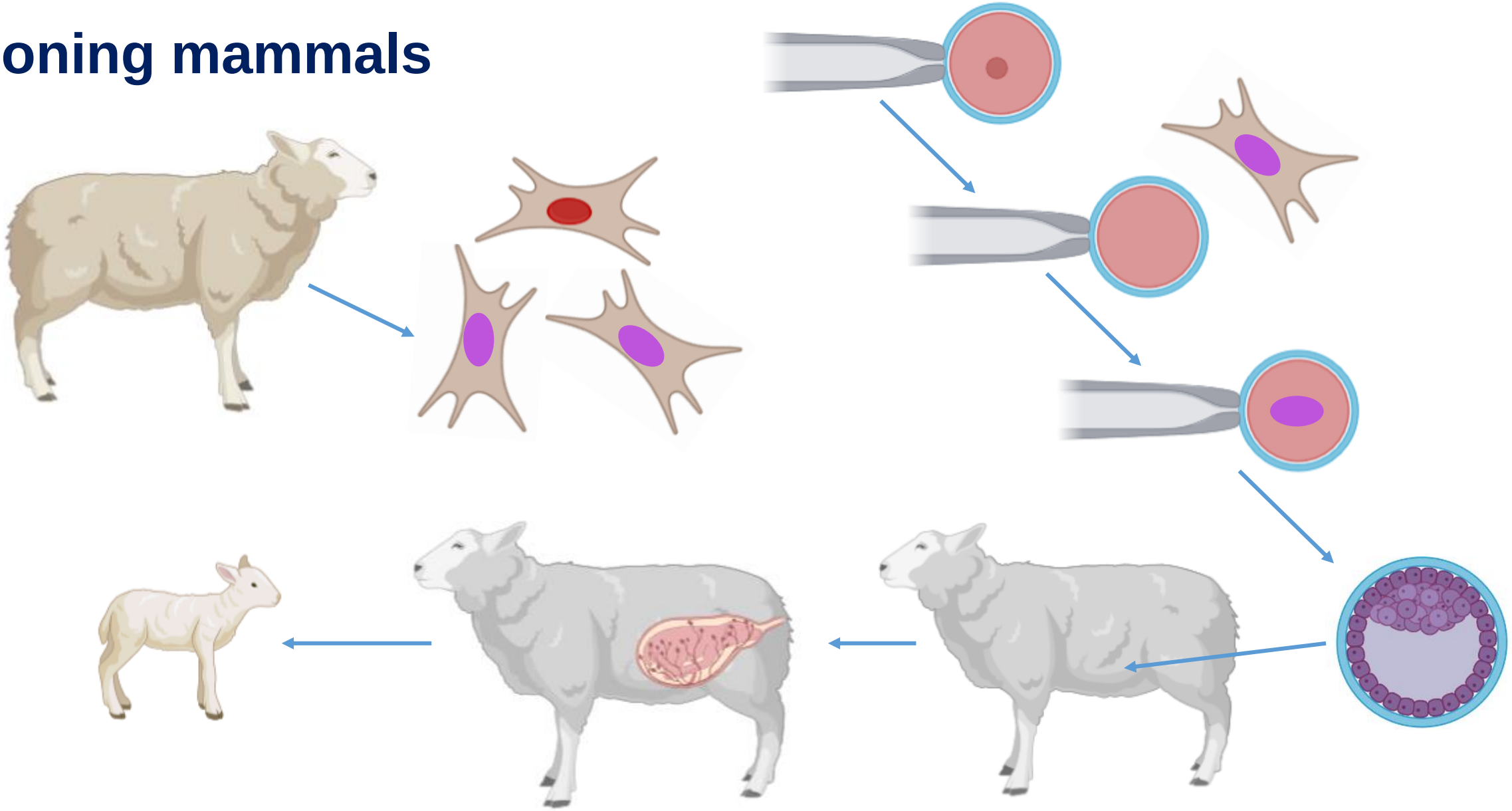




Cloning mammals



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