

Maternal control of embryonic axis formation in *Drosophila*

Part 1 Establishing the axes of the egg in *Drosophila*

Trudi Schupbach
Princeton University
HHMI

How are eggs built during oogenesis to allow the development of normally patterned offspring?



The egg of *Drosophila*

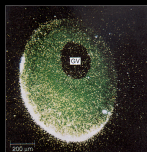


An adult *Drosophila*

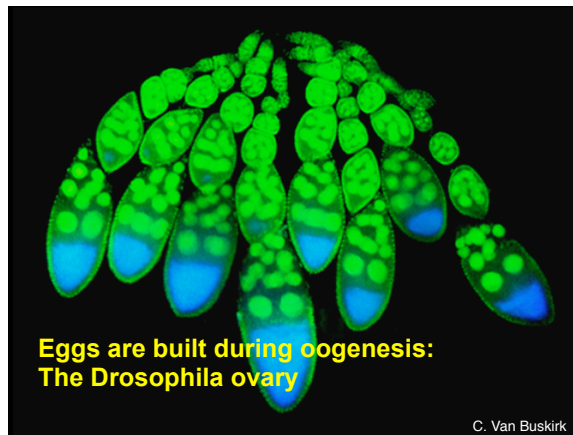
Eggs of many species of animals contain pre-localized RNAs and proteins

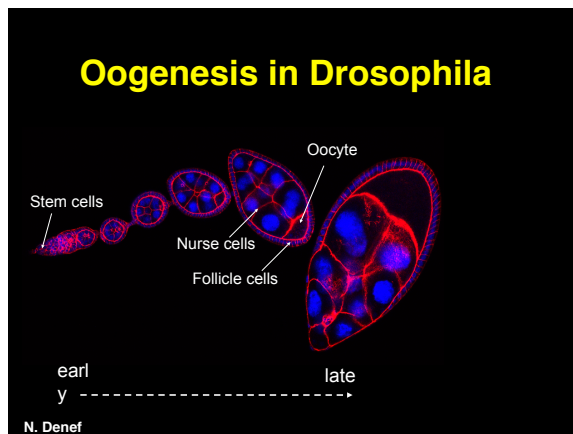


Drosophila egg:
oskar RNA at
posterior pole

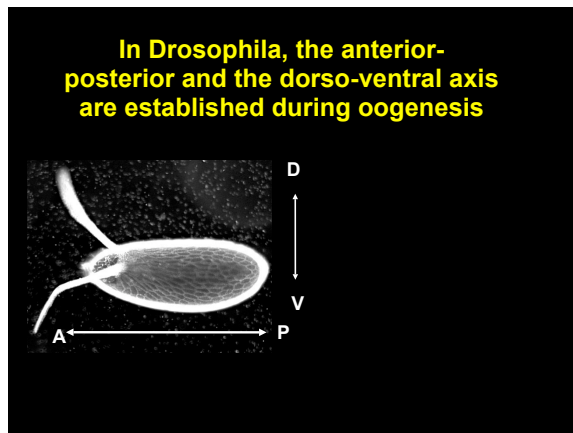


Xenopus oocyte:
Vg-1 RNA at
animal pole
(D. Melton)

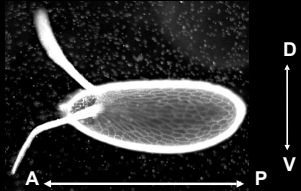
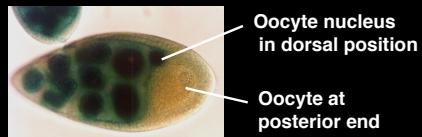




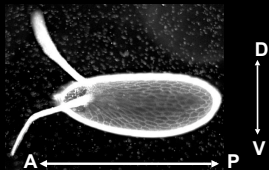
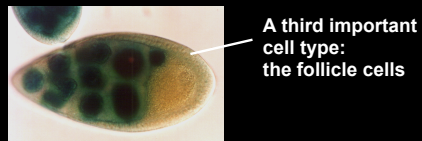
Not only ask question about structure of epithelium - also on morphogenesis



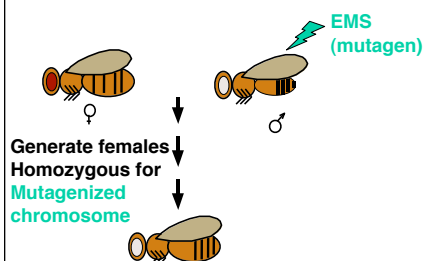
The future axes of the egg are already visible during oogenesis



