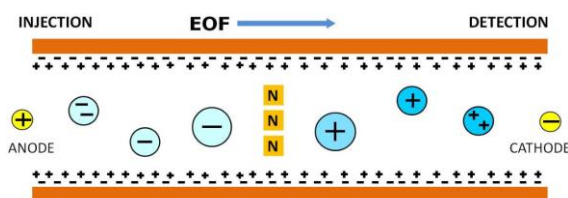


# Characterizing the Protein-Antibody Interactions Involved in Ovarian Cancer Detection

Prof. Rebecca Whelan

Ovarian cancer is responsible for approximately 14,000 deaths in the United States each year. A blood test for a protein (CA125) is used to follow patient response to treatment and monitor patients for cancer recurrence. Considering its importance in making serious

clinical care decisions, surprisingly little is known about how the CA125 test works. The Whelan lab uses bioanalytical chemistry to probe the interactions that underlie the CA125 test. In this project, a student will study the interactions of CA125 with the antibodies that recognize CA125 in the clinical test. CA125 protein subdomains will be expressed and purified. Samples containing CA125 and antibodies in known ratios will be prepared. Nanoliter volumes of these samples will be analyzed using capillary electrophoresis, a high-resolution separation and detection method in which CA125/antibody complexes will be detectable through their intrinsic absorbance. Knowing which subdomains of CA125 are detected in the clinical test will help us build a foundation for our ultimate goal: a more reliable test for early-stage ovarian cancer. Skills that will be gained include cell culture; protein expression and purification; operation of a capillary electrophoresis instrument; safe, ethical, and well-documented laboratory practices; troubleshooting; working collaboratively; and communicating with expert and lay audiences. Prof. Whelan joined our faculty in 2022 and published 15 papers with 39 different undergraduate co-authors at her previous institutions.<sup>1-15</sup>



## References.

Names of non-KU REU authors are in **bold**; Names of other undergraduates are underlined.

1. DeRosa, C. M.; Weaver, S. D.; Wang, C. W.; Schuster-Little, N.; Whelan, R. J., Simultaneous N-Deglycosylation and Digestion of Complex Samples on S-Traps Enables Efficient Glycosite Hypothesis Generation. *Acs Omega* **2023**.
2. Sherman, L. M.; Finley, M. D.; Borsari, R. K.; Schuster-Little, N.; Strausser, S. L.; Whelan, R. J.; Jenkins, D. M.; Camden, J. P., N-Heterocyclic Carbene Ligand Stability on Gold Nanoparticles in Biological Media. *Acs Omega* **2022**, 7, 1444-1451.
3. Schuster-Little, N.; Fritz-Klaus, R.; Etzel, M.; Patankar, N.; Javeri, S.; Patankar, M. S.; Whelan, R. J., Affinity-free enrichment and mass spectrometry analysis of the ovarian cancer biomarker CA125 (MUC16) from patient-derived ascites. *Analyst* **2021**, 146, 85-94.
4. Garvin, M. C.; Schijf, J.; Kaufman, S. R.; Konow, C.; Liang, D.; Nigra, A. E.; Stracker, N. H.; Whelan, R. J.; Wiles, G. C., A survey of trace metal burdens in increment cores from eastern cottonwood (*Populus deltoides*) across a childhood cancer cluster, Sandusky County, OH, USA. *Chemosphere* **2020**, 238.
5. Mears, K. S.; Markus, D. L.; Ogunjimi, O.; Whelan, R. J., Experimental and mathematical evidence that thrombin-binding aptamers form a 1 aptamer:2 protein complex. *Aptamers (Oxf)* **2018**, 2, 64-73.

6. Garvin, M. C.; Austin, A.; Boyer, K.; Gefke, M.; Wright, C.; Pryor, Y.; Soble, A.; Whelan, R. J., Attraction of *Culex pipiens* to House Sparrows Is Influenced by Host Age but Not Uropygial Gland Secretions. *Insects* **2018**, *9*, 127.
7. Garvin, M. C.; Austin, A. L.; Stracker, N. H.; Slowinski, S. P.; Rutter, J. E.; Butler, M.; Michel, M.; Whelan, R. J., Attraction of *Culex pipiens* to uropygial gland secretions does not explain feeding preference for American robins. *J Vector Ecol* **2018**, *43*, 110-116.
8. Pires, T. A.; Narovec, C. M.; Whelan, R. J., Effects of Cationic Proteins on Gold Nanoparticle/Aptamer Assays. *Acs Omega* **2017**, *2*, 8222-8226.
9. Scoville, D. J.; Uhm, T. K.; Shallcross, J. A.; Whelan, R. J., Selection of DNA Aptamers for Ovarian Cancer Biomarker CA125 Using One-Pot SELEX and High-Throughput Sequencing. *J Nucleic Acids* **2017**, Article ID 9879135, 9 pages.
10. Kapur, A.; Felder, M.; Fass, L.; Kaur, J.; Czarnecki, A.; Rathi, K.; Zeng, S.; Oowski, K. K.; Howell, C.; Xiong, M. P.; Whelan, R. J.; Patankar, M. S., Modulation of oxidative stress and subsequent induction of apoptosis and endoplasmic reticulum stress allows citral to decrease cancer cell proliferation. *Sci Rep-Uk* **2016**, *6*, 27530.
11. Eaton, R. M.; Shallcross, J. A.; Mael, L. E.; Mears, K. S.; Minkoff, L.; Scoville, D. J.; Whelan, R. J., Selection of DNA aptamers for ovarian cancer biomarker HE4 using CE-SELEX and high-throughput sequencing. *Analytical and Bioanalytical Chemistry* **2015**, *407*, 6965-6973.
12. Felder, M.; Kapur, A.; Gonzalez-Bosquet, J.; Horibata, S.; Heintz, J.; Albrecht, R.; Fass, L.; Kaur, J.; Hu, K.; Shojaei, H.; Whelan, R. J.; Patankar, M. S., MUC16 (CA125): tumor biomarker to cancer therapy, a work in progress. *Mol Cancer* **2014**, *13*, 129.
13. Shaw, C. L.; Rutter, J. E.; Austin, A. L.; Garvin, M. C.; Whelan, R. J., Volatile and Semivolatile Compounds in Gray Catbird Uropygial Secretions Vary with Age and Between Breeding and Wintering Grounds. *J. Chem. Ecol.* **2011**, *37*, 329-339.
14. Berman, Z. T.; Moore, L. J.; Knudson, K. E.; Whelan, R. J., Synthesis and structural characterization of the peptide epitope of the ovarian cancer biomarker CA125 (MUC16). *Tumor Biol* **2010**, *31*, 495-502.
15. Whelan, R. J.; Levin, T. C.; Owen, J. C.; Garvin, M. C., Short-chain carboxylic acids from gray catbird (*Dumetella carolinensis*) uropygial secretions vary with testosterone levels and photoperiod. *Comp Biochem Phys B* **2010**, *156*, 183-188.