How Macrophages Respond to Cancer Conditions

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Background

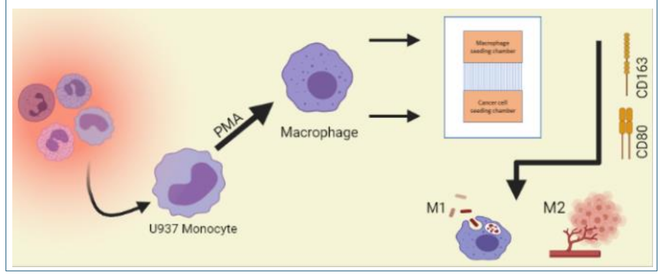
- Macrophages are innate immune cells that attack foreign particles and initiate an immune response
- Macrophages include two main subtypes: M1 (anti-tumorigenic) and M2 (pro-tumorigenic)
- Macrophages have been shown to involve in tumor surveillance and anti-tumorigenesis
- Microfluidic devices and breast cancer cells offer an experimental platform and clinical model to understand macrophage behaviors in tumor microenvironment

Main Research Goals

- How do varying cancer conditions affect macrophage migration?
- Which macrophage subtype is more common in the presence of breast cancer cells?

Research Methods

- Human monocytes were grown and activated with PMA into macrophages for experimentation, human breast cancer cells were grown separately
- Breast cancer cells or condition culture medium were introduced to microfluidic devices along with macrophages
- Macrophage migration was visualized using a microscope and quantified by imageJ software
- Macrophages were immunostained with CD markers for M1 or M2 subtype and the fluorescent intensity were analyzed.



Results

Exposure to condition medium and pre-seeded breast cancer cells resulted in similar higher levels of monocyte migration.

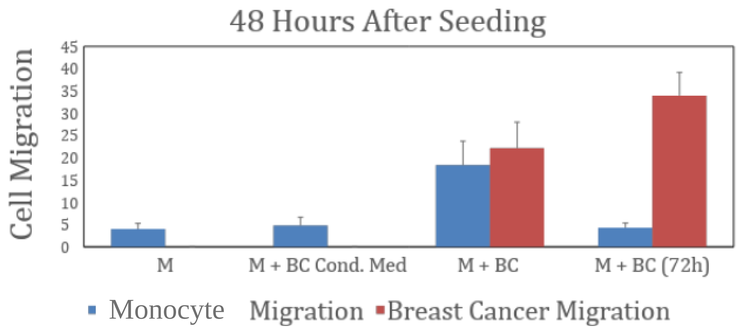


Figure 1. Monocyte and breast cancer migration was measured in µm. Reference points in the microfluidic device were used to ensure accurate measurements. Condition medium refers to just the medium cancer cells grew in.

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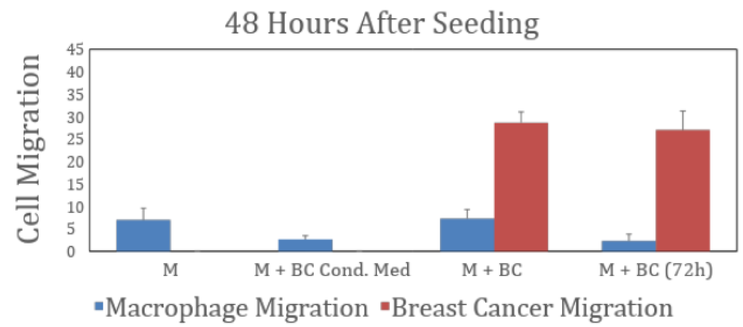


Figure 2. Macrophage and breast cancer migration was measured in µm. Reference points in the microfluidic device were used to ensure accurate measurements. Condition medium refers to just the medium cancer cells grew in.

Monocytes travel further than activated macrophages.

