SUMMARY

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BIOHACKER'S Fluguides Biohacker's

FORTIFYING YOURSELF AGAINST PATHOGENS



This is a comprehensive summary of <u>Biohacker's Flu Guide</u> (2020) which focuses on improving immunity and strategies for building various barricades against intruders before they get the opportunity to take hold. The aim is to inhibit their proper functioning and make one more resistant to their effects.

INTRODUCTION

The world has turned into a giant petri dish for brewing potential pathogens that can wreak havoc on our health, productivity and wellbeing. Luckily, modern times bring modern responses to epidemics: outbreaks are identified much more quickly, disease agents are identified at record speed, epidemics get contained quickly and treatments are developed faster.

We take no opinion on vaccination, as it is a controversial topic, although our recommendation is to do your own research, look into historical data, read scientific peer-reviewed journals and talk to specialists regarding actual risks and trade-offs.

INCREASE AWARENESS AND GETTING PREPARED

It is important to become aware of various ways on how to become well-prepared from the inside-out. Here are the steps to increase awareness and get prepared for anything that happens in the environment:

1. PRECAUTION

Increase one's knowledge regarding various pathogens, biochemical basis of their infection mechanisms and potential means of mitigation.

2. PREPARATION

Prepare the internal environment (the body and the immune system) before possible contact with a potential disease agent to become more resistant and/or immune to it.

3. PREVENTION

Prepare ones external environment (the immediate surroundings) to reduce the likelihood of contracting a disease agent. This means diminishing the predispositition risk for example to a seasonal flu virus by doing preventive procedures such as practicing proper hand hygiene and avoiding contaminated areas.

4. ACTION

In an event of infection, slow down the proliferation of the disease agent, support the immune system in its adequate functioning, and avoid infecting others in the process.

5. RESPONSE

Speed up recovery, restore the balance of the body after the infection, and avoid the emergence of secondary diseases. Reflect on the experience, incubation period, symptoms and lessons learned.

BASICS OF THE IMMUNE SYSTEM

The immune system is divided into two major parts:

- **1. Innate immunity:** is what a person is born with. It is also affected by the vaccinations received and microbes the person is exposed to during their lifetime.
- **2. Adaptive immunity:** is what a human being learns over a lifetime by exposing oneself to various pathogens

Reaction to a pathogen can be:

- 1. Asymptomatic: you may still spread it to others although you have no symptoms
- 2. Mild: it goes away in a few days
- 3. "Full-on" pathogenic: noticeable and takes 1–2 weeks to resolve at minimum

If you want to learn more in detail about the immune system, we recommend reading the **Biohacker's Handbook's Immunity special chapter** (2017).



PREPARATION OF YOUR BODY WITH NUTRITIONAL INTERVENTIONS

Body's biochemical defense systems and immunity are modulated by the following factors and pathways:

- 1. Glutathione: body's main antioxidant produced in the liver¹²
- 2. Nfr2 pathway: one of the main regulators of antioxidants and cell protection
- **3. Autophagy:** cellular self-eating process that helps the body to eliminate pathogens and damaged cells³ can be promoted with positive stressors such as intermittent fasting, regular sauna, exercise and cold exposure
- **4. Uric acid:** most concentrated antioxidant in the human blood that helps to mitigate oxidative stress, especially at high altitudes and under hypoxia.⁴ Obtained from purine-rich foods like organ meat, wild game, red meat and seafood.
- 5. NAD+: cofactor that partakes in virtually all cellular reactions and energy production⁵
- 6. NADPH: cofactor for cellular growth and nucleic acid synthesis⁶
- **7. Strong gut lining:**⁷⁸⁹ can be supported with bone broth, tendons and ligaments and butyrate-rich foods (fermentation of fiber, beans, and legumes but also from ghee and butter¹⁰¹¹
- **8. Diversity of the gut microbiota:**¹² supported with probiotics and a diverse diet rich in foods that enrich the gut microbiota may be beneficial for boosting immunity

