



# Congenital Anomaly Research Center Kyoto University Graduate School of Medicine 40th Anniversary Commemoration Symposium

京都大学医学研究科  
先天異常標本解析センター  
開設40周年記念シンポジウム



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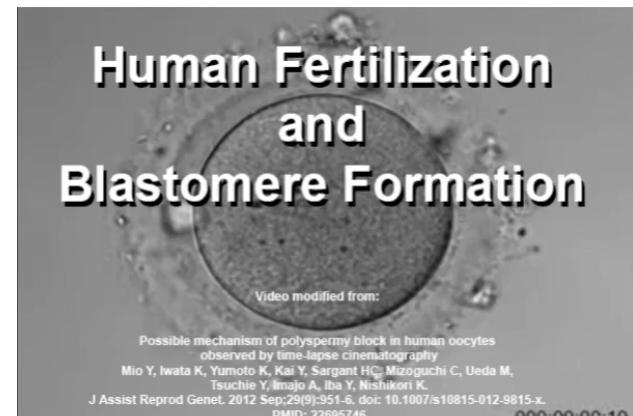


Never Stand Still

# Developing the Digital Kyoto Collection in Education and Research

Dr Mark Hill

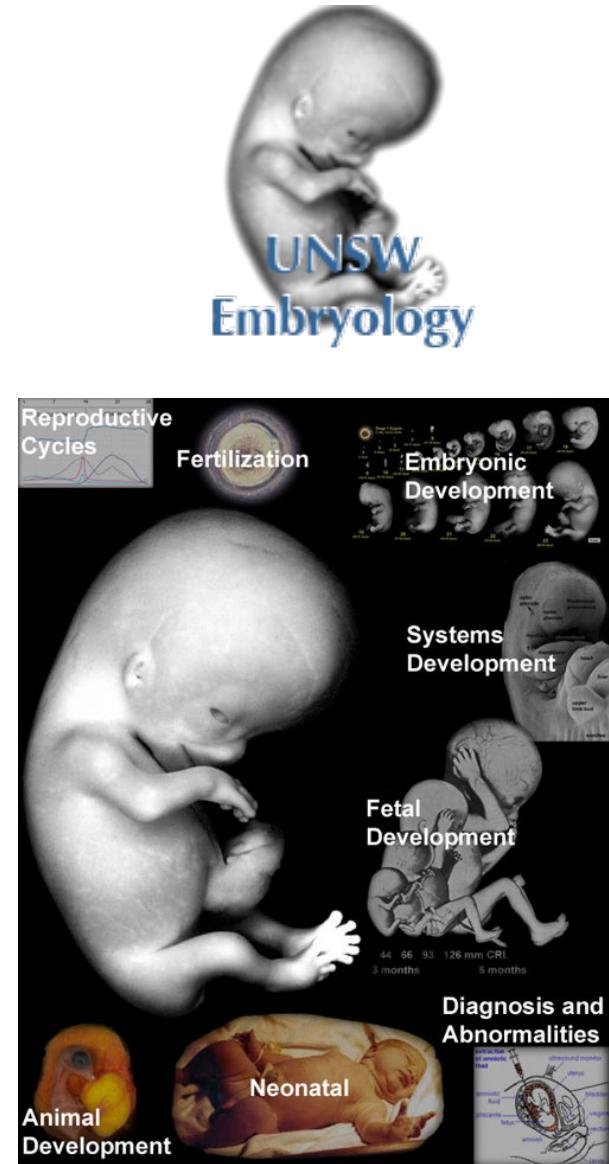
1. Education – Kyoto Collection eBook
2. Research – Digital Embryology Consortium



Prof Yasuyuki Mio, Tottori University)

# 1. Education – Kyoto Collection eBook

- Teaching embryology online for 20 years
- **1996** began collaboration with Kyoto and Carnegie collections
  - Images of stage embryos
  - UNSW histology of stage 13 and 22
- **2009** updated to interactive Wiki format
  - <https://embryology.med.unsw.edu.au>
  - 2 million hits/month
  - Teachers and students can work online
- **2012** Carnegie collection eBook
- **2015** Kyoto collection eBook



