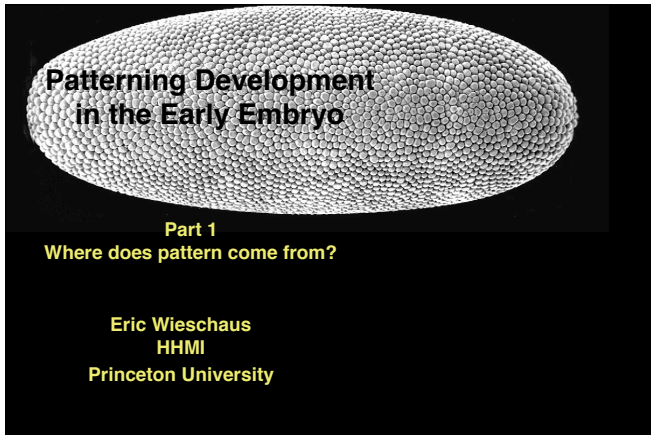
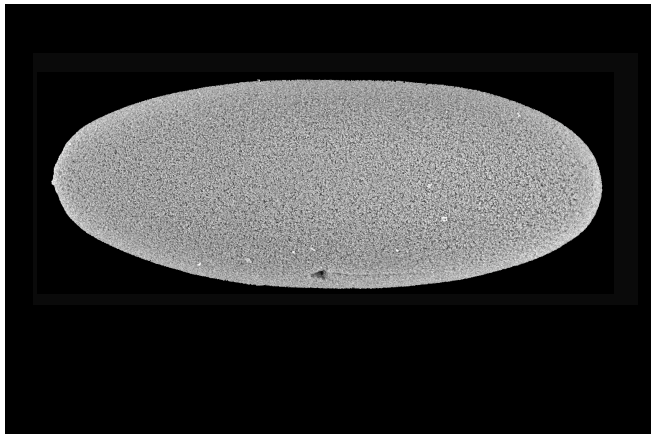
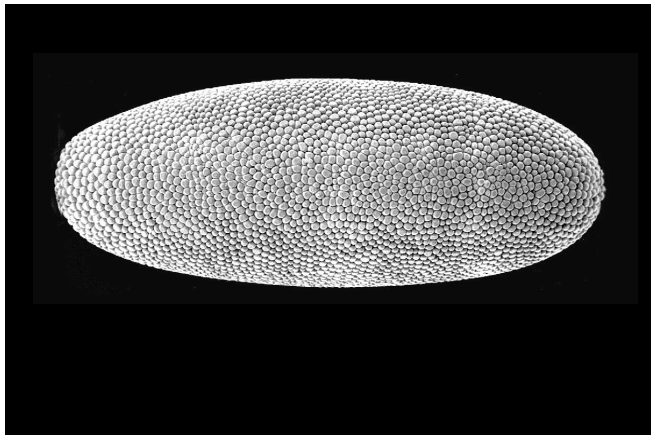
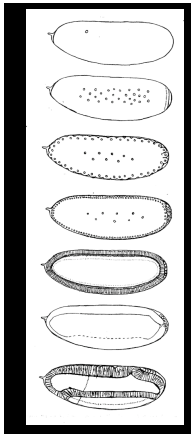

Patterning Development
in the Early Embryo
Part 1
Where does pattern come from?
Eric Wieschaus
HHMI
Princeton University



