

Glossary

- Adrishta** A word meaning invisible force in Sanskrit Language.
- Acne** A common skin disease when pores are clogged.
- Actinobacteria** A phylum of Gram-positive bacteria.
- ATP** Adenosine triphosphate, the energy currency in living organisms.
- Amylase** An enzyme that converts starch and glycogen into glucose.
- Alginate** A polysaccharide produced by some bacteria prominent during lung infections.
- Akkermensia muciniphilia*** A bacterium that resides in human intestine and may be involved in obesity and other diseases.
- Androstenol** A male pheromone that can cause attraction to women.
- Androstenone** A pheromone found in urine and axillary sweat in humans.
- Animalcule** A microscopic animal.
- Anthrax** An infection caused by the bacterium *Bacillus anthracis*
- Anti-proteases** Molecules designed to inhibit the activity of proteases.
- Apigenin** A natural plant product with numerous health benefits.
- Apoptosis** A process of programmed cell death.
- Archaea** Microbes resembling bacteria with unique chemical features.
- Aspergillus oryzae*** A fungus found in fermented foods rich in enzymes like amylase and lipases.
- Atopobium spp.** Bacteria associated with vaginosis and other diseases.
- Atopic dermatitis** A type of eczema when the skin becomes red and itchy.
- Azoreductase** An enzyme that can activate and de-activate drugs.
- Bacterium** Single-cell organism lacking organelles.
- Bacteriodes*** Anaerobic bacteria also found in humans.
- Bacteriodes fragilis*** A bacterium associated with good health in Malawian children.
- BC** Before Christ.
- Bifidobacterium breve*** A bacterium with wide ranging health benefits.
- Bifidobacterium fragilis*** A bacterium in the gut that helps fortify the immune system.

- Bioinformatics** A subject that utilizes computational tools to analyze biological data.
- Bile acid** An acid produced by the liver and is involved in the digestion of fatty acids.
- Bisphenol A** A chemical utilized in the synthesis of plastic that interferes with the endocrine system.
- 2,3 Biphosphoglycerate** A metabolite involved in the release of oxygen from haemoglobin.
- Biofilms** Exopolysaccharides produced by microbes for a variety of functions.
- Body Mass Index BMI** The measurement of body fat based on height and weight.
- Butanoic acid** A short-chain fatty acid with an unpleasant smell.
- Cadaverine** A polyamine responsible for malodour.
- Cadmium** A metal pollutant that leads to dysbiosis
- Carbohydrates** Biomolecules essential for energy production.
- Carboxymethyl cellulose (CMC)** A food additive derived from cellulose.
- Carnitine** A naturally occurring amino acid involved in the metabolism of fats.
- Catecholamine** Catechol containing molecules that are hormones or neurotransmitters.
- Cefoxilin** An antibiotic that blocks the synthesis of bacterial cell wall.
- Cellulose** A polymer of β -glucose found mostly in plant products.
- Chitin** A biomolecule containing N-acetylglucosamine.
- Chitinase** An enzyme that breaks chitin into N-acetylglucosamine.
- Chromosome** Nuclear material where genes are stored.
- Clostridium difficile*** A bacterium involved in a variety of diseases that may become resistant to antibiotics.
- Clostridium symbiosis*** A bacterium that helps in cellulose metabolism and can reverse growth deficit.
- Chlorhexidine** A disinfectant found in mouthwash.
- COPD** A chronic obstructive pulmonary disease characterized by breathlessness.
- Creatine** A nitrogen containing compound involved in ATP (energy) homeostasis.
- Crohn's Disease** A disease of the bowel characterized by abdominal pain.
- Curcumin** A plant product with anti-oxidant and anti-inflammatory properties.
- Cystic fibrosis** A genetic disease that primarily affects the lungs.
- Dahi** A fermented milk product originating from India.
- Deoxyribonucleic acid DNA** The chemical carrying genetic information.
- Desulfovibrio spp.*** A bacterium associated with increased consumption of alcohols and preserved foods.
- Dermicidin** An anti-microbial peptide secreted by human sweat glands.
- Dopamine** A chemical secreted by the brain cells.
- Dosa** A pancake made from fermented batter of lentils.
- Dysbiosis** An imbalance of microbial system in the human body.
- Ebola virus** A virus causing severe hemorrhagic fever.
- Escherichia coli Nissle*** A bacterium used as a probiotic for a variety of gastrointestinal ailments.