- ² Lu, S. (2013). Glutathione synthesis. *Biochimica et Biophysica Acta (BBA)-General Subjects* 1830 (5): 3143–3153
- ³ Deretic, V. (2006). Autophagy as an immune defense mechanism. Current Opinion in Immunology 18 (4): 375–382.
- ⁴ Glantzounis, G. & Tsimoyiannis, E. & Kappas, A. & Galaris, D. (2005). Uric acid and oxidative stress. *Current Pharmaceutical Design* 11 (32): 4145–4151.
- ⁵ Zhang, M., & Ying, W. (2019). NAD+ deficiency is a common central pathological factor of a number of diseases and aging: mechanisms and therapeutic implications. *Antioxidants & Redox Signaling* 30 (6): 890–905.
- ⁶ Bradshaw, P. (2019). Cytoplasmic and Mitochondrial NADPH-Coupled Redox Systems in the Regulation of Aging. *Nutrients* 11 (3): 504.
- ⁷ Arrieta, M. & Bistritz, L. & Meddings, J. (2006). Alterations in intestinal permeability. *Gut* 55 (10): 1512–1520.
- ⁸ Mu, Q. & Kirby, J. & Reilly, C. & Luo, X. (2017). Leaky Gut As a Danger Signal for Autoimmune Diseases. *Frontiers in Immunology* 8: 598.
- ⁹ Pahwa, R. & Singh, A. & Jialal, I. (2019). *Chronic Inflammation*. In: StatPearls [Internet]. Treasure Island (FL): Stat Pearls Publishing. [date of reference: 6.2.2020]
- ¹⁰ Elam, M. et al. (2015). A Calcium-Collagen Chelate Dietary Supplement Attenuates Bone Loss in Postmenopaus al Women with Osteopenia: A Randomized Controlled Trial. *Journal of Medicinal Food* 18 (3): 324–331.
- ¹¹ Canani, R. (2011). Potential beneficial effects of butyrate in intestinal and extraintestinal diseases. *World Journal of Gastroenterology* 17 (12): 1519.
- ¹² Wu, H.-J. & Wu, E. (2012). The role of gut microbiota in immune homeostasis and autoimmunity. *Gut Microbes* 3 (1): 4–14.

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¹ Lu, S. (2009). Regulation of glutathione synthesis. *Molecular Aspects of Medicine* 30 (1-2): 42–59.

NUTRIENTS RELEVANT TO THE IMMUNE SYSTEM

Correcting nutrient deficiencies is a useful strategy to prevent weakened immunity caused by malnourishment.¹³ If you have no deficiencies, the benefits of supplementation may be limited.

- 1. Vitamin D: plays a key role in regulating the balance of the immune system¹⁴¹⁵
- 2. Selenium: essential mineral that is a cofactor in glutathione production
- 3. Vitamin B3 (niacin:) increases NAD+ biosynthesis¹⁶¹⁷
- **4. Vitamin C:** antioxidant produced in response to stress.¹⁸ Needs to be obtained from diet.
- 5. Ubiquinone: contributor to the electron transport chain
- **6. Zinc:** required for the function of more than 300 enzymes.¹⁹ Important for hormone production and immunity.²⁰
- **7. Nitric oxide:** important signaling molecule between cells. Has been shown to fight against some viral and bacterial infections.²¹

You can read more specific protocols on using the Top 3 micronutrients (Vitamin D, Zinc & Vitamin C) for the immune system in the <u>Biohacker's Flu Guide</u>.