# eBook (iBook) Format

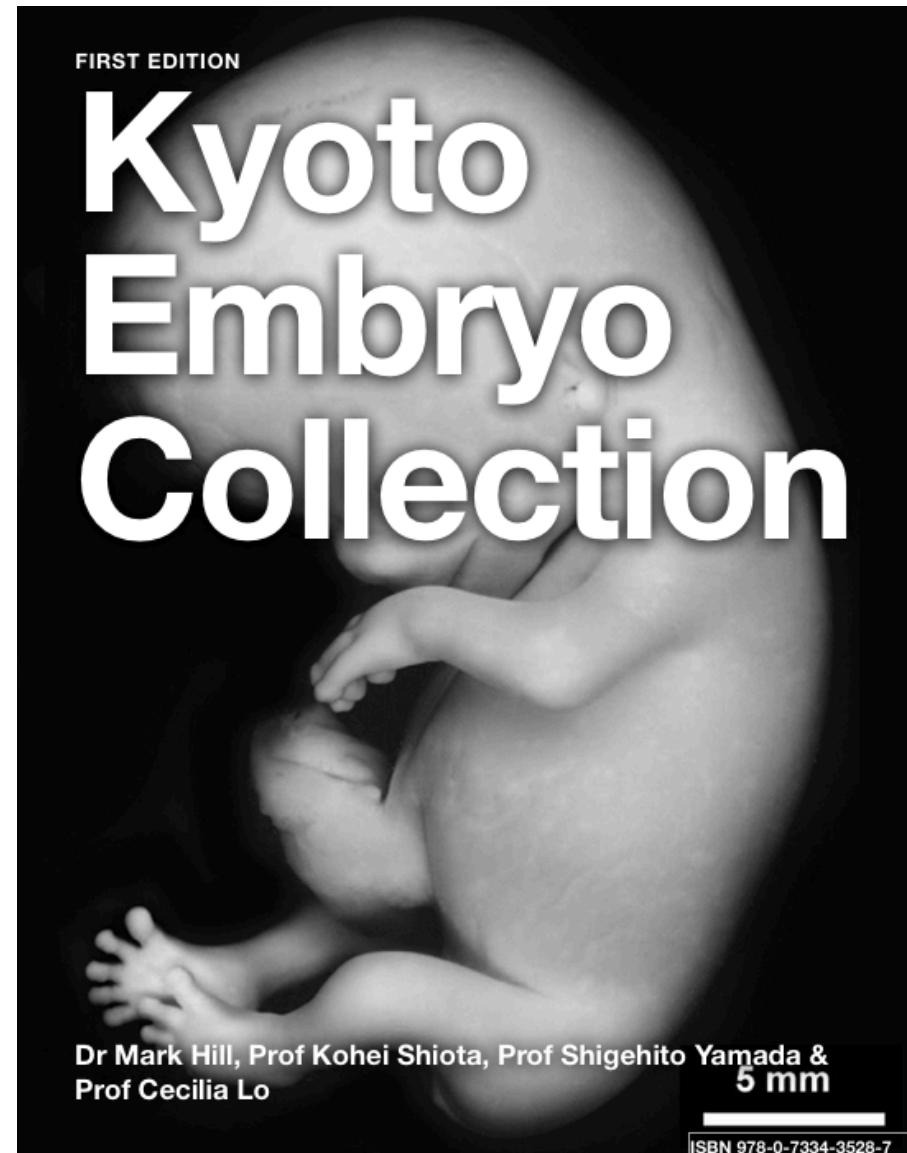


- Format opens on all Mac platforms
  - Desktop, laptop, iPad and iPhone
  - Software required for compatible with PC
- Applestore (iTunes) manages
  - Publishing, distribution, statistics
  - 8,500 copies “sold” of already published embryology iBooks



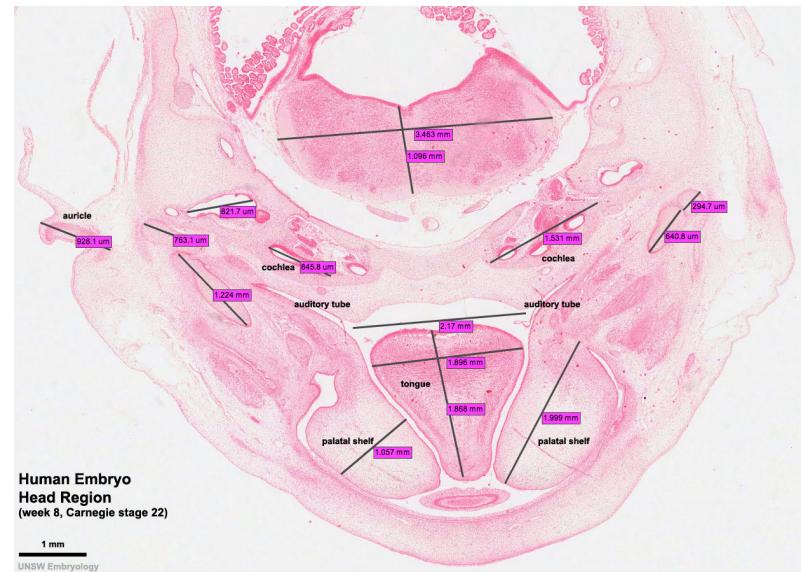
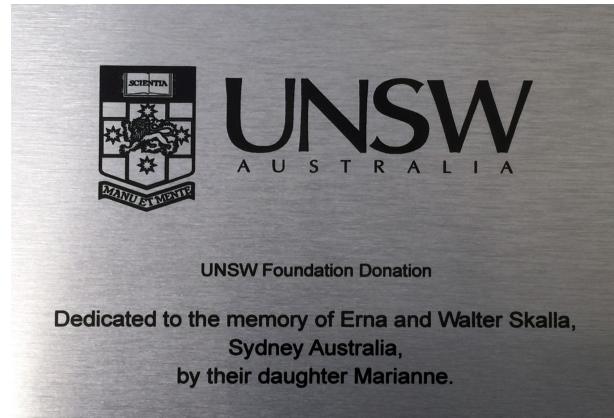
# Kyoto Embryo Collection (first edition)

- Each chapter an embryonic stage
  - Description of stage
  - Images of embryo (F, L, R, D)
  - Image galleries
  - Histology
  - Movies
- Interactive images
  - Labeled key structures
- Glossary
  - Linked to text
- Student Notes
  - Can be added to to own eBook
- Internet links to additional resources
- **eBook Demonstration**



## 2. Research – Digital Embryology Consortium

- **2013** visited major embryology collections
- **2014** planned with partners the digitization project
  - Researched scanner options
- **2015** purchased Zeiss Axioscan.Z1
  - Special thanks **Marianne Skalla** and the UNSW Foundation



Embryo (Stage 22) from the UNSW collection

# Official Opening of DEC Göttingen University

- April 2015 – 3 major collections and Zeiss represented.



Prof Christoph Viebahn



Prof. Beate Brand-Saberi

# Consortium Partners and Collaborators

## Digital Embryology Consortium



museum für  
naturkunde  
berlin



UNSW Australia	Kyoto University	University of Göttingen	Ruhr-University Bochum	Museum für Naturkunde Berlin	Complutense University of Madrid
School of Medical Sciences, Medicine	Graduate School of Medicine	Anatomy and Embryology, Medicine	Hinrichsen Human Embryology Collection	Embryological Collection	Department of Anatomy and Embryology, Medicine
Dr. Mark Hill	Prof. Shigehito Yamada	Prof. Christoph Viebahn	Prof. Beate Brand-Saberi	Dr. Peter Giere	Prof. José F. Rodríguez-Vázquez

