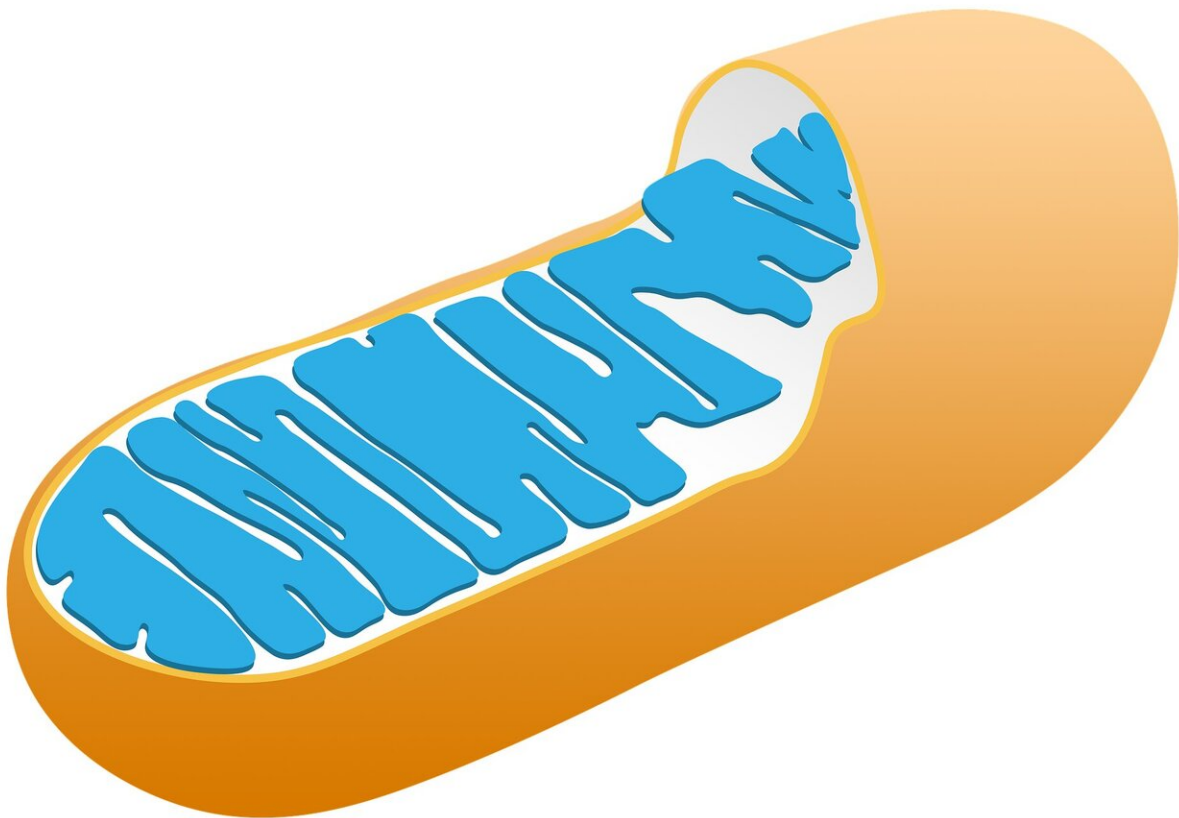


# A new blood component revealed

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Does the blood we thought to know so well contain elements that had been undetectable until now? The answer is yes, according to a team of researchers from Inserm, Université de Montpellier and the Montpellier Cancer Institute (ICM) working at the Montpellier Cancer Research Institute (IRCM), which has revealed the presence of whole functional mitochondria in blood circulation. The discovery may deepen our knowledge of physiology and open up new avenues for treatment.

Mitochondria are organelles that are found in the [eukaryotic cells](#). A place of cellular respiration, they are the cells' "batteries" and play a major role in energy metabolism and intercellular communication. Their unique trait is they possess their own genome, transmitted solely by the mother and separate from the DNA contained in the nucleus. Mitochondria can sometimes be observed outside cells in the form of fragments encapsulated within microvesicles. Under certain very specific conditions, platelets are also capable of releasing intact [mitochondria](#) into the extracellular space.

The work of a team led by Inserm researcher Alain R. Thierry at the Montpellier Cancer Research Institute (Inserm/Université de Montpellier/Montpellier Cancer Institute) has now revolutionized knowledge of this organelle by revealing that whole functioning extracellular mitochondria are in fact found in the bloodstream.

The researchers used previous findings which showed that the plasma of a healthy individual contains up to 50,000 times more mitochondrial DNA than nuclear DNA. They hypothesized that for it to be detectable and quantifiable in the blood in this manner, the mitochondrial DNA had to be protected by a structure of sufficient stability. In order to identify such a structure, plasma samples from around 100 individuals were analyzed.

This analysis revealed the presence in the [blood circulation](#) of highly stable structures containing whole mitochondrial genomes. Following examination of their size and density, as well as the integrity of their mitochondrial DNA, these structures observed using electron microscopy (up to 3.7 million per ml of plasma) were revealed to be intact and functional mitochondria.

Throughout the seven-year research period, the scientists used as many technical and methodological approaches as possible to validate this presence of circulating extracellular mitochondria in the blood.

"When we consider the sheer number of extracellular mitochondria found in the blood, we have to ask why such a discovery had not been made before," Thierry says. "Our team has built up expertise in the specific and sensitive detection of DNA in the [blood](#), by working on the fragmentation of extracellular DNA derived from the mitochondria in particular," he adds.

But what is the role of these extracellular mitochondria? The answer to that could be linked to the structure of the mitochondrial DNA, similar to that of bacterial DNA, which gives it the ability to induce immune and inflammatory responses. Based on this observation, the researchers hypothesize that these circulating mitochondria could be implicated in many physiological and/or pathological processes requiring communication between the cells (such as the mechanisms of inflammation). Indeed, recent studies have demonstrated the ability of certain cells to transfer mitochondria between themselves, such as stem cells with damaged cells. "The extracellular mitochondria could perform various tasks as messenger for the entire body," Thierry explains.

In addition to its importance to our knowledge of physiology, this discovery could lead to improvements in the diagnosis, monitoring and treatment of certain diseases. In fact, the research team is now devoting

its attention to evaluating extracellular mitochondria as biomarkers in non-invasive prenatal diagnosis and cancer.

**More information:** Zahra Al Amir Dache et al, Blood contains circulating cell-free respiratory competent mitochondria, *The FASEB Journal* (2020). [DOI: 10.1096/fj.201901917RR](https://doi.org/10.1096/fj.201901917RR)

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