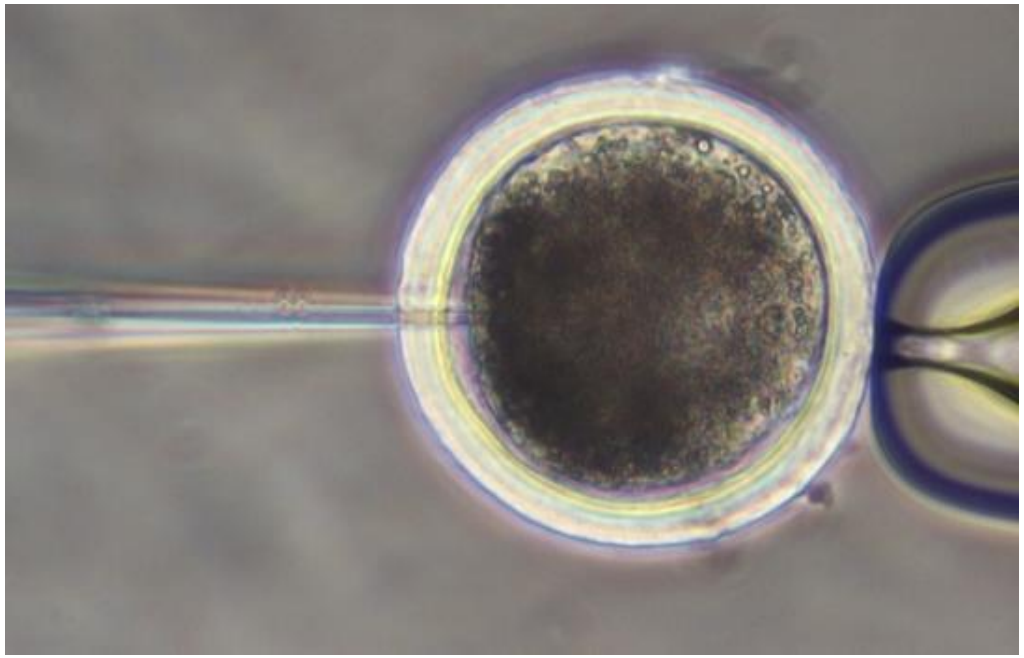
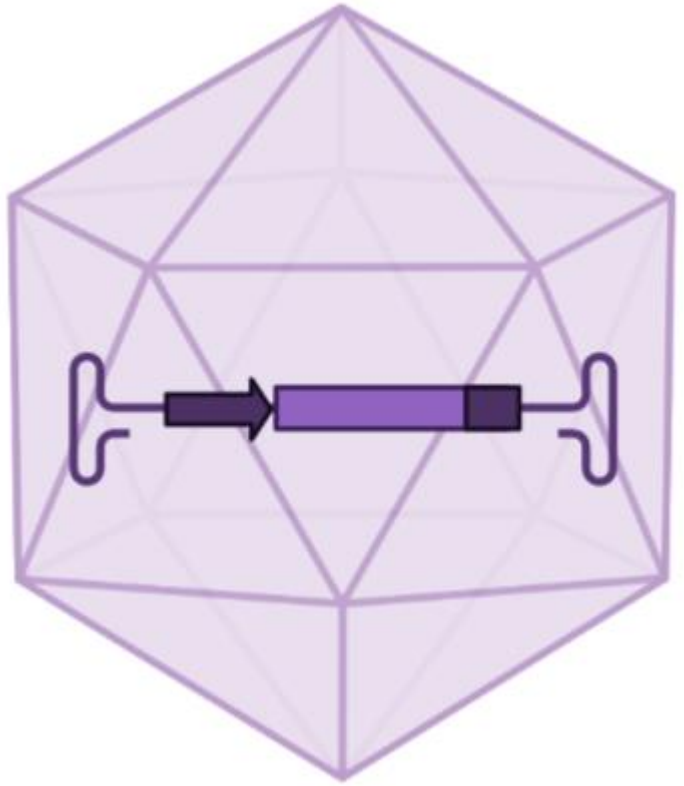