# Consortium Partners and Potential Collaborators

## Digital Embryology Consortium



National Museum of Health  
and Medicine\*

University of British Columbia

Universidad Autonoma de  
Barcelona\*\*

Human Developmental Anatomy  
Center

Perry-Arey-Milligan  
Collection

Barcelona Embryos

Ms Elizabeth Lockett

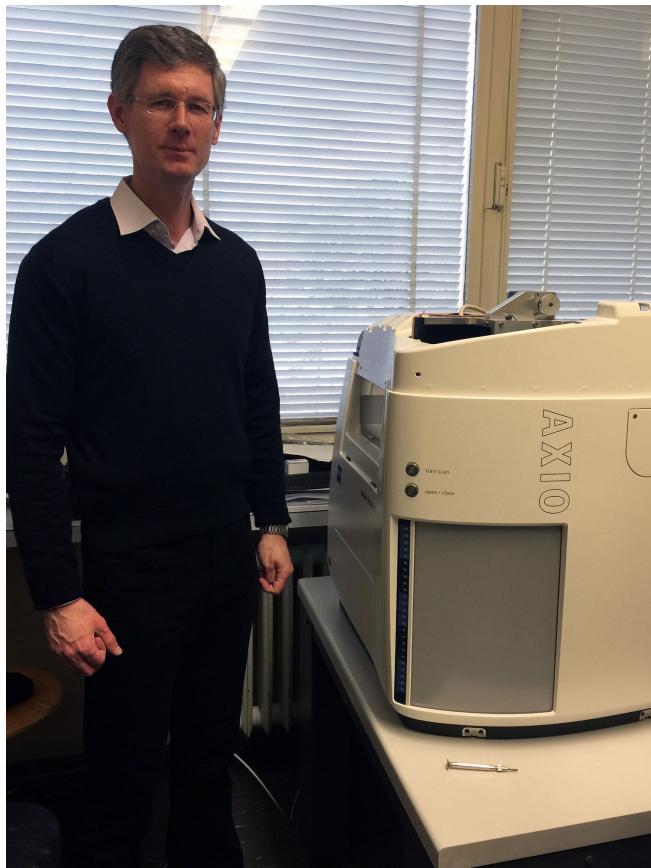
Prof. Virginia Diewert

Dr Mirapeix

\* Research collaborators

\*\* In progress

# Zeiss Axio Scan.Z1 - Slide Digitization



Dr. Thorsten Heupel (Zeiss Product Manager)

- Handle a range of slide sizes
- Does not directly handle the slide
- Generates high resolution digital image
- Automatically
  - Selects regions of interest
  - Adjusts focus
  - Handles 50 to 100 slides
- Can be transported to each collection in its own transport case

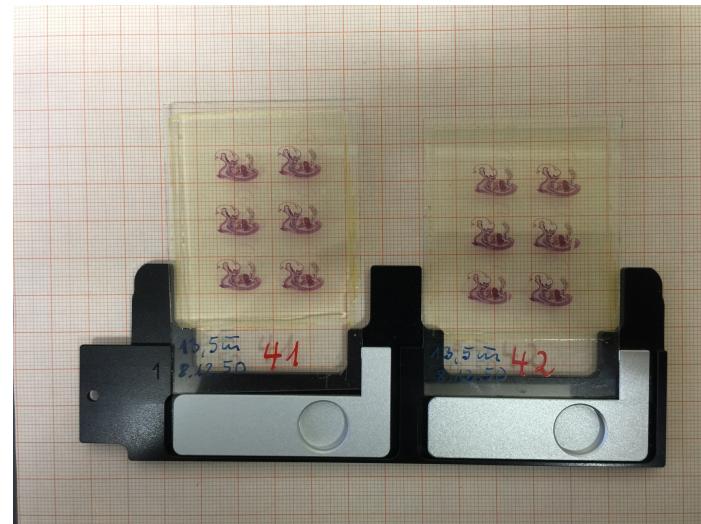


Zeiss Axio Scan.Z1

# Zeiss Axio Scan.Z1 – Transport



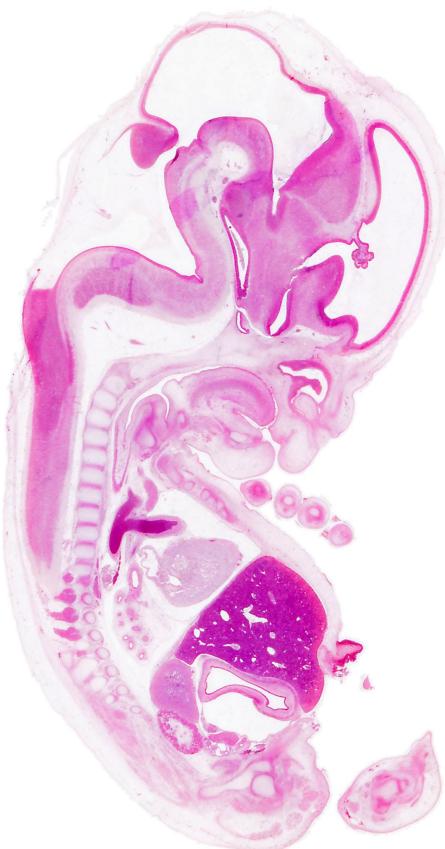
Box includes also all the accessories!



Specialised slide holders for oversize slides

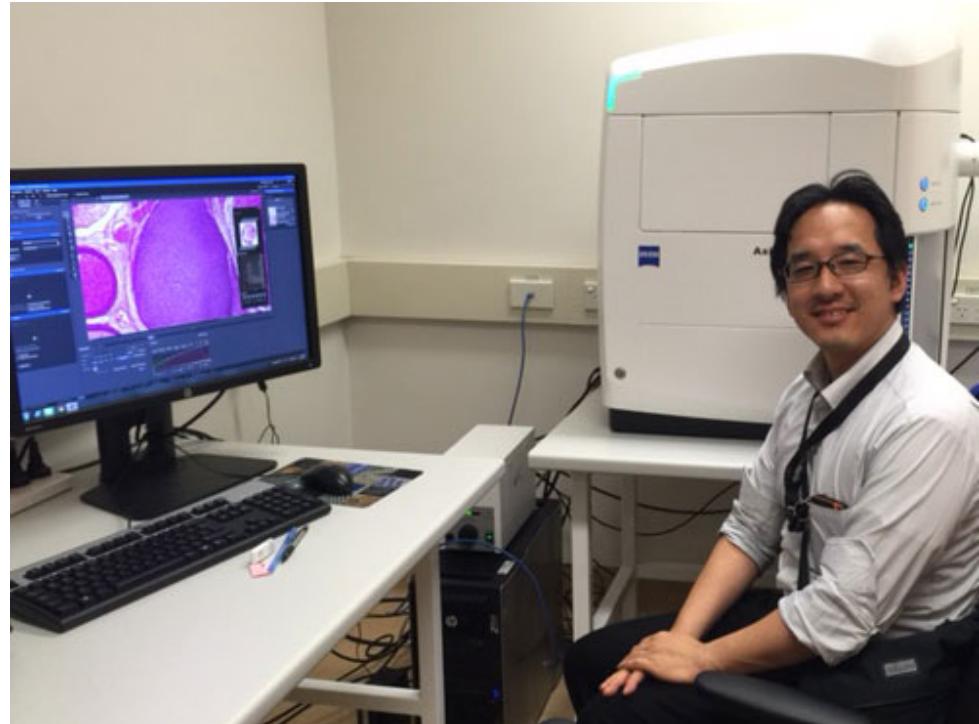
# Kyoto Collection Partner – Visited Sydney 2015

