

# **Evaluation of Natural Compounds for Antimicrobial Activity**

**By Catherine Bischoff, Rye Country Day School, Rye, NY**

This project is intended to merge the areas of botany, folk medicine and microbiology by demonstrating if plant extracts can have antimicrobial activity. Substances believed to be responsible for antimicrobial activity include terpenes, phenols, tannins, alkaloids, quinones, and flavinoids. In this project, you will attempt to isolate some active compounds from plant materials and demonstrate their antibacterial activity.

## **Possible Herbs to Evaluate:**

- Aloe Vera
- Black Cohosh
- Catnip
- Cilantro
- Echinacea
- Garlic
- Ginkgo
- Ginger
- Parsley
- Rose hips
- Raspberry
- St. John's Wort
- Tea Tree Oil
- Turmeric
- Willow
- Others herbs you may find in your research (if available)

Note: You will all use the methods and materials below but in your project proposal you must include how many replicates of each plant material you are going to use and how you are going to include controls.

## Methods and Materials:

### I. Preparation of Plant Extract

Choose two to three plant materials and perform the following two extractions on each material.

#### Water extraction:

- A. Place 2 g of sample and 10 ml of water into a mortar.
- B. Grind the sample thoroughly with the pestle.
- C. Filter the sample into a small beaker.

#### 95% ethanol extraction:

- A. Place 2 g of sample and 10 ml of ethanol into a mortar.
- B. Grind the sample thoroughly with the pestle.
- C. Filter the sample into a small beaker.

### II. Inoculation of culture plate (These are non-pathogenic strains of bacteria)

- A. Obtain two swabs and a liquid culture of *Escherichia coli* and one of *Staphylococcus epidermidis*.
- B. Place a sterile swab (aseptically) into the *E. coli* culture; lift it above the liquid level and press against the side of the tube with a gentle rolling motion to remove excess liquids.
- C. Swab one plate heavily with *E. coli* and the other with *S. epidermidis*. **This is not an isolation streak - the entire plate should be covered with the swab.**

### III. Experimental and Control Discs

#### Experimental Discs:

- A. Immerse a pair of forceps in the alcohol and flame to remove most of the bacteria. (Be careful not to ignite the alcohol in the beaker)
- B. Aseptically saturate a sterile filter paper disc in your extract.
- C. Place the impregnated discs on the *E. coli* plate agar surface in a location that will give equal distances between all discs.
- D. Mark the location on the plate to identify the extract preparation.
- F. Repeat with the same extract for the *S. epidermidis* plate.
- G. Repeat the above procedure for all three preparations for each plant tissue.

#### Control Discs:

- A. You will have both a positive and negative control in this experiment.
- B. The positive control will be either a penicillin disc or a tetracycline disc.
- C. The negative control will be sterile water on a filter paper disc.
- D. Aseptically place a positive and negative control on each plate.

## LAB REPORT RUBRIC (THE GRADING SCALE)

	6-4	3	2	1
<b>1. TITLE</b>	<ul style="list-style-type: none"> <li>• Appropriate</li> <li>• Clearly Written</li> </ul>	<ul style="list-style-type: none"> <li>• Appropriate</li> <li>• Not clearly written</li> </ul>	<ul style="list-style-type: none"> <li>• Not appropriate</li> </ul>	<ul style="list-style-type: none"> <li>• Not listed</li> </ul>
<b>2. INTRODUCTION (6 pts. possible)</b>	<ul style="list-style-type: none"> <li>• Clearly states purpose of experiment</li> <li>• Background information included</li> <li>• Background information supports purpose</li> <li>• Well written</li> </ul>	<ul style="list-style-type: none"> <li>• Clearly states purpose of experiment</li> <li>• Does not include background information</li> </ul>	<ul style="list-style-type: none"> <li>• Purpose not clearly stated</li> </ul>	<ul style="list-style-type: none"> <li>• Purpose not stated</li> </ul>
<b>3. HYPOTHESIS</b>	<ul style="list-style-type: none"> <li>• Relevant prediction</li> <li>• Clearly developed</li> </ul>	<ul style="list-style-type: none"> <li>• Relevant prediction</li> <li>• Not clearly developed</li> </ul>	<ul style="list-style-type: none"> <li>• Irrelevant prediction</li> </ul>	<ul style="list-style-type: none"> <li>• Not listed</li> </ul>
<b>4. MATERIALS</b>	<ul style="list-style-type: none"> <li>• All materials listed</li> </ul>	<ul style="list-style-type: none"> <li>• At least half materials listed</li> </ul>	<ul style="list-style-type: none"> <li>• Less than half materials listed</li> </ul>	<ul style="list-style-type: none"> <li>• Not listed</li> </ul>
<b>5. PROCEDURE</b>	<ul style="list-style-type: none"> <li>• Passive tense used</li> <li>• All steps listed</li> <li>• Clearly expressed</li> </ul>	<ul style="list-style-type: none"> <li>• Passive tense used</li> <li>• All steps listed</li> <li>• Not clearly expressed</li> </ul>	<ul style="list-style-type: none"> <li>• Passive tense used</li> <li>• Some steps listed</li> </ul>	<ul style="list-style-type: none"> <li>• Did not use passive tense</li> </ul>
<b>6. DATA &amp; OBSERVATIONS</b>	<ul style="list-style-type: none"> <li>• If warranted, chart /table used</li> <li>• Directly correlated to procedure</li> <li>• Clearly expressed</li> <li>• Pictures included, if warranted</li> </ul>	<ul style="list-style-type: none"> <li>• If warranted, chart /table used</li> <li>• Directly correlated to procedure</li> <li>• Not clearly expressed</li> <li>• Pictures included, if warranted</li> </ul>	<ul style="list-style-type: none"> <li>• Not all observations are correlated to procedure</li> <li>• Chart/table used</li> </ul>	<ul style="list-style-type: none"> <li>• No chart/table</li> <li>• Not all observations are correlated to procedure</li> </ul>
<b>7. DISCUSSION &amp; CONCLUSIONS (6 pts. Possible)</b>	<ul style="list-style-type: none"> <li>• Directly correlated to observations</li> <li>• Hypothesis supported/unsupported</li> <li>• All interpretive questions are answered</li> <li>• Written in paragraph form</li> </ul>	<ul style="list-style-type: none"> <li>• Most ideas correlated to observations</li> <li>• Hypothesis supported/unsupported</li> <li>• All interpretive questions answered</li> <li>• Not in paragraph form</li> </ul>	<ul style="list-style-type: none"> <li>• Some ideas unrelated to observations</li> <li>• Hypothesis supported/unsupported</li> <li>• Not all interpretive questions answered</li> </ul>	<ul style="list-style-type: none"> <li>• Ideas unrelated to observations</li> <li>• Hypothesis not supported/unsupported</li> <li>• Some interpretive questions answered</li> </ul>
<b>8. LITERATURE CITED</b>	<ul style="list-style-type: none"> <li>• Included and proper format used</li> <li>• All non-original information/data is cited</li> </ul>	<ul style="list-style-type: none"> <li>• Included and proper format used</li> <li>• Some non-original information/data is cited</li> </ul>	<ul style="list-style-type: none"> <li>• Included but improper format used</li> </ul>	<ul style="list-style-type: none"> <li>• Not included</li> </ul>

