



# Compounding Herbal Medicine for the Treatment of Drug Resistant Bacteria

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## Where do bacteria come from?

When we begin to consider how to treat someone with a bacterial infection, we may do well to remember where bacteria have come from and how their evolution has progressed to present day. Bacteria were one of the very first species to appear on earth. They are single-celled organisms, mostly surrounded by a cell wall, named prokaryotes, meaning before (pro) nucleus (karyote).

Eukaryotes, in contrast, are much larger cells found in plants and animals. They are more complex cells comprised of DNA enclosed in a nucleus, organelles including energy-producing mitochondria.<sup>1,2</sup> Current evidence suggests cooperation between bacterial and eukaryotic cells was highly important for human origins and existence. As a result of this union, primitive eukaryote cells were formed and have evolved into the complex ecosystems that we have today. The relationship between bacteria and humans may be observed in our microbiome.<sup>3,4</sup> The “good” bacteria or “probiotics” that we as Naturopathic Doctors so often prescribe are key factors in maintaining important physiological functions including the assimilation of nutrients, regulation of the immune system and the restriction of potentially-pathogenic bacteria.<sup>3,4</sup>

Bacteria are our ancestors. Human beings on earth are dependent bacteria for health.<sup>5,6,7</sup>

Bacteria can be found in almost every environment. If bacteria have lived and helped us evolve for millennia, how did we fall so far to consider bacteria an “enemy”, forgetting that our ecosystem functions in an intricate balance where cooperation and an interweaving of support allows us to thrive.

Louis Pasteur, known for his work in chemistry, microbiology, and the germ theory, is reported to have renounced much his life’s work, on his death bed claiming that the microbe is nothing, the terrain is everything. The terrain theory, introduced by Claude Bernard, a contemporary of Louis Pasteur and furthered by Antoine Béchamp (among others) proposed that it is the terrain or the internal environment that determines an individual’s state of health. A healthy terrain would not host an overgrowth of pathogenic bacteria, however, if the internal milieu was out of balance inharmonious bacteria would take their opportunity to flourish.

## Antibiotic resistance

We must question if the entire concept of an ‘antibiotic’ is in itself problematic. The term antibiotic stems from “antibiosis”, meaning “against” (anti) “life” (biosis). When antibiotics first came into practice, there was much optimism surrounding them, and for

good reason — they worked. They saved lives. Alexander Fleming’s discovery of penicillin in 1928 was lauded as a miracle drug. It was thought of as a way to kill all of the germs that caused disease. More antibiotic types and classes were developed to destroy a greater variety of bacteria. Antibiotics revolutionized medicine, saved lives and destroyed the bacteria they were designed to attack. However, what has emerged in the hundred years since their introduction is a growth in antibiotic resistance.

Drug-resistant strains were first identified in hospitals in the 1930’s-40’s where the majority of the antibiotics were being used.<sup>8</sup> Resistance begins when a minority of organisms survive the onslaught of an antibiotic.<sup>9</sup> With repeated exposure to an antibiotic, the few resistant, surviving bacteria begin to multiply.<sup>10</sup> In our enthusiasm over the success of antibiotics, the innate intelligence of life and the microorganism’s purpose to survive was underestimated. Though simple prokaryotes, bacteria have faced innumerable threats to their survival by antimicrobial compounds and survived, with eons to practice adaption and mutation. Our present dilemma of antibiotic resistance has numerous biochemical and physiological mechanisms as contributors.

Antibiotics target essential bacterial physiology and biochemistry, causing microbial cell death or the cessation of growth.<sup>11</sup> The five major targets include: the bacterial cell wall (e.g., beta-lactams, Vancomycin), the cell membrane (e.g., Daptomycin), protein synthesis (e.g., Linezolid, Tetracyclines, Macrolides, Aminoglycosides), DNA and RNA synthesis (e.g., Fluoroquinolones, Rifamycins) and folic acid metabolism (e.g., Trimethoprim, Sulfonamides).<sup>11</sup>

Bacterial resistance to antibiotics can occur in a number of ways:<sup>12,13</sup>

- Altered uptake of antibiotics: many antibiotics use special “holes” to enter into the bacteria cell in order to destroy them. To resist this cell entry, bacteria have closed these “holes” or permanently eliminate them.<sup>14</sup>
- Target modification: bacteria physically change their structure to prevent the antibiotic targets effect.<sup>14</sup>
- Enzymes: bacteria produce antibiotic-degrading enzymes to degrade the antibiotics and render them useless.<sup>14</sup>
- Efflux pumps: bacteria pump out antibiotics before they have a chance to work.<sup>14</sup>

The development of tolerance and resistance to antibiotic treatment has become commonplace. Antimicrobial resistance is now occurring

in every reporting country in the world.<sup>15</sup> Globally, bacteria such as *Staphylococcus aureus*, *Escherichia coli*, and *Klebsiella pneumoniae*, are demonstrating a reported range of resistance of between 5% and 80% of tested strains.<sup>15</sup> Although Canada is not seeing the same general level of resistance as some other countries, there are areas of concern. Antibiotics have become ubiquitous in our modern day environment and bacteria are consequently adapting and developing resistance to drugs designed to eliminate them. The farming industry has introduced small, continuous amounts of antibiotics for non-therapeutic purposes contributing to antibiotic resistance.<sup>16</sup> As certain bacteria gain resistance, they are able to transfer information about antibiotic resistance to other forms of bacteria in which they come in contact. They promiscuously cooperate in sharing survival information, rather than compete for resources.<sup>17</sup> This information exchange among bacteria and the continuous exposure supports exponential growth of antibiotic resistance.

Antibiotic resistant bacterial infections add considerable costs to our overburdened health care system. In the U.S.A., health care-associated (nosocomial) infections afflict about 2 million people and kill approximately 90,000 people every year.<sup>18</sup> While Canada has a lower antibiotic resistance rate than most other countries the numbers are still significant, 220,000 to 250,000 annual hospital acquired infections resulting in 8,000 to 12,000 deaths.<sup>19</sup> In addition, since antibiotic resistant infections often require a longer hospital stay and more complex treatment the bacterial resistance incurs estimated annual costs of 1 billion dollars annually in Canada.<sup>20</sup> At the beginning of the 20th century with improvements in hygiene in the hospitals, sanitation of water, proper disposal of sewage, the judicious use of antimicrobials and technological advances in detecting and monitoring infectious disease, the incidents of death due to infectious disease began to decline.<sup>21</sup> This decreasing trend in mortality due to infectious disease began changing, however, at the end of the 20th century with the re-emergence of Tuberculosis, the appearance of AIDS and an increase of mortality due to infectious disease. Now in the 21st century, with the emergence of new infectious diseases, the re-emergence of old disease, large foodborne outbreaks and acts of bioterrorism we are facing a reversal of the previous decreasing trend in mortality due to infectious disease.<sup>22</sup> There is also evidence surfacing that bacteria that survive treatment with antibiotics are more likely to have inflammatory properties as the drug may alter the mechanism by which our immune system responds to the microbe, and therefore also contribute to non-communicable diseases.<sup>23</sup>

As naturopathic health care providers, we have tools at our disposal not only to address and interfere with the microbes that are resistant to antibiotics, but we also have the skills and tools to address and improve the terrain of the body, reducing the development of severe disease from infections. Reversing resistance requires restoration of the former beneficial flora in people and animals and in the environment.<sup>24</sup> One of the brightest tools we have in addressing antibiotic resistant microbes and supporting the immune system is botanical medicine. The remainder of this paper will discuss herbal medicine and specific herbs that may be compounded together in

order to support the body's resistance to harmful bacteria and to improve the terrain.

It is more difficult to treat the whole with a part than it is to treat a part with the whole.<sup>25</sup>

## Herbal medicine

Plants have been adapting and evolving along with bacteria for billions of years. Whereas bacteria have quickly adapted to a single antibiotic, they have been less successful in resisting the complex patterns found in living herbs.<sup>26</sup> Herbal medicines contain many active constituents and it is not always possible to identify a single active compound or method of action responsible for the clinical effect. It is more likely that several compounds using multiple strategies combined provide a synergistic effect.<sup>27</sup> For example, *Hydrastis canadensis* contains berberine, an antimicrobial substance as well as a potent synergist that acts as an efflux pump inhibitor.<sup>15</sup> Though berberine can be quite effective against many microorganisms on its own, it is markedly more effective by the potentization of another constituent called 5'-methoxyhydrocarpin, a multidrug efflux pump inhibitor.<sup>28</sup>

Some herbal antimicrobials act primarily on the bacteria's cell membrane functions, disrupting normal metabolic processes in the cells causing cell death whereas others target the microbial virulence factors.<sup>29</sup> For complete and effective treatment of bacteria using botanical medicines, antimicrobials are used alongside other herbs that have a system tropism or support particular body systems improving the tissue state, assisting in the rejuvenation of the body post-infection and enhancing the immune system.

In the following section, a number of antibiotic resistant bacteria will be discussed along with a selection of herbal medicines that may be combined for effective treatment. This system may be used to address both the elimination of the specific bacteria and at the same time improve the terrain of the patient.

Informed and responsible care must be taken when using herbs to treat infection. Improvement should be observed within a day or two, signs of improvement should continue, and the infection should be resolved in seven to ten days.