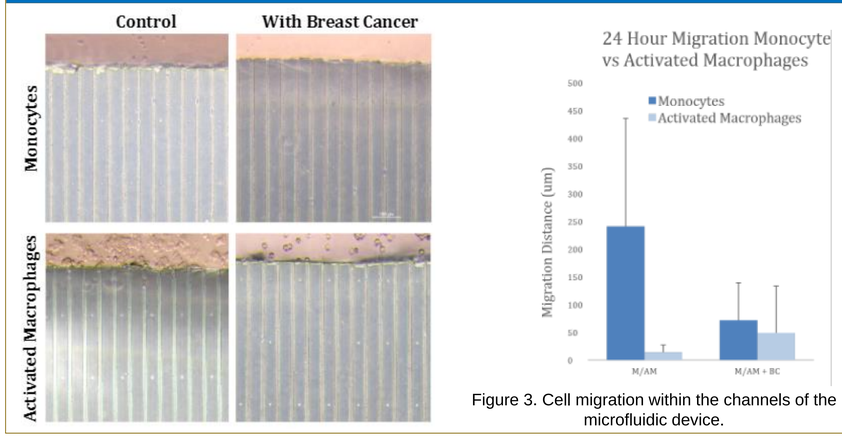


Figure 3. Cell migration within the channels of the microfluidic device.

Results

CD163 is found in higher levels in migrating macrophages which indicates an M2 macrophage phenotype.

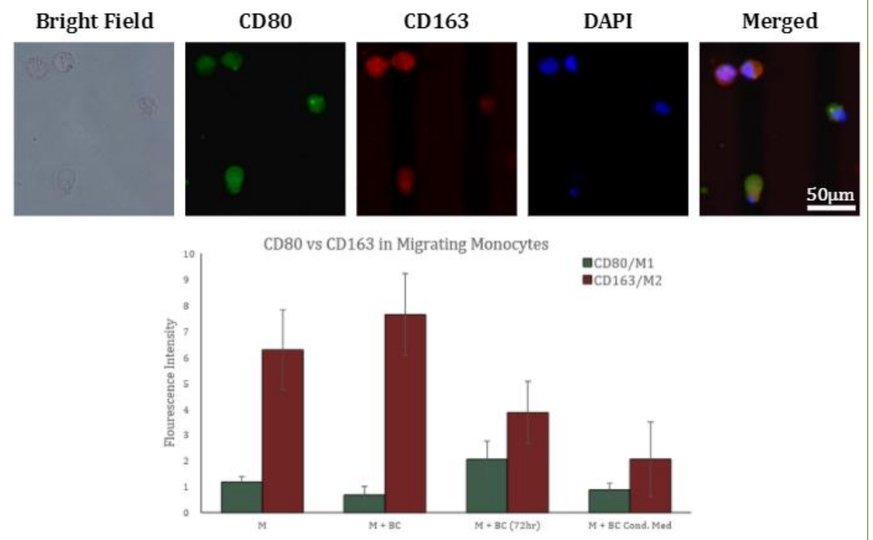


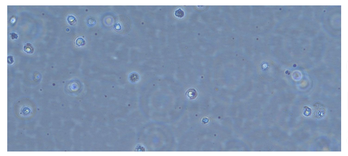
Figure 4. Macrophages were immunostained using standard methods. Fluorescent intensity was measured using fluorescence microscopy and imageJ software.

Conclusions

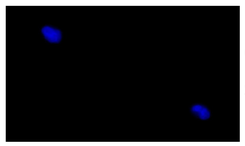
- Macrophage cells likely respond to the breast cancer environment leading to increased cell migration
- Initial evidence showed a prevalence of the M2 phenotype in migrating cells which suggested tumorigenesis roles may outperform anti-tumorigenesis

Future Goals

- Identify key factors affecting M1, M2 differentiation
- Continue to perform further study to identify the biomarker expression and resulting cellular interaction between macrophages and breast cancer cells
- Optimize current technical challenges



Optimizing PMA activation



Optimizing staining procedures

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