Investigating the Role of the Immune System in the Pre-Metastatic Niche in Breast Cancer

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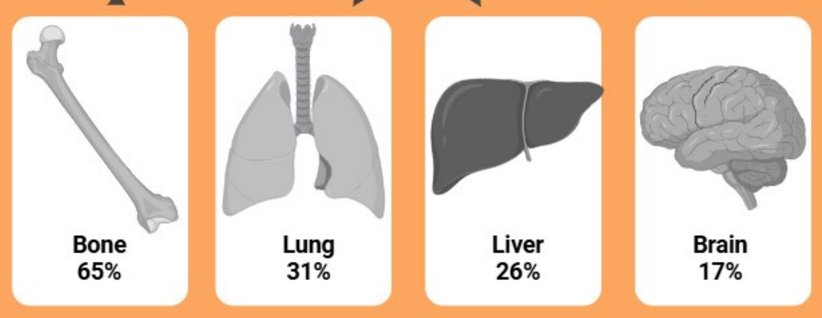
What is secondary breast cancer?

Secondary breast cancer happens when cancer cells spread from the breast to other parts of the body. This process is called metastasis.

56,000 women diagnosed with primary breast cancer each year[1]

7500 women diagnosed with secondary breast cancer each year[2]

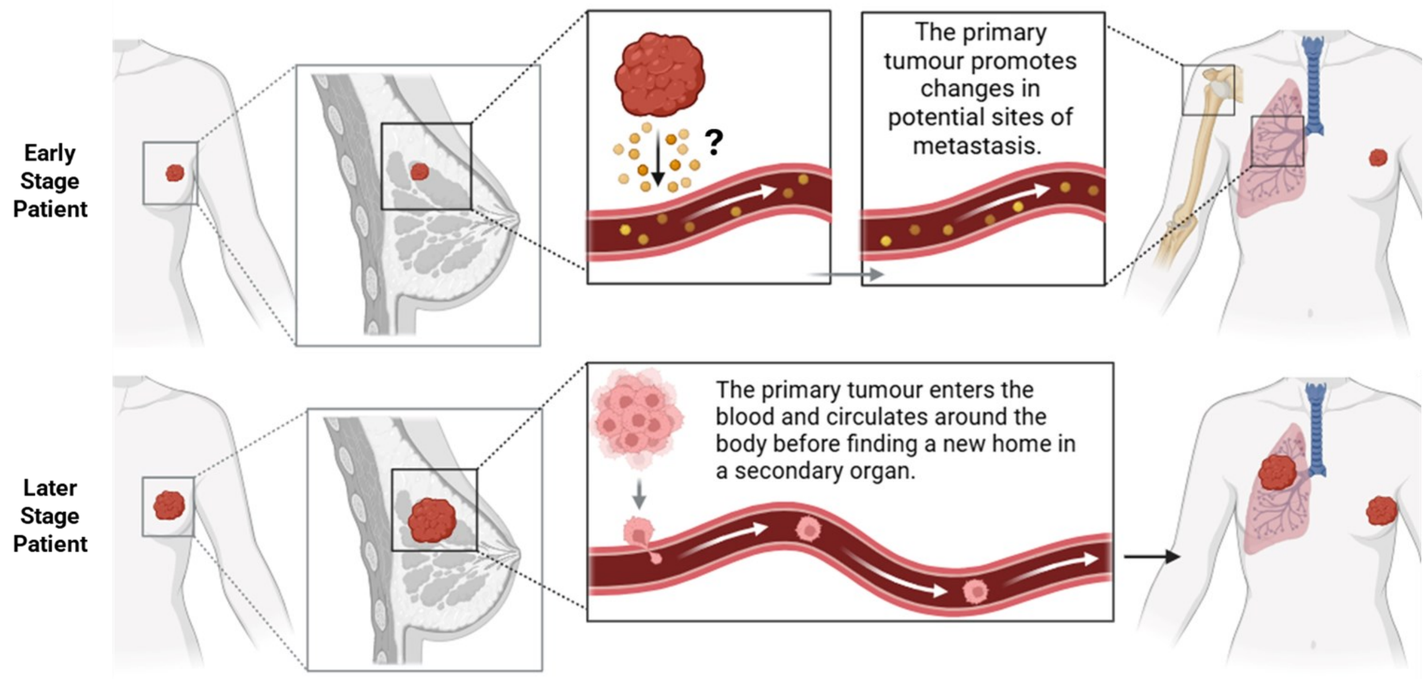


Most common sites of metastasis[3]