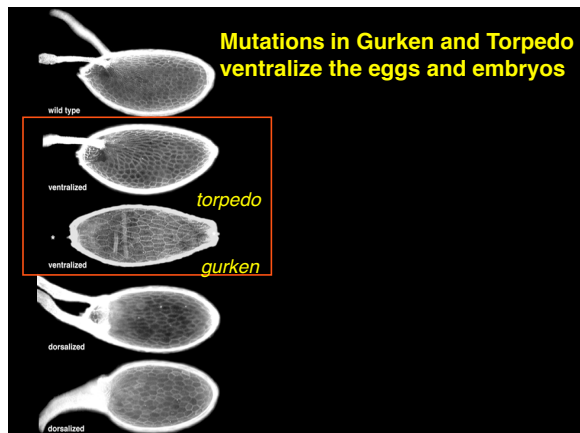
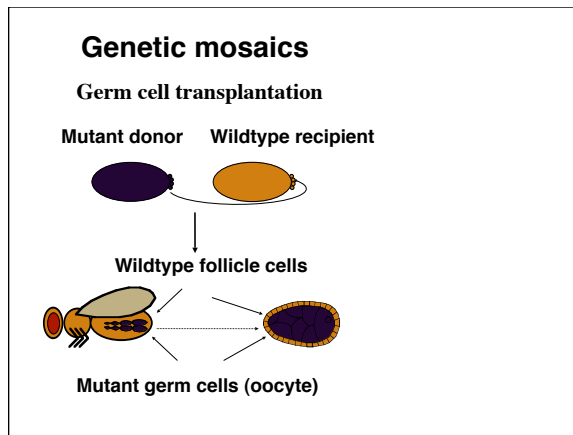
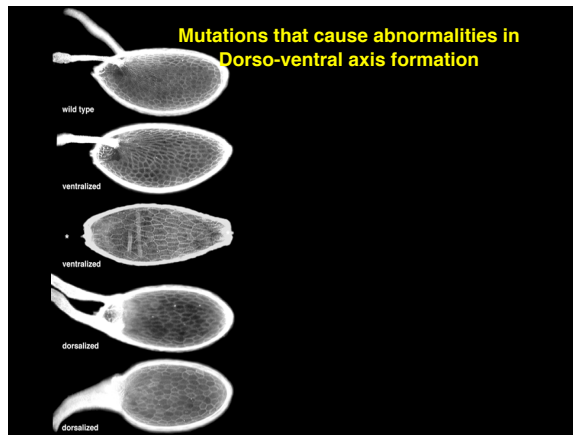
The future axes of the egg are already visible during oogenesis

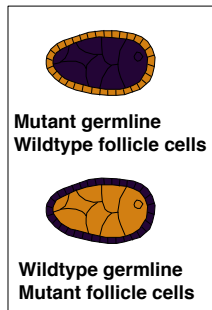
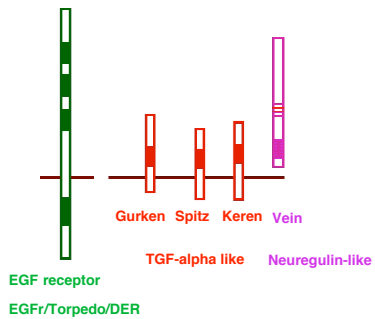


Genetic screen for female sterile mutations

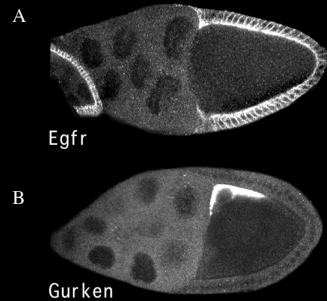


Fertile? - discard
Sterile? - no eggs
- abnormal eggs
- normal eggs, no viable embryos



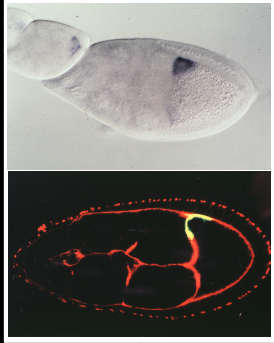
**Gurken:****Ventralized
eggs and
embryos****Wildtype
eggs and
embryos****Torpedo:****Wildtype
eggs and
embryos****Ventralized
eggs and
embryos****Gurken: required in germline****Torpedo: required in follicle cells**

Protein expression pattern of EGF receptor and its ligand, Gurken



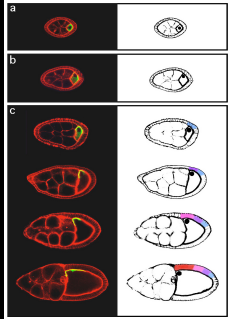
A: from B.Z. Shilo: Sapir et al (1998) Development

Gurken RNA and protein are localized in the oocyte



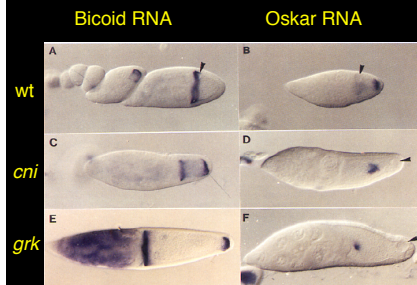
Neuman-Silberberg & Schupbach, 1993, 1996

Over the course of oogenesis, Gurken activates the EGF receptor in different populations of follicle cells

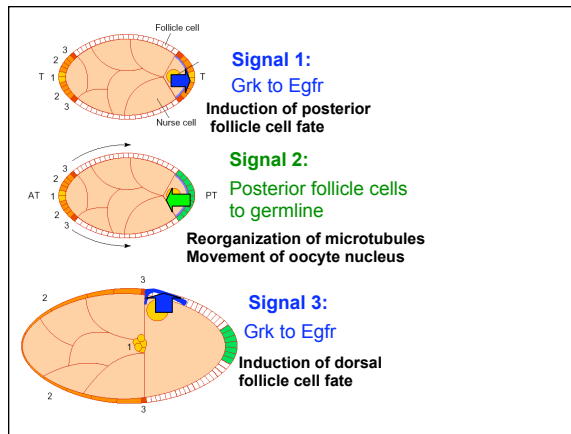


- 1) Grk signals to induce posterior follicle cell fate
- 2) Posterior follicle cells signal to oocyte
- 3) Grk signals to induce dorsal follicle cell fate

In Mutations that block Gurken-Egfr signaling, anterior and posterior determinants are mislocalized

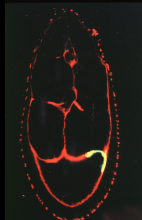


Roth, Neuman-Silberberg, Barcelo & Schupbach, 1995



Conclusion:

In *Drosophila*, the anterior posterior and dorso ventral asymmetries of the egg arise through sequential signaling between the oocyte and the surrounding follicle cells



Localized Gurken protein activates the EGF receptor in the Follicle cells