# Morphogenesis

Motivation for this year's course



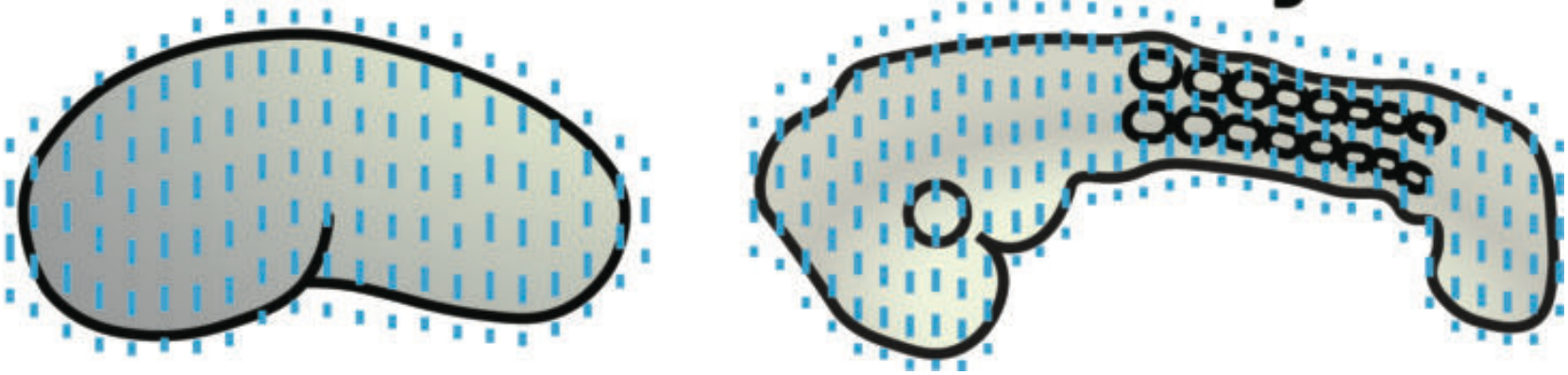
FOTO: NTB/SCANPIX - SVEIN ERIK FURULUND/AFTENPOSTEN.

