

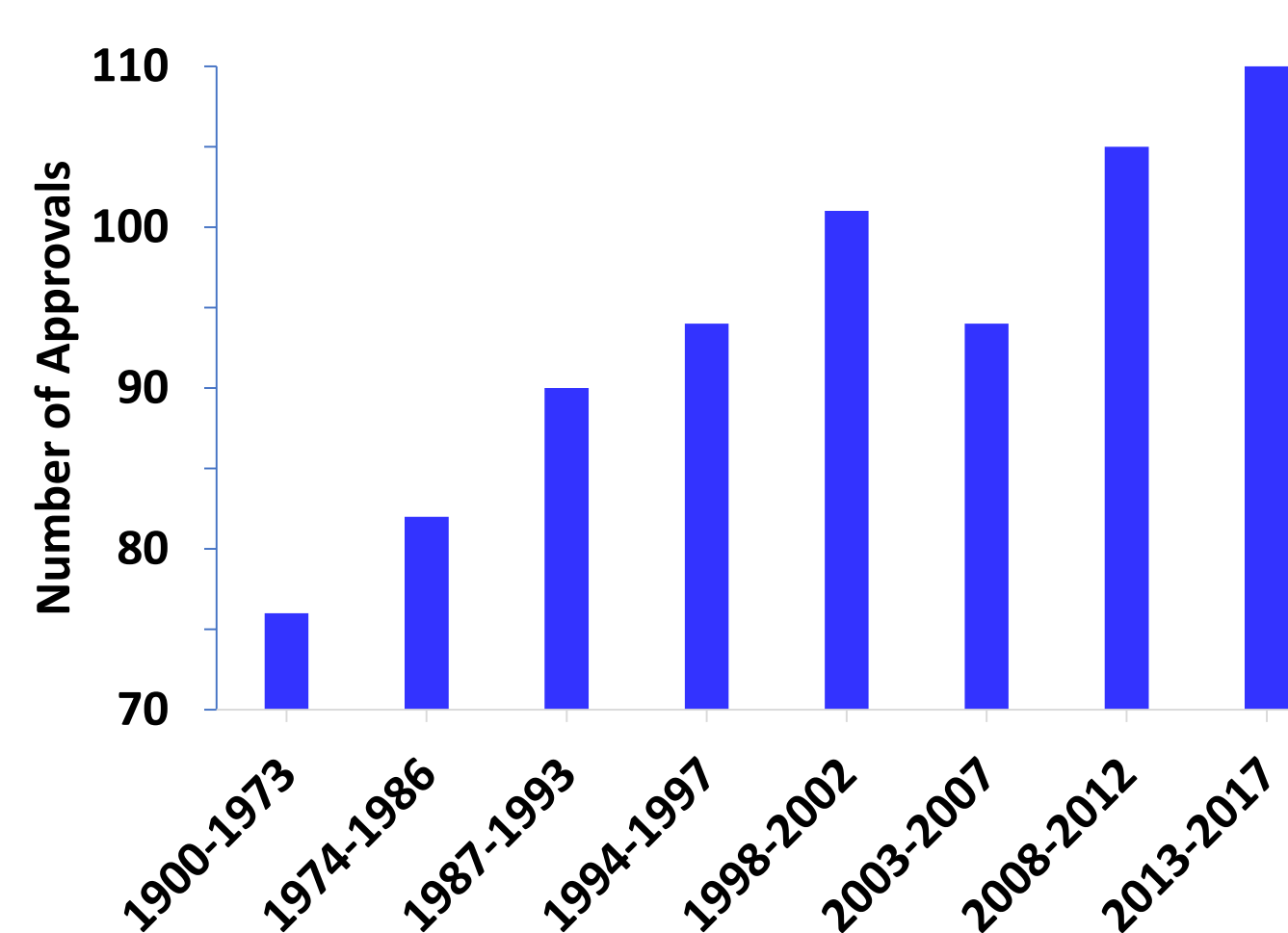
Chemical Exploration of Douglas Fir Tree associated Fungi