## Gram positive bacteria

### *Clostridium difficile* (C. difficile)

*C. difficile* is found primarily in hospitalized patients and in those that have been on antibiotic therapies for an extended period of time. It manifests as watery diarrhea from 10 to 15 times a day. Other symptoms include abdominal tenderness and pain, bloating, fatigue, fever, and nausea. In some situations *C. difficile* can cause life threatening pseudomembranous colitis, bowel perforation and sepsis. In physiomedical terms this condition may be considered as hot (inflammation in the colon, fever) and wet (watery diarrhea).

A supportive herbal formula may include: *Cryptolepis sanguinolenta*, *Glycyrrhiza glabra*, *Echinacea angustifolia*, *Zingiber off.* and *Rubus villosus radix*.

A first consideration would be to treat with antimicrobial herbs for the infection such as *Cryptolepis sanguinolenta*, or herbs containing the isoquinoline alkaloid, berberine, like *Hydrastis canadensis*. *Cryptolepis sanguinolenta* is a systemic antimicrobial herb, and the most active constituent is the antibacterial alkaloid Cryptolepine.<sup>30</sup> In terms of energetics *Cryptolepis sanguinolenta* is considered cooling and berberine-containing herbs, specifically *Hydrastis canadensis*, are cooling and very drying thereby helpful in this hot, wet condition whereby the bowel tissue is relaxed. *Glycyrrhiza glabra* is cooling, anti-inflammatory and has immunomodulating properties as well as synergistic action in herbal formulation. It helps to soothe the fiery intestines. *Echinacea angustifolia* is antibacterial, anti-inflammatory and immune stimulating. In herbal energetic terms it is cool and dry. *Zingiber off.* is a useful herb to consider adding a small percentage of a formula because it is an effective antispasmodic and as an antimicrobial it is especially useful for a lack of tone in the intestinal tract.

*Rubus villosus radix* as a strong astringent and specific for gastrointestinal atony with copious watery feces.<sup>31</sup> Replenishing electrolytes is paramount when dealing with this infection as well.

#### **Enterococcus spp.**

This bacteria species is a part of the normal human bacterial flora. However, if the *Enterococcus spp.* overgrows it can cause urinary tract infections, bacteremia, endocarditis, diverticulitis and meningitis. In cases of *Enterococcus spp.* infection a reasonable approach would first be to choose strong systemic antimicrobial herbs such as *Cryptolepis* or *Sida cordifolia*. Then consider herbs that have a tropism for the system affected by the bacteria. For the urinary tract, *Juniperis communis* and *Arctostaphylus uva-ursi* are specific for that organ system. The principal constituent of *Juniperis communis* is an antimicrobial essential oil that gathers in the urinary tract and is irritating to microbes. Juniperis also increases the production of urine and is useful where there is a lack of tone in the urinary tract or where the ureters may be congested with catarrh or pus.<sup>31</sup> *Arctostaphylus uva-ursi* is probably the go-to herb for both acute urinary tract infections such as cystitis and pyelitis in a program for chronic kidney issues. The primary active constituent is arbutin (hydroquinone beta-glycoside) and with lesser amounts of methylarbutin and picoside. It also contains the flavonoids quercetin and iso-quercetin. Arbutin undergoes hydrolysis in the body to form hydroquinone, which is a urinary antimicrobial.<sup>32</sup> *Arctostaphylus uva-ursi* may be used when there is relaxation (excessive dampness) of the urinary tract, with pain and mucous or bloody secretions.<sup>33</sup> It tones the walls of the bladder and strengthens and soothes the urinary tissues. For the bacteremia, *Echinacea angustifolia* offers systemic antimicrobials support. Echinacea has two primary actions: it stimulates the immune system and is a very potent hyaluronidase inhibitor.<sup>32</sup> It is thought that Enterococcal hyaluronidase plays a role

in its virulence.<sup>34,35</sup> Echinacea inhibits the action of hyaluronidase by bonding with it in some way, causing a temporary increase in the integrity of the barrier and impairing the ability of the pathogen to stimulate the destruction of the ground substance.<sup>32</sup>

For diverticulitis, *Glycyrrhiza glabra* serves as a synergist, is demulcent, antispasmodic and a major anti-inflammatory. Its anti-inflammatory effect may be due to the constituent triterpenes: glycyrrhizin, glycyrrhetic acid and phytosterols that are metabolized in the body with a structure similar to that of the adrenal cortex hormones.<sup>32</sup>

For meningitis, *Gelsemium serprevirens* may be used in carefully compounded dosages. It is to be used only with appropriate supervision and under the guidance of a qualified medical practitioner that has an acute awareness of its toxicity and physiological action. *Gelsemium serprevirens* acts directly upon the central nervous system. Characteristic toxic symptoms are palpebral relaxation, disturbance of the ocular muscles, dropping of the lower jaw, and the profound prostration and muscular relaxation.<sup>33</sup> The pupils dilate, the eyelids droop (ptosis), and double vision (diplopia) occurs.<sup>33</sup> Ellingwood writes that: “in acute cerebral, spinal, cerebro-spinal, or meningeal inflammations, its (*Gelsemium serprevirens*) symptomatology is usually strongly marked at first.<sup>36</sup> He also states that doses should be reduced as symptoms abate, and that it should not be continued beyond the sthenic stage.<sup>36</sup> *Gelsemium serprevirens* is icy cold in terms of energetics.

#### **Staphylococcus aureus**

Presently, MRSA or Methicillin Resistant *Staphylococcus aureus* has become concerning as its presence increased both in hospital settings and in public spheres. The presentation of MRSA begins as a cluster of inflamed, red spots sometimes mistaken as spider bites. Fever often accompanies the rash. Soon after, the spots open up to fluid filled boils. If the infection progresses it can spread and penetrate deep into the tissues, causing serious consequences.<sup>37</sup>

For topical cases, unpasteurized honey is a treatment of choice.<sup>38,39,40</sup> The application of an occlusive bandage with honey is effective, and must be changed daily.

#### **Streptococcus spp.**

Of the *Streptococcus spp.*, the *Streptococcus pyrens* is most commonly known to be the cause of strep throat or bacterial pharyngitis, and *Streptococcus pneumoniae* is often the cause of bacterial pneumonia. For herbal treatment the following are useful systemic antimicrobials: *Cryptolepis sanguinolenta*, *Sida cordifolia*, *Berberis vulgaris*, *Mahonia aquifolium* and may be combined with *Echinacea angustifolia* and *Baptisia tinctoria* for infections in the throat, and *Inula helenium* as well as *Thymus spp.* for infections in the lungs.<sup>30,41</sup>

*Sida cordifolia* also contains the alkaloid Cryptolepine as well as quindoline, quindolinone, cryptolepinone, and 11-mehoxyquindoline.<sup>17</sup> The Chinese have used it as an antibacterial, anti-inflammatory and tonic. In the understanding of Traditional

## GRAM POSITIVE BACTERIA

When treating a patient with a Gram Positive bacterial infection we must remember to treat:

- 1) Bacterial infection with the correct antimicrobials
- 2) System tropism choosing herbs that are the most relevant
- 3) Immune system adjuvants & immunomodulators & immune stimulants
- 4) Tissue states infected Hot | Cold | Wet | Dry | Relaxed | Tense
- 5) Adaptogens, Trophorestoratives, Nutritives