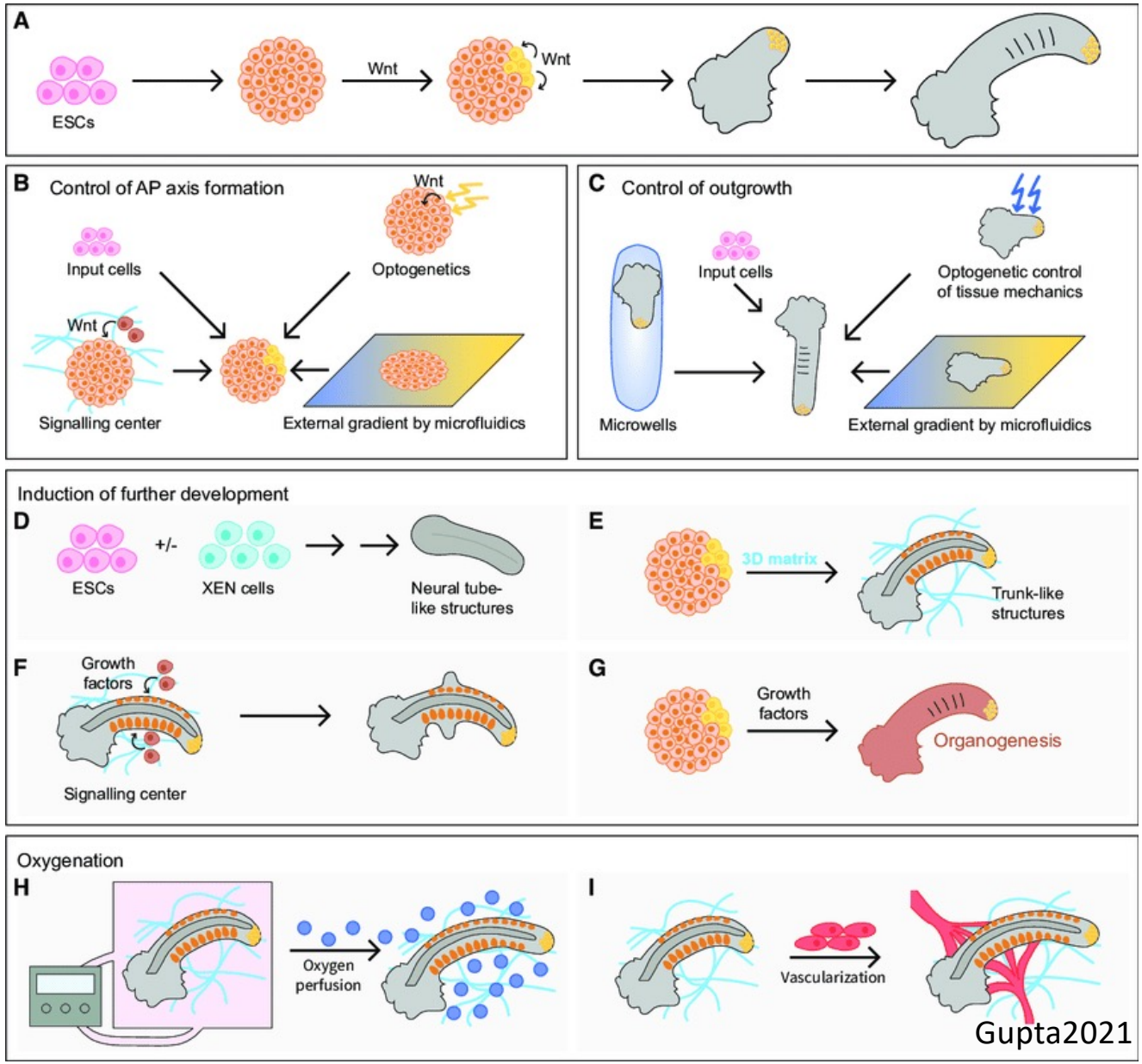
I dag er det stor mangel på organer til organtransplantasjoner. I fremtiden kan organene forhåpentligvis dyrkes i laboratorier. Nå er forskere i gang med de første spede forsøkene.

Tester ut helt ny teknologi:

