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Review Article

The tobacco can kill the cancer –by a molecule called "NAD1" which is obtained from flowers of *Nicotiana alata*

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ABSTRACT

Now a Days the usage of tobacco is the major cause for cancer but in this study we are presenting a new Interesting thing that it also has ability to kill cancerous tissue by a self-defensing molecule called NaD1. NaD1 is a molecule isolated from the flowers of the ornamental tobacco plant *Nicotiana alata*. In this study, we identified that the defensing NaD1 binds to a small Phospholipid (a lipid molecule with a phosphate molecule attached to it) known as **PIP2**. The defense molecule, called NaD1, works by forming a pincer-like structure that grips onto lipids present in the membrane of cancer cells and rips it open, causing the cell to expel its contents and explode This binding results in a NaD1:PIP2 complex which they visualized using transmission electron microscopy. NaD1 is able to polymerize and form long string-like structures in the presence of PIP2. This binding is crucial for NaD1's microbe-killing abilities. We tested the ability of NaD1 to cause changes in the cell membrane. We used a dye that normally does not cross the cell membrane to monitor cell membrane integrity; if the dye shows up inside the cells, the cell membrane is obviously damaged. Sure enough, NaD1 caused an influx of the dye into the cell, and also leakage of ATP molecules from the cell to the outside. Since PIP2 is found in many different cell types, we also evaluated NaD1's cell membrane destroying capabilities in many different cell types. We found that immortal cells (i.e. tumor cells) were more susceptible to killing by NaD1 than normal cells**. In future we would expect that this molecule can laid down new pathways for cancer treatment discovery.**

Keywords: NaD1, *Nicotiana alata;* PIP2; tumor cells; phospholipid; defensing molecule; pincer- like structure.

INTRODUCTION

CANCER

Now a Days the usage of tobacco is the major cause for cancer but in this study we are presenting a new Interesting thing that it also has ability to kill cancerous tissue by a self-defensing molecule called NaD1. NaD1 is a molecule isolated from the flowers of the ornamental tobacco plant *Nicotiana alata* (Brigitte M. E. Hayes, Mark R. Bleackley2012)

WHAT ARE DEFENSINS?

They are **small protein molecules** found across many different species of animals and plants. As their name implies, these molecules function as part of the **host innate immune system**; they have anti- microbial activity against bacteria, viruses and fungi. As a general rule, defenseing bind to the cell membrane of the microbe causing changes to cell membrane structure, allowing essential ions and nutrients to leak out, thereby killing the cell. (LW Hung, GJ Kapral.2014).

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METHOD OF EXTRACTION OF NaD1

The mature NaD1 protein was extracted from flowers (stages I–IV) in 50 mM sulfuric acid and purified using ammonium sulfate precipitation, heat treatment, and gel filtration. Fractions containing NaD1 were identified by SDS-AGE and immune blot analysis with the α-6H.p oNaD1 antibodies proteins in the immune reactive fractions were resolved further by reverse phase (RP)-HPLC. Purification of defensing from ornamental tobacco flower buds and petunia petals, RP-HPLC profile of gel filtration fractions from ornamental tobacco (A) and petunia (B) extracts showing percentage buffer B (%B) and retention times in minutes. The masses also revealed that all 10 Cys residues were oxidized. (Brigitte M. E. Hayes, Mark R. Bleackley, 2012).

MECHANISM OF ACTION ON CANCER CELLS

TESTING ON MICE

Ten mices were previously treated with malieic hydrazine (carcinogen that induces liver cancer). Now the mices are treated with extracted NaD1 molecule NaD1 binds to a small phospholipid (a lipid molecule with a phosphate molecule attached to it) known as **PIP2**. The defense molecule, called NaD1, works by forming a pincer-like structure that grips onto lipids present in the membrane of cancer cells and rips it open, causing the cell to expel its contents and explode without causing damage to normal cells.