GRAM POSITIVE BACTERIA	THERAPEUTIC HIERARCHY	HERB
<b>Clostridium difficile</b>	1) Treat the primary bacterial infection with the correct antimicrobials choose herb(s) that are the most relevant and begin considering proportions for the final formula	<i>Cryptolepis sanguinolenta</i> <i>Berberis vulgaris</i> <i>Coptis chinensis</i> <i>Hydrastis canadensis</i> <i>Mahonia aquifolium</i>
	2) System tropism choosing herbs that are the most relevant	<i>Berberis vulgaris</i> <i>Coptis chinensis</i> <i>Hydrastis canadensis</i> <i>Mahonia aquifolium</i>
	3) Immune system adjuvants & immunomodulators & immune stimulants	<i>Medicinal mushrooms</i> <i>Echinacea angustifolium</i> <i>Glycerrhiza glabra</i> <i>Zingiber off.</i>
	4) Tissue states infected Hot   Cold   Wet   Dry   Relaxed   Tense	Blackberry root
	5) Adaptogens, Trophorestoratives, Nutritives	Carminatives
<b>Enterococcus spp.</b>	1) Treat the primary bacterial infection with the correct antimicrobials choose herb(s) that are the most relevant and begin considering proportions for the final formula	<i>Cryptolepis sanguinolenta</i> <i>Sida cordifolia</i> <i>Bidens pilosa</i> <i>Zingiber off.</i>
	2) System tropism choosing herbs that are the most relevant	<i>Echinacea angustifolium</i> <i>Juniperis communis</i> <i>Usnea barbata</i>
	3) Immune system adjuvants & immunomodulators & immune stimulants	<i>Medicinal mushrooms</i> <i>Astragalus membranaceus</i> <i>Echinacea angustifolium</i> <i>Glycerrhiza glabra</i> <i>Rhodiola rosea</i>
	4) Tissue states infected Hot   Cold   Wet   Dry   Relaxed   Tense	<i>Glycerrhiza glabra</i> <i>Echinacea angustifolium</i>
	5) Adaptogens, Trophorestoratives, Nutritives	Carminatives Urinary Anti-Inflammatories, Urinary Astringents Cardiovascular tonics
<b>Enterococcus &amp; Diverticulitis</b>	1) Treat the primary bacterial infection with the correct antimicrobials choose herb(s) that are the most relevant and begin considering proportions for the final formula	<i>Cryptolepis sanguinolenta</i> <i>Sida cordifolia</i>
	2) System tropism choosing herbs that are the most relevant	<i>Glycerrhiza glabra</i> <i>Astragalus membranaceus</i> <i>Echinacea angustifolium</i>
	3) Immune system adjuvants & immunomodulators & immune stimulants	<i>Medicinal mushrooms</i> <i>Astragalus membranaceus</i> <i>Echinacea angustifolium</i> <i>Glycerrhiza glabra</i> <i>Rhodiola rosea</i>
	4) Tissue states infected Hot   Cold   Wet   Dry   Relaxed   Tense	<i>Glycerrhiza glabra</i> <i>Echinacea angustifolium</i>
	5) Adaptogens, Trophorestoratives, Nutritives	Carminatives
<b>Enterococcus &amp; Urinary Tract Infection</b>	1) Treat the primary bacterial infection with the correct antimicrobials choose herb(s) that are the most relevant and begin considering proportions for the final formula	<i>Sida cordifolia</i> <i>Cryptolepis sanguinolenta</i> <i>Juniperis communis</i> <i>Bidens pilosa</i>
	2) System tropism choosing herbs that are the most relevant	<i>Agathosma betulina</i> <i>Agropyron repens</i> <i>Arctostaphylos uva-ursi</i> <i>Echinacea angustifolium</i> <i>Eupatorium purpureum</i> <i>Hydrastis canadensis</i> <i>Piper methysticum</i> <i>Solidago odorata</i> <i>Usnea barbata</i> <i>Zea mays</i> <i>Zingiber off.</i>
	3) Immune system adjuvants & immunomodulators & immune stimulants	<i>Medicinal mushrooms</i> <i>Astragalus membranaceus</i>
	4) Tissue states infected Hot   Cold   Wet   Dry   Relaxed   Tense	<i>Agathosma betulina</i> <i>Agropyron repens</i> <i>Arctostaphylos uva-ursi</i> <i>Echinacea angustifolium</i> <i>Eupatorium purpureum</i> <i>Hydrastis canadensis</i> <i>Piper methysticum</i> <i>Solidago odorata</i> <i>Usnea barbata</i> <i>Zea mays</i> <i>Zingiber off.</i>

**GRAM POSITIVE BACTERIA** *continued*

GRAM POSITIVE BACTERIA	THERAPEUTIC HIERARCHY	HERB
<b>Enterococcus &amp; Urinary Tract Infection (continued)</b>	5) Adaptogens, Trophorestoratives, Nutritives	Urinary Anti-Inflammatories, Urinary Astringents <i>Glycyrrhiza glabra</i> <i>Polygonum multiflorum</i> <i>Urtica dioica fol.</i>
	1) Treat the primary bacterial infection with the correct antimicrobials choose herb(s) that are the most relevant and begin considering proportions for the final formula	<i>Cryptolepis sanguinolenta</i> <i>Sida cordifolia</i> <i>Echinacea angustifolium</i>
		<i>Zingiber off.</i> <i>Echinacea angustifolium</i> <i>Juniperis communis</i> <i>Usnea barbata</i>
	2) System tropism choosing herbs that are the most relevant	Medicinal mushrooms <i>Astragalus membranaceus</i> <i>Echinacea angustifolium</i> <i>Glycyrrhiza glabra</i> <i>Rhodiola rosea</i>
	3) Immune system adjuvants & immunomodulators & immune stimulants	<i>Glycyrrhiza glabra</i> <i>Echinacea angustifolium</i>
<b>Enterococcus &amp; Meningitis</b>	4) Tissue states infected Hot   Cold   Wet   Dry   Relaxed   Tense	<i>Glycyrrhiza glabra</i> <i>Echinacea angustifolium</i>
	5) Adaptogens, Trophorestoratives, Nutritives	Carminatives Urinary Anti-Inflammatories, Urinary Astringents Cardiovascular tonics
	1) Treat the primary bacterial infection with the correct antimicrobials choose herb(s) that are the most relevant and begin considering proportions for the final formula	<i>Cryptolepis sanguinolenta</i> <i>Sida cordifolia</i> <i>Gelsemium sepervirens</i>
		<i>Zingiber off.</i> <i>Echinacea angustifolium</i> <i>Usnea barbata</i> <i>Artemesia annua</i> <i>Glycyrrhiza glabra</i>
	2) System tropism choosing herbs that are the most relevant	Medicinal mushrooms <i>Astragalus membranaceus</i> <i>Echinacea angustifolium</i> <i>Glycyrrhiza glabra</i>
3) Immune system adjuvants & immunomodulators & immune stimulants	<i>Isatis tinctoria</i> <i>Polygonum cuspidatum</i>	
<b>Mycobacterium tuberculosis</b>	4) Tissue states infected Hot   Cold   Wet   Dry   Relaxed   Tense	Adrenal tonics
	5) Adaptogens, Trophorestoratives, Nutritives	<i>Cryptolepis sanguinolenta</i> <i>Sida cordifolia</i> <i>Bidens pilosa</i> <i>Capsicum annua</i>
	1) Treat the primary bacterial infection with the correct antimicrobials choose herb(s) that are the most relevant and begin considering proportions for the final formula	<i>Artemesia annua</i> <i>Berberis vulgaris</i> <i>Mahonia aquifolium</i> <i>Hydrastis canadensis</i> <i>Coptis chinensis</i> <i>Juniperis communis</i> <i>Lomatium dissectum</i> <i>Ligusticum porteri</i> <i>Glycyrrhiza glabra</i> <i>Echinacea angustifolium</i> <i>Rhodiola rosea</i> <i>Ganoderma spp.</i>
		<i>Artemesia annua</i> <i>Berberis vulgaris</i> <i>Mahonia aquifolium</i> <i>Hydrastis canadensis</i> <i>Coptis chinensis</i> <i>Juniperis communis</i> <i>Lomatium dissectum</i> <i>Ligusticum porteri</i> <i>Glycyrrhiza glabra</i> <i>Echinacea angustifolium</i> <i>Rhodiola rosea</i> <i>Ganoderma spp.</i>
	2) System tropism choosing herbs that are the most relevant	Medicinal mushrooms <i>Astragalus membranaceus</i> <i>Echinacea angustifolium</i>
3) Immune system adjuvants & immunomodulators & immune stimulants	Mustard plasters Lung trophorestoratives	
4) Tissue states infected Hot   Cold   Wet   Dry   Relaxed   Tense	<i>Cryptolepis sanguinolenta</i> <i>Sida cordifolia</i> <i>Bidens pilosa</i> <i>Berberis vulgaris</i> <i>Mahonia aquifolium</i> <i>Hydrastis canadensis</i> <i>Juniperis communis</i> <i>Isatis tinctoria</i> <i>Scutellaria baicalensis</i> Honey	
<b>Staphylococcus aureus &amp; Methicillin Resistant Staphylococcus aureus (MRSA)</b>	5) Adaptogens, Trophorestoratives, Nutritives	<i>Artemesia annua</i> Medicinal mushrooms <i>Glycyrrhiza glabra</i> <i>Zingiber off.</i> <i>Echinacea angustifolium</i> <i>Inula helenium</i> <i>Eupatorium perfoliatum</i> <i>Thymus spp.</i> <i>Oreganum spp. Essential Oil</i> <i>Baptisia tinctoria</i> <i>Arctostaphylos uva-ursi</i> Urinary Anti-Inflammatories Urinary Astringents
	1) Treat the primary bacterial infection with the correct antimicrobials choose herb(s) that are the most relevant and begin considering proportions for the final formula	<i>Cryptolepis sanguinolenta</i> <i>Sida cordifolia</i> <i>Bidens pilosa</i> <i>Berberis vulgaris</i> <i>Mahonia aquifolium</i> <i>Hydrastis canadensis</i> <i>Juniperis communis</i> <i>Isatis tinctoria</i> <i>Scutellaria baicalensis</i> Honey
		<i>Artemesia annua</i> Medicinal mushrooms <i>Glycyrrhiza glabra</i> <i>Zingiber off.</i> <i>Echinacea angustifolium</i> <i>Inula helenium</i> <i>Eupatorium perfoliatum</i> <i>Thymus spp.</i> <i>Oreganum spp. Essential Oil</i> <i>Baptisia tinctoria</i> <i>Arctostaphylos uva-ursi</i> Urinary Anti-Inflammatories Urinary Astringents
	2) System tropism choosing herbs that are the most relevant	Adrenal tonics Carminatives Lung trophorestoratives
	3) Immune system adjuvants & immunomodulators & immune stimulants	
4) Tissue states infected Hot   Cold   Wet   Dry   Relaxed   Tense		