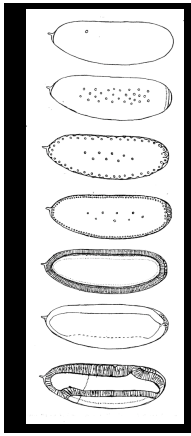




Rapid Uniform
Cell Cycle

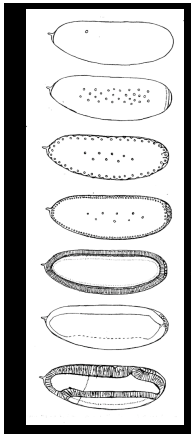
Nuclear Mitoses
No Cytokinesis

Distinct
Cell Behaviors
Gastrulation



Maternal
RNAs and
Proteins

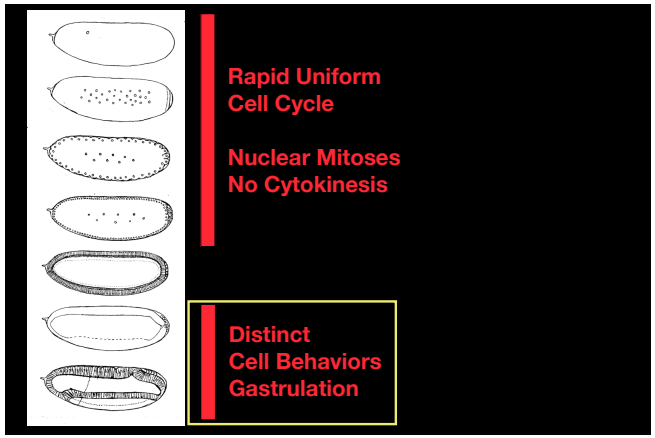
Zygotic
RNAs and
Proteins

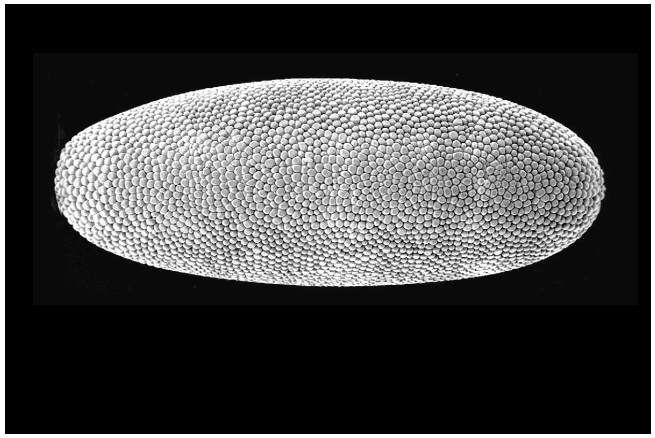


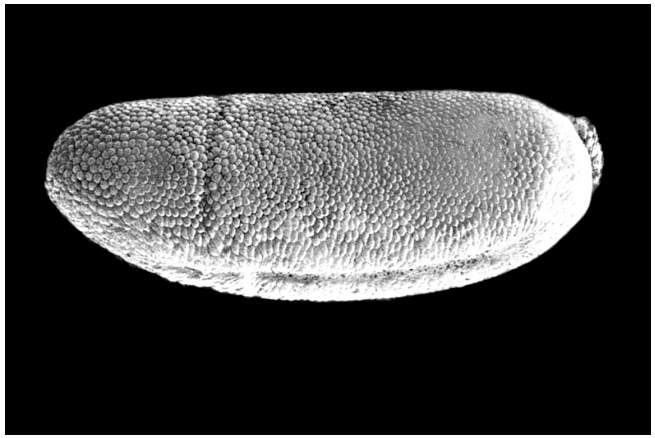
Maternal
RNAs and
Proteins

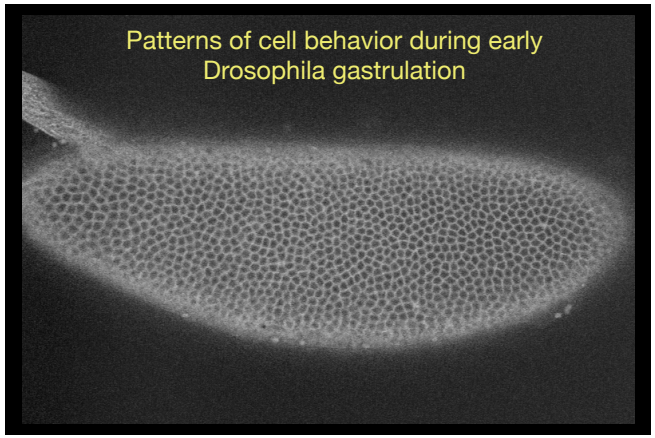
MAJOR ONSET OF
TRANSCRIPTION

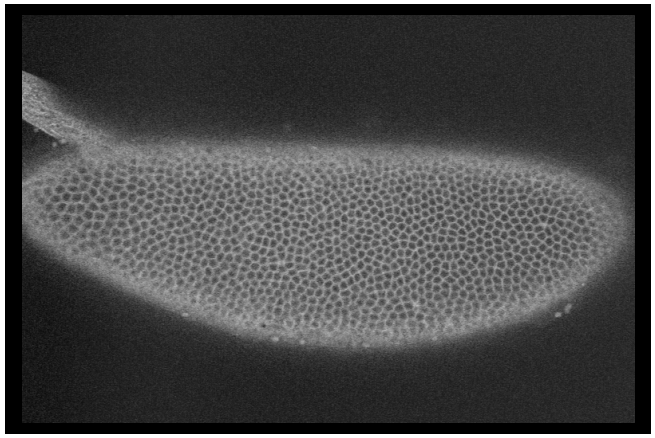
Zygotic
RNAs and
Proteins

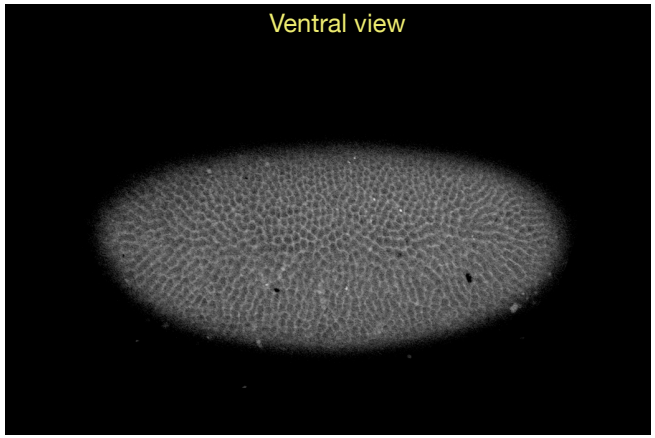

Rapid Uniform