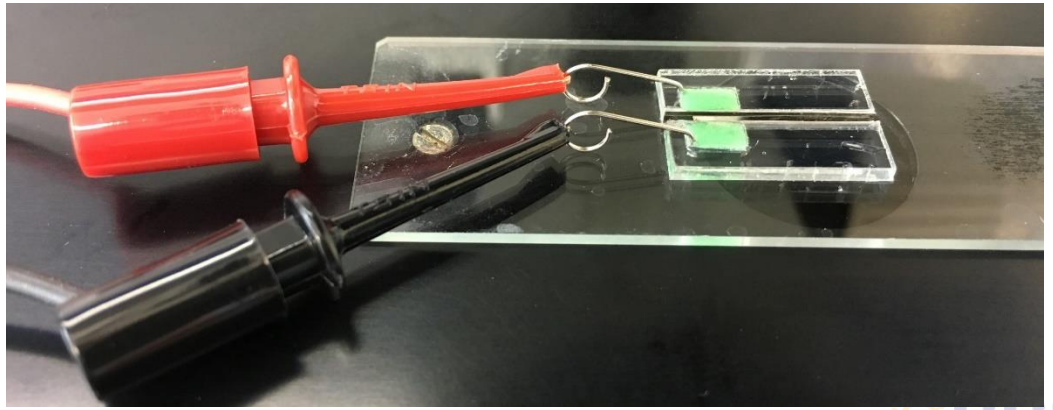
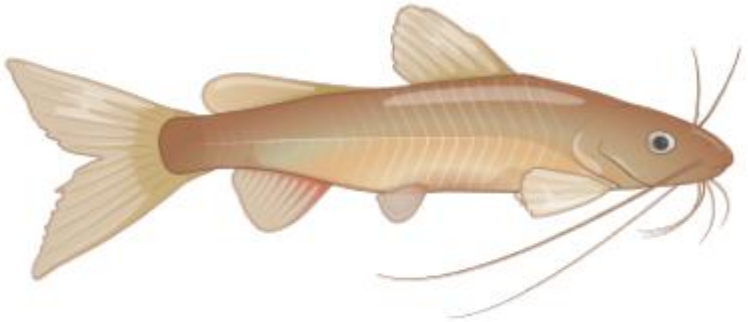
Direct mammalian zygote editing