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GRAM POSITIVE BACTERIA *continued*

GRAM POSITIVE BACTERIA	THERAPEUTIC HIERARCHY	HERB
<b><i>Streptococcus spp.</i></b>	1) Treat the primary bacterial infection with the correct antimicrobials choose herb(s) that are the most relevant and begin considering proportions for the final formula	<i>Cryptolepis sanguinolenta</i> <i>Sida cordifolia</i> <i>Bidens pilosa</i> <i>Juniperis communis</i> <i>Berberis vulgaris</i> <i>Mahonia aquifolium</i> <i>Coptis chinensis</i> <i>Usnea barbata</i>
	2) System tropism choosing herbs that are the most relevant	<i>Lomatium dissectum</i> <i>Ligustrum lucidum</i> Honey <i>Echinacea angustifolium</i> <i>Glycyrrhiza glabra</i> <i>Zingiber off.</i>
	3) Immune system adjuvants & immunomodulators & immune stimulants	<i>Ceanothus americanus</i> Medicinal mushrooms <i>Glycyrrhiza glabra</i> <i>Zingiber off.</i> <i>Echinacea angustifolium</i> <i>Inula helenium</i> <i>Eupatorium perfoliatum</i>
	4) Tissue states infected Hot   Cold   Wet   Dry   Relaxed   Tense	<i>Thymus spp.</i> <i>Oreganum spp. Essential Oil</i> <i>Baptisia tinctoria</i> <i>Arctostaphylos uva-ursi</i> Urinary Anti-Inflammatories
	5) Adaptogens, Trophorestoratives, Nutritives	Urinary Astringents Adrenal tonics Carminatives Lung trophorestoratives

Chinese Medicine, *Sida* is used to clear heat and benefit dampness.<sup>17</sup> *Berberis vulgaris* and *Mahonia aquifolium* belong to the berberine-containing family of plants. They are antimicrobial, berberine has been the most studied alkaloid in these plants, however the various other antimicrobial alkaloids in the berberines tend to be active against different organisms and are highly synergistic with each other and additionally benefit from other compounds of the plants whose only known functions are to disable antibiotic resistance mechanisms in microbial organisms.<sup>17,42</sup> Keeping plant synergy in mind it is worthwhile to consider how whole plant extracts might be more effective than a single constituent in practice.

Streptococcal tonsillitis on observation reveals tonsils that are swollen and red (inflamed) often with streaks of pus on their surface, and swollen, tender lymph glands in the neck. There is a stagnation of fluid, the tissue of the throat is hot and relaxed. A gargle of *Echinacea angustifolia* (the *Echinacea* needs to be in direct contact with the tissue which feels tingly) can be most effective especially when the tissue is inflamed, ulcerated and painful.<sup>17</sup> *Echinacea angustifolia* is cool and dry. It is also a lymphatic herb, which helps to move stagnation in the lymph system. *Baptisia tinctoria* is considerable as a synergist for inflamed tissues and tendency to infection, pustules, fetid tonsils, enlarged lymph glands and frequent infections.<sup>43</sup> The Eclectics used *Baptisia tinctoria* especially with *foul conditions*, halitosis, dusky, purplish, lurid discoloration.<sup>33</sup> *Baptisia tinctoria* combines well with *Echinacea spp.*, *Capsicum frutescens* and *Commiphora myrrh*.<sup>44</sup> *Inula helenium* as well as *Thymus spp.* both have an affinity for respiratory system. In cases of lung infections *Inula helenium* acts as an expectorant, antitussive, diaphoretic and antimicrobial. It may be used whenever copious catarrh is present and for persistent coughs accompanied with substernal pain and profuse secretion.<sup>32,33</sup> *Thymus spp.* is antibacterial, antispasmodic, dry and warming. The essential

oils containing thymol and carvacol will gather in the lungs and penetrate deep into the respiratory system to produce antimicrobial effects.<sup>45</sup> They will dry out mucous before it becomes catarrh, and therefore it is not to be used if thick catarrh is already present, it will make it worse.<sup>45</sup> Joseph Lister used the essential oils of *Thymus spp.*, *Salvia off.* and *Eucalyptus globulus* in an alcohol spray for hygiene in hospitals. He called the formula "Listerine".<sup>45</sup> The chief concern in using herbal treatments for sore throats is that a strep infection may progress to a more serious disease, and an improperly treated strep infection may cause kidney damage or heart disease.

## Gram negative bacteria

*Acinetobacter baumannii*

*Acinetobacter baumannii* thrive in moist, aquatic environments. They are often found to be resistant to antibiotics and are also known as Multi Drug Resistant *Acinetobacter baumannii* or MDRAB. Entryways for infection by MDRAB include breathing tubes, catheters, open wounds, and needles used for injections, blood draws and intravenous lines. Oftentimes, when infections occur, they involve organ systems that have a high fluid content such as the respiratory tract, the peritoneal fluid and the urinary tract.<sup>46</sup> Specific herbal considerations to address *Acinetobacter baumannii* bacteria are the systemic: *Cryptolepis sanguinolenta*, *Sida cordifolia*, and *Isatis tinctoria*. *Lomatium dissectum*, *Astragalus membranaceus* and *Rhodiola rosea* are all indicated for Immunomodulation and support.

For manifestation in the lungs, herbs to examine include: *Echinacea angustifolium* for stimulation the immune system and move fluids; *Zingiber off.*, as a warming stimulating diaphoretic; *Thymus spp.* as an antimicrobial and to dry up the fluids in the respiratory tract;

and *Inula helenium* to get moisture to move. *Inula helenium* helps both wet or dry lungs, is antibacterial, and particularly indicated for the urge to cough because of fluid build-up (pneumonia).<sup>45</sup> For manifestation in a wound, use honey dressings. For urinary tract infections, consider *Juniperis communis*, *Bidens pilosa* and *Piper methysticum*. Juniperis is used for its diuretic action and to help tone the tissues where there is a lack of tone, and where the ureters may be congested with catarrh or pus.<sup>31</sup> *Bidens pilosa* is an antimicrobial and urinary system tonic. *Bidens pilosa* is a common and accessible herb. It has the ability to tighten up boggy or relaxed tissues as well as stimulating and warming the tissue.<sup>47,48,49,50</sup> *Piper methysticum*, while not antimicrobial, is a diuretic, analgesic and has noticeable effect on the mucous membranes. It is specifically useful in chronic catarrhal conditions especially for inflammation of the neck of the bladder and aiding the pain of micturition to disappear.<sup>33</sup>

### **Campylobacter jejuni**

The intestinal infection caused by this organism is primarily passed through contaminated food. It is the most common cause of gastroenteritis illness in North America. Infections often present with watery diarrhea, fever, abdominal pain and fatigue. The intestinal tissues here are extremely relaxed and incapable of holding fluids. There is caution to be aware of any signs of dehydration. Antimicrobial herbs include *Cryptolepis sanguinolenta*, *Sida cordifolia*, *Berberis vulgaris*, *Hydrastis canadensis*, *Mahonia aquifolium*, *Zingiber off.*, and *Andrographis paniculata*.<sup>51</sup>

In addition to the antimicrobial actions of *Cryptolepis sanguinolenta*, *Sida cordifolia*, *Berberis vulgaris*, *Hydrastis canadensis*, *Mahonia aquifolium*, they also have the ability to clear heat (inflammation) and dry tissues. *Zingiber off.* in this case exerts a warming effect, is a diaphoretic and helpful as an antispasmodic. *Andrographis paniculata* on the other hand is chillingly cool, is anti-inflammatory, immunostimulating and antimicrobial. It has been used in Asia for centuries for the treatment of infectious diseases that cause fever and diarrhea.<sup>52</sup>

Anti-inflammatory & astringent herbs include *Calendula off.*, *Filipendula ulmaria*, and *Matricaria recutita*. *Filipendula ulmaria* is described by David Hoffmann as an astringent and the gentlest herb for the overall tonification of the small intestine.<sup>32</sup> Warming and drying, *Matricaria recutita* is soothing to the intestines, cooling and astringing.<sup>53</sup> It is also a mild antispasmodic.

Fluids and electrolytes must be replenished in cases of severe diarrhea.

### **Enterhaemorrhagic Escherichia Coli (E. Coli)**

This infection has a bovine reservoir and can be transmitted via food, such as undercooked beef or water contaminated with cow manure. Signs of infection are severe abdominal cramping and watery diarrhea that becomes hemorrhagic. The toxins created by the *Enterhaemorrhagic E. Coli* bacteria can directly impair the intestinal mucosa and vascular endothelial cells in the gut wall, causing ulceration, bleeding, purulent discharge and stimulate the secretion

of electrolytes and water into the lumen of the intestinal tract.<sup>54,55</sup> Useful antimicrobial herbs include those containing berberine: *Berberis vulgaris*, *Hydrastis canadensis*, *Mahonia aquifolium*, *Coptis chinensis*, along with *Cryptolepis sanguinolenta*, *Sida cordifolia*, *Artemesia spp.*, *Lomatium dissectum*, *Glycerrhiza glabra*, *Juniperis communis* (for Urinary or Kidney infection) and *Panax notoginseng* to arrest any bleeding from the bowel.