Cell Cycle
Nuclear Mitoses
No Cytokinesis
Distinct
Cell Behaviors
Gastrulation



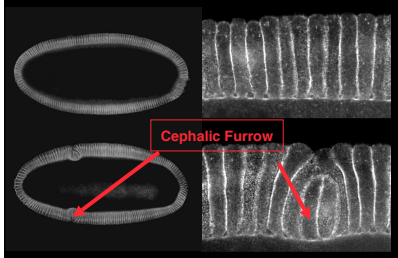



Patterns of cell behavior during early
Drosophila gastrulation



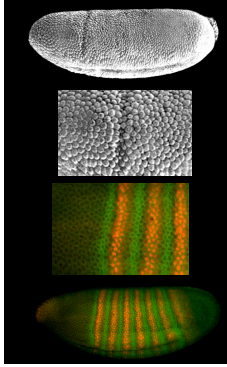

Ventral view

Changes in Morphology depend on local changes in cell shape



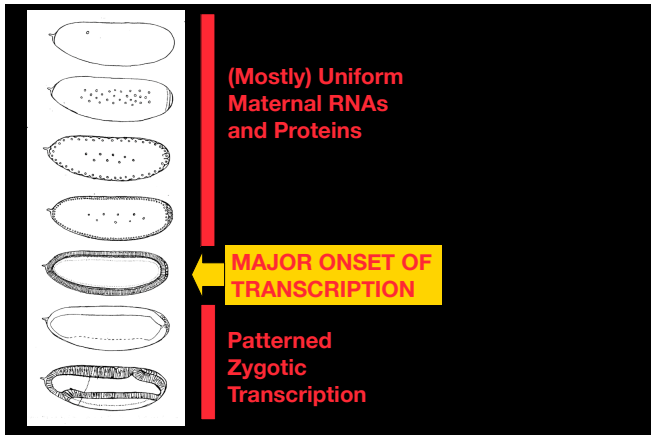
Why do certain cells change shape and others not?

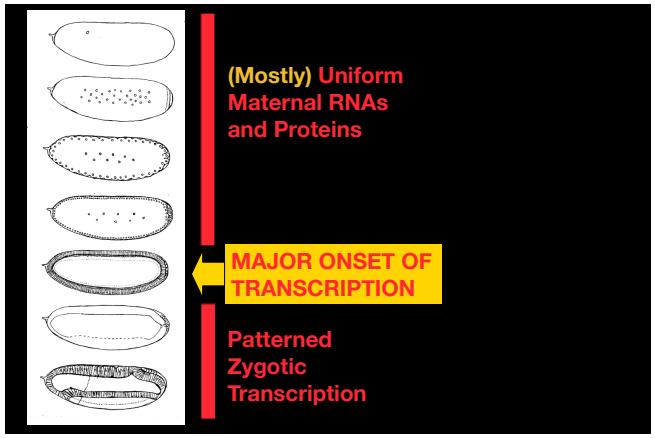
Patterns of cell behavior reflect underlying patterns of gene activity

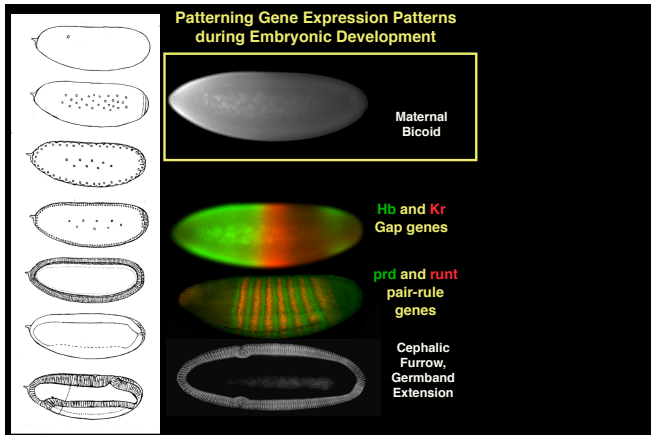


Where does pattern come from?