- ¹³ Katona, P. & Katona-Apte, J. (2008). The Interaction between Nutrition and Infection. *Clinical Infectious Diseases* 46 (10): 1582–1588.
- ¹⁴ Aranow, C. (2011). Vitamin D and the immune system. Journal of Investigative Medicine 59 (6): 881–886.
- ¹⁵ Mangin, M. & Sinha, R. & Fincher, K. (2014). Inflammation and vitamin D: the infection connection. *Inflammation Research* 63 (10): 803–819.
- ¹⁶ Sauve, A. (2008). NAD+ and vitamin B3: from metabolism to therapies. *Journal of Pharmacology and Experimental Therapeutics* 324 (3): 883-893.
- ¹⁷ Murray, M. (2003). Nicotinamide: an oral antimicrobial agent with activity against both Mycobacterium tuberculosis and human immunodeficiency virus. *Clinical Infectious Diseases* 36 (4): 453-460.
- ¹⁸ Drouin, G. & Godin, J.-R. & Page, B. (2011). The Genetics of Vitamin C Loss in Vertebrates. *Current Genomics* 12 (5): 371–378.
- ¹⁹ McCall, K. & Huang, C. & Fierke, C. (2000). Function and mechanism of zinc metalloenzymes. The Journal of Nutrition 130 (5): 1437S–1446S.
- ²⁰ Barnett, J. & Hamer, D. & Meydani, S. (2010). Low zinc status: a new risk factor for pneumonia in the elderly? *Nutrition Reviews* 68 (1): 30–37.
- ²¹ Reiss, C. & Komatsu, T. (1998). Does nitric oxide play a critical role in viral infections? *Journal of Virology* 72 (6): 4547-4551.

FOODS, SUPPLEMENTS AND HERBS RELEVANT TO THE IMMUNE SYSTEM

- 1. Collagen: important building block in various immune system functions²²
- **2. Licorice:** *Isoliquiritigenin* (ILG) in licorice has been recognized as a potent inhibitor of influenza virus replication in human bronchial epithelial cells and an inhibitor of inflammatory cytokines²³
- **3. Lactoferrin:** mediates antiviral activity against viral pathogens that cause common infections^{24 25 26 27}
- 4. L-Glutamine: used by various immune system cells²⁸ and protect the gut lining²⁹

Other important nutrients for the immune system (reviewed in the Flu Guide):

- Elderberries and other dark berries
- Fruits and vegetables
- Probiotic foods
- Probiotic supplements
- Sulfur-rich foods
- Butyrate
- Olive Leaf Extract
- Alliums and Garlic
- Oregano and other herbs spices

- ²³ Cinatl, J. et al. (2003). Glycyrrhizin, an active component of liquorice roots, and replication of SARS-associated coronavirus. *The Lancet* 361 (9374): 2045–2046.
- ²⁴ Roxas, M. & Jurenka, J. (2007). Colds and influenza: a review of diagnosis and conventional, botanical, and nutritional considerations. *Alternative Medicine Reviews* 12 (1): 25–48.
- ²⁵ Wakabayashi, H. et al. (2014). Lactoferrin for prevention of common viral infections. *Journal of Infection and Chemotherapy* 20 (11): 666–671.
- ²⁶ Scala, M. et al. (2017). Lactoferrin-derived Peptides Active towards Influenza: Identification of Three Potent Tetrapeptide Inhibitors. *Scientific Reports* 7 (1): 10593.
- ²⁷ Tasala, T. et al. (2018). Concentration-dependent Activation of Inflammatory/Anti-inflammatory Functions of Macrophages by Hydrolyzed Whey Protein. Anticancer Research 38 (7): 4299–4304.
- ²⁸ Calder, P. & Yaqoob, P. (1999). Glutamine and the immune system. *Amino Acids* 17 (3): 227–241. Review.
- ²⁹ Chang, W-K. & Yang, K. & Shaio, M.-F. (1999). Effect of Glutamine on Th1 and Th2 Cytokine Responses of Human Peripheral Blood Mononuclear Cells. *Clinical Immunology* 93 (3): 294–301.

²² Ng, W, & Tate, M. & Brooks, A. & Reading, P. (2012). Soluble host defense lectins in innate immunity to influenza virus. *Journal of Biomedicine & Biotechnology* 2012: 732191.

TOP ADAPTOGENS AND MEDICINAL MUSHROOMS THAT SUPPORT THE IMMUNE SYSTEM

Adaptogens help the body to adapt to stress. Medicinal mushrooms stimulate the production of macrophages that eat identified pathogens.^{30 31}

- **1. Chaga mushroom** (*Inonotus obliquus*): has the highest antioxidant capacity of any other food³²
- **2. Reishi mushroom** (*Ganoderma lucidum*): increases overall well-being, raises HDL-cholesterol, activates the immune system^{33 34}
- **3. Ashwagandha** (*Withania somnifera*): possess immunomodulatory effects and lowers stress^{35 36 37 38}
- 4. Ginseng: regulates the immune cells and has antimicrobial properties³⁹
- **5. Curcumin & turmeric:** have antibacterial, antiviral and antifungal properties and boost glutathione production⁴⁰