While breast cancer that has spread elsewhere is currently incurable, our research focuses on understanding how this spread occurs. By uncovering these mechanisms, we hope to develop new treatments to better manage, or even prevent, the cancer's progression.

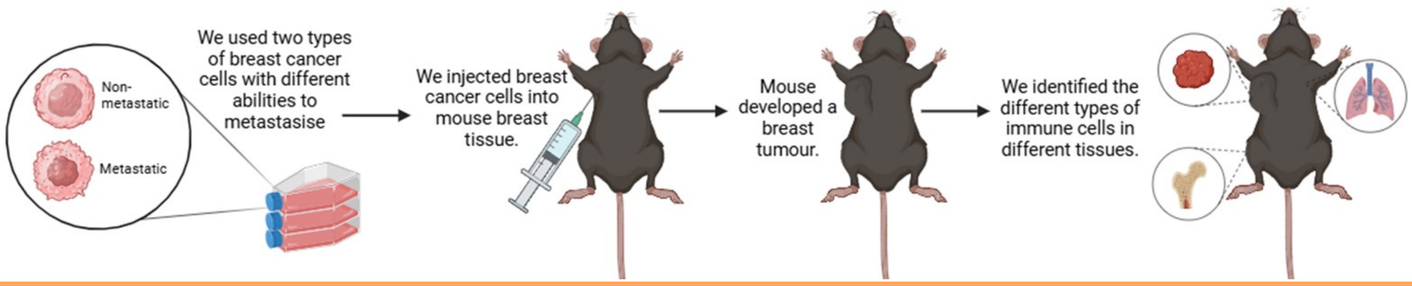
The Pre-Metastatic Niche

Before metastasis occurs, the primary tumour is able to influence potential sites of metastasis from afar to prepare them for the arrival of metastasizing cells[4]. This is referred to as the **pre-metastatic niche** and involves many changes, including effects on white blood cells, which are key components of the immune system.



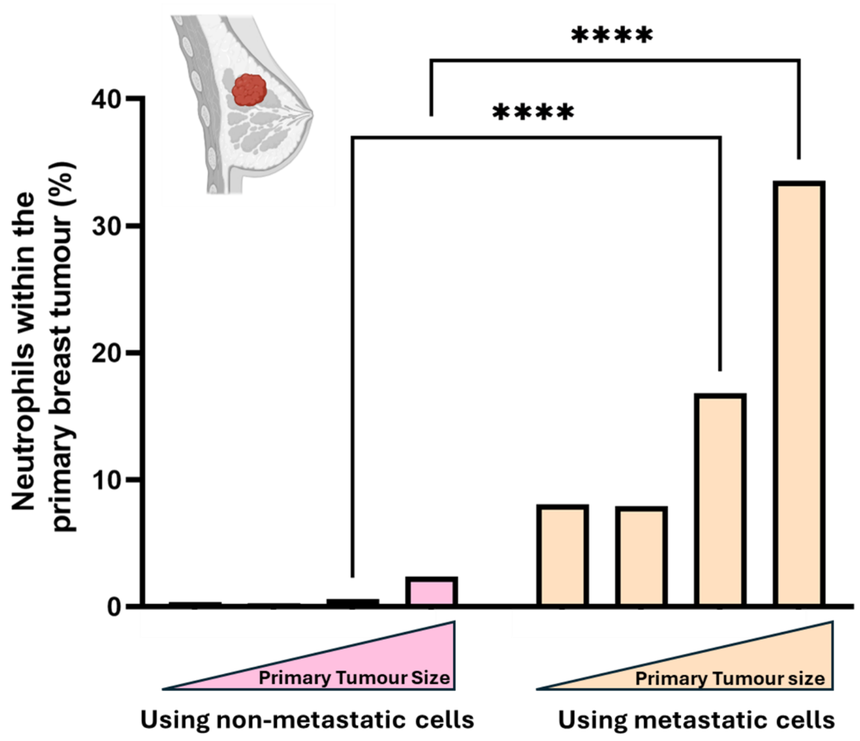
Our aim is to investigate how the immune system changes during generation of the pre-metastatic niche.