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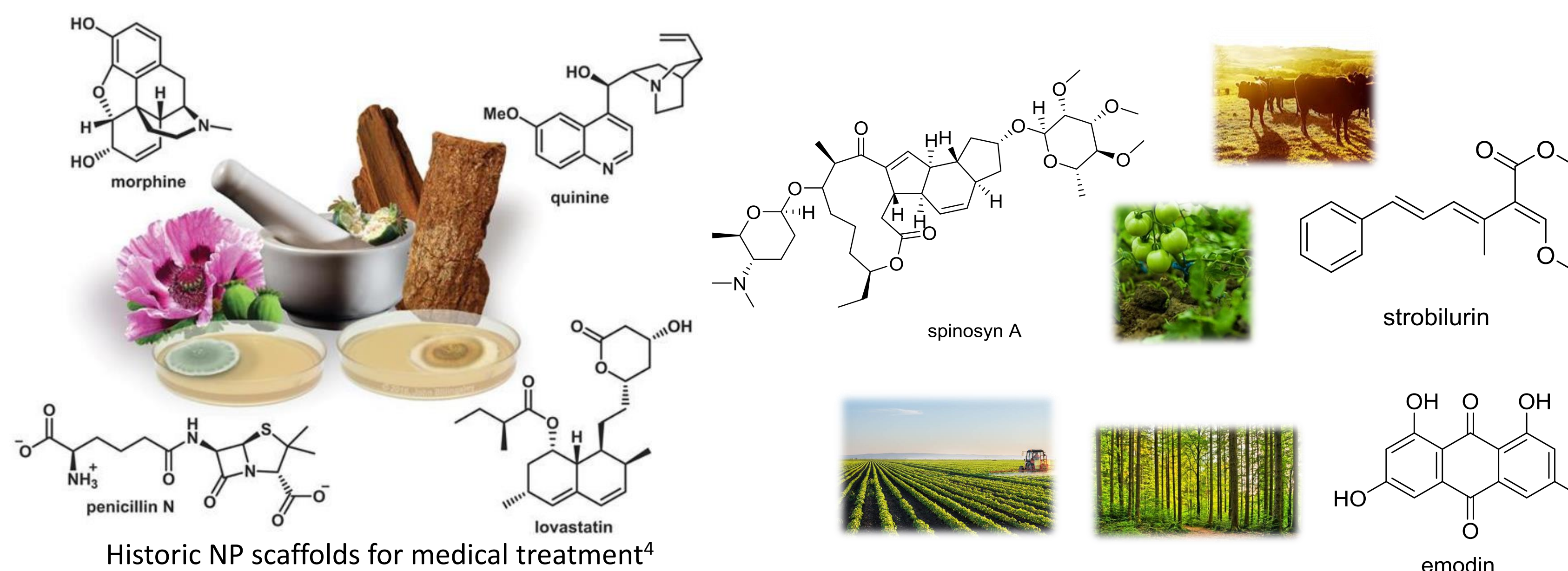
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Natural Products & Society

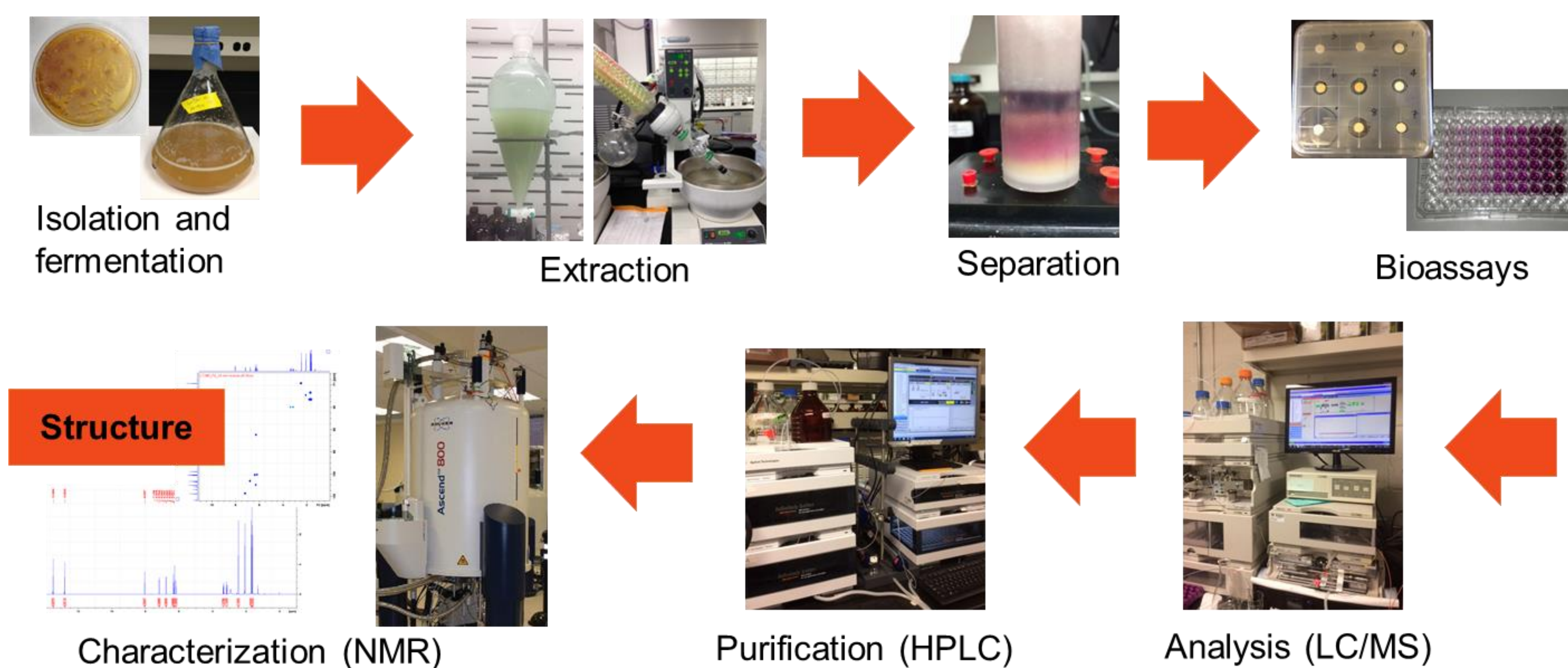
- Natural products (NPs) are small compounds not essential for immediate survival of an organism, but aid in other functions (i.e. signaling, defense, attraction)¹
- NPs historically have inspired pharmaceuticals (morphine, penicillin, aspirin)
- NPs have also inspired the design of 32% of insecticides, 13% of fungicides, and 12% of herbicides²



