Stanford



Matteo Amitaba Mole'

Assistant Professor of Obstetrics and Gynecology (Reproductive, Perinatal & Stem Cell Biology Research)

Obstetrics & Gynecology - Reproductive Biology

CONTACT INFORMATION

- **Administrative Contact**

  SKR Douglas - Lab Manager

  Email skrdouglas@stanford.edu

  Tel +1 (408) 569-1826

Bio

BIO

Matteo A. Molè, PhD, is an Assistant Professor in the Department of Obstetrics and Gynecology at Stanford University. He is faculty member of the Division of Reproductive, Stem Cell and Perinatal Biology, the Dunlevie Maternal-Fetal Medicine Center for Discovery, Innovation and Clinical Impact and the Stanford Institute for Stem Cell Biology and Regenerative Medicine.

Dr. Molè earned his PhD from University College London (UCL) and pursued postdoctoral research fellowships at the University of Cambridge and the Babraham Institute, where he established a license under the UK Human Fertilisation and Embryology Authority (HFEA) to conduct research on human embryos donated by patients undergoing IVF.

In the summer of 2023, Dr. Molè joined Stanford University as an Assistant Professor. His work focuses on investigating the mechanisms of human embryo implantation.

ACADEMIC APPOINTMENTS

- Assistant Professor, Obstetrics & Gynecology - Reproductive Biology
- Member, Bio-X
- Member, Cardiovascular Institute
- Member, Institute for Stem Cell Biology and Regenerative Medicine
- Member, Maternal & Child Health Research Institute (MCHRI)

HONORS AND AWARDS

- Research Grant, The Shurl and Kay Curci Foundation, Shurl and Kay Curci Foundation (2026-2028)
- ASRM Discovery & Innovation Grant Award, American Society for Reproductive Medicine (2025-2028)
- Stinehart-Reed Collaborative Investigator Seed Grant Award, Stanford Institute for Stem Cell Biology and Regenerative Medicine (2025-2027)
- Dunlevie Maternal-Fetal Medicine Center Spring 2025 Seed Grant, Dunlevie Maternal-Fetal Medicine Center (2025-2026)

- Stanford Cancer Institute Innovation Award, Stanford Cancer Institute (2025-2026)
- Stanford Maternal and Child Health Institute Pilot Grant Award, Stanford Maternal and Child Health Institute (2024-2025)
- The Duan Family Faculty Scholar in Maternal-Fetal Medicine, Stanford Medical School (2024- present)

BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS

- Member, International Society for Stem Cell Research (ISSCR) (2021 - present)
- Member, American Society of Reproductive Medicine (ASRM) (2025 - present)
- Member, Society for Reproductive Investigation (SRI) (2024 - present)

PROFESSIONAL EDUCATION

- Postdoctoral Research Associate, University of Cambridge and the Babraham Institute, Cambridge, UK , Developmental Epigenetics (2023)
- Postdoctoral Research Associate, University of Cambridge, Cambridge, UK , Mammalian Development and Stem Cell (2020)
- PhD Developmental Neurobiology, University College London (UCL), London, UK , Developmental Neurobiology (2017)
- MSc in Neuroscience, University College London (UCL), London, UK , Neuroscience (2012)
- BSc in Biological Sciences, Università degli Studi di Pavia, Pavia, Italy , Molecular Biology (2011)

PATENTS

- Matteo Mole', Peter Rugg-Gunn. "United States Patent BAB-C-P3371GBp A Method of Generating an In Vitro Endometrium Assembloid", Jul 1, 2023

LINKS

- Lab website: https://med.stanford.edu/matteo-mole.html

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

The research focus of our laboratory is centered on investigating the complex process of human embryo implantation. Due to the limited availability of suitable model systems and inability to directly observe this process in vivo, this has been traditionally referred to as the enigmatic stage of human embryonic development.

The successful implantation of an embryo is crucial for the establishment of a healthy pregnancy. During the transition between the first and second week of gestation, the human embryo must securely implant into the maternal uterus, initiating development of the placenta to receive necessary nutrients and oxygen for its growth until birth.

However, the process of implantation in humans is highly susceptible to failure, with a significant percentage of embryos unable to develop beyond this stage leading to early miscarriages. This clinically observed "implantation barrier" often requires patients to undergo numerous cycles of IVF treatment, with no guarantee of a successful pregnancy outcome.

The primary objective is to increase the understanding of maternal-embryo interactions initiated at implantation, with the goal of developing clinical interventions to address the high incidence of implantation failures underlying pre-clinical miscarriages.