- ³² Balandaykin, M. & Zmitrovich, I. (2015). Review on Chaga medicinal mushroom, Inonotus obliquus (Higher Basidiomycetes): Realm of medicinal applications and approaches on estimating its resource potential. International Journal of Medicinal Mushrooms 17 (2): 95–104.
- ³³ Lin, Z. (2005). Cellular and molecular mechanisms of immuno-modulation by Ganoderma lucidum. Journal of Pharmacological Sciences 99 (2): 144–153. Review.
- ³⁴ Dudhgaonkar, S. & Thyagarajan, A. & Sliva, D. (2009). Suppression of the inflammatory response by triterpenes isolated from the mushroom Ganoderma lucidum. *International immunopharmacology* 9 (11): 1272–1280.
- ³⁵ Davis, L. & Kuttan, G. (2002). Effect of Withania somnifera on cell mediated immune responses in mice. Journal of Experimental & Clinical Cancer Research 21 (4): 585–590.
- ³⁶ Malik, F. et al. (2007). A standardized root extract of Withania somnifera and its major constituent withanolide-A elicit humoral and cell-mediated immune responses by up regulation of Th1-dominant polarization in BALB/c mice. *Life Sciences* 80 (16): 1525–1538.
- ³⁷ Chandrasekhar, K. & Kapoor, J. & Anishetty, S. (2012). A prospective, randomized double-blind, placebocontrolled study of safety and efficacy of a high-concentration full-spectrum extract of ashwagandha root in reducing stress and anxiety in adults. *Indian Journal of Psychological Medicine* 34 (3): 255–262.
- ³⁸ Andrade, C. & Aswath, A. & Chaturvedi, S. & Srinivasa, M. & Raguram, R. (2000). A double-blind, placebocontrolled evaluation of the anxiolytic efficacy of an ethanolic extract of withania somnifera. *Indian Journal of Psychiatry* 42 (3): 295–301.
- ³⁹ Kang, S. & Min, H. (2012). Ginseng, the 'Immunity Boost': The Effects of Panax ginseng on Immune System. *Journal of Ginseng Research* 36 (4): 354–368.
- ⁴⁰ Moghadamtousi, S. et al. (2014). A review on antibacterial, antiviral, and antifungal activity of curcumin. *Biomed Research International* 2014: 186864.

³⁰ Ayeka, P. (2018). Potential of Mushroom Compounds as Immunomodulators in Cancer Immunotherapy: A Review. *Evidence-based Complementary and Alternative Medicine* 2018: 7271509.

³¹ Lull, C. & Wichers, H. & Savelkoul, H. (2005). Antiinflammatory and immunomodulating properties of fungal metabolites. *Mediators of Inflammation* 2005 (2): 63–80.

Other adaptogens and medicinal mushrooms that support the immune system (reviewed in the Flu Guide):

- Shiitake mushroom (Lentinula edodes)
- Turkey tail (Coriolus/Trametes versicolor)
- Ginger
- Astragalus

An example page from the guide:

TOP ADAPTOGENS AND MEDICINAL MUSHROOMS That support the immune system

Adaptogens (herbs and other substances that have been shown to help the body to adapt to stress) can also be helpful. Medicinal mushrooms, in general, are stimulating the production of macrophages that eat identified pathogens.¹¹⁸ ¹¹⁹

CHAGA MUSHROOM (INONOTUS OBLIQUUS)

- Chaga mushroom has the highest ORAC value (measure of antioxidant capacity) of any other food. It lowers cholesterol, triglycerides, inflammation and oxidative stress.¹²⁰ Polysaccharides from the chaga mushroom's fruiting body (PFIO) have been shown to effectively promote macrophage activation through the MAPK and NF-KB signaling pathways, which regulate the immune system function.¹²¹
- Use as a water extract or an alcohol extract; combining both is the best option

REISHI MUSHROOM (GANODERMA LUCIDUM)