Number of FDA approved oral drugs from 1900-2017³



Bioactivity-guided fractionation of Fungal Metabolites

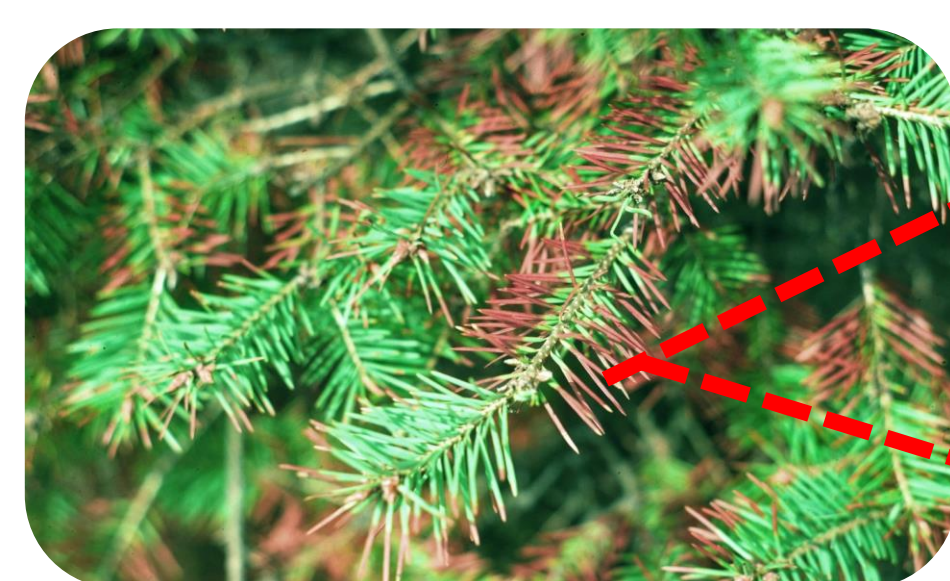


Bioassays include testing for human pathogens (*Staphylococcus aureus*, *Candida albicans*), and cytotoxicity (human colon carcinoma, HCT-116).