Teaching

COURSES

2026-27

- Stem Cell Intensive: STEMREM 200 (Aut)

2025-26

- Stem Cell Intensive: STEMREM 200 (Aut)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

James Zwierzynski

Postdoctoral Faculty Sponsor

Purbasa Dasgupta, Magdalena Ladron de Guevara

Doctoral Dissertation Advisor (AC)

Nicole Horsley, Zachary Michel

Doctoral (Program)

Max Polanek

GRADUATE AND FELLOWSHIP PROGRAM AFFILIATIONS

- Biophysics (PhD Program)
- Maternal-Fetal Medicine (Fellowship Program)
- Reproductive Endocrinology and Infertility (Fellowship Program)
- Stem Cell Biology and Regenerative Medicine (PhD Program)

Publications

PUBLICATIONS

- **Modeling human embryo implantation in vitro.** *Cell*
  Molè, M. A., Elderkin, S., Zorzan, I., Penfold, C., Horsley, N., Pokhilko, A., Polanek, M., Palomar, A., Sinha, M., Wang, Y., Quiñonero, A., Androulidakis, C., Acton, et al
  2025

- **Human Embryo Implantation In Vitro: A Standardized Framework for Basic Research and Clinical Translation.** *Fertility and sterility*
  Horsley, N., Polanek, M., Michel, Z., Dominguez, F., Molè, M. A.
  2025

- **A single cell characterisation of human embryogenesis identifies pluripotency transitions and putative anterior hypoblast centre** *NATURE COMMUNICATIONS*
  Mole, M. A., Coorens, T. H. H., Shahbazi, M. N., Weberling, A., Weatherbee, B. A. T., Gantner, C. W., Sancho-Serra, C., Richardson, L., Drinkwater, A., Syed, N., Engley, S., Snell, P., Christie, et al
  2021; 12 (1): 3679

- **Integrin beta 1 coordinates survival and morphogenesis of the embryonic lineage upon implantation and pluripotency transition** *CELL REPORTS*
  Mole, M., Weberling, A., Faessler, R., Campbell, A., Fishel, S., Zernicka-Goetz, M.
  2021; 34 (10): 108834

- **Integrin-Mediated Focal Anchorage Drives Epithelial Zippering during Mouse Neural Tube Closure** *DEVELOPMENTAL CELL*
  Mole, M. A., Galea, G. L., Rolo, A., Weberling, A., Nychyk, O., De Castro, S. C., Savery, D., Faessler, R., Ybot-Gonzalez, P., Greene, N. D. E., Copp, A. J.
  2020; 52 (3): 321-+

- **Standardizing Cell Ontology terms for cross-study integration in the female reproductive tract.** *Science advances*

Ong, H. T., Saunders, D. C., Eastwood, C., Puig-Barbe, A., Kochersberger, A., Galligos, A., Marshall, B., Johnson, B. K., Kratka, C. E., Jin, C., Betancur, D., Guimarães, G. R., Machlin, et al
2026; 12 (41): eaef2358