Reishi contains a huge variety of bioactive polysaccharides, beta-glucans and over 120 different triterpenoid compounds.¹²² It increases overall well-being, raises HDL-cholesterol, activates the immune system (CD3 and CD4 lymphocytes, NK cells), decreases TNF-alpha and reduces fatigue.¹²³¹²⁴

SHIITAKE MUSHROOM (LENTINULA EDODES)

Regular shiitake mushroom consumption has been shown to improve immunity (improved cell proliferation and activation and increased sIgA production) in a randomized dietary intervention in young adults.¹²⁵

TURKEY TAIL (CORIOLUS/TRAMETES VERSICOLOR)

Turkey tail has been shown to fight against leukemia cells *in vitro*¹²⁶ and improve the immune system of people getting chemotherapy.¹²⁷ It contains 35 different phenolic compounds and flavonoid antioxidants *quercetin* and *baicalein*, which are strong antioxidants.¹²⁸ Turkey tail also contains other substances, such as *Polysaccharide Krestin* (PSK) and *Polysaccharide Peptide* (PSP), which activate macrophages and modulate immune response.¹²⁹ ¹³⁰ Turkey tail extract has been found to inhibit the growth of *Staphylococcus aureus* and *Salmonella enterica* in vitro (a test tube study).¹³¹

FOODS AND SUPPLEMENTS THAT WEAKEN THE IMMUNE SYSTEM

Avoiding the following:

- **1. Cigarette smoking:** undermines the immune system and increases risk of respiratory infections and pneumonia and the risk of death from these diseases⁴¹
- **2. Excessive alcohol intake:** impairs the immune system and increases the vulnerability to lung infections⁴²
- **3. Inflammatory oils and rancid fats:** canola oil, margarine, sunflower oil, and seed oils in general are highly inflammatory and damage cell membranes when rancid⁴³

Other foods and substances that weaken the immune system (reviewed in the Flu Guide):

- High sugar consumption
- Gluten and grains (e.g. pastries and white bread)
- Poultry (i.e. factory-farmed bird meat in combination with high omega-6 fat diet)
- Processed meat (e.g. bacon, sausages, dumpling, canned meat)
- Toxic seafood (i.e. such that is high in mercury)

⁴¹ Bello, S. et al. (2014). Tobacco smoking increases the risk for death from pneumococcal pneumonia. *Chest* 146 (4): 1029–1037.

⁴³ Ng, C. et al. (2014). Heated vegetable oils and cardiovascular disease risk factors. Vascular Pharmacology 61 (1): 1–9.



⁴² Zhang. P. & Bagby, G. & Happel, K. & Raasch, C. & Nelson, S. (2008). Alcohol abuse, immunosuppression, and pulmonary infection. *Current Drug Abuse Reviews* 1 (1): 56–67. Review.

COMMON SUPPLEMENTS AND DRUGS THAT SHOW NO PROMISE IN INFECTION PREVENTION

Over-the-counter supplements and drugs are common but often ineffective (reviewed in the <u>Flu Guide</u>):

- 1. Multivitamins
- 2. Echinacea
- 3. Fish oil (mixed results)
- 4. Coughing medications
- 5. Inhaling menthol
- 6. Paracetamol and NSAIDs

* VITAMIN E

Vitamin E is a common antioxidant and fat-soluble vitamin that improves cellular functioning by preventing the oxidation of cell wall protein structures.¹⁷³ It is very difficult to be vitamin E-deficient if you are eating some healthy fats and vegetables. Based on an observational study on 72 000 participants, dietary vitamin E was associated with reduced risk of lung cancer, but vitamin E supplementation increased the risk.¹⁷⁴

STRATEGIES FOR STRENGTHENING THE IMMUNE SYSTEM

In addition to nutritional interventions, you can increase resilience against pathogens with healthy regular lifestyle interventions:

- **1. Regular exercise:** stimulates the body's defense mechanisms and strengthens immunity by activating Nrf2⁴⁴
- **2. Regular sauna bathing (traditional and infrared):** flushes the body from toxins and infections by improving lymphatic drainage and blood circulation, and strengthening the immune system⁴⁵

⁴⁴ Pall, M. & Levine, S. (2015). Nrf2, a master regulator of detoxification and also antioxidant, anti-inflammatory and other cytoprotective mechanisms, is raised by health promoting factors. *Sheng Li Xue Bao* 67 (1): 1–18.