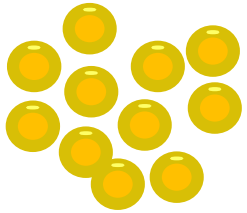


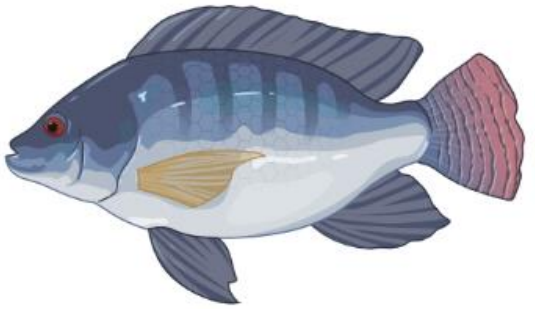




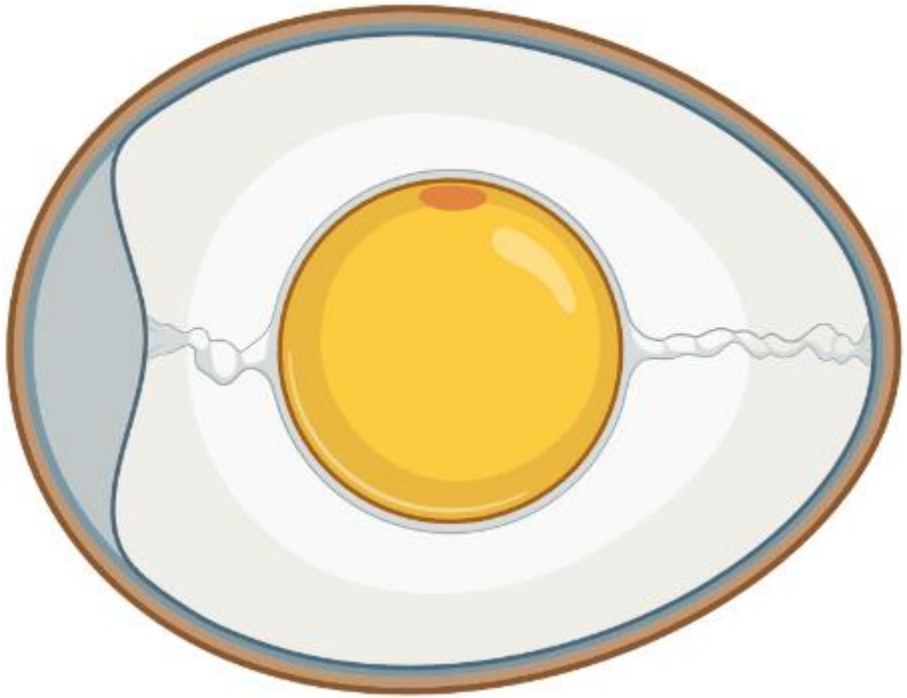
GA fish

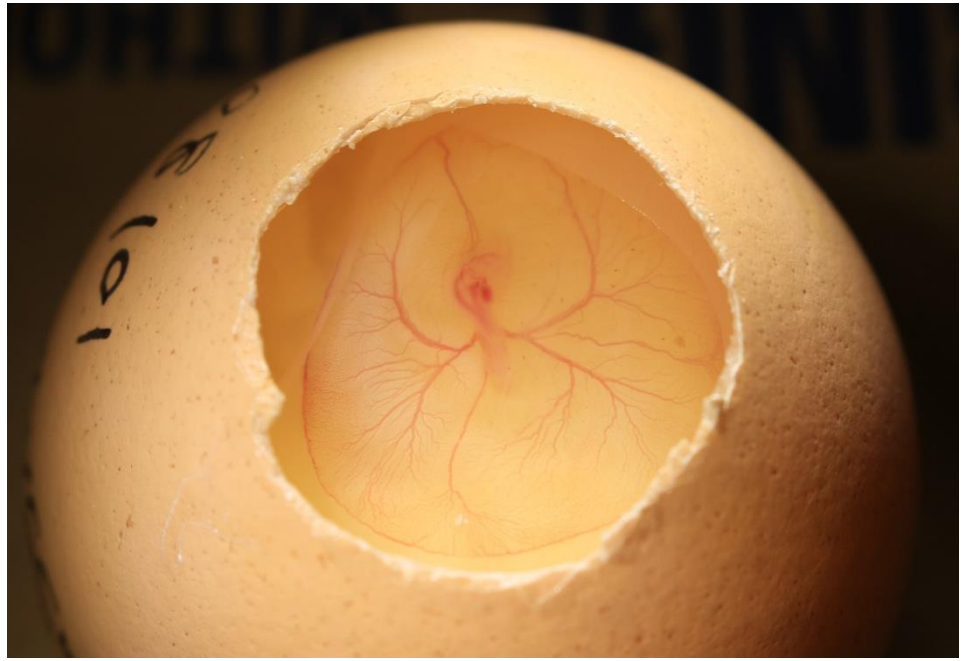




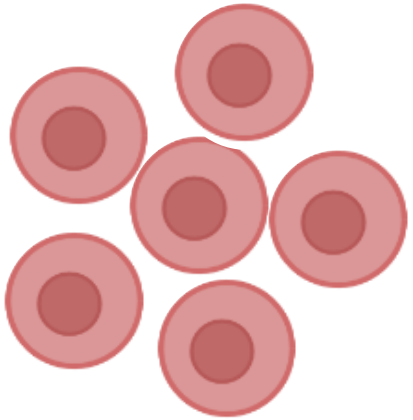


Birds (chickens)