- Enzymes** Biomolecules that catalyze biochemical reactions and are mostly proteins.
- Enterobacteria spp.*** A bacterium that is abundant during irritable bowel syndrome.
- Enterotype** A classification system based on the bacteria residing in the human gut.
- Erythropoietin EPO** A hormone produced in the kidney that promotes the formation of red blood cells.
- Ethyl phenyl sulphate** A chemical of microbial origin that may be associated with autism.
- Eubacterium ramulus*** A gut microbe that can metabolize flavonoids and may lead to weight gain.
- Eukaryote** An organism with a nucleus.
- Fatty liver disease** A disease of the liver resulting in the accumulation of triglycerides.
- Firmicutes*** A phylum of usually rod-shaped bacteria.
- Filaggrin** A protein involved in skin maturation.
- Flavanoids** A group of plant-derived polyphenol containing compounds with numerous health benefits.
- FOS** Fucosylated oligosaccharides (prebiotics) usually found in milk that favour the growth of beneficial bacteria.
- Fucosylated** The process of adding fucose, a hexose deoxy monosaccharide.
- Fungus** A single-cell or multinucleate organism.
- Fusobacteria*** A family of slender rod-shaped bacteria.
- Galactosidase** An enzyme that breaks chemical bonds made up of galactose.
- GABA** γ Amino butyric acid is a neurotransmitter that reduces neuronal activity.
- Gastric juice** A colourless acidic liquid secreted by the stomach.
- Glucagon like peptide (GLP)** A biomolecule that works like the hypoglycemic hormone glucagon.
- Glutathione transferase** An enzyme that adds glutathione to other molecules.
- Gene** Contains DNA and carries instruction to make proteins.
- Genome** All the genetic material in an organism.
- Gnotobiotic** An environment without microbes.
- GOS** Galactose-containing oligosaccharides that are prebiotics.
- Granulicella*** A genus of bacteria abundant in individuals with dental cavities.
- Halitosis** A disease characterized by bad breath.
- HDAC** Histone deacetylases are a class of enzymes that regulate nuclear metabolism.
- HDL** High density lipoprotein, a marker of healthy cholesterol.
- Helicobacter pylori*** A bacterium that can infect the stomach.
- Hydrogen sulphide** A gas that helps in blood flow in the arteries.
- HMP** Human Microbiome Project is an initiative to identify all the microbes found in humans.
- Hydrothermal Vent** A fissure with geo-thermally heated water.
- Hyperoxaluria** A disease characterized by high oxalate levels in the urine.
- Hypothiocyanite** A natural anti-microbial.
- Homocysteine** An amino acid found in high amounts during some diseases.

- Interleukin-12** A natural protein involved in immune response.
- Inulin** A dietary fibre containing fructans.
- Irritable bowel syndrome** A common disease affecting the large intestine.
- Kefir** A fermented milk beverage.
- Kimchi** A fermented Korean staple made of cabbage and other vegetables.
- Lactobacillus acidophilus*** A bacterium that bestows numerous health benefits.
- Lactobacillus casei*** A bacterium known to decrease symptoms associated with rheumatoid arthritis.
- Lactobacillus rhamnonus*** A bacterium known to improve defecation frequency.
- Lactoferrin** A protein found in milk that has antimicrobial property.
- Lactoperoxidase** An enzyme that has anti-microbial property.
- Lactase** An enzyme involved in the digestion of lactose, the sugar in milk.
- LDL** Low density lipoprotein, a marker for unhealthy cholesterol.
- Leptin** A hormone synthesized by adipose tissues that is involved in energy balance.
- Leucine** An essential amino acid for humans.
- Lignin** A phenolic polymer found in plants.
- Lima Syndrome** A feeling of affection of kidnappers for their victims.
- Linoleic acid** A polyunsaturated omega fatty acid with numerous health benefits.
- Lipase** An enzyme that breaks bonds involving fatty acids.
- Lipids** Biomolecules containing or derived from fatty acids.
- Lipoic acid** An organosulfur containing chemical with numerous biological properties.
- Lipopolysaccharide** A chemical containing both lipid and polysaccharide.
- Luciferin** A light-emitting compound found in living organisms.
- Lymphoma** Cancer of the lymph nodes.
- Mawe** A fermented maize dough.
- Meconium** The first stool of human infant.
- Melanin** Natural pigments found in the skin.
- Mercury** A metal pollutant that promotes microbial imbalance in the body.
- Meta organisms** The disparate biological entities residing within a living system.
- Metabolites** Products formed and utilized during metabolism.
- Metabolome** All the metabolites in a living organism.
- Metagenome** All genetic material from a natural sample in the environment.
- Metformin** A medication for type II diabetes that may impede the mobility of the gut.
- Micro-array** A laboratory technique to detect DNA and RNA.
- Microbe** Single-cell organism invisible to the naked eyes.
- Microbiome** All microbes within and on an organism.
- Microbiota** Microbes inhabiting an ecosystem.
- Miso** A Japanese seasoning obtained by fermenting soya beans.
- Moraxella spp.*** A genus of bacteria found in nasal cavities and lungs.
- Mucin** Glycoproteins found in mucus.
- NGS** Next generation sequencing involves the modern techniques to sequence DNA and identify organisms in their natural environments.