Berberine has demonstrated antibacterial, antimalarial, amoebicidal and hepatoprotective actions. It has also been noted as effective in the treatment of *E. coli* in a number of studies.<sup>56,57,58</sup>

In addition to its antimicrobial property, *Cryptolepis sanguinolenta* has hypothermic properties and is traditionally used for malaria, fevers and diarrhea. There is evidence now for its specific use in cases of *Escherichia coli*.<sup>41,59</sup> *Sida cordifolia*, like *Cryptolepis sanguinolenta* also contains the alkaloid Cryptolepine an isolated compound found to inhibit *E. coli*.

*Artemesia spp.* is very useful in cases of gastrointestinal infection and fever.<sup>32</sup> All species are bitter to the highest degree, cooling and dry. *Lomatium dissectum* was one of the key medicinal plants of Native North Americans in the west. The water soluble triterpenoidal saponins reportedly enhance antibody production, suggesting they actively stimulate the immune system. The traditional form of use is by decoction, taken in large quantities, or inhalation of the steam of the decoction.<sup>60</sup> More common in modern herbalism is the use of the tincture, but with this method, if not decocted and fixed with alcohol, a whole-body rash is a common side effect.<sup>60</sup>

*Glycerrhiza glabra* demonstrates anti-inflammatory and demulcent properties, and lessens the irritation in the gastrointestinal tract, useful for intestinal pain with diarrhea.<sup>33</sup> *Juniperis communis* is specific for catarrh and congestion especially due to infections in the urinary tract.

*Panax notoginseng* is a strong hemostatic and anti-inflammatory. It is one of the main ingredients in the Chinese formula Yunnan Baiyao, a ubiquitous formula to stop bleeding and may be useful in persistent bleeding from the bowel.<sup>61</sup>

### **Haemophilus influenza**

*Haemophilus influenza* causes many childhood infections including pneumonia, meningitis, bacteremia, tracheobronchitis, otitis media, conjunctivitis, sinusitis septic arthritis, osteomyelitis and acute epiglottitis.<sup>62</sup> The nontypeable or unencapsulated strains generally cause mucosal infections such as otitis media, sinusitis, conjunctivitis, and bronchitis.<sup>62</sup> *Haemophilus* means blood loving. *Haemophilus influenza* belongs to the group of bacteria known as fastidious bacteria, which need an iron source to grow.<sup>17</sup> The iron source that the *Haemophilus spp.* includes human hemoglobin. *Sida cordifolia* may be used effectively for this infection, as it both antimicrobial and helps to protect the blood cells.<sup>17</sup> Other useful herbs include *Zingiber off.*, *Glycerrhiza glabra*, *Isatis tinctoria*, and *Lomatium dissectum*.

Eucalyptus essential oil may be considered as a vapour where there is fetid expectoration and profuse mucous discharge. *Ceanothus americanus* is trophorestorative to the spleen. It is stimulating and tonifying to the mucous membranes and useful when the tissues are relaxed and weak and the discharge is free.<sup>36</sup>

### *Klebsiella pneumonia*

While *Klebsiella pneumonia* infection may be less common, it is serious. Often a hospital-acquired disease, *Klebsiella pneumonia* invades the lung tissue and presents with lung abscess formation, tissue inflammation, necrosis and thick green, dark brown or red currant jelly-like sputum. Beneficial herbal therapies for the infection are *Cryptolepis sanguinolenta*, *Bidens pilosa* and Berberidaceae family herbs. Immune supportive herbs to consider are *Glycyrrhiza glabra*, *Ceanothus americanus* and *Echinacea angustifolium*.

The medicinal mushroom *Ganoderma spp.* may also be helpful. It increases the cells' ability to increase oxygen without expending energy.<sup>45</sup> It has immunomodulating qualities and the sesquiterpenoid hydroquinones, called ganomycins, have activities against multiresistant bacteria.<sup>63</sup>

### *Neisseria gonorrhoeae*

This organism affects the genitourinary system, causing sexually transmitted gonorrhea. Male patients present with painful urination, purulent discharge from the penis or testicular swelling.

Women also have painful urination in addition to abnormal vaginal discharge or bleeding and abdominal or pelvic pain. Treatment focus with herbal medicine in this case may be an adjuvant. Herbs to consider in addressing the bacteria are *Cryptolepis sanguinolenta* or *Sida cordifolia*. To support the urinary tract herbs such as *Arctostaphylos uva-ursi*, *Agathosma betulina*, *Juniperis communis* and *Piper methysticum* are worthwhile choices.<sup>36</sup> Immune enhancers such as *Ganoderma spp.*, and *Echinacea angustifolia* may also work as adjuvants to primary medical care.

### *Proteus spp.*

The *Proteus mirabilis* strain is the cause of most human infections. In cases where healthy bacterial flora has been disturbed or wiped out by antibiotic therapy, *Proteus spp.* is opportunistic and can lead to bacteremia, infected wounds, pneumonia, urinary tract infections and alkaline kidney stones. *Proteus* organisms produce urease, which hydrolyzes urea, leading to alkaline urine and the formation of struvite stones.<sup>64</sup>

Herbs that could be helpful include *Cryptolepis sanguinolenta* and *Sida cordifolia* as antimicrobials.<sup>65</sup> *Artemisia annua* provides antimicrobial support. It has been used for centuries in Chinese medicine for the treatment of fevers, including malaria.<sup>66,67,68</sup> The artemisinin assists in the control of malaria because it reacts with the high iron concentrations found in the malaria parasite. *Artemisia annua*'s properties are described by Chinese medical terms as being

bitter in taste and cold. It has a long traditional use in China as a gentle herb for heat clearing especially summer heat or deficient heat.<sup>69,70</sup> *Juniperis communis*, as described earlier, is antimicrobial and the volatile oils in the *Juniperis* collect specifically in the kidney and urinary system thereby helpful in cases of cystitis.

*Lomatium dissectum*, along with *Ligusticum porteri* were used and documented during the Spanish influenza. *Lomatium*, contains oleo-resins rich in terpenes and sesquiterpenes that act as stimulating expectorants in the lungs and may enhance immunity in the mucosa indirectly through increased secretions of IgA antibodies inherent in the mucous.<sup>60</sup> It is indicated for infections especially in the lungs and upper respiratory tract particularly when there is a large amount of sticky mucous and where the infection is deep seated and persistent.<sup>71</sup> *Usnea barbata* is a lichen — a fungus and algae living together as a single organism. This lichen contains lichen acids, powerful antimicrobial compounds useful in respiratory and urinary tract infections as well as in fungal infections along with immune-stimulating polysaccharides and mucilage that is soothing to the mucous membranes.<sup>72,73</sup> *Zingiber off.* is warming, anti-inflammatory and antispasmodic. It promotes gentle diaphoresis, favours circulatory flow, increases the mucous production and movement in the lungs, bowels, and relieves flatulence. It is noted as an effective herb for pneumonia, acute and sub-acute dysentery as well as being useful in fevers and inflammatory cases requiring sustained diaphoresis.<sup>74</sup>

### *Pseudomonas aeruginosa*

Infections caused by *Pseudomonas aeruginosa* are frequently hospital acquired. The organism takes opportunity with those who are immunocompromised or debilitated. The organism can affect almost any part of the body. Oftentimes, the tissue infected depends on the where there has been either a trauma or a breach in cutaneous or mucosal barriers by mechanical ventilation, tracheostomy, catheters, surgery or severe burns.<sup>75</sup> It can cause pneumonia, wound infections, urinary tract infection and septicemia. Beneficial herbal medicines include *Isatis tinctoria*, *Bidens pilosa*, *Cryptolepis sanguinolenta*, *Echinacea angustifolia* along with tissue specific herbs such as *Thymus spp.* for pneumonia, *Baptisia tinctoria* and honey dressings for wound infections, *Artostaphylos uva-ursi* and *Juniperis communis* for urinary tract infections and *Baptisia tinctoria* for septicemia as well.