What we did:

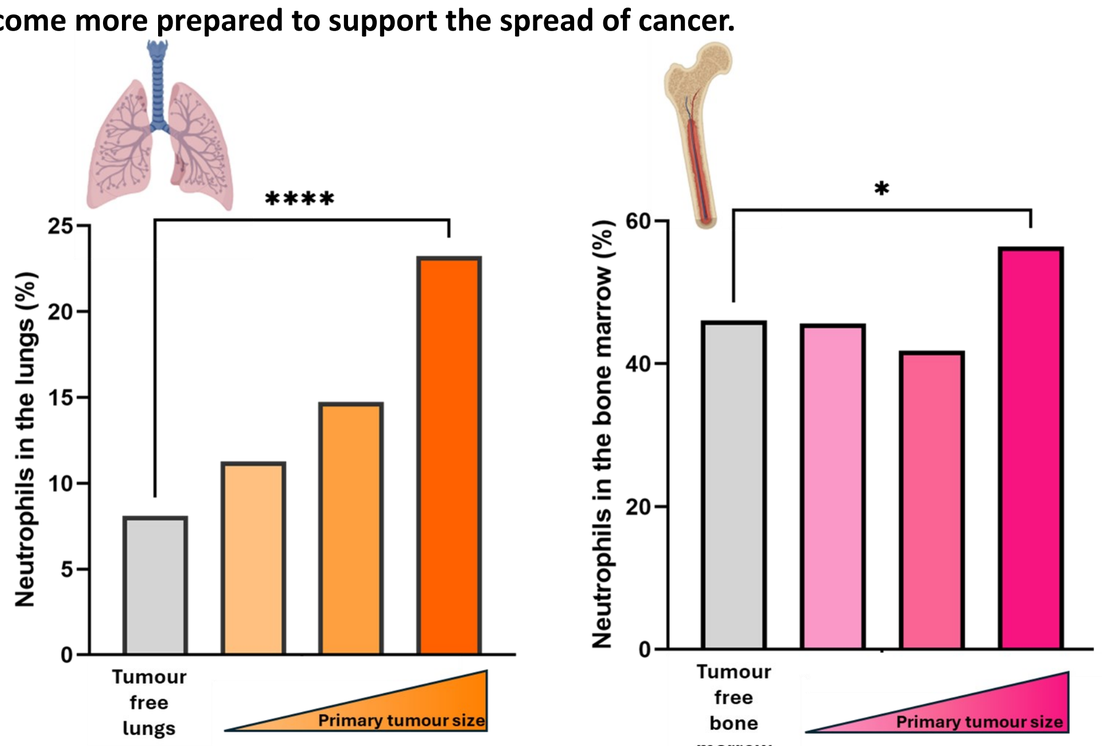


What we found:

1. When comparing all the different types of immune cells, metastatic tumours have lots more of one in particular: neutrophils (see information box below)**.**

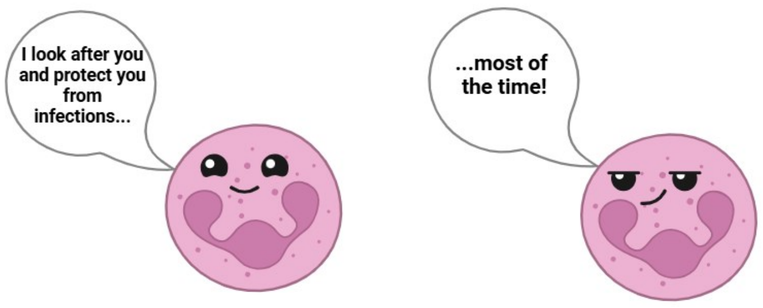


2. As the primary tumour grows, we found that more neutrophils gather in these distant pre-metastatic sites of the lung and bone, suggesting that these areas gradually become more prepared to support the spread of cancer.