- **Today officially welcome Kyoto partner to the consortium**
- Collection scanning will start in 2016



Embryo Stage 21

|



March 2015 – testing the Axioskan digital scanner. Prof Shigehito Yamada

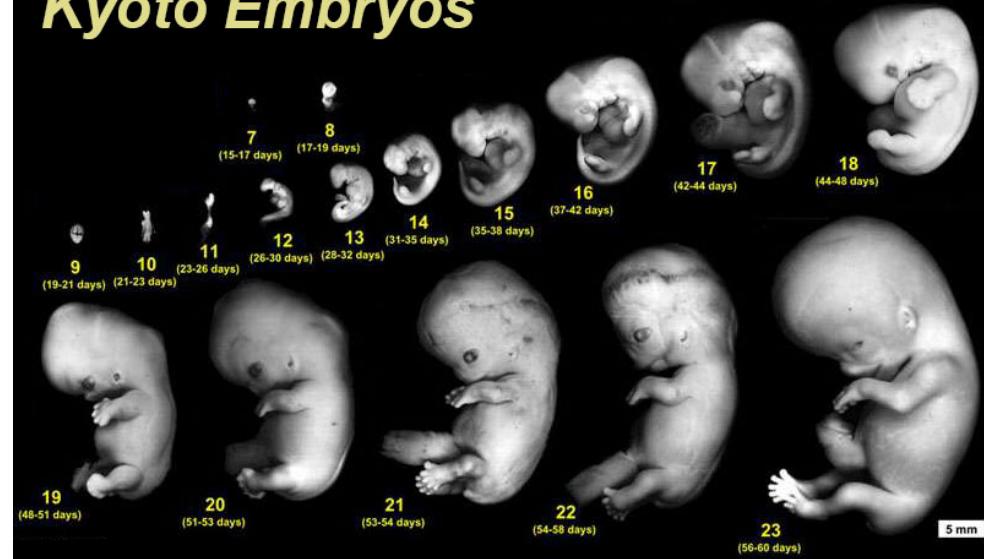
# Kyoto – Embryology Collection

- 44,000 embryos 1962 to 1974
- Normal and abnormal
- Histology and whole embryos
- Researchers are actively using the collection



Hideo Nishimura

## Kyoto Embryos



Prof. Kohei Shioto

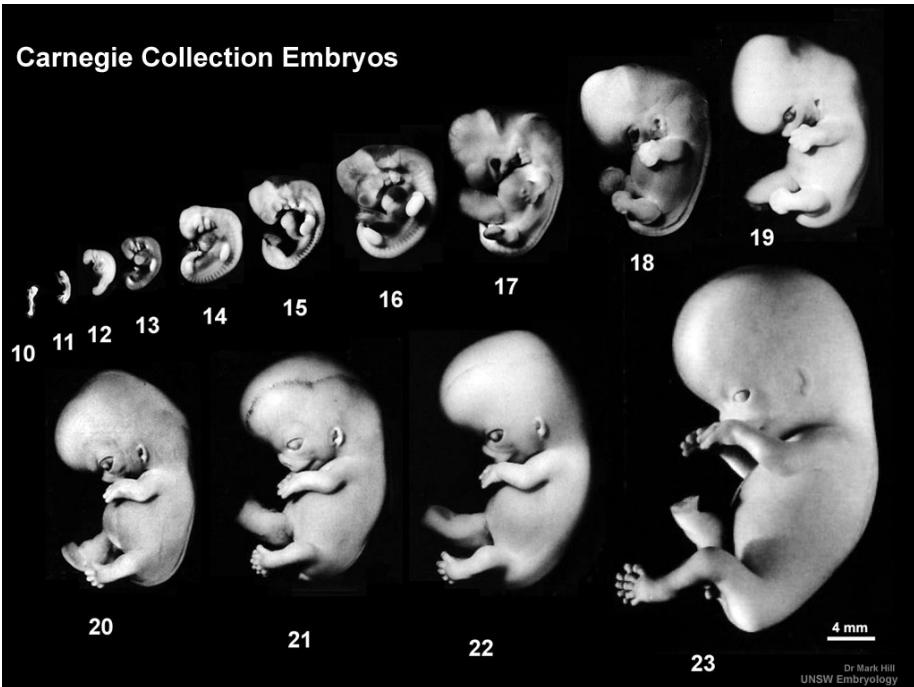


Prof. Shigehito Yamada



# USA - NMHM Developmental Collections

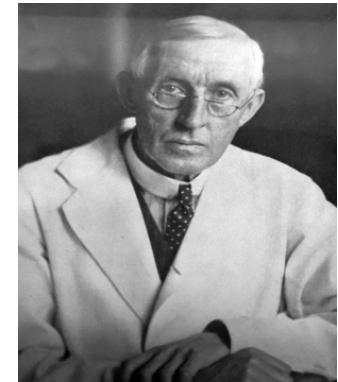
- **Carnegie Collection of Embryology**
  - Normal development in the first eight weeks.
- **George Sedgewick Minot Embryological Collection**
  - Harvard School of Medicine collected by Charles S. Minot.
- **Hooker-Humphrey Collection**
  - University of Chicago then University of Alabama neural development.
- **Cornell Human and Comparative Embryology Collection**
  - Cornell School of Veterinary Medicine includes human, rat, mouse and guinea pig.