*Isatis tinctoria* is an antimicrobial, immuno-stimulant and antiplatelet. Bitter and cold, *Isatis tinctoris* is described from a traditional Chinese medicine perspective as having properties to clear heat and eliminate toxins both from the qi, or energy level, and xue, or blood level.<sup>69</sup> *Bidens pilosa* has been traditionally used as an antimicrobial and has been studied for specific action against *Pseudomonas*. It is also a mucous membrane tonic and is specific for inflamed mucous membranes.<sup>53,76</sup> In cases of severe respiratory infection or pneumonia, *Thymus spp.* may be considered suitable. *Thymus spp.* has long been valued for its antimicrobial properties mostly stemming from the volatile oil, thymol.<sup>32,77</sup>



## GRAM NEGATIVE BACTERIA

GRAM NEGATIVE BACTERIA	THERAPEUTIC HIERARCHY	HERB
<b><i>Acinetobacter baumannii</i> MDRAB</b>	1) Treat the primary bacterial infection with the correct antimicrobials choose herb(s) that are the most relevant and begin considering proportions for the final formula	<i>Cryptolepis sanguinolenta</i> <i>Sida cordifolia</i> <i>Juniperis communis</i> <i>Isatis tinctoria</i> <i>Zingiber off.</i> <i>Lomatium dissectum</i> <i>Ligustrum lucidum</i> Honey <i>Oreganum spp.</i>
	2) System tropism choosing herbs that are the most relevant	<i>Rhodiola rosea</i> <i>Astragalus membranaceus</i>
	3) Immune system adjuvants & immunomodulators & immune stimulants	Medicinal mushrooms <i>Andrographis paniculata</i> <i>Echinacea angustifolium</i> <i>Eupatorium perfoliatum</i> <i>Inula helenium</i>
	4) Tissue states infected Hot   Cold   Wet   Dry   Relaxed   Tense	Pneumonia: <i>Thymus spp.</i> <i>Oreganum spp.</i> Wound: <i>Baptisia tinctoria</i> UTI: <i>Arctostaphylos uva-ursi</i> Urinary Anti-Inflammatories Urinary Astringents
	5) Adaptogens, Trophorestoratives, Nutritives	Adrenal tonics Carminatives Lung trophorestoratives
	EXAMPLE protocol for <i>Acinetobacter baumannii</i> MDRAB:	Custom formula: 5 parts <i>Cryptolepis sang.</i> 3 parts <i>Lomatium dissectum</i> 2 parts <i>Zingiber off.</i> 1 part <i>Rhodiola rosea</i> 1 tsp. TID Medicinal mushrooms
	<b><i>Acinetobacter baumannii</i> pneumonia</b>	1) Treat the primary bacterial infection with the correct antimicrobials choose herb(s) that are the most relevant and begin considering proportions for the final formula
2) System tropism choosing herbs that are the most relevant		<i>Rhodiola rosea</i> <i>Astragalus membranaceus</i>
3) Immune system adjuvants & immunomodulators & immune stimulants		Medicinal mushrooms <i>Andrographis paniculata</i> <i>Echinacea angustifolium</i> <i>Eupatorium perfoliatum</i> <i>Inula helenium</i>
4) Tissue states infected Hot   Cold   Wet   Dry   Relaxed   Tense		<i>Thymus spp.</i> <i>Oreganum spp.</i>
5) Adaptogens, Trophorestoratives, Nutritives		Lung trophorestoratives
EXAMPLE protocol for <i>Acinetobacter baumannii</i> pneumonia:		Custom formula: 5 parts <i>Cryptolepis sang.</i> 2 parts <i>Lomatium dissectum</i> 2 parts <i>Inula tinctoria</i> 2 parts <i>Zingiber off.</i> 2 parts <i>Thymus spp.</i> 1 tsp. TID Medicinal mushrooms Garlic honey 1 tsp. TID <i>Oreganum spp.</i> Essential Oil steam inhalation consider mustard plasters
<b><i>Acinetobacter baumannii</i> wound</b>		1) Treat the primary bacterial infection with the correct antimicrobials choose herb(s) that are the most relevant and begin considering proportions for the final formula
	2) System tropism choosing herbs that are the most relevant	<i>Rhodiola rosea</i> <i>Astragalus membranaceus</i> daily Honey dressing
	3) Immune system adjuvants & immunomodulators & immune stimulants	Medicinal mushrooms <i>Andrographis paniculata</i> <i>Echinacea angustifolium</i> <i>Eupatorium perfoliatum</i> <i>Baptisia tinctoria</i>
	4) Tissue states infected Hot   Cold   Wet   Dry   Relaxed   Tense	Adrenal tonics
	5) Adaptogens, Trophorestoratives, Nutritives	
	EXAMPLE protocol for <i>Acinetobacter baumannii</i> wound:	Custom formula: 5 parts <i>Cryptolepis sang.</i> 2 parts <i>Lomatium dissectum</i> 2 parts <i>Astragalus mem.</i> 2 parts <i>Rhodiola rosea</i> 2 parts <i>Baptisia tinctoria.</i> 1 tsp. TID Medicinal mushrooms Honey dressings DAILY

**GRAM NEGATIVE BACTERIA** *continued*

GRAM NEGATIVE BACTERIA	THERAPEUTIC HIERARCHY	HERB
<b>Acinetobacter baumannii</b> <b>Urinary Tract Infection</b>	1) Treat the primary bacterial infection with the correct antimicrobials choose herb(s) that are the most relevant and begin considering proportions for the final formula	<i>Lomatium dissectum</i> <i>Rhodiola rosea</i> <i>Astragalus membranaceus</i>
	2) System tropism choosing herbs that are the most relevant	<i>Juniperis communis</i> <i>Bidens pilosa</i> <i>Oreganum spp. Essential Oil</i>
	3) Immune system adjuvants & immunomodulators & immune stimulants	Deep Immune Activation <i>Andrographis paniculata</i> <i>Echinacea angustifolium</i> <i>Eupatorium perfoliatum</i>
	4) Tissue states infected Hot   Cold   Wet   Dry   Relaxed   Tense	<i>Vitex agnus castus</i> Urinary Anti-Inflammatories Urinary Astringents
	5) Adaptogens, Trophorestoratives, Nutritives	Adrenal tonics
	EXAMPLE protocol for <i>Acinetobacter baumannii</i> Urinary Tract Infection	Custom formula: 5 parts <i>Cryptolepis sang.</i> 2 parts <i>Lomatium dissectum</i> 2 parts <i>Arctostaphylos uva-ursi</i> 2 parts <i>Juniperis communis</i> 2 parts <i>Zingiber off.</i> 1 part <i>Piper methysticum</i> 1 tsp. TID Medicinal mushrooms Cold infusion of <i>Althea off. radix</i> 1L to sip all day
<b>Campylobacter jejuni</b>	1) Treat the primary bacterial infection with the correct antimicrobials choose herb(s) that are the most relevant and begin considering proportions for the final formula	<i>Cryptolepis sanguinolenta</i> <i>Sida cordifolia</i> <i>Zingiber off.</i> <i>Berberis vulgaris</i> <i>Hydrastis canadensis</i> <i>Mahonia aquifolium</i> <i>Coptis chinensis</i>
	2) System tropism choosing herbs that are the most relevant	<i>Andrographis paniculata</i> Medicinal mushrooms
	3) Immune system adjuvants & immunomodulators & immune stimulants	<i>Andrographis paniculata</i> <i>Echinacea angustifolium</i> <i>Eupatorium perfoliatum</i>
	4) Tissue states infected Hot   Cold   Wet   Dry   Relaxed   Tense	Blackberry root <i>Calendula off.</i> <i>Capsicum annua</i> <i>Curcuma longa</i> <i>Filipendula ulmaria</i> <i>Foeniculum vulgare</i> <i>Glycyrrhiza glabra</i> <i>Matricaria recutita</i> <i>Salvia off.</i>
	5) Adaptogens, Trophorestoratives, Nutritives	<i>Silybum marianum</i>
	EXAMPLE protocol for <i>Campylobacter jejuni</i> :	Custom formula: 5 parts <i>Cryptolepis sang.</i> 3 parts <i>Andrographis paniculata</i> 2 parts <i>Glycyrrhiza glabra</i> 2 parts <i>Echinacea angustifolia</i> 1 part <i>Zingiber off.</i> 1 tsp. TID Blackberry root 1 tsp. TID
<b>Enterhaemorrhagic E. Coli</b>	1) Treat the primary bacterial infection with the correct antimicrobials choose herb(s) that are the most relevant and begin considering proportions for the final formula	<i>Berberis vulgaris</i> <i>Hydrastis canadensis</i> <i>Mahonia aquifolium</i> <i>Coptis chinensis</i> <i>Cryptolepis sanguinolenta</i> <i>Sida cordifolia</i> <i>Bidens pilosa</i> <i>Artemesia spp.</i> <i>Juniperus communis</i> <i>Usnea barbata</i> <i>Lomatium dissectum</i> <i>Isatis tinctoria</i> <i>Glycyrrhiza glabra</i> <i>Withania somnifera</i>
	2) System tropism choosing herbs that are the most relevant	<i>Panax noto-ginseng</i>
	3) Immune system adjuvants & immunomodulators & immune stimulants	<i>Ganoderma spp.</i>
	4) Tissue states infected Hot   Cold   Wet   Dry   Relaxed   Tense	<i>Calendula off.</i> <i>Capsicum annua</i> <i>Curcuma longa</i> <i>Filipendula ulmaria</i> <i>Foeniculum vulgare</i> <i>Glycyrrhiza glabra</i> <i>Matricaria recutita</i> <i>Salvia off.</i>
	5) Adaptogens, Trophorestoratives, Nutritives	<i>Glycyrrhiza glabra</i>
	EXAMPLE protocol for <i>Enterhaemorrhagic E. Coli</i> :	Custom formula: 5 parts <i>Cryptolepis sang.</i> 3 parts <i>Glycyrrhiza glabra</i> 2 parts <i>Echinacea angustifolia</i> 1 part <i>Astragalus mem.</i> 1 part <i>Zingiber off.</i> 1 tsp. TID Blackberry root 1 tsp. TID

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**GRAM NEGATIVE BACTERIA** *continued*

