

ANTAGONISTIC ACTIONS BETWEEN ESTROGEN AND RETINOIC ACID SIGNALING FOR DISEASE TREATMENT

[Ma, Liang, Yin, Yan](#)

[Richards, Jennifer](#)

T-021039

Published date: 7/22/2026

Value Proposition: *New process that tackles two RA signaling pathways to improve treatment of various diseases.*

Technology Description

Researchers at Washington University in St. Louis have uncovered an antagonistic interaction between estrogen and retinoic acid (RA) signaling in maintaining uterine epithelial cell fate. In adult uteri, loss of RA signaling leads to transformation of uterine epithelia to cervical/vaginal epithelia. As a result, estrogen signaling is elevated, reflected by its target gene expression.

This discovery offers a new prospective in treatment of several diseases by tackling two signaling pathways simultaneously and could drastically improve outcome compared to current drugs targeting only one pathway. Additionally, it was found that a balance of E2 and RA signaling is required to maintain adult uterine epithelial cell fate. Such an antagonistic relationship between the two signaling also functions during the embryo implantation process and possibly many other biological processes including cancer. Therefore, the combined use of RA-agonists and E2 antagonists could be a viable therapeutic approach for potentially treating many diseases including endometrial cancer, endometriosis, acne, squamous carcinomas etc.

Stage of Research

- Treated RA mutant mice with an E2 antagonist.
- Restored uterine epithelial morphology in these mutants as well as the immune cell infiltration phenotype.

Publications

Yin Y, Haller M, Goldinger L, Bharadwaj S, So E, Robles-Pinos V, Chen D, Ma L. Retinoic acid antagonizes estrogen signaling to maintain adult uterine cell fate. *Proc Natl Acad Sci U S A*. 2025 Feb 4;122(5):e2416089122. doi: 10.1073/pnas.2416089122. Epub 2025 Jan 28. PMID: 39874292; PMCID: PMC11804538.

Applications

- Disease treatment for endometrial cancer, endometriosis, and beyond
- Maintaining uterine epithelial cell fate

Key Advantages

- Can treat several diseases including endometrial cancer, endometriosis, acne, squamous carcinomas etc.
- Tackles two signaling pathways

Patents

Patent pending

Related Web Links – [Liang Ma Profile](#)