- Nanotag** A molecular identifying label.
- Necrotizing enterocolitis** A disease when damaged intestinal tissue begins to die.
- Nitric oxide** A biological gas involved in numerous bodily functions.
- Nitrogen Fixers** Organisms that can convert nitrogen in the air into ammonia.
- Nitroreductases** Enzymes involved in the reduction of nitrogen containing compounds.
- Nori** Japanese name for edible seaweeds.
- Nucleus** Where all genetic material in a eukaryotic organism is stored.
- Oligosaccharides** Molecules containing a few monosaccharides.
- Organogenesis** A process during which organs develop.
- Oxytocin** A biomolecule linked to humour and laughter.
- PCR** Polymerase Chain Reaction is a technique used to make copies of genes.
- Paleo-diet** A diet consisting of foods like fruits, nuts, roots, vegetables that was available during paleolithic era.
- Parkinson's disease** A degenerative disease that affects the motor system.
- Pasteurization** A process of killing microbes in foods discovered by the French scientist Louis Pasteur.
- Psychobiotics** Probiotics or prebiotics that can help improve mental health by modifying the microbiome in the body.
- Peptidoglycan** A biomolecule containing amino acids and monosaccharides found in microbial cell walls.
- Peptoniphilus*** A genus of Gram-positive bacteria that increases during menopause.
- Prevotella*** A genus of Gram-negative bacteria associated with the oral and vaginal microbial flora.
- Propionobacterium acnes*** A rod-shaped Gram positive bacterium linked to acne.
- PUFA** Polyunsaturated fatty acids contain more than one double bonds and are essential for good health.
- Pilosebaceous** A microscopic exocrine gland in the skin that secretes sebum.
- Phylum** A primary category in the classification of living organisms.
- Polyphenol** A component of numerous foods that has anti-oxidant properties.
- Polysaccharides** Molecules containing numerous simple monosaccharides like glucose.
- Porphyran** A sulphate containing carbohydrate found in seaweeds.
- Porphyromonas gingivalis*** A bacterium responsible for the destruction of gums.
- Porphyrin** A molecule containing pyrrole found in haemoglobin.
- Prebiotics** Nutrients that promote the growth of healthy bacteria in the body.
- Prednisone** A synthetic steroid utilized to treat numerous diseases.
- Probiotics** Live microbes with health benefits.
- Prokaryote** Single-celled organism without a nucleus.
- Prevotella copri*** A bacterium that is abundant during rheumatoid arthritis.
- Proteases** Enzymes that degrade proteins.
- Proteins** Biomolecules containing nitrogen that are essential nutrients for humans.
- Proteobacteria*** A phylum of bacteria found in humans.
- Proteome** All the proteins expressed in a living organism.
- Psoriasis** An autoimmune disease characterized by patches of abnormal skin.