GRAM NEGATIVE BACTERIA	THERAPEUTIC HIERARCHY	HERB
<b><i>Haemophilus influenzae</i></b>	1) Treat the primary bacterial infection with the correct antimicrobials choose herb(s) that are the most relevant and begin considering proportions for the final formula	<i>Zingiber off.</i> <i>Glycyrrhiza glabra</i> <i>Isatis tinctoria</i> <i>Lomatium dissectum</i> <i>Eucalyptus globulus E.O.</i> <i>Sida cordifolia</i>
	2) System tropism choosing herbs that are the most relevant	<i>Ceanothus americanus</i> <i>Achillea millefolium</i> <i>Asclepias tuberosa</i> <i>Capsicum annua</i> <i>Eupatorium perfoliatum</i> <i>Mentha piperita</i> <i>Nepeta cataria</i> <i>Sambucus nigra flos.</i> <i>Sambucus nigra fruc.</i> <i>Zingiber off.</i>
	3) Immune system adjuvants & immunomodulators & immune stimulants	Medicinal mushrooms <i>Andrographis paniculata</i> <i>Echinacea angustifolium</i> <i>Eupatorium perfoliatum</i> <i>Glycyrrhiza glabra</i> <i>Usnea barbata</i>
	4) Tissue states infected Hot   Cold   Wet   Dry   Relaxed   Tense	<i>Achillea millefolium</i> <i>Capsicum annua</i> <i>Mentha piperita</i> <i>Zanthoxylum clava-herculis</i> <i>Zingiber off.</i>
	5) Adaptogens, Trophorestoratives, Nutritives	Lung trophorestoratives
	EXAMPLE protocol for <i>Haemophilus influenzae</i> :	Custom formula: 4 parts <i>Sambucus nigra fruc.</i> 3 parts <i>Echinacea angustifolia</i> 3 parts <i>Lomatium dissectum</i> 2 parts <i>Glycyrrhiza glabra</i> 1 part <i>Sambucus nigra flos.</i> 1 part <i>Zingiber off.</i> 1 tsp. TID Garlic honey 1 tsp. TID Lung trophorestoratives should there be any residual inflammation in the respiratory system
<b><i>Neisseria gonorrhoeae</i></b>	1) Treat the primary bacterial infection with the correct antimicrobials choose herb(s) that are the most relevant and begin considering proportions for the final formula	<i>Cryptolepis sanguinolenta</i> <i>Bidens pilosa</i> <i>Juniperis communis</i> <i>Berberis vulgaris</i> <i>Hydrastis canadensis</i> <i>Coptis chinensis</i> <i>Mahonia aquifolium</i>
	2) System tropism choosing herbs that are the most relevant	<i>Artemesia annua</i> <i>Ganoderma spp.</i> <i>Glycyrrhiza glabra</i> Honey
	3) Immune system adjuvants & immunomodulators & immune stimulants	Medicinal mushrooms <i>Ceanothus americanus</i> <i>Echinacea angustifolium</i> <i>Ganoderma spp.</i> <i>Glycyrrhiza glabra</i>
	4) Tissue states infected Hot   Cold   Wet   Dry   Relaxed   Tense	<i>Calendula off.</i> <i>Capsicum annua</i> <i>Curcuma longa</i> <i>Filipendula ulmaria</i> <i>Foeniculum vulgare</i> <i>Glycyrrhiza glabra</i> <i>Salvia off.</i>
	5) Adaptogens, Trophorestoratives, Nutritives	<i>Glycyrrhiza glabra</i>
<b><i>Proteus spp.</i></b>	1) Treat the primary bacterial infection with the correct antimicrobials choose herb(s) that are the most relevant and begin considering proportions for the final formula	<i>Cryptolepis sanguinolenta</i> <i>Sida cordifolia</i>
	2) System tropism choosing herbs that are the most relevant	<i>Artemesia annua</i> <i>Juniperis communis</i> <i>Usnea barbata</i> <i>Lomatium dissectum</i> <i>Ligusticum porteri</i> <i>Zingiber off.</i> Honey
	3) Immune system adjuvants & immunomodulators & immune stimulants	Medicinal mushrooms <i>Andrographis paniculata</i> <i>Echinacea angustifolium</i> <i>Eupatorium perfoliatum</i>
	4) Tissue states infected Hot   Cold   Wet   Dry   Relaxed   Tense	<i>Bidens pilosa</i> <i>Rhodiola rosea</i> <i>Chionanthus virginicus</i>
	5) Adaptogens, Trophorestoratives, Nutritives	Adrenal tonics Carminatives Lung trophorestoratives



## GRAM NEGATIVE BACTERIA *continued*

GRAM NEGATIVE BACTERIA	THERAPEUTIC HIERARCHY	HERB
<b><i>Pseudomonas aeruginosa</i></b>	1) Treat the primary bacterial infection with the correct antimicrobials choose herb(s) that are the most relevant and begin considering proportions for the final formula	<i>Isatis tinctoria</i> <i>Bidens pilosa</i> <i>Cryptolepis sanguinolenta</i> <i>Sida cordifolia</i>
	2) System tropism choosing herbs that are the most relevant	<i>Artemisia annua</i> <i>Juniperis communis</i> <i>Zingiber off.</i> <i>Coptis chinensis</i> <i>Berberis vulgaris</i> <i>Mahonia aquifolium</i> <i>Hydrastis canadensis</i> <i>Lomatium dissectum</i> <i>Withania somnifera</i> <i>Echinacea angustifolium</i> <i>Ganoderma spp.</i>
	3) Immune system adjuvants & immunomodulators & immune stimulants	Medicinal mushrooms <i>Andrographis paniculata</i> <i>Ceanothus americanus</i> <i>Echinacea angustifolium</i> <i>Eupatorium perfoliatum</i>
	4) Tissue states infected Hot   Cold   Wet   Dry   Relaxed   Tense	Pneumonia: <i>Thymus spp.</i> <i>Oreganum spp. Essential Oil</i> Wound: <i>Baptisia tinctoria</i> UTI: <i>Arctostaphylos uva-ursi</i> Urinary Anti-Inflammatories Urinary Astringents Septicemia: <i>Baptisia tinctoria</i>
	5) Adaptogens, Trophorestoratives, Nutritives	Adrenal tonics Carminatives Lung trophorestoratives <i>Cryptolepis sanguinolenta</i>
<b><i>Salmonella spp.</i></b>	1) Treat the primary bacterial infection with the correct antimicrobials choose herb(s) that are the most relevant and begin considering proportions for the final formula	<i>Sida cordifolia</i> <i>Bidens pilosa</i> <i>Berberis vulgaris</i> <i>Coptis chinensis</i> <i>Hydrastis canadensis</i> <i>Mahonia aquifolium</i> <i>Juniperis communis</i>
	2) System tropism choosing herbs that are the most relevant	Honey <i>Glycyrrhiza glabra</i> <i>Zingiber off.</i> <i>Lomatium dissectum</i> Carminatives
	3) Immune system adjuvants & immunomodulators & immune stimulants	Medicinal mushrooms <i>Andrographis paniculata</i> <i>Ceanothus americanus</i> <i>Echinacea angustifolium</i> <i>Eupatorium perfoliatum</i>
	4) Tissue states infected Hot   Cold   Wet   Dry   Relaxed   Tense	<i>Calendula off.</i> <i>Capsicum annua</i> <i>Curcuma longa</i> <i>Filipendula ulmaria</i> <i>Foeniculum vulgare</i> <i>Glycyrrhiza glabra</i> <i>Matricaria recutita</i> <i>Salvia off.</i>
	5) Adaptogens, Trophorestoratives, Nutritives	<i>Glycyrrhiza glabra</i> Carminatives
<b><i>Serratia marcescens</i></b>	1) Treat the primary bacterial infection with the correct antimicrobials choose herb(s) that are the most relevant and begin considering proportions for the final formula	<i>Juniperis communis</i> <i>Bidens pilosa</i> <i>Glycyrrhiza glabra</i> <i>Lomatium dissectum</i>
	2) System tropism choosing herbs that are the most relevant	<i>Coptis chinensis</i> Honey <i>Tribulus terrestris</i>
	3) Immune system adjuvants & immunomodulators & immune stimulants	Medicinal mushrooms <i>Andrographis paniculata</i> <i>Echinacea angustifolium</i> <i>Eupatorium perfoliatum</i>
	4) Tissue states infected Hot   Cold   Wet   Dry   Relaxed   Tense	Pneumonia: <i>Inula helenium</i> <i>Thymus spp.</i> <i>Oreganum spp. Essential Oil</i> Wound: <i>Baptisia tinctoria</i> UTI: <i>Arctostaphylos uva-ursi</i> Urinary Anti-Inflammatories Urinary Astringents Septicemia: <i>Baptisia tinctoria</i>
	5) Adaptogens, Trophorestoratives, Nutritives	Adrenal tonics Carminatives

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**GRAM NEGATIVE BACTERIA** *continued*

