

The Chick Embryo



SDB Bootcamp 2012




Aimee Ryan and Lab
McGill University

Outline


Brief overview of the chick embryo

Hands-on dissection and culturing of chick embryos



Ryan Lab, McGill University
SDB Bootcamp 2012


In the beginning...



Hippocrates
460-370 BC

“the view that in the chick the bird is formed from the yolk of the egg and the white is the food, and when there is no food left it hatches.”

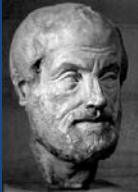
- Wolpert 2004 via Needham 1934




Ryan Lab, McGill University
SDB Bootcamp 2012

Aristotle

384-322 BC




- ✓ first to dissect chick embryos
- ✓ opened eggs at different stages and examined embryos
- ✓ thought that the embryo was formed from the white and got its nourishment from the yolk
- ✓ realized the importance of heat




Ryan Lab, McGill University
SDB Bootcamp 2012

William Harvey

1578 - 1657




- ✓ observed embryos *in ovo* with magnifying lenses
- ✓ examined the different stages of heart development and commencement of beating
- ✓ prior to Harvey it was believed that the heart and circulation were idle prior to hatching/birth




Ryan Lab, McGill University
SDB Bootcamp 2012

Wilhelm Roux

1850-1924



- “father of experimental embryology”
- manipulated embryos and observed the outcome
- established first tissue culture techniques with medullary plate from chick embryo in 1885



Ryan Lab, McGill University
SDB Bootcamp 2012

Chick Genetics


- ◆ $2n = 78$
- ◆ 1×10^9 nucleotides/genome; more compact regulatory regions and smaller/fewer introns
- ◆ 9 pairs of macrochromosomes (including sex chromosomes)
- ◆ 30 pairs of microchromosomes (# according to size)
- ◆ Females are ZW; males are ZZ
- ◆ Ensembl = source for chicken genomic info

Ryan Lab, McGill University
SDB Bootcamp 2012

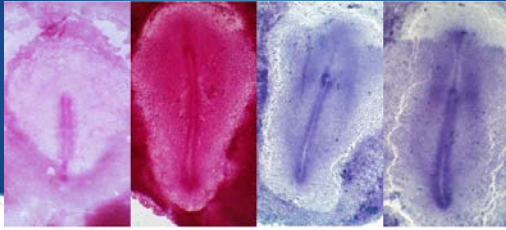
Gallus gallus - The chick

- ✓ Advantages
 - ✓ excellent as a model for developmental biology and early embryonic development
 - ✓ embryo gastrulates as a flat blastodisc (like humans and rabbits; not like mice)

Ryan Lab, McGill University
SDB Bootcamp 2012




Hamburger, V and Hamilton, H.L. (1951) A series of normal stages in the development of the chick embryo. *J. Morph.* 88:49-92 [reprinted in 1992 in *Dev Dyn* vol 195]




3 4 5 6

Ryan Lab, McGill University
SDB Bootcamp 2012




7 8- 8 9

Ryan Lab, McGill University
SDB Bootcamp 2012



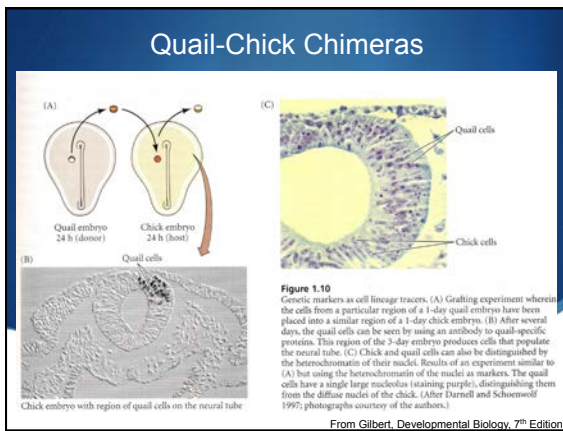
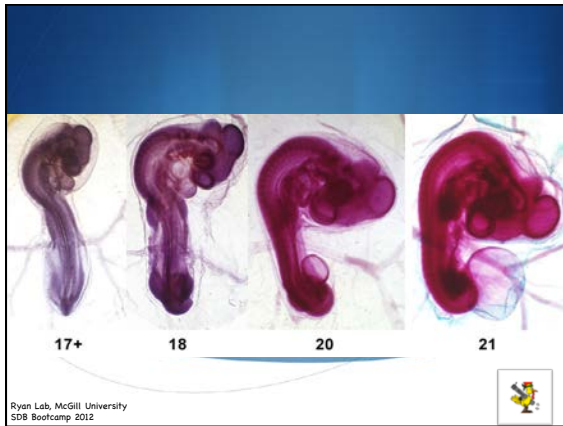
10 11 12 13

