

## SP2016 Proposal

**Title** –Antimicrobial Effect of Active Ingredients in Essential Oils

**Program of Study** – Biomedical Sciences (Department of Biology and Chemistry), Clinical Health Promotions (Department of Public and Community Health), Environmental Biology (Department of Biology and Chemistry)

**Presentation Type** – **Choose one of the following:** Experimental- Theoretical Poster

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**Category** – **Choose one of the following:** Experimental (Theoretical)

**Abstract:** Interest in essential oils has grown rapidly in recent years. Studies are showing that certain antimicrobial properties of essential oils can be utilized in a world where bacterial strains are becoming increasingly resistant to antibiotics. Due to this, researchers are seeking out various natural options such as plant and fruit extracts to combat bacterial infections. Essential oils have been used to treat dermatological, respiratory, and gastrointestinal bacterial infections with success. Oils such as peppermint, cloves (eugenol), and eucalyptus have been used to treat respiratory infections *in vitro*, and new studies are progressing to *in vivo* research as well. Fewer studies on the effect of essential oils on gastrointestinal (GI) bacterial strains have been conducted. Diarrheal disease is a major concern for countries who are exposed to harmful bacteria through contaminated food and water. GI infections are not limited to a particular group but can adversely affect all ages.

While researchers have studied the antimicrobial properties of essential oils, investigation of the active components of oils that influence these properties has not been conducted in depth. This research proposal is an interdisciplinary examination between microbiology, analytical and

organic chemistry to isolate, study, and understand the individual components that allow essential oils to combat infections.

Most essential oils are terpenes (monoterpenes, sesquiterpenes, diterpenes) or terpene based compounds (terpenoids) that can be classified into simple hydrocarbons and oxygenated compounds (esters, aldehydes, ketones, alcohols, phenols, oxides). Oils are typically obtained from a root, leaf or fruit peel, and often contain very complex mixtures of several (tens to hundreds of) chemical compounds. For this reason, characterization of the oils is important for determining the composition and for investigating which has the greatest anti-microbial effect. Gas chromatography mass spectrometry is frequently used for identifying the individual compounds and quantifying the amount of each of these components in the essential oils.

Some studies have demonstrated that the oxygenated components of an essential oil contribute to its ability to fight bacterial infection. Yet, *in vivo* studies have shown discrepancies when treating gram negative bacteria versus gram positive bacteria. This may be due to the structure of the cell wall. Gram positive bacteria are known to have a cell wall that mainly consists of peptidoglycan, which allow hydrophobic molecules to penetrate the cell wall causing a reaction within the cell. Furthermore, gram negative bacteria cell walls are made up of a thin layer of peptidoglycan and an outer membrane held together by lipoprotein. This complex makeup of the gram negative cell wall gives it higher impermeability from hydrophobic molecules present in essential oils.

Based on the identification of the active ingredients, specific rather than random selection of essential oils can be chosen to effectively treat the bacterial strain. This research will also aid in the identification of oils, or components of oils, to fight gram negative bacteria which is

difficult to combat due to its membrane layout. This research is significant since many strains are becoming antibiotic resistant and natural medicinal approaches are needed to fight infection.

### **Christian worldview integration:**

The Bible contains numerous references to essential oils. They were used for religious rituals, burial customs, and healing purposes. In Exodus 30, Moses was given a recipe for a “holy anointing oil” containing myrrh, cinnamon, and olive oil. The wise men delivered gifts of frankincense and myrrh to the infant Jesus. These plant-derived resources have been used around the world for their antiseptic properties for thousands of years. Through His creation, the Lord has given us access to plants that have healing properties.

Before the 19<sup>th</sup> century, people were reliant upon medicinal plants to treat their ailments. Still today, people are using herbal medicine for treatment. In Africa, up to 80% of the population uses traditional medicine for health care. Popular culture is also moving towards using natural, holistic medicinal approaches.

This research investigates natural medicinal approaches of oils to fight bacterial infections that affect various populations. Gastrointestinal infections are of large concern in developing countries that do not have access to clean water or clean food resources. Due to this many individuals die from infections that could be prevented and treated. As Christians we are mandated to help those in need. In Genesis 12:2, God states to Abraham, “I will make you into a great nation, and I will bless you; I will make your name great and you will be a blessing.” We are called to help others through the resources and blessings we have been given. Through the research of essential oils and their antimicrobial properties, we are better equipped to help those in developing countries who may not have the means to purchase costly pharmaceuticals. Additionally, essential oils may be the new frontier in combating antibiotic resistance.

## Relevant Literature

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Patrick, Graham L (Jun 2013) History of Drug Discovery. In: eLS. John Wiley & Sons Ltd, Chichester. <http://www.els.net> [doi: 10.1002/9780470015902.a0003090.pub2]

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