GRAM NEGATIVE BACTERIA	THERAPEUTIC HIERARCHY	HERB
<b><i>Shigella spp.</i></b>	1) Treat the primary bacterial infection with the correct antimicrobials choose herb(s) that are the most relevant and begin considering proportions for the final formula	<i>Cryptolepis sanguinolenta</i> <i>Sida cordifolia</i> <i>Bidens pilosa</i>
	2) System tropism choosing herbs that are the most relevant	<i>Berberis vulgaris</i> <i>Coptis chinensis</i> <i>Hydrastis canadensis</i> <i>Mahonia aquifolium</i> <i>Juniperis communis</i> Honey <i>Glycerrhiza glabra</i> <i>Lomatium dissectum</i> <i>Zingiber off.</i> Carminatives
	3) Immune system adjuvants & immunomodulators & immune stimulants	Medicinal mushrooms <i>Glycerrhiza glabra</i>
	4) Tissue states infected Hot   Cold   Wet   Dry   Relaxed   Tense	<i>Calendula off.</i> <i>Capsicum annua</i> <i>Curcuma longa</i> <i>Filipendula ulmaria</i> <i>Foeniculum vulgare</i> <i>Glycerrhiza glabra</i> <i>Matricaria recutita</i> <i>Salvia off.</i>
	5) Adaptogens, Trophorestoratives, Nutritives	Adrenal tonics Carminatives
<b><i>Stenotrophomonas maltophilia</i></b>	1) Treat the primary bacterial infection with the correct antimicrobials choose herb(s) that are the most relevant and begin considering proportions for the final formula	<i>Cryptolepis sanguinolenta</i> <i>Sida cordifolia</i> <i>Bidens pilosa</i>
	2) System tropism choosing herbs that are the most relevant	<i>Berberis vulgaris</i> <i>Coptis chinensis</i> <i>Hydrastis canadensis</i> <i>Mahonia aquifolium</i> <i>Eupatorium perfoliatum</i> Honey <i>Eucalyptus globulus E.O.</i> <i>Salvia off.</i> <i>Menyanthes trifoliata</i> <i>Rosmarinus off.</i>
	3) Immune system adjuvants & immunomodulators & immune stimulants	Medicinal mushrooms <i>Andrographis paniculata</i> <i>Ceanothus americanus</i> <i>Echinacea angustifolium</i> <i>Eupatorium perfoliatum</i>
	4) Tissue states infected Hot   Cold   Wet   Dry   Relaxed   Tense	<i>Thymus spp.</i> <i>Oreganum spp. Essential Oil</i> <i>Baptisia tinctoria</i> <i>Arctostaphylos uva-ursi</i> Urinary Anti-Inflammatories Urinary Astringents <i>Baptisia tinctoria</i>
	5) Adaptogens, Trophorestoratives, Nutritives	Adrenal tonics Carminatives Lung trophorestoratives
<b><i>Vibrio cholera</i></b>	1) Treat the primary bacterial infection with the correct antimicrobials choose herb(s) that are the most relevant and begin considering proportions for the final formula	<i>Berberis vulgaris</i> <i>Coptis chinensis</i> <i>Hydrastis canadensis</i> <i>Mahonia aquifolium</i> <i>Cryptolepis sanguinolenta</i> <i>Glycerrhiza glabra</i> <i>Zingiber off.</i>
	2) System tropism choosing herbs that are the most relevant	<i>Geranium spp.</i> <i>Krameria triandra</i> <i>Ocimum sanctum</i>
	3) Immune system adjuvants & immunomodulators & immune stimulants	Medicinal mushrooms <i>Glycerrhiza glabra</i>
	4) Tissue states infected Hot   Cold   Wet   Dry   Relaxed   Tense	<i>Calendula off.</i> <i>Capsicum annua</i> <i>Curcuma longa</i> <i>Filipendula ulmaria</i> <i>Foeniculum vulgare</i> <i>Glycerrhiza glabra</i> <i>Matricaria recutita</i> <i>Salvia off.</i>
	5) Adaptogens, Trophorestoratives, Nutritives	Carminatives

It is hot and drying and is quite useful for coughs as it stimulates expectoration but can also reduce spasm.<sup>45</sup> *Baptisia tinctoria* is a herb to consider when there is oozing and pus.

Antimicrobial and antiscorbutic, *Baptisia tinctoria* is also a systemic lymphatic. It is indicated in pathological conditions characterized by a feeble vitality (hospitalized patient) with a tendency to disintegration of tissues or sepsis.<sup>32,33</sup>

### **Salmonella spp.**

Most infections from the *Salmonella spp.* come from food. Many plant and animal products that have been grown with the use of antibiotics carry Salmonella that has become antibiotic resistant. When Salmonella infects a human the symptoms include diarrhea, vomiting, abdominal cramping and fever. Herbal medicines are useful adjuvant in cases of *Salmonella spp.* Possible complementary herbs include *Cryptolepis sanguinolenta*, *Sida cordifolia*, herbs from the Berberidaceae family, *Juniperis communis*, *Glycyrrhiza glabra*, *Zingiber off.* and *Lomatium dissectum*. Electrolyte replacement is also very important.

### **Serratia marcescens**

For the most part, *Serratia marcescens* infections are found in hospital settings. The organism can infect the respiratory tract causing pneumonia, catheter sites causing urinary tract infections, surgical wounds and the blood resulting in septicemia.

Herbs that can help to treat *Serratia marcescens* include *Juniperis communis*, *Bidens pilosa* and *Glycyrrhiza glabra*, *Lomatium dissectum*, *Coptis chinensis* and *Tribulus terrestris*. For pneumonia, *Inula helenium*. For wounds, *Baptisia tinctoria* along with honey dressings. For UTI's, *Arctostaphylos uva-ursi* and for septicemia, *Baptisia tinctoria*.

### **Shigella spp.**

There are a number of *Shigella* species that cause infection in humans. Spread of *Shigella spp.* is through fecal-oral transmission. The organisms are able to penetrate the mucosa of the colon initially causing watery diarrhea, abdominal pain, cramping and urgency to defecate then dysentery occurs. As *Shigella spp.* is increasingly becoming antibiotic resistant herbal therapies can serve very well as auxiliary care. Suitable herbs for use are *Cryptolepis sanguinolenta*, *Sida cordifolia*, *Bidens pilosa*, *Berberis vulgaris*, *Juniperis communis*, *Glycyrrhiza glabra*, *Zingiber off.*, *Lomatium dissectum*, *Calendula off.*, and *Filipendula ulmaria*. Electrolyte replacement is important as well.

### **Stenotrophomonas maltophilia**

Infection with *Stenotrophomonas maltophilia* is often found in hospital settings with those who are immunocompromised.<sup>78</sup> Herbal medicines that may be useful are *Cryptolepis sanguinolenta*, *Sida cordifolia*, *Bidens pilosa*, *Berberis vulgaris*, *Eupatorium perfoliatum*, *Menyanthes trifoliata*, *Rosmarinus off.*, and *Thymus spp.*

*Eupatorium perfoliatum* can be useful in the immunocompromised as a diaphoretic. It is a safe choice for fever and aids in the relief of body aches and pains while debilitated. *Menyanthes trifoliata* is a bitter, diuretic, cholagogue and acts as an aperient by stimulating the walls of the colon promoting the flow of digestive juices and bile.<sup>32</sup> It is useful for debilitated states related to sluggish digestion, indigestion and disorders of the liver and gallbladder.<sup>32</sup>

### **Vibrio cholera**

*Vibrio cholera* is the cause of cholera. It is spread by the ingestion of water, seafood or other foods that have been contaminated by the excrement of people with either symptomatic or asymptomatic infection.<sup>79</sup> Manifestation of the disease presents as painless, copious watery diarrhea. The danger of this infection is electrolyte depletion. Herbs to consider include *Berberis vulgaris*, *Coptis chinensis*, *Hydrastis canadensis*, *Mahonia aquifolium*, *Cryptolepis sanguinolenta*, *Glycyrrhiza glabra*, *Zingiber off.*, *Geranium spp.*, *Krameria triandra*, *Capsicum annuum*, and *Filipendula ulmaria*. Monitoring and replenishing electrolytes is also crucial when dealing with this organism.

## **Conclusion**

In this paper we have discussed what antibiotic resistant bacteria are and how they came into existence. We have also attempted to provide a solution in dealing with the microbes through the careful combination of herbal medicines. The use of herbal medicines allows not only the elimination of infection from the body but the ability to strengthen the immune system and heal the tissues affected.

With the increase of antibiotic resistant bacteria, we must come to an understanding whereby we recognize the significance of healing the environment both on an individual and a global scale. In doing so we may be able to also heal our relationship with the ever evolving bacteria. 🍃

### **Resources for the understanding of tissue states and actions in herbal medicine**

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Jim MacDonald: <http://www.herbcraft.org/properties.html>

*Study Guide to the Six Tissue States* Matthew Wood MSc  
(Herbal Medicine)

Registered Herbalist (AHG)

## About the Author

**Tiffany Wyse, ND** is a licensed naturopathic doctor, medical herbalist and a birth doula.

Tiffany came to naturopathic medicine from a teaching background. She was first introduced to the concept of holism when working within a First Nations education model. Then, during a four-year sojourn teaching in Europe and Asia, she was made aware of the incredible healing power of nature, the importance of nutrition and discovered Eastern healing techniques and meditation.

This awareness led her to study medical sciences upon her return to Canada, and to enroll at the Canadian College of Naturopathic Medicine (CCNM).

In addition to studies at CCNM, her ongoing training and interests include herbal medicine, nutrition, women's health, homeopathy, acupuncture and auricular medicine.

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