Ryan Lab, McGill University
SDB Bootcamp 2012



14 15+ 16+ 17

Ryan Lab, McGill University
SDB Bootcamp 2012



Gallus gallus - The chick

- ✓ Advantages
 - ✓ excellent as a model for developmental biology and early embryonic development
 - ✓ embryo gastrulates as a flat blastodisc (like humans and rabbits; not like mice)
 - ✓ relatively easy to manipulate gene expression
 - ✓ relatively cheap to get large numbers of stage matched embryos

Ryan Lab, McGill University
SDB Bootcamp 2012

Manipulating Gene Expression

- ✓ Implant bead coated with protein
- ✓ Implant cell pellet expressing protein of interest [stably transfected with eukaryotic expression vector]
- ✓ Retroviral misexpression
- ✓ Electroporation of expression vectors
- ✓ All methods can be used to target spatially and temporally-specific expression
- ✓ Potentially different methods for gain-of-function and loss-of-function experiments [dependent on experimental design]

Ryan Lab, McGill University
SDB Bootcamp 2012

Gallus gallus - The chick

- ✓ Disadvantages
 - ✓ genome is not easily manipulable for genetic studies
 - ✓ large

Ryan Lab, McGill University
SDB Bootcamp 2012

AvianNET - The avian information network

Resources HOME
Bioinformatics
Databases
Gene Expression
Genomics
Microarrays
News/Labware

AvianNET HOME
AvianNET SEARCH
Google SEARCH
Nucleic Acids

Databases

Chicken Genome Sequences | GSI | SNP | Physical Mapping | Genes | Genome Browser
GSI: Avian Genomes | SNP: Avian Genomes | Physical Mapping: Avian Genomes | Genes: Avian Genomes

Chicken Genome Sequence

- **Ensembl Chicken Genome Browser**
- **NCBI Taxonomy** - Avian genome browser
- **NCBI Gene** - Avian genome browser
- **Ensembl Chicken Genome Browser** - Avian genome browser
- **NCBI Taxonomy** - Avian genome browser
- **NCBI Gene** - Avian genome browser
- **NCBI SRA** - Avian genome browser
- **NCBI GEO** - Avian genome browser
- **NCBI EBI** - Avian genome browser
- **NCBI RefSeq** - Avian genome browser
- **NCBI UniProt** - Avian genome browser
- **NCBI TrEMBL** - Avian genome browser
- **NCBI SwissProt** - Avian genome browser
- **NCBI PDB** - Avian genome browser
- **NCBI KEGG** - Avian genome browser
- **NCBI KEGG Pathway** - Avian genome browser
- **NCBI KEGG Compound** - Avian genome browser
- **NCBI KEGG BRITE** - Avian genome browser
- **NCBI KEGG GLOSSARY** - Avian genome browser
- **NCBI KEGG GENES** - Avian genome browser
- **NCBI KEGG PATHWAY** - Avian genome browser
- **NCBI KEGG COMPOUND** - Avian genome browser
- **NCBI KEGG BRITE** - Avian genome browser
- **NCBI KEGG GLOSSARY** - Avian genome browser

Ryan Lab, McGill University
SDB Bootcamp 2012

GEISHA

gallus expression in situ hybridization analysis

SEARCH: [gene name or descriptor] [go]

WELCOME TO GEISHA

What's New

- Updated GEISHA database and website for the gene database and user interface have been released to include:
 - probe sequences mapped to the full 2005 chicken assembly (WDR4.1C2) and paralogues
 - enhanced search tools
 - published expression patterns
 - expanded chicken embryo anatomy
- 100,000+ gene expression mappings
- 20,000 feature chicken long oligo microarray arrays

Search Images

Ryan Lab, McGill University
SDB Bootcamp 2012

Images by anatomical location: Neural Crest

Ryan Lab, McGill University
SDB Bootcamp 2012

So what do you need?

Ryan Lab, McGill University
SDB Bootcamp 2012

Windowing and dissection

SpringerImages

Garriock And Mikawa 2011

Ryan Lab, McGill University
SDB Bootcamp 2012