PGC



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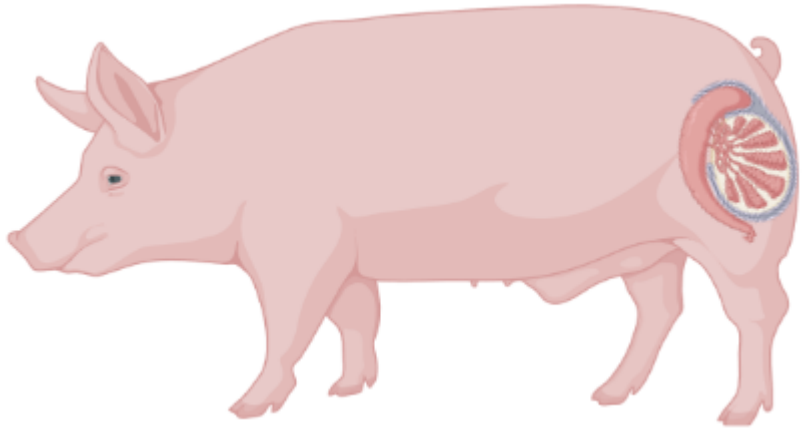
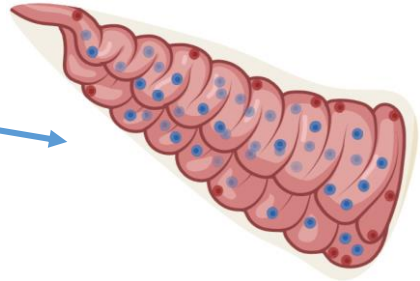
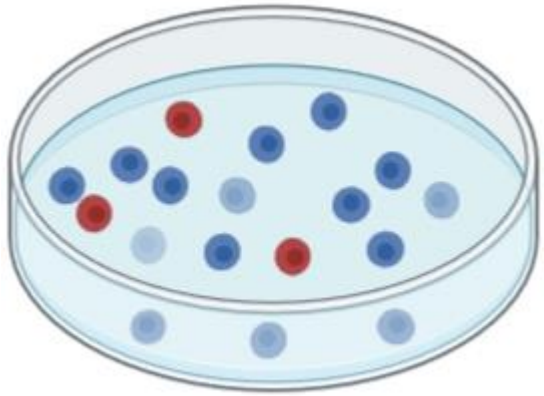
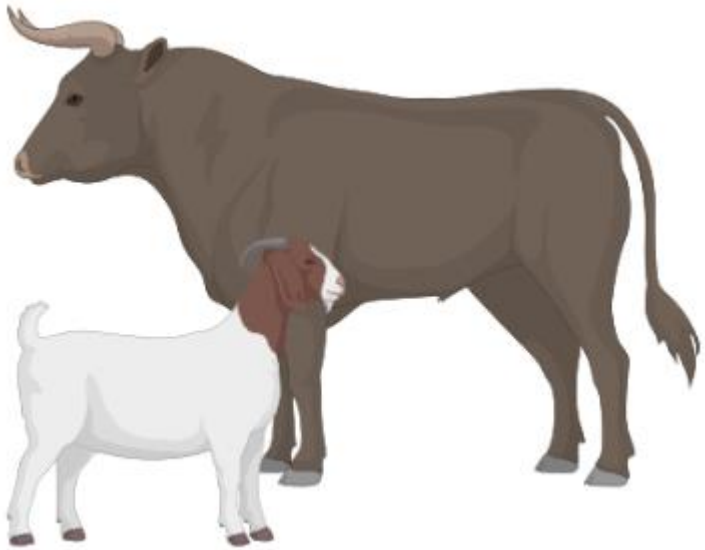
Mammalian SSCs and surrogate sires