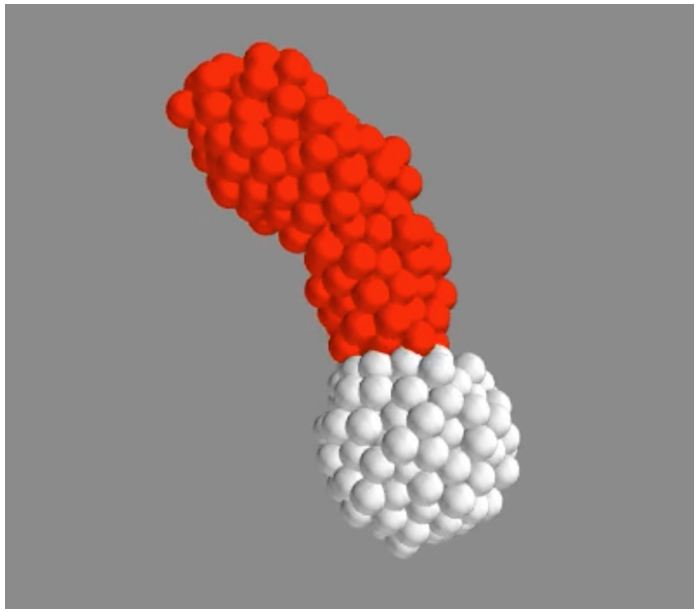
# Bereder grunnen for kunstige organer

Gastruloid Embryo






Gupta2021



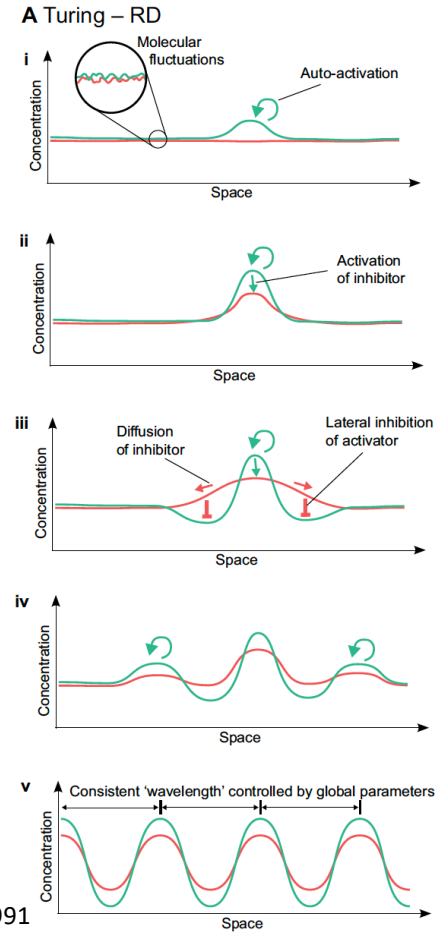
[Richard's models]

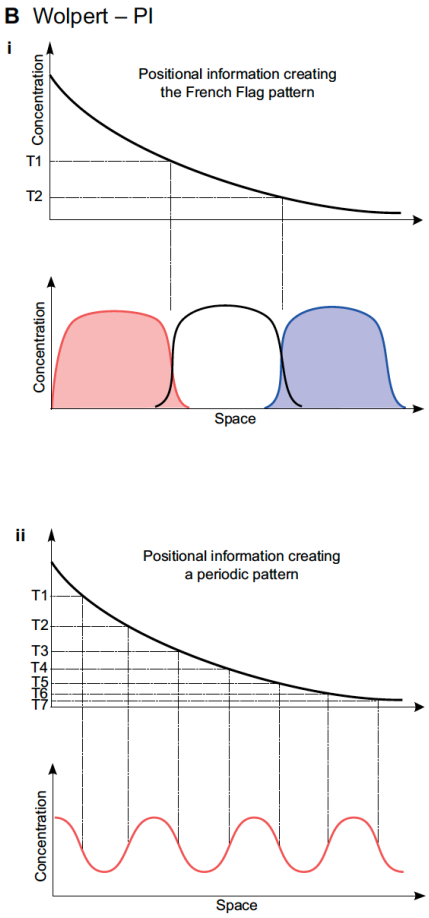
# Reaction-Diffusion vs Positional Information

## Turing (RD) vs Wolpert (PI)

$$\partial_t u = D\partial_x^2 u + R(u),$$

$$\begin{pmatrix} \partial_t u \\ \partial_t v \end{pmatrix} = \begin{pmatrix} D_u & 0 \\ 0 & D_v \end{pmatrix} \begin{pmatrix} \partial_{xx} u \\ \partial_{xx} v \end{pmatrix} + \begin{pmatrix} F(u,v) \\ G(u,v) \end{pmatrix}$$