Information box: What are neutrophils?

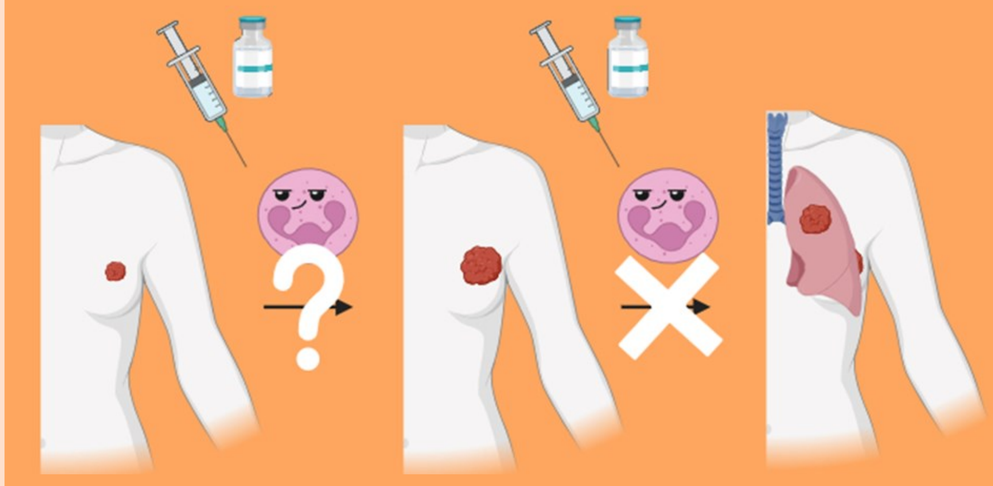
Neutrophils are the most common white blood cells in your body.



Normally, they are one of the first responders to an infection. They are the main component of pus and help the body fight bacteria.

In cancer, they are often the bad guys. They can help the tumour grow by improving its blood supply and helping it to metastasise.

Why is this important?



- **This work suggests that blocking harmful neutrophils could help stop the cancer from spreading.**
- **This approach might also work in patients with earlier tumours, by targeting the harmful neutrophils before they increase and help the cancer spread. More research is needed to explore whether this could be a way to prevent metastasis.**

References: [1]Cancer Research UK (2022). *Breast cancer statistics*. [online] Cancer Research UK. Available at: https://www.cancerresearchuk.org/health-professional/cancer-statistics/statistics-by-cancer-type/breast-cancer. [2]Palmieri, C., Owide, J. and Fryer, K. (2022). Estimated Prevalence of Metastatic Breast Cancer in England, 2016-2021. *JAMA Network Open*, 5(12), p.e2248069. doi:https://doi.org/10.1001/jamanetworkopen.2022.48069. [3]Chen, M.-T., Sun, H.-F., Zhao, Y., Fu, W.-Y., Yang, L.-P., Gao, S.-P., Li, L.-D., Jiang, H. and Jin, W. (2017). Comparison of patterns and prognosis among distant metastatic breast cancer patients by age groups: a SEER population-based analysis. *Scientific Reports*, [online] 7(1), p.9254. doi:https://doi.org/10.1038/s41598-017-10166-8. [4] Kaplan, R.N., Riba, R.D., Zacharoulis, S., Bramley, A.H., Vincent, L., Costa, C., MacDonald, D.D., Jin, D.K., Shido, K., Kerns, S.A., Zhu, Z., Hicklin, D., Wu, Y., Port, J.L., Altorki, N., Port, E.R., Ruggero, D., Shmelkov, S.V., Jensen, K.K. and Rafii, S. (2005). VEGFR1-positive haematopoietic bone marrow progenitors initiate the pre-metastatic niche. *Nature*, 438(7069), pp.820–827. doi:https://doi.org/10.1038/nature04186.