⁴⁵ Hussain, J., & Cohen, M. (2018). Clinical Effects of Regular Dry Sauna Bathing: A Systematic Review. *Evidence-Based Complementary and Alternative Medicine* 2018: 1857413.

- **3. Mild cold exposure:** increases resilience against infections.^{46 47} Make sure the exposure time to cold or wind does not last too long.
- **4. Intermittent fasting:** can upregulate glutathione and autophagy to protect against sickness⁴⁸
- **5. Nutritional ketosis:** activates the Nrf2 pathway that lowers inflammation and oxidative stress⁴⁹
- 6. Regular sunlight: the most bioavailable source of vitamin D is the sun⁵⁰
- **7. Reduce elevated cortisol (recovery):** stress is one of the major contributors to an unbalanced immune system and predisposition to diseases^{51 52}
- **8. Sleep:** melatonin is also a powerful antioxidant that modulates autophagy and deep cell repair during sleep.^{53 54} The body repairs itself primarily during deep sleep.

🗸 REGULAR SUNLIGHT

The most bioavailable source of vitamin D is the sun.²⁰² You should get daily sunlight exposure as often as you can, but avoid getting burnt. The best time for sunlight is in the morning to help in balancing the circadian rhythm, which also has an effect on the function of the immune system.²⁰³ The immune system actually has its own circadian clocks, and when disturbed, the immune system also is disrupted.²⁰⁴

⁴⁶ Castellani J. & M Brenner, I. & Rhind, S. (2002). Cold exposure: human immune responses and intracellular cytokine expression. *Medicine & Science in Sports & Exercise* 34 (12): 2013–2020. Review.

⁴⁷ Janský, L. et al. (1996). Immune system of cold-exposed and cold-adapted humans. *European Journal of Applied Physiology and Occupational Physiology* 72 (5-6): 445–450.

⁴⁸ Anton, S. et al. (2018). Flipping the Metabolic Switch: Understanding and Applying the Health Benefits of Fasting. Obesity (Silver Spring, Md.) 26 (2): 254–268.

⁴⁹ Milder, J. & Patel, M. (2012). Modulation of oxidative stress and mitochondrial function by the ketogenic diet. *Epilepsy Research* 100 (3): 295–303.

⁵⁰ Nair, R. & Maseeh, A. (2012). Vitamin D: The "sunshine" vitamin. *Journal of Pharmacology & Pharmacotherapeutics* 3 (2): 118–126.

⁵¹ Segerstrom, S. & Miller, G. (2004). Psychological stress and the human immune system: a meta-analytic study of 30 years of inquiry. *Psychological Bulletin* 130 (4): 601–630.

⁵² Dhabhar, F. (2014). Effects of stress on immune function: the good, the bad, and the beautiful. *Immunologic Research* 58 (2-3): 193–210.

⁵³ Reiter, R. & Tan, D. & Fuentes-Broto, L. (2010). Melatonin: a multitasking molecule. *Progress in Brain Research* 181: 127–151.

⁵⁴ Boga, J. et al. (2019). Therapeutic potential of melatonin related to its role as an autophagy regulator: A review. Journal of Pineal Research 66 (1): e12534.

ENVIRONMENTAL PREVENTION AND TECHNOLOGICAL INTERVENTIONS

- Be mindful about surfaces: influenza viruses can survive up to 24 hours on hard surfaces and longer in more protected and moist environments. Flu viruses survive only 5–15 minutes on hands or tissues.⁵⁵
- 2. Be mindful of what & where you eat: avoid eating in restaurants of poor hygiene
- 3. Go contactless: use contactless payment cards instead of paper money⁵⁶
- 4. Wash your hands: soap and water are best for washing hands^{57 58}
- 5. Wipe your phone daily with an antiseptic towel⁵⁹