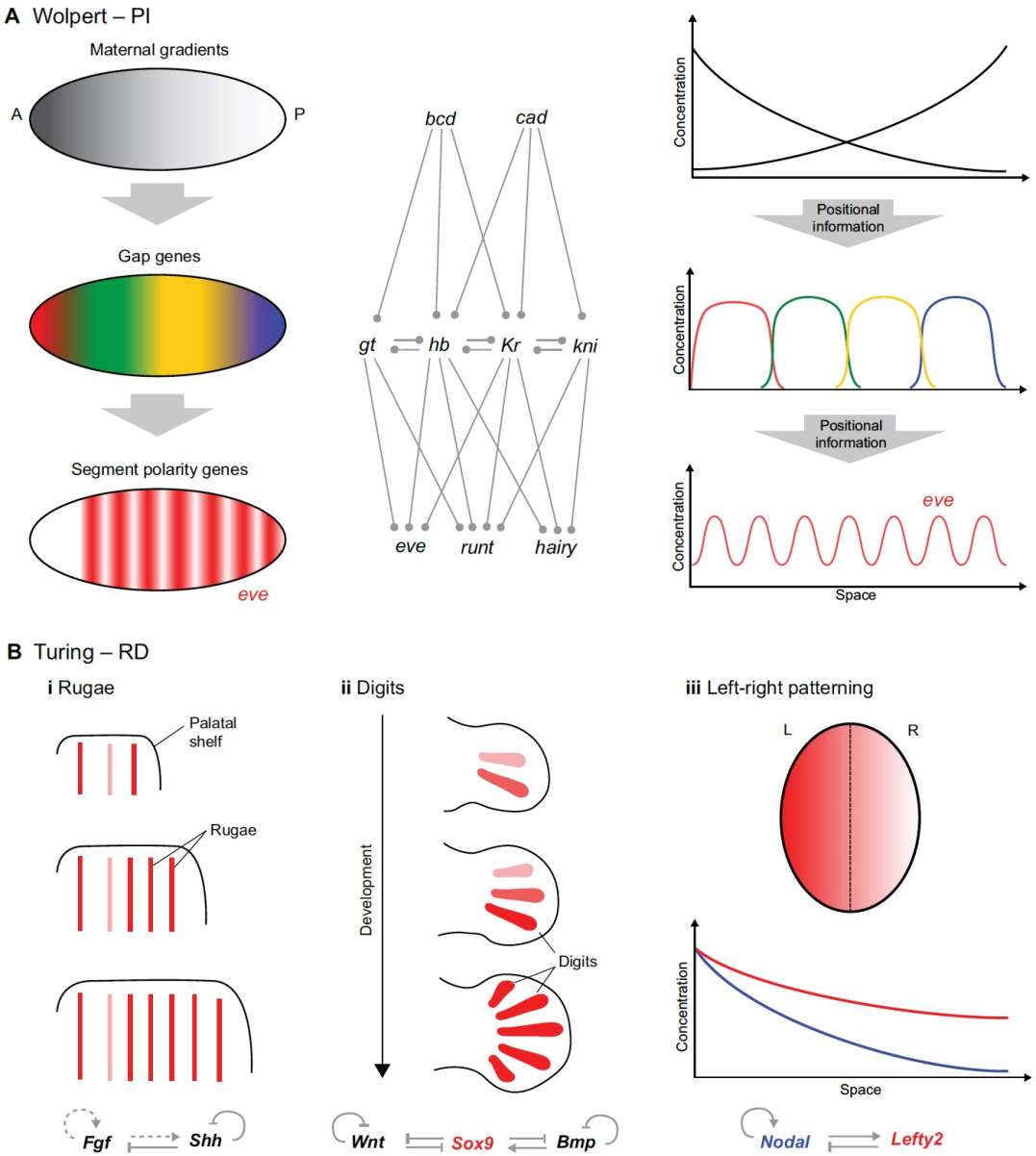




HYPOTHESIS

Positional information and reaction-diffusion: two big ideas in developmental biology combine