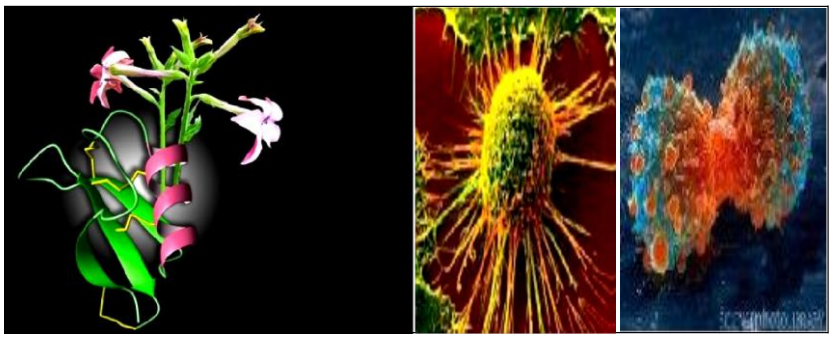

Figure 1: *Nicotiana alata* tobacco plant

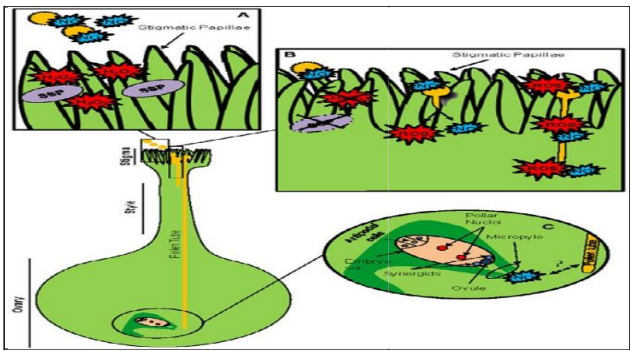

Figure 2: Extraction of NaD1

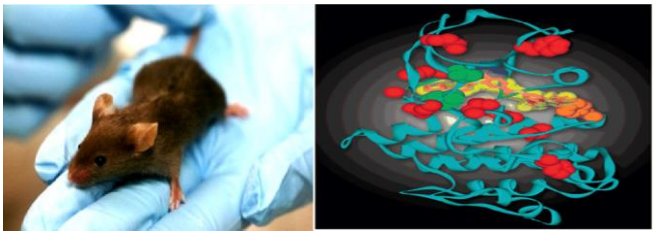

Figure 3: Testing on mice

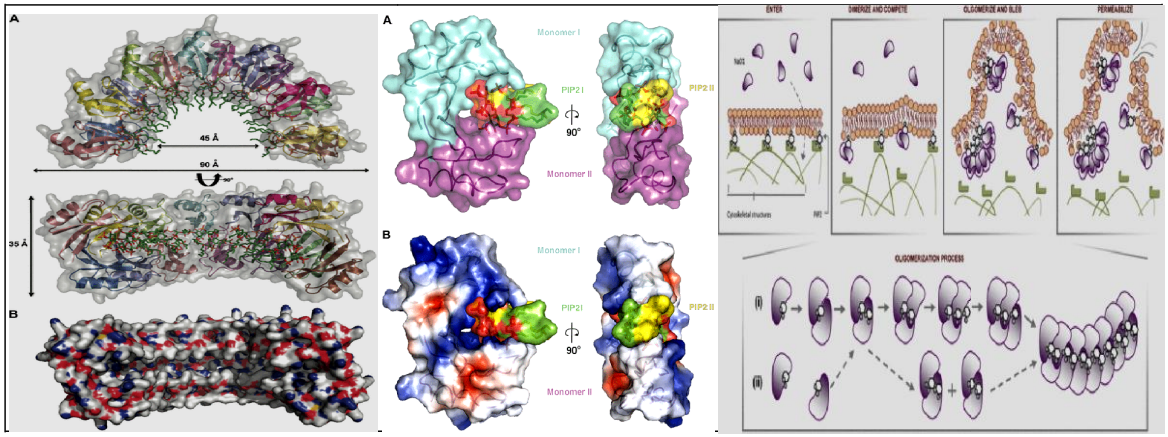

Figure 4: Crystal structure of the NaD1:PIP2 complex. Proposed molecular mechanism of NaD1-mediated tumor cell lysis

This binding is crucial for NaD1's microbe-killing abilities. We tested the ability of NaD1 to cause changes in the cell membrane. We used a dye that normally does not cross the cell membrane to monitor cell membrane integrity; if the dye shows up inside the cells, the cell membrane is obviously damaged. Sure enough, NaD1 caused an influx of the dye into the cell, and also leakage of ATP molecules from the cell to the outside. Since PIP2 is found in many different cancer cell types, we also evaluated NaD1's cell membrane destroying capabilities in many different cancer cell types(VB Chen, IW Davis, N Echols, JJ Headd, 2011) We found that immortal cells (i.e. tumor cells) were more susceptible to killing by NaD1 than normal cells. This is attributed to the different properties that cancer cell membranes have when compared against normal cell

membranes, and the precise mechanism for this is yet to be assessed. (VB Chenetal 2011).

CONCLUSION

In future we would expect that this molecule can laid down new pathways for cancer treatment discovery and may provide low cost therapy for cancer patients.

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