Air travel during pandemic

- Do not dry your hands in jet air or warm air dryers
- Do not immediately queue to the plane. Crowded areas at one airport increase exposure to respiratory pathogens.⁶⁰
- Always use a paper towel or disinfectant wipe to touch doorknobs and locks
- Disinfect the seat belt buckle, armrests, remote control, touch screen, tray table, and overhead air vent buttons with a disinfectant wipe before you touch them

- ⁵⁶ Angelakis E. et al. (2014). Paper money and coins as potential vectors of transmissible disease. Future Microbiology 9 (2): 249–261. Review.
- ⁵⁷ Hirose, R. et al. (2019). Situations Leading to Reduced Effectiveness of Current Hand Hygiene against Infectious Mucus from Influenza Virus-Infected Patients. *mSphere* 4 (5): e00474-19.
- ⁵⁸ Tuladhar, E. et al. (2015). Reducing viral contamination from finger pads: handwashing is more effective than alcohol-based hand disinfectants. *Journal of Hospital Infection* 90 (3): 226–234
- ⁵⁹ Martina, P. et al. (2019). Dangerous passengers: multidrug-resistant bacteria on hands and mobile phones. Journal of Preventive Medicine and Hygiene 60 (4): E293–E299.
- ⁶⁰ Bailey, E. & Choi, J. & Zemke, J. & Yondon, M. & Gray, G. (2018). Molecular surveillance of respiratory viruses with bioaerosol sampling in an airport. *Tropical Diseases Travel Medicine and Vaccines* 4: 11.

⁵⁵ Choices, N. H. S. (2015). How Long Do Bacteria and Viruses Live Outside the Body. 10 August 2018. https://www.nhs.uk/common-health-questions/infections/how-long-do-bacteria-and-viruses-live-outside-the-body/ [date of reference: 12.02.2020]

TECHNOLOGICAL TOOLS FOR REDUCING PATHOGEN Exposure

- **1. Light technologies:** light therapy has been used in many kinds of situations and health problems to promote healing of the target tissue(s). Light technology can also be used to improve immunity and kill off pathogenic microbes.⁶¹
 - Blue light therapy (400-450 nm)
 - Red- and near-infrared light (780-940 nm)
 - Ultraviolet light-emitting diodes (UV-LEDS) for disinfection
 - Photodynamic inactivation (PDI) methods
- **2. Air purification technologies:**⁶² indoor air can be 2–5 times (and sometimes up to 100 times) more polluted than fresh outdoor air.⁶³ Air purification techniques include for example:
 - Cleaning and wiping off dust from surfaces⁶⁴
 - Ventilating home frequently
 - Air purifiers and an ionizers
 - Plants that purify indoor air. Plants recommended by NASA include for example gerbera daily, bamboo and peace lily.⁶⁵
 - Sunlight inactivates microbes under daylight conditions. When the sun is up, open up the curtains to let the sunlight in.
 - Use essential oils (eucalyptus, cinnamon, clove, rosemary)

⁶³ EPA. (2016). Air and Radiation: Indoor Air Quality. U.S. Environmental Protection Agency.

⁶¹ de Freitas, L. & Hamblin, M. (2016). Proposed Mechanisms of Photobiomodulation or Low-Level Light Therapy. IEEE journal of selected topics in quantum electronics : a publication of the IEEE Lasers and Electro-optics Society 22 (3): 7000417.

⁶² Jiang, X. & Mei, X. & Feng, D. (2016). Air pollution and chronic airway diseases: what should people know and do? *Journal of Thoracic Disease* 8 (1): E31–E40.

⁶⁴ Lopez, G. & Kitajima, M. & Havas, A. & Gerba, C. & Reynolds, K. (2014). Evaluation of a disinfectant wipe intervention on fomite-to-finger microbial transfer. *Applied and Environmental Microbiology* 80 (10): 3113–3118.

⁶⁵ Wolverton, B. & Johnson, A. & Bounds, K. (1989). Interior landscape plants for indoor air pollution abatement. NASA 1–22.