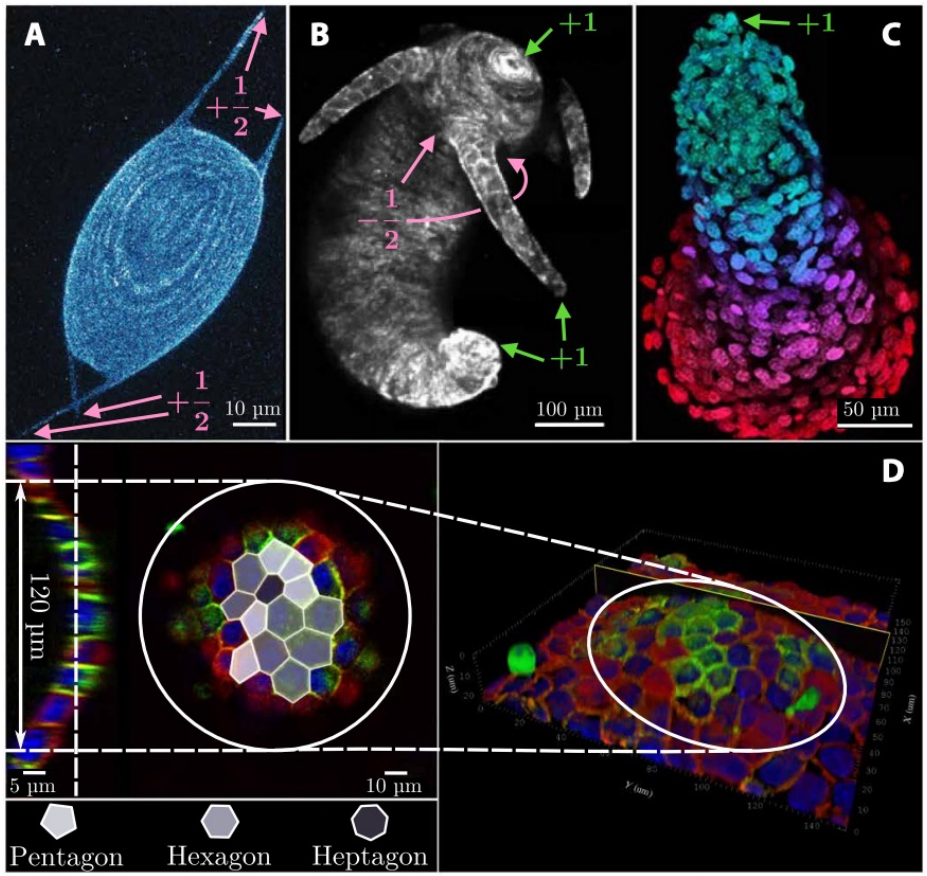
Jeremy B. A. Green[1,*] and James Sharpe[2,3,*]

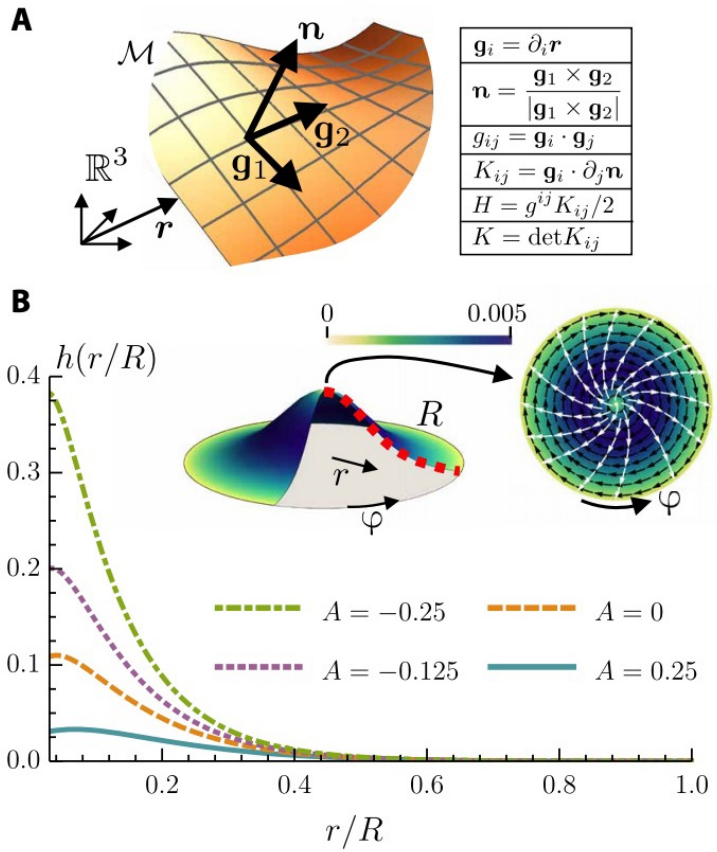
Development (2015) 142, 1203-1211 doi:10.1242/dev.114991