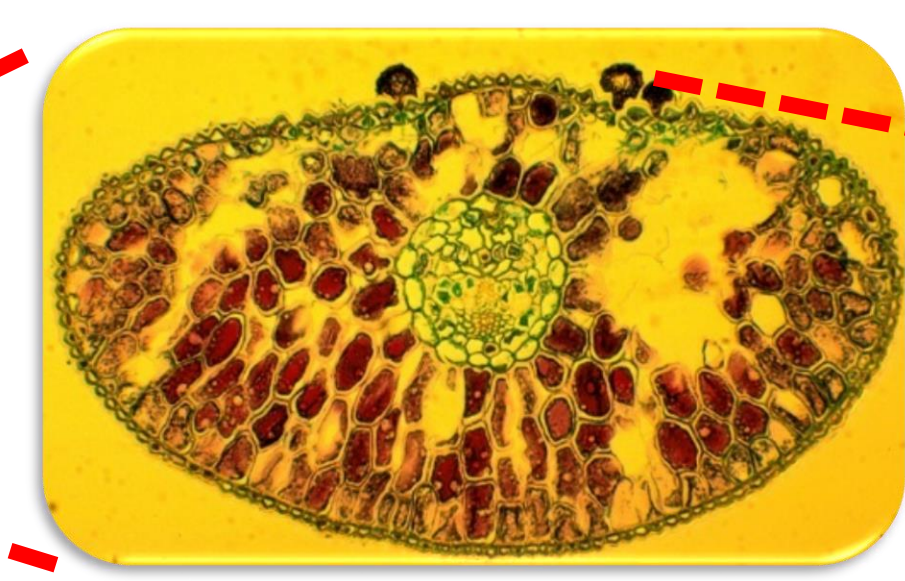
Fungal Isolates from Douglas Fir Tree

PURPOSE Fungi isolated from Oregonian Douglas fir trees (*Pseudotsuga menziesii*) were investigated for potentially bioactive metabolites (Fungi were isolated by Dr. Jeffrey Stone, OSU).

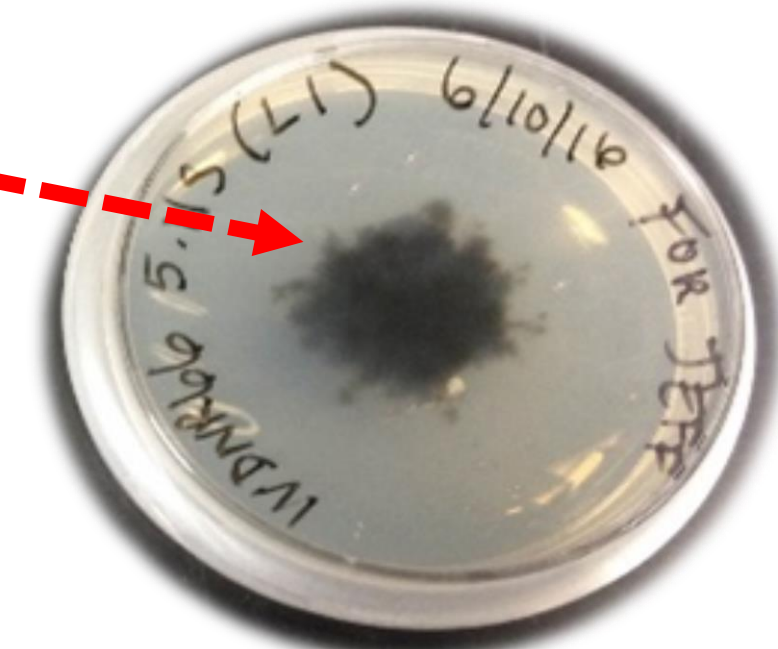
- Phaeocryptopus gaeumannii* and *Rasutoria pseudotsugae* are underexplored, no NPs are reported from these fungi
- Swiss needle cast in Douglas fir is caused by the *P. gaeumannii* and in 2011 more than 4 million acres of Oregonian forest were affected^{5,6}
- P. gaeumannii* physically obstructs the needle stomata^{7,8}
- Fungal epiphyte *R. pseudotsugae* is weakly parasitic, growing superficial round colonies on Douglas fir needles