- **Elevated contractility drives implantation failure in mouse embryos from aged females.** *Nature cell biology*
  Cavanaugh, K. E., Franco-Oñate, M. J., Horsley, N., Gokyer, D., Atazhanova, T., Laird, D. J., Oakes, P. W., Riley, J. K., Duncan, F. E., Pavone, M., Molé, M., Alert, R., Weiner, et al
  2026
- **Creating a Multi-Modal Atlas of Human Embryo Implantation**
  Horsley, N., Levin, M., Mole, M.
  SPRINGER HEIDELBERG.2026
- **Modeling Early Human Placentation and Embryo-Endometrial Crosstalk In Vitro**
  Elderkin, S., Zorzan, I., Penfold, C., Horsley, N., Dominguez, F., Rugg-Gunn, P., Mole, M.
  SPRINGER HEIDELBERG.2026
- **Modeling Human Embryo Implantation in a 3D Cell-Engineered Endometrial Model**
  Mole, M., Elderkin, S., Palomar, A., Zorzan, I., Penfold, C., Pokhilko, A., Dominguez, F., Rugg-Gunn, P.
  SPRINGER HEIDELBERG.2025: 150A
- **ORGANIZATION OF HUMAN STEM CELL-DERIVED VASCULAR PROGENITORS INTO VASCULAR NETWORKS**
  Chen, B., Kim, K., Wen, Y., Huyan, C., Sinha, M., Su, D., Ang, L., Dunn, A., Mole, M.
  WILEY.2025: S23-S24
- **3D In Vitro Modelling of Embryo-Endometrial Interface Unravels Entosis Role on Cell-in-Cell Invasion During Human Embryo Implantation.**
  Palomar, A., Zorzan, I., Mole, M., Quinonero, A., Rugg-Gunn, P., Dominguez, F.
  SPRINGER HEIDELBERG.2024: 91A-92A
- **Live-Imaging Analysis of Epithelial Zippering During Mouse Neural Tube Closure.** *Methods in molecular biology (Clifton, N.J.)*
  Mole, M. A., Galea, G. L., Copp, A. J.
  2023; 2608: 147-162
- **Vangl2-environment interaction causes severe neural tube defects, without abnormal neuroepithelial convergent extension** *DISEASE MODELS & MECHANISMS*
  Nychyk, O., Galea, G. L., Mole, M., Savery, D., Greene, N. D. E., Stanier, P., Copp, A. J.
  2022; 15 (1)
- **The role of cell-ECM adhesions in mouse neural tube closure**
  Papastergios, E. V., Mole, M. A., Galea, G. L., Greene, N. D. E., Copp, A. J.
  WILEY.2021: 959
- **Human embryo polarization requires PLC signaling to mediate trophectoderm specification** *ELIFE*
  Zhu, M., Shahbazi, M., Martin, A., Zhang, C., Sozen, B., Borsos, M., Mandelbaum, R. S., Paulson, R. J., Mole, M. A., Esbert, M., Titus, S., Scott, R. T., Campbell, et al
  2021; 10
- **Modelling the impact of decidual senescence on embryo implantation in human endometrial assembloids** *ELIFE*
  Rawlings, T. M., Makwana, K., Taylor, D. M., Mole, M. A., Fishwick, K. J., Tryfonos, M., Odendaal, J., Hawkes, A., Zernicka-Goetz, M., Hartshorne, G. M., Brosens, J. J., Lucas, E. S.
  2021; 10
- **RETHINKING HUMAN EMBRYO RESEARCH POLICIES** *HASTINGS CENTER REPORT*
  Matthews, K. R. W., Iltis, A. S., Marquez, N., Wagner, D. S., Robert, J., de Melo-Martin, I., Bigg, M., Franklin, S., Holm, S., Metzler, I., Mole, M. A., Taupitz, J., Testa, et al
  2021; 51 (1): 47-51
- **The role of Sox2 in neuromesodermal progenitors and neural specification in the mouse**
  Papastergios, E. V., Mugele, D., Moulding, D. A., Savery, D., Mole, M. A., Greene, N. D. E., Martinez-Barbera, J., Copp, A. J.
  WILEY.2020: 338

- **Comparative analysis of human and mouse development: From zygote to pre-gastrulation** *GASTRULATION: FROM EMBRYONIC PATTERN TO FORM*
  Mole, M. A., Weberling, A., Zernicka-Goetz, M.
  edited by SolnicaKrezel, L.
  2020; 136: 113-+
- **Vangl2 disruption alters the biomechanics of late spinal neurulation leading to spina bifida in mouse embryos** *DISEASE MODELS & MECHANISMS*
  Galea, G. L., Nychyk, O., Mole, M. A., Moulding, D., Savery, D., Nikolopoulou, E., Henderson, D. J., Greene, N. D. E., Copp, A. J.
  2018; 11 (3)
- **Biomechanical coupling of the closing spinal neural tube facilitates neural fold apposition**
  Galea, G. L., Cho, Y., Galea, G., Mole, M. A., Rolo, A., Savery, D., Moulding, D., Nikolopoulou, E., Greene, N. D. E., Copp, A. J.
  HINDAWI LTD.2017
- **Biomechanical coupling facilitates spinal neural tube closure in mouse embryos** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
  Galea, G. L., Cho, Y., Galea, G., Mole, M. A., Rolo, A., Savery, D., Moulding, D., Culshaw, L. H., Nikolopoulou, E., Greene, N. D. E., Copp, A. J.
  2017; 114 (26): E5177-E5186
- **Regulation of cell protrusions by small GTPases during fusion of the neural folds** *ELIFE*
  Rolo, A., Savery, D., Escuin, S., de Castro, S. C., Armer, H. E. J., Munro, P. M. G., Mole, M. A., Greene, N. D. E., Copp, A. J.
  2016; 5: e13273
- **Cellular basis of neuroepithelial bending during mouse spinal neural tube closure** *DEVELOPMENTAL BIOLOGY*
  McShane, S. G., Mole, M. A., Savery, D., Greene, N. D. E., Tam, P. P. L., Copp, A. J.
  2015; 404 (2): 113-124
- **Cell-matrix interactions and cell dynamics of neuroepithelial bending during mouse spinal neural tube closure**
  Mole, M. A., Mugele, D., Ybot-Gonzalez, P., Greene, N. D. E., Copp, A. J.
  HINDAWI LTD.2015