Elizabeth Lockett

# Berlin – Embryological Collections

- Hubrecht, Hill, Dohrn, Bolk and Kückenthal collections
- Histology and whole embryos
- Human and many other species
- Study leave 2013-14



Dr Peter Giere

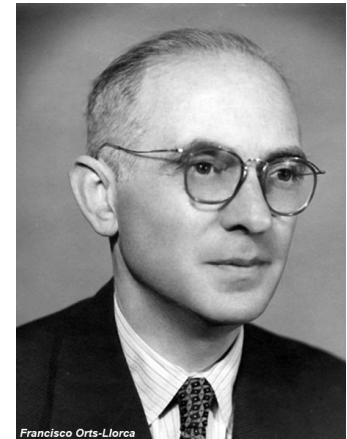


UNSW Embryology



# Madrid – Embryology Collection

- Histology collection
- Covering embryonic and fetal



Francisco Orts-Llorca  
(1905-1993)



Prof José Rodríguez-Vázquez



# Ruhr-Universität Bochum

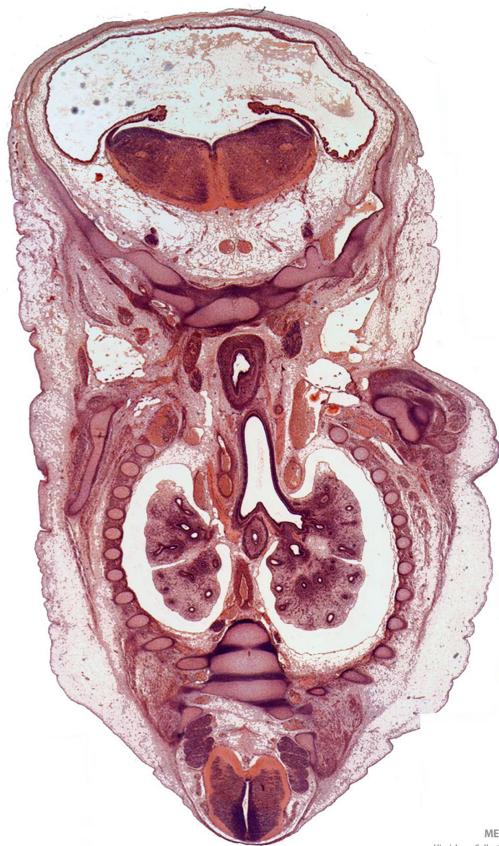
## Hinrichsen Collection

- **Klaus Volquardt Hinrichsen** (1927-1997)
  - Department of Anatomy and Molecular Embryology
  - Collected between 1969 and 1994
  - Histological sections of 100+ specimens from 4 to 20 weeks
  - Plastic sections of 20 specimens
  - Additional 70 unsectioned fetuses



*Klaus Volquardt Hinrichsen*

ME 54 Carnegie stage 21  
22.5 mm, 8 weeks, female, frontal,  
(Stain - Haematoxylin Eosin)