If you have symptoms, consider the safety of others:

- Use a face mask and ensure a tight fit if you are sick
- Isolate yourself from others until you are well
- Cough into a handkerchief or your elbow never into your hands
- Dispose used handkerchiefs immediately
- Avoid touching public surfaces without gloves on



DETECTING AN INFECTION

Consider getting yourself checked by a medical doctor if you have many of the following symptoms:

- Red or runny eyes
- Loss of smell or taste
- Runny nose or sneezing
- Difficulty breathing or swallowing
- Sore throat, cough or wheezing
- Changes in skin color
- Swollen tongue or lymph nodes
- Headache, photosensitivity or sensory distortions
- Stomach pain, cramps, diarrhea or vomiting
- Internal bleeding or bloody stool
- Skin rashes or bleeding
- Joint or muscle aches
- Sinus, ear or urinary tract infection

LABORATORY TESTING AND SELF-QUANTIFICATION

Pay attention to the following biomarkers that can be quantified at home with wearables and finger blood tests.

- Body temperature
- Resting heart rate
- Heart-rate variability (HRV)
- Respiratory rate continuously
- C-reactive protein (CRP)

These tests should be performed in a rested state and values can be influenced by alcohol, drugs, heavy exercise and sleep deprivation.

You can take these basic laboratory tests to evaluate the possibility of an infection:⁶⁶

- C-reactive protein (CRP)
- Complete blood count
- White blood cell count (WBC count), in particular consider also taking WBC differential
- Polymorphonuclear leukocyte counts (to distinguish between bacterial and viral infections)
- Procalcitonin (PCT)
- Interleukin-6 (IL-6)

⁶⁶ Kapasi, A. & Dittrich, S. & González, I. & Rodwell, T. (2016). Host Biomarkers for Distinguishing Bacterial from Non-Bacterial Causes of Acute Febrile Illness: A Comprehensive. Review. *PloS one* 11 (8): e0160278.

RECIPE: FERMENTED FOODS

Find many more recipes in the <u>Flu Guide</u>. There are also great recipes in the <u>Biohacker's</u> <u>Invincible Immunity Book</u>.

RECIPE PIMP YOUR FERMENTED FOODS Buy an organic sauerkraut or kimchi box from the food store, then do the following to make a delicious meal: • 100–150 grams of fermented foods on a plate • Add in some lemon juice, ginger juice and salt to taste • Add a pinch of black pepper, cayenne pepper & turmeric • 50 grams of lingonberries • 4 large brazil nuts (for selenium) 2–4 organic pasture-raised boiled eggs (running yolk) • Pour into a glass 200 ml of seabuckthorn juice and mix in 1 000 mg of lactoferrin (open up capsules and pour in) Enjoy the meal with gratitude and take your time.

CONCLUSION

The best way to protect yourself from new pathogens comes through balancing the basic elements of your life: sound sleep, diverse whole-food diet, adequate exercise and movement, proper stress management and recovery, reduced alcohol and cigarette use, positive outlook on life and fixing possible nutritional deficiencies.

In times of an epidemic, it is a great excuse to change your lifestyle. A well-functioning immune system is a reflection of the total state of health of the body. A healthy person is an ecosystem of different life-forms that live in balance with each other and the environment. This is called the *holobiont* which is essentially a collection of the host (human) and many other species living in and around it (colonies such as the microbiome, fungiome and virome), which together form a discrete well-functioning ecological unit.

Best recommendations for supplements, nutrients and technological tools for protecting your immune system and attacking pathogens presented in this guide are found in the bonus materials page.

THE COMPLETE BIOHACKER'S FLU GUIDE

The **Biohacker's Flu Guide** is the most comprehensive guide available for natural, nutritional and technological prevention of infections based on 260+ research articles and references, mainly meta-studies published in the last couple of years. **In this 60-page complete guide we cover the following:**

- Transmission of viral and bacterial diseases
- Immune system and how it functions
- Behavioral strategies for strengthening the immune system
- Nutrients, foods, supplements, and herbs relevant to the immune system
- Foods and substances that can weaken the immune response
- Common supplements and drugs that show no promise in infection prevention
- Technological and practical interventions to prevent infections
- Air purification and adequate disinfection
- Detecting an infection with laboratory testing and self-quantification
- Biohacking air travel
- Food recipes for supporting the immune system

Buy the Flu Guide here.