A Wolpert – PI
Maternal gradients
A
P
Gap genes
Segment polarity genes
eve
bcd
cad
gt
hb
Kr
kni
eve
runt
hairy
Concentration
Positional information
Concentration
Positional information
eve
Concentration
Space
B Turing – RD
i Rugae
Palatal shelf
Rugae
Fgf
Shh
ii Digits
Development
Digits
Wnt
Sox9
Bmp
iii Left-right patterning
L
R
Concentration
Space
Nodal
Lefty2

# Theory of defect-mediated morphogenesis

Hoffmann2020

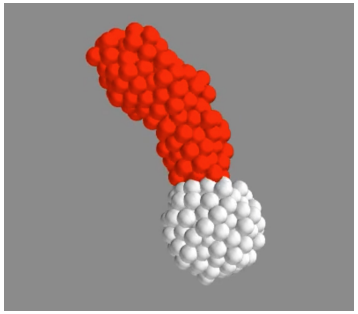


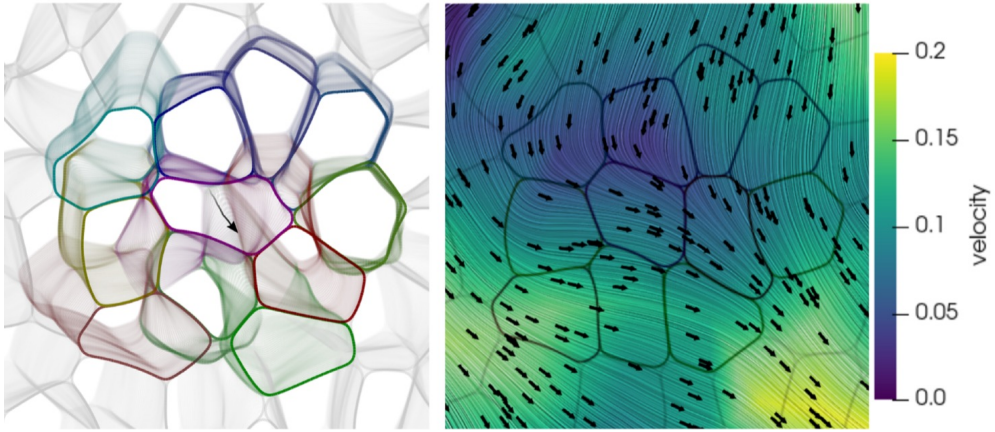



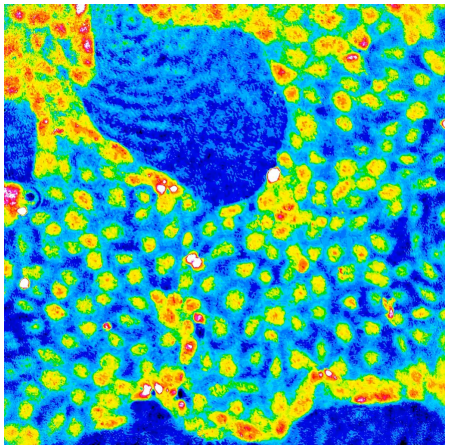

Friday 01.09. 13:15 Lille Fy: Thesis defence Jonas Rønning, **Topological defects and flows in BECs and Active matter**

# Ideas for themes of research project:

- Individual variability & fluctuations in shape of gastruloids, image analys & simulation
- Topological defects & motion in cell sheets, experiments, image analysis & simulation





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lectures

papers

FYS4715 - Biologisk fysikk

# papers



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gupta2021.pdf



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turing_wolpert.pdf