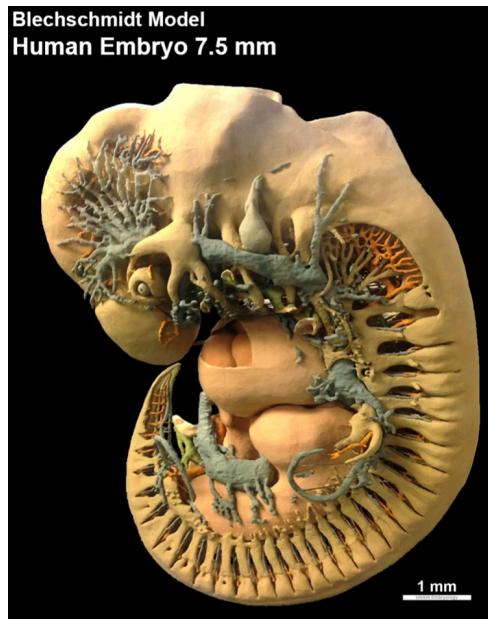
ME 54  
Hinrichsen Collection



# Göttingen - Blechschmidt Collection

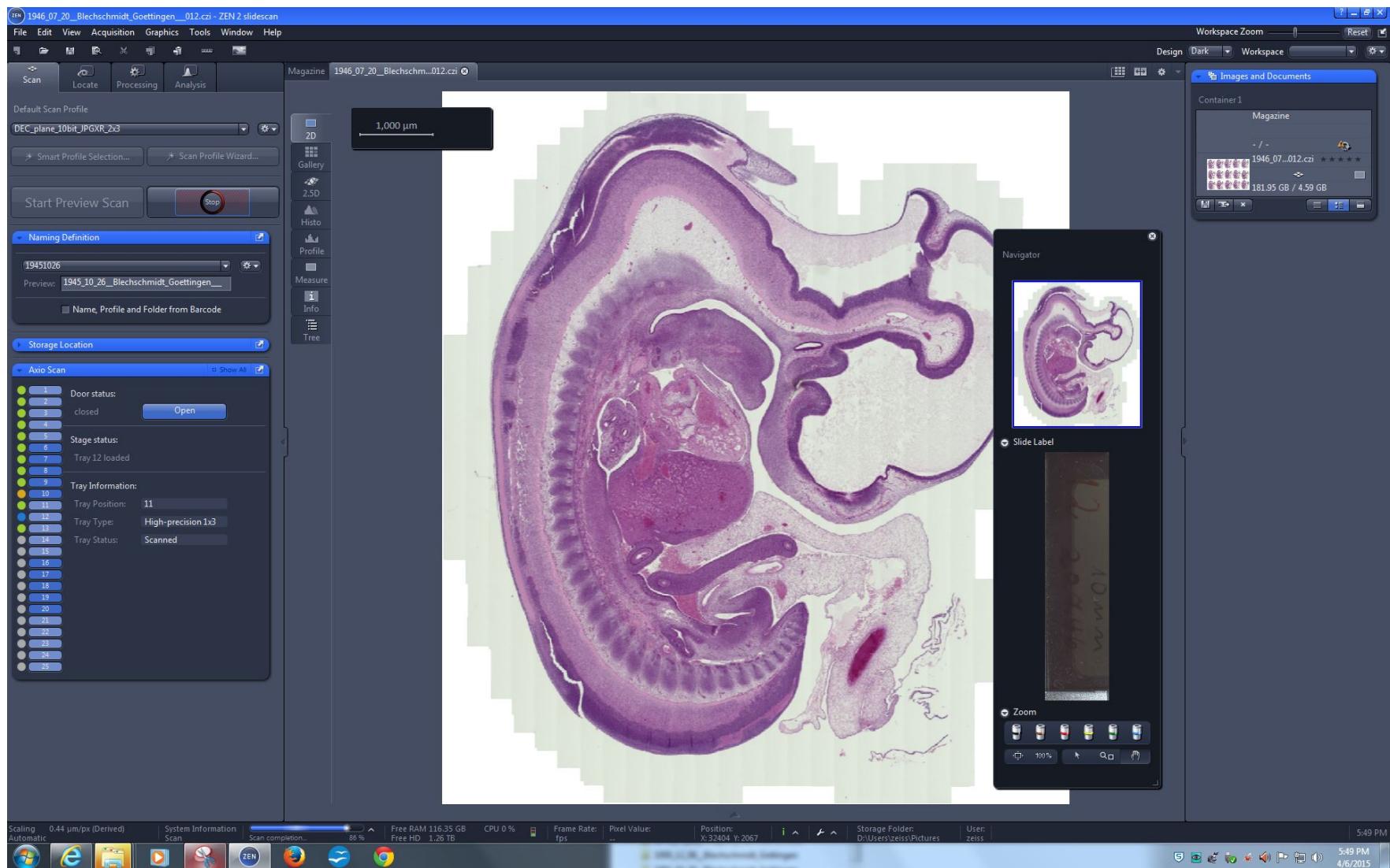
- **Erich Blechschmidt (1904–92)**

- Director of Göttingen University's Anatomical Institute from 1942 until 1973.
- 200,000 serial sections of embryos and 64 models.
- Some of the collection were assigned Carnegie Nos. 10315 -10434 in 1972.



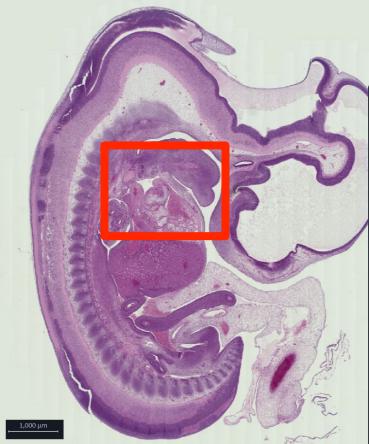
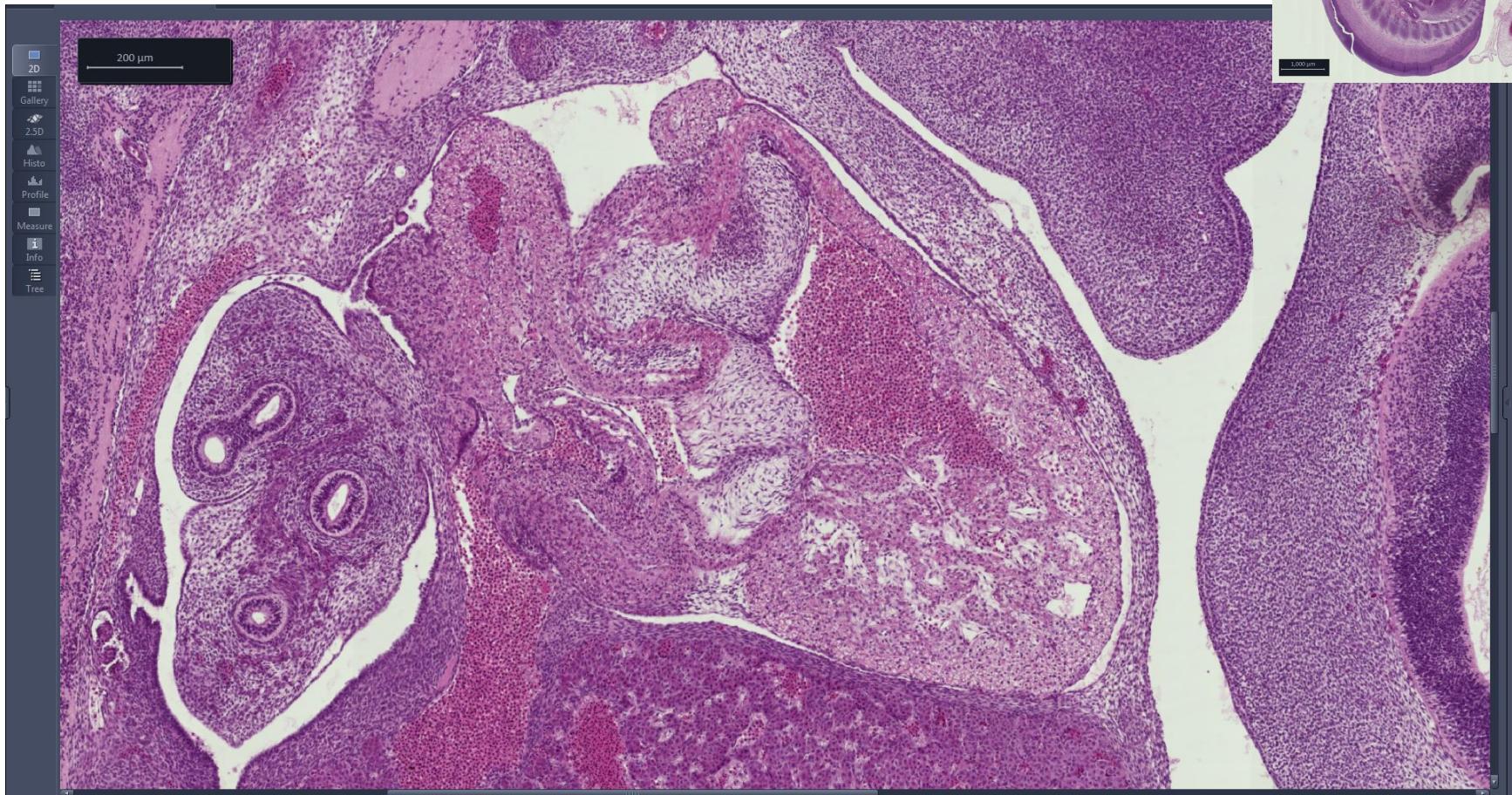
Prof. Christoph Viebahn

