

Pyrrolidine Derivative Targets Actin Cytoskeleton in MCF-7 Breast Cancer Cells

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ABSTRACT

Recent research has brought pyrrolidine derivatives into consideration for the development of anticancer drugs with high efficacy and low toxicity. Dr. Hansen's lab at DePauw has synthesized a pyrrolidine derivative that demonstrated anticancer activity. However, there are many ways a compound can affect cancer cells. In this research, we decided to investigate the mechanism of action of this new compound, specifically on MCF-7 breast cancer cell line. Based on the results, we believe that there is a great likelihood that the pyrrolidine derivative can induce apoptosis (cell death) and disrupt cell movement in MCF-7 cells. In other words, these are strong indicators that this compound can inhibit both early and late-stage cancer cells.

BACKGROUND

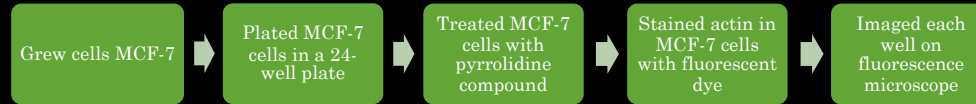
Breast Cancer - one of the most prevalent diseases diagnosed in women. Breast cancer is complex and particular to each individual. Metastatic tumors and triple-negative breast cancer remain insurmountable.

MCF-7 - a breast cancer cell line

Pyrrolidine - a chemical ring structure commonly used in drug discovery. Pyrrolidine derivatives are structurally modified pyrrolidine rings.

Actin - a type of protein in the cytoskeleton of eukaryotic cells. It is crucial in cell shape, adhesion, migration, and division.

METHOD



RESULT

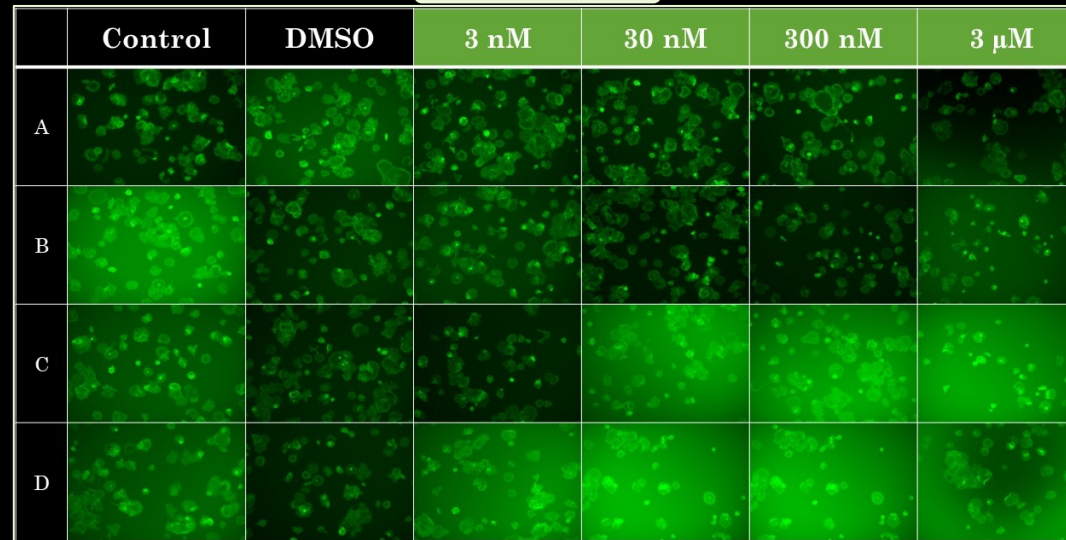


Figure 1. From 3nM to 3μM, cells decrease in number and size, and grow more sparse compared to control cells. Apoptotic cells also increase.

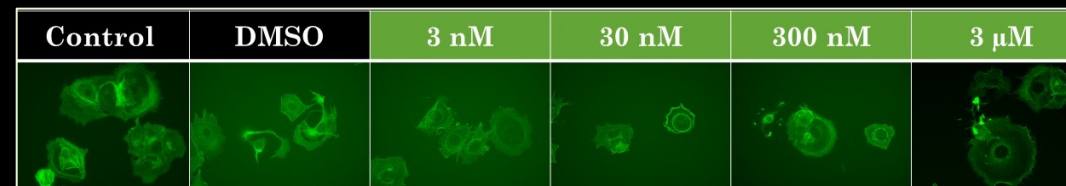


Figure 2. Treated cells have concentrated actin at the edges and around their nucleus. Their shape becomes dissimilar to control cells. These are strongly evident in 3μM donut-shaped cell.

CONCLUSION

Based on the two figures, we postulate that the pyrrolidine derivative compound is capable of inhibiting the proliferation of MCF-7 cells through two pathways:

1. **Inducing apoptosis (cell death)**
2. **Interfering with the activity of actin, which consequently disrupts cell migration and cytoskeleton shape**

The first pathway suggests the compound can hamper the growth of early-stage cancer cells.

As for the second pathway, there is great significance to this finding. As mentioned in the background, actin is essential for cells to migrate and adhere to neighboring cells. Due to this cell movement, metastatic cancer cells can spread to surrounding tissues and inflict distant body organs. Thus, the ability to block cell migration of the pyrrolidine derivative implies potential efficacy against late-stage cancer cells.

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