Swiss needle cast on Douglas fir¹³



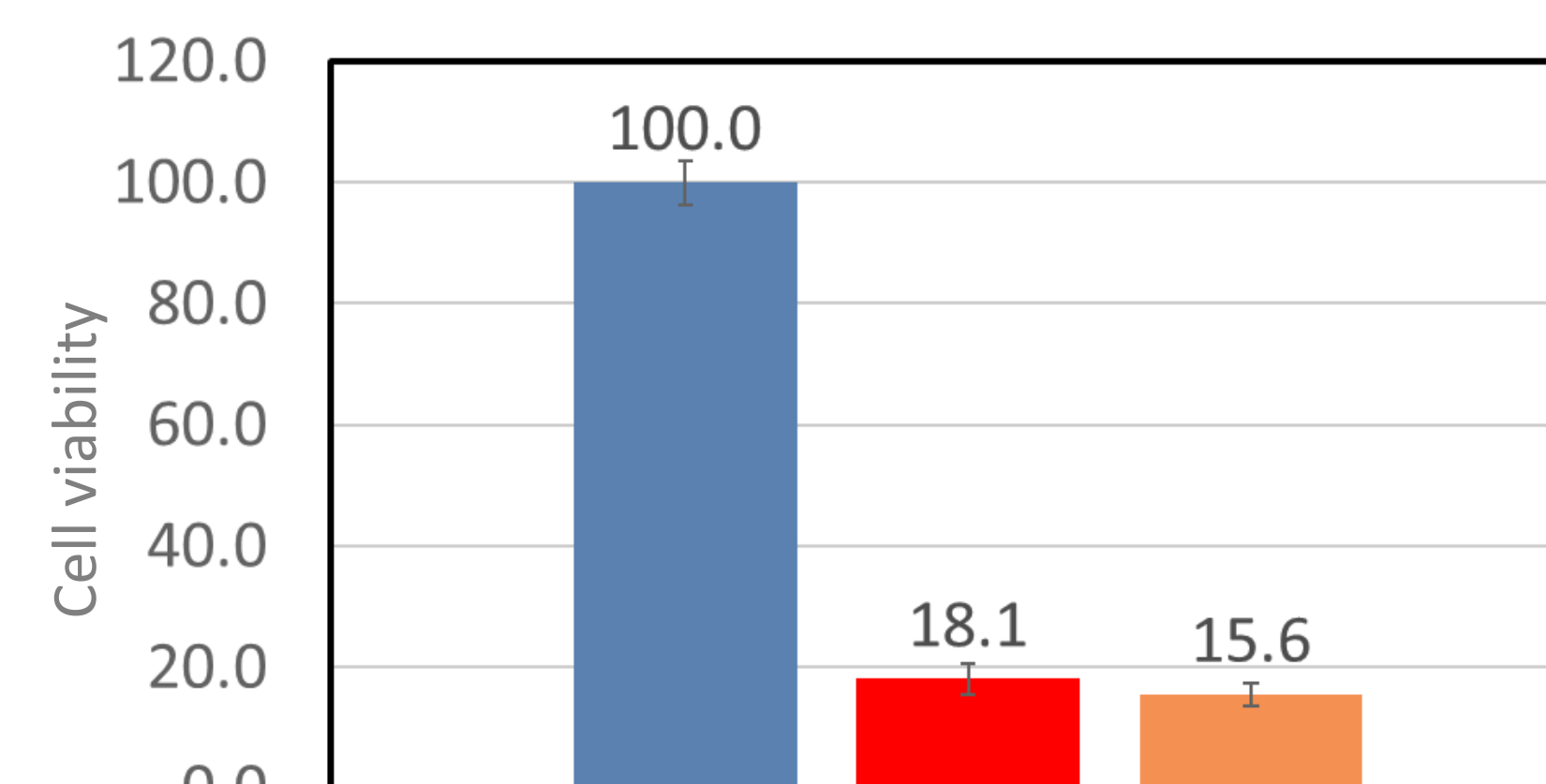
Fruiting bodies blocking stomata¹²



Phaeocryptopus gaeumannii

Bioactivity of *R. pseudotsugae*

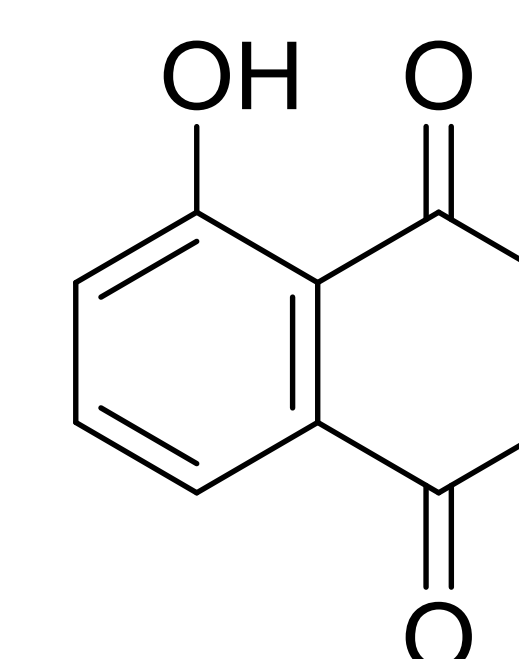
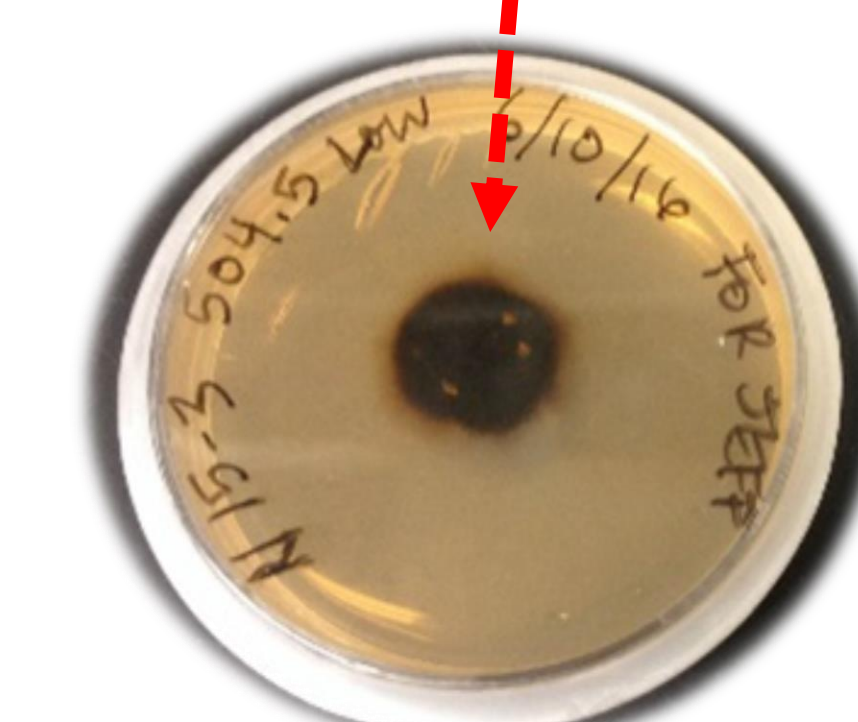
Bioactivity-guided fractionation of *R. pseudotsugae* extract was performed to identify molecules with cytotoxicity activity



■ Negative Ctrl ■ Positive Ctrl ■ Rasutoria

Single dose HCT-116 MTT assay results: *Rasutoria* extract at 29 mM, 0.1% DMSO as (-) control, and 250 μM Etoposide as (+) control.

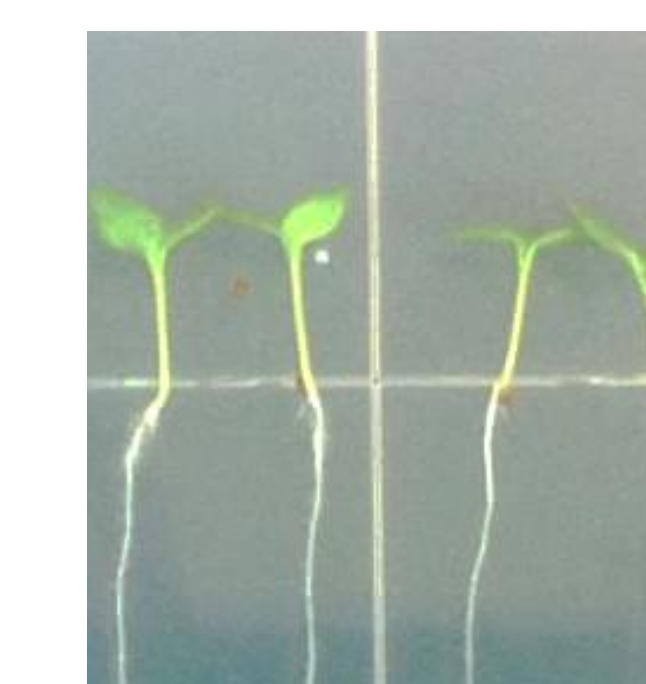
A new NP (juglone derivative) was isolated and structure elucidated by NMR⁹, it exhibits potent anticancer activity against colon carcinoma cells.



Juglone from black walnut trees is an allelopathic toxin¹⁰

Future Goals

- P. gaeumannii* and *R. pseudotsugae* are chemically underexplored and provide new sources for potential therapeutics and agrochemicals.
- To fully access the expression of metabolites, we will grow the strains in different nutrient conditions.
- Fungal metabolites will be tested for phytotoxicity, effects on root development, and antibacterial activity.



Root inhibition assay of *Nicotiana benthamiana* seedlings¹¹



2% malt-agar plates with Douglas fir needles inoculated with *P. gaeumannii* (left) and *R. pseudotsugae* (right).

References

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Image References

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