# Blechschmidt Embryo Scanning - 2015

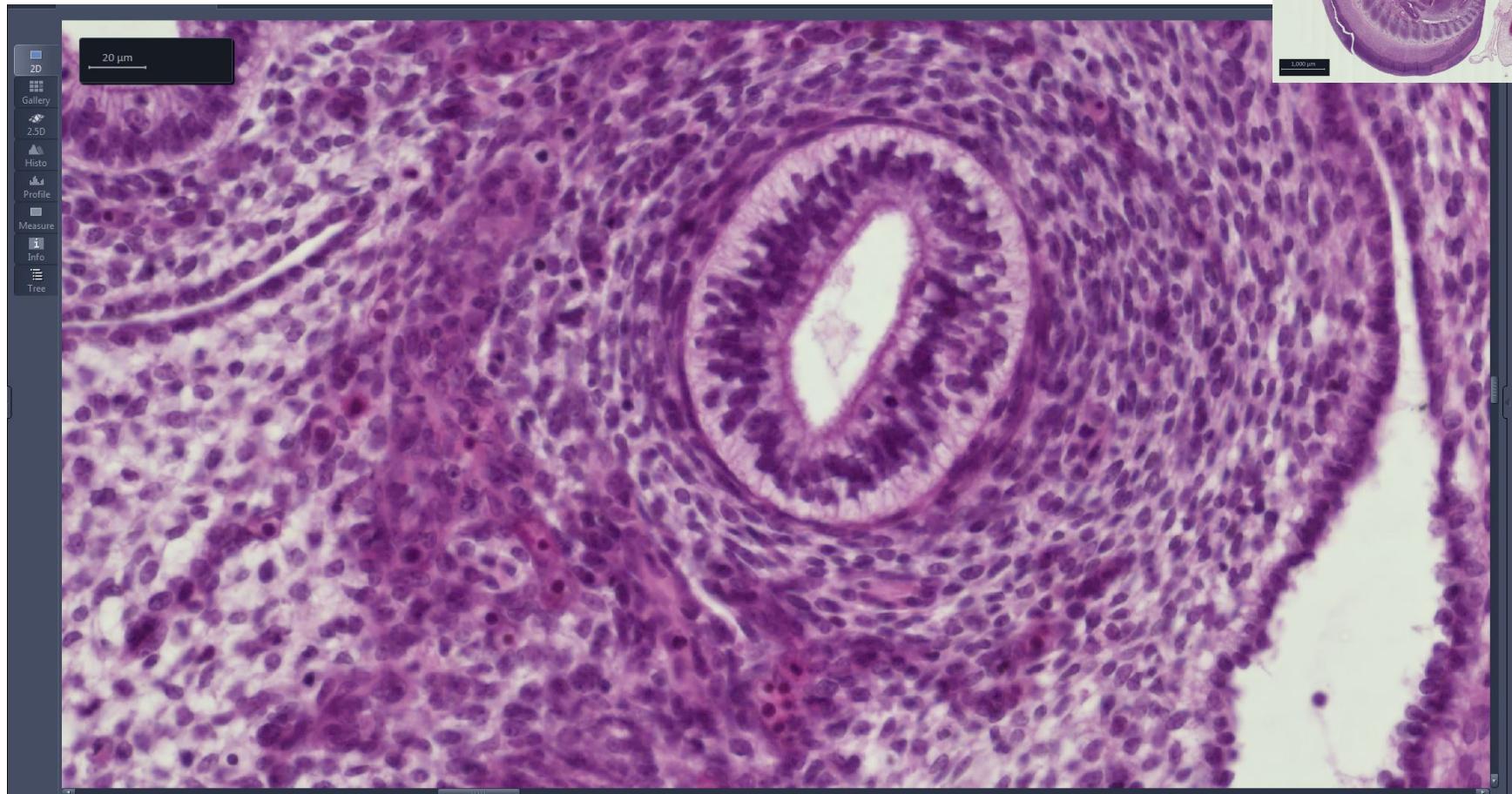


Scanned embryo viewed in Zen software

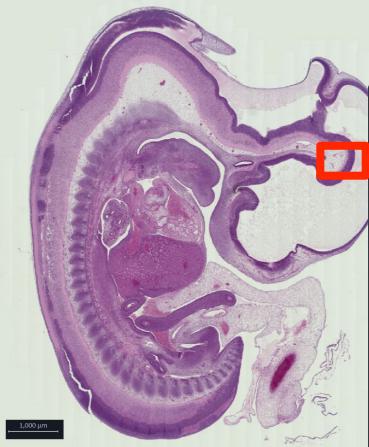
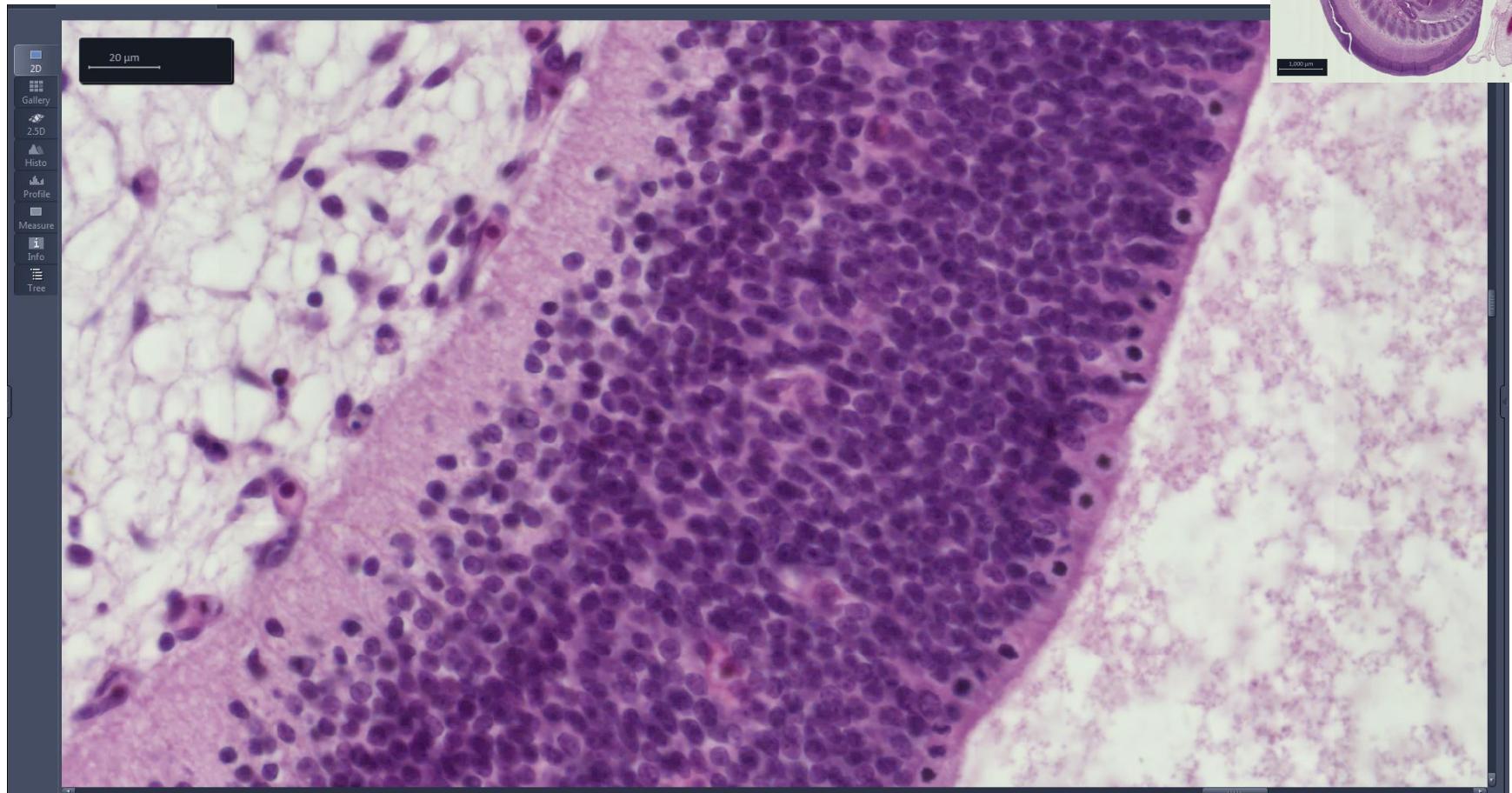
# Lung and Heart



# Bronchiole and Developing Lung



# Developing CNS – ventricular mitosis

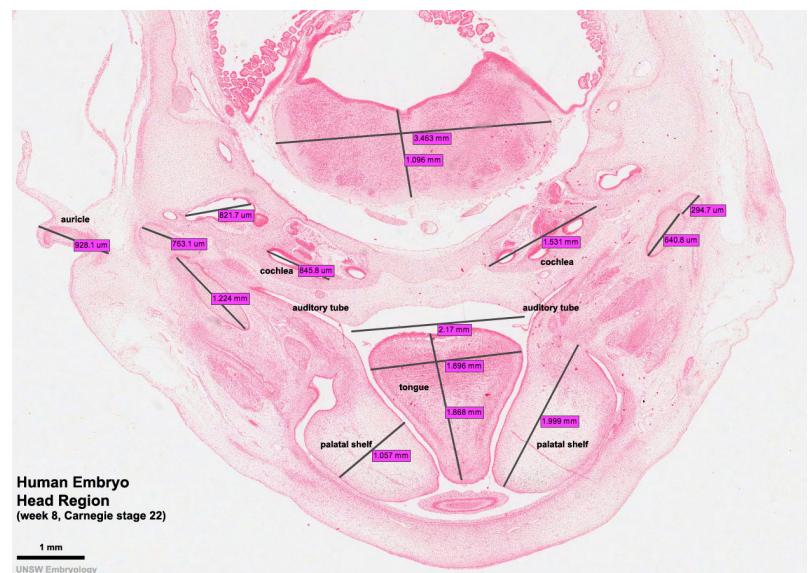


# Online Image Database

- Open Microscope Environment
  - OMERO image database
  - Tiff format images compatible with Zeiss
  - Scanner metadata included
- Separate programs available
  - Image upload
  - Image analysis
  - <http://www.openmicroscopy.org>
- Test Database Server
  - <http://149.171.80.223:4080>
- **Server Demonstration**



*"OME develops open-source software and data format standards for the storage and manipulation of biological microscopy data. It is a joint project between universities, research establishments, industry and the software development community."*



Stage 22 Embryo from the UNSW collection



# Kyoto Collection

- **Historic collection** of human embryos
  - Hugely valuable to developmental research
- Digitization of collection
  - Preserve the collection
  - Researcher access
  - Detailed analysis
  - Share understanding
  - Educational access
- **Modern collection** for ongoing research and teaching

# Thank You

- Prof. Shigehito Yamada
  - Kyoto University Graduate School of Medicine
- Prof Kohei Shiota
  - Shiga University of Medical Science
- Prof. Christoph Viebahn
  - University of Gottingen
- Prof. Beate Brand-Saberi
  - Ruhr-University Bochum
- Prof. Jose Rodriguez Vazquez
  - Complutense University of Madrid
- Prof. Virginia Diewert
  - University of British Columbia
- Dr. Peter Giere
  - Museum fur Naturkunde Berlin
- Ms Elizabeth Lockett
  - National Museum of Health and Medicine





**Congratulations to  
Congenital Anomaly Research Center  
40th Anniversary!**