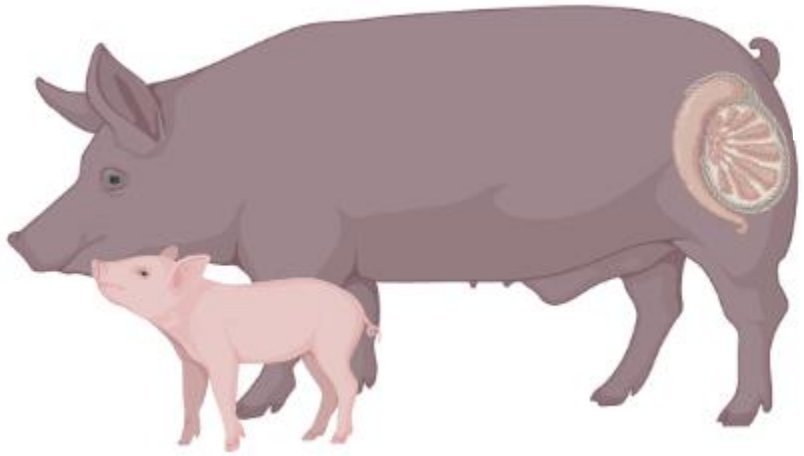




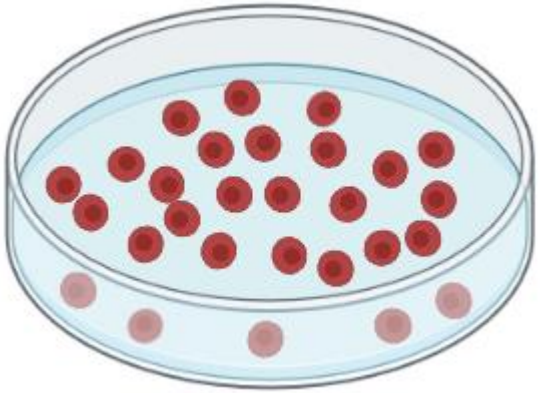
Testicular cells







SSC



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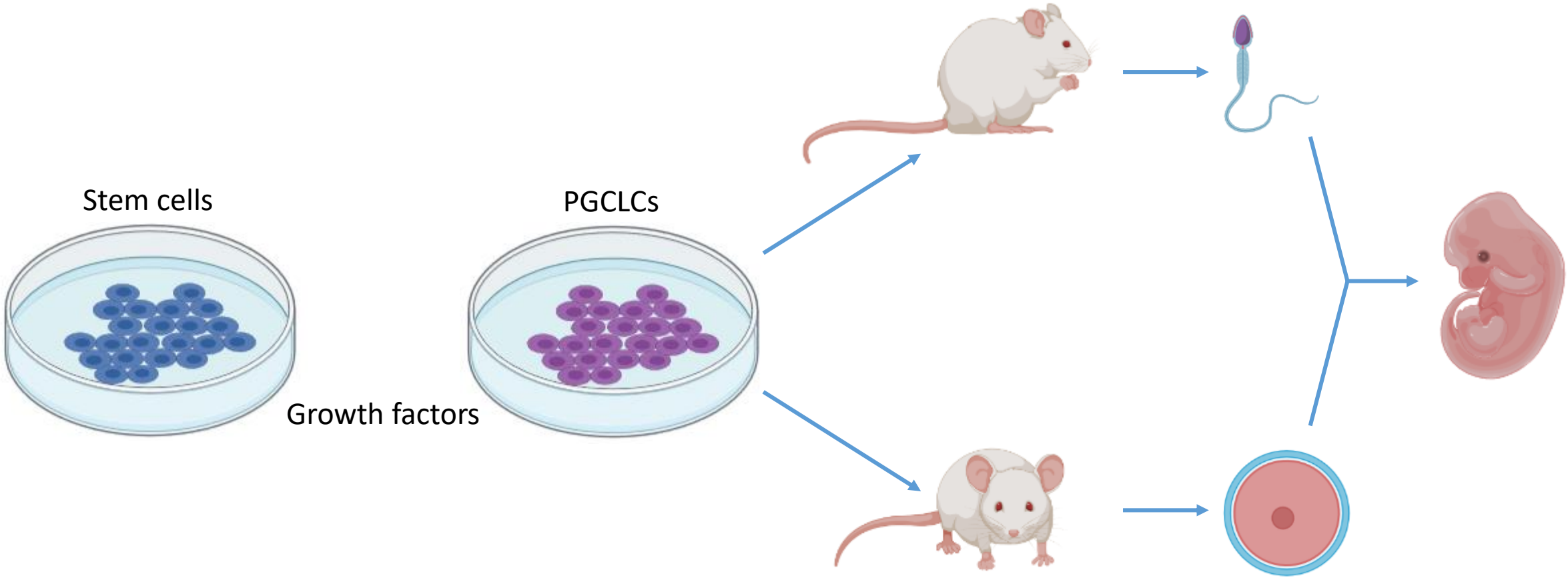
Just over the horizon



Challenges

Perception

Views vary within and between societies

There is no such thing as “the public”

Efficiencies

Fine for making individuals for science

Not so fine for making large cohorts with identical edits

Targets

Causative SNPs are rare

Better understanding of genes vs phenotype

Polygenic traits

Regulations

A work in progress – why we are here today

Vary between jurisdictions