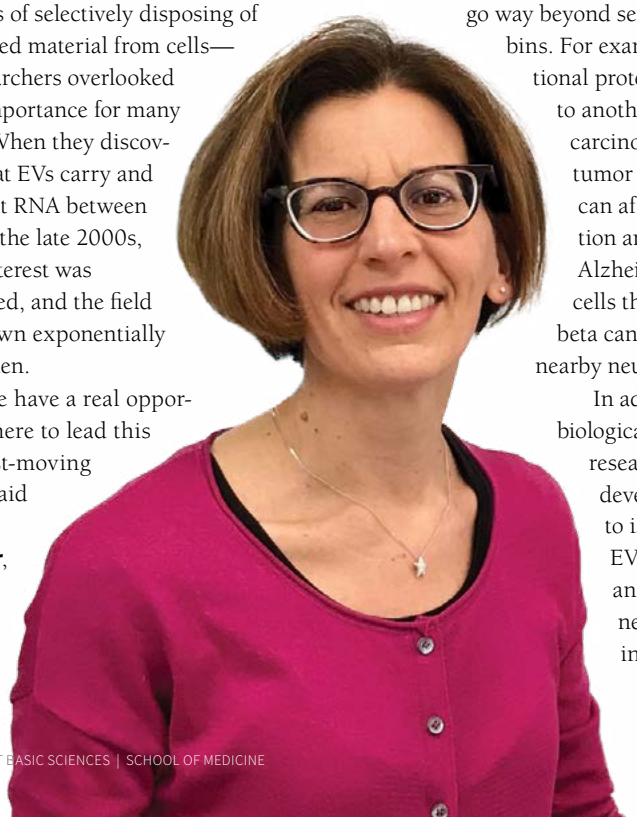
New research program seeks to understand extracellular vesicles

By Lorena Infante Lara

Extracellular vesicles, tiny pouches loaded with different kinds of molecules, roam our bodies. But what effect do they have on our normal functioning—or in disease? The Vanderbilt Program for Extracellular Vesicle Research is here to find out.

Basic Sciences has established a new research program focused on how tiny pouches that get secreted from cells act as messengers and communicators throughout the body. Extracellular vesicles, which actively get released from cells, ferry biologically active protein, lipid, and nucleic acids to themselves or to other cells to induce a change in behavior; they are messengers with instructions on how to act in certain situations.

EVs were discovered a few decades ago, but their role in normal and disease physiology has been historically underappreciated. They were initially described as "cellular garbage"—merely a means of selectively disposing of unwanted material from cells—so researchers overlooked their importance for many years. When they discovered that EVs carry and transmit RNA between cells in the late 2000s, their interest was rekindled, and the field has grown exponentially since then.



"We have a real opportunity here to lead this very fast-moving field," said **Alissa Weaver**, Cornelius Vanderbilt Chair and Professor of Cell and Developmental Biology. Weaver, who founded the program alongside Adjunct Professor of Pathology Microbiology and Immunology **Andries Zijlstra**, will direct the Vanderbilt Program for Extracellular Vesicle Research.

The field's initial belief was that EVs were secreted only from highly specialized cells, but researchers now know that all cells secrete them. "Even bacteria and plants release these vesicles," said Weaver. "They are evolutionarily conserved and are important in a variety of normal and disease events."

Researchers now know that the roles of EVs go way beyond serving as disposable garbage bins. For example, they can transfer functional proteins and RNA from one cell to another. In the case of colorectal carcinoma, when released into the tumor microenvironment, EVs can affect cell-cell communication and tumor progression. In Alzheimer's, EVs released from cells that accumulate amyloid beta can induce cell death in nearby neurons.

In addition to exploring the biological role of EVs, Vanderbilt researchers are pursuing the development of technologies to isolate, analyze, and track EVs throughout the body and in cell cultures. The new technologies will help investigators pick apart the role of EVs in different contexts, eventually leading to better detection methods or treatments for various diseases.

Vanderbilt already has a large number of investigators who are working on EVs. Formalizing the group under a single umbrella facilitates synergy among existing research efforts, fosters new collaborations, and connects Vanderbilt's EV research to the broader national and international communities.

The National Cancer Institute, for example, recently awarded a new program project grant focused on EVs and extracellular RNA to a group of 12 Basic Sciences and VUMC labs and 2 outside labs. Although the NCI-funded collaborative group is already in a position to clarify important biological questions, such as how cells choose which RNAs get secreted, how they get packaged, and how efficient exRNAs are at enabling change in other cells, the EV Research program is set to enhance the project by helping extend the program project's reach to the rest of the Vanderbilt EV community.

This new research program was established with funding from Basic Sciences, which will go toward inviting seminar speakers, supporting a works-in-progress data club, hosting events and workshops, and purchasing and maintaining shared equipment that's essential for EV purification and analysis but whose price tag would be prohibitive for individual labs.

"This program has the potential to launch Vanderbilt to the forefront of EV research," Weaver said, "and to advance our understanding of a variety of physiological and pathological states that rely on EVs for communication." ■