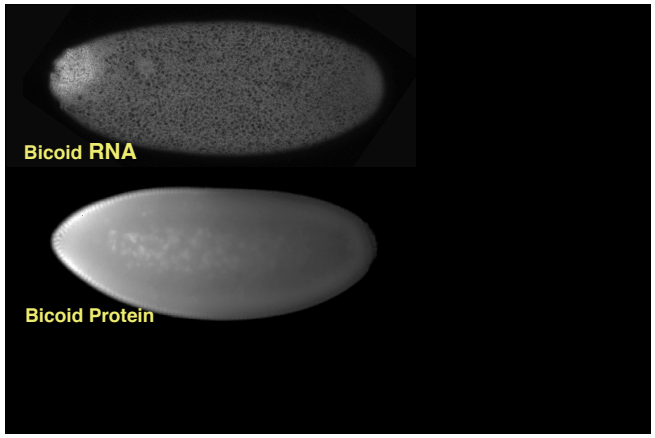
How are spatial and temporal patterns of gene expression established at the blastoderm stage?

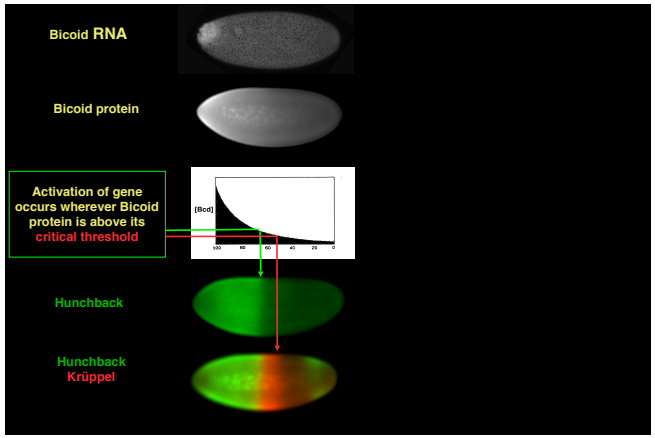

(Mostly) Uniform
Maternal RNAs
and Proteins
MAJOR ONSET OF
TRANSCRIPTION
Patterned
Zygotic
Transcription


(Mostly) Uniform
Maternal RNAs
and Proteins
MAJOR ONSET OF
TRANSCRIPTION
Patterned
Zygotic
Transcription


Patterning Gene Expression Patterns
during Embryonic Development
Maternal
Bicoid
Hb and Kr
Gap genes
prd and runt
pair-rule
genes
Cephalic
Furrow,
Germband
Extension

How is the embryonic gradient of maternal Bicoid protein formed?



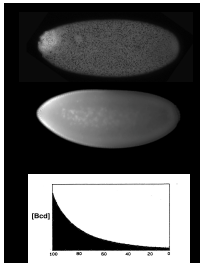


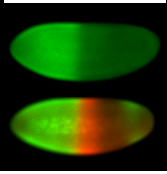
Why is Bicoid so cool?

Why was its discovery by Nusslen-Volhard and Driever

(more than 15 years ago)

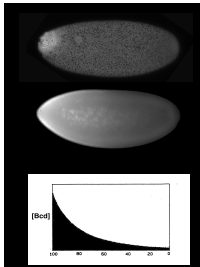
so important?

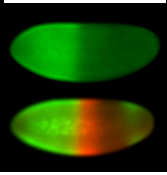




Information is Quantitative

Response depends on concentration levels



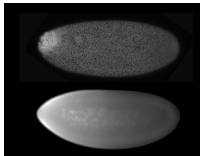


Initial localized source

Final (information rich) distribution reflects simple physical parameters (diffusion, degradation)

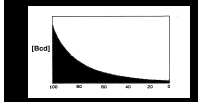
Information is Quantitative

Response depends on concentration levels

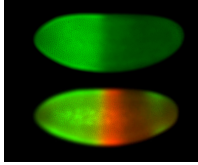


Initial localized source

Final (information rich) distribution reflects simple physical parameters (diffusion, degradation)



Evolution vs. conservation of developmental pathways



Information is Quantitative

Response depends on concentration levels

Plan for this talk

Part 2
Stability of Morphogen Gradients

Movement of Molecules

Part 3
Evolution of Bicoid scaling