- Rebiosis** A procedure to re-establish microbial balance in the body.
- Rhesus factor** An antigen found in the red blood cells.
- Rheumatoid arthritis** An autoimmune disease resulting in chronic inflammation of the joints.
- Ribonucleic acid RNA** The chemical that decodes genetic information.
- Resvesatrol** A phenolic compound found in numerous plants including grapes and berries linked to healthy outcomes.
- Rosburia spp.*** A genus of anaerobic bacteria in the gut that may be associated with healthy outcomes.
- Rumen** The first chamber of the alimentary canal of ruminants that serves as the primary site of microbial fermentation.
- Ruminococcus gnavus*** An intestinal bacterium that can metabolize mucin.
- 16S rRNA** 16 S ribosomal ribonucleic acid gene is utilized to identify and classify bacteria.
- Sake** A Japanese rice wine.
- Sialic acid** A chemical found in human milk associated with good health in infants.
- Sebum** The oily secretion of the skin.
- Serotonin** A neurotransmitter associated with mood and happiness.
- Shoyu** A dark brown liquid obtained from fermented soya beans.
- Skin cartography** Metabolites and bacteria on the skin indicative of a specific individual.
- Sorivudine** A thymine analogue serving as anti-viral drugs.
- Species** A group of organisms with similar genetic information that they can exchange.
- Starch** A polymer of α glucose and an important source of energy in humans.
- Stockholm Syndrome** A feeling of affection of the victims towards their kidnappers.
- Strain** A genetic variant of a microorganism.
- Staphylococcus aureus*** A bacterium that increases during atopic epidermis.
- Staphylococcus epidermis*** A bacterium being introduced in cream to fight dermal dysbiosis.
- Staphylococcus horminis*** A bacterium associated with the worst odour in humans.
- Streptococcus*** A genus of bacteria associated with a variety of infections.
- Supraorganism** Collection of different organisms that behave like a single entity.
- Synbiotics** A mixture of prebiotics and probiotics given to restore healthy microbes in the body.
- α Synuclein** A neuronal protein involved in Parkinson's disease.
- Thioalcohol** An alcohol containing sulphur associated with strong odours.
- Triclosan** A chemical added to a variety of consumer products in order to reduce bacterial contamination.
- Trimethylamine oxide (TMAO)** A metabolite produced by gut microbes and linked to various diseases.
- Treponema*** A genus of spiral-shaped bacteria found in rural communities in Africa and is linked to good health.

Tryptophan An essential amino acid.

Ulcerative colitis A disease that causes inflammation in the large intestine.

Uncoupling protein (UCP) A protein that dissipates the proton gradient and is responsible to make energy in the mitochondria.

Ugi A porridge made of corn and millet.

Urate A chemical derived from nucleic acid metabolism that can result in gout.

Trait Characteristic belonging typically to a specific organism or individual.

Vaginosis A disease of the vagina caused by microbes.

Verrucomicrobacteria A phylum of wart-shaped bacteria found in human.

Virus Single-cell organism that needs other organisms to live.

Vitamin B An essential nutrient involved in metabolism.

Vitamin K An essential nutrient involved in blood coagulation.

XOS Xylose containing oligosaccharides that are probiotics.

Yakult A Japanese milk drink rich in probiotics.

Zika virus A virus that causes the Zika fever, a disease associated with red eyes and joint pain.

Index

A

Acetate, 72, 98
Acetobacteria, and psoriasis, 86
Acidic stomach, 69–70
Acne, dysbiosis and, 84, 85f
Acquisition of microbiome, 39f
Actinobacteria, 31
 adults, 48, 70
 factors contributing to establishment of, 41
 food factor and, 49
 life-style and climate, effect of, 55
 mercury exposure, 52
 skin, 63
Activity-specific microbiomes, 154–156, 155f
Adaptability of immune system, 58–60, 59f
Adenosine triphosphate (ATP), 7, 9
Adrista, 10
Adult(s)/hood
 evolution of microbiome, 46–49
 microbiome, modulators of, 57f
Ageing, 57–58
Agro-food business, 147–149
Akkermansia, 115
Akkermansia muciniphilia, 32, 109
Alzheimer's disease, 98
Ampicillin, 83
Amylase, 20
Anemia, pernicious, 25
Animalcules, 14
Animal lovers, 55–56
Anthrax, 16
Anthrocyanins, and obesity, 117f
Apigenin, 71
Aspergillus oryzae, 106
Asthma, dysbiosis and, 90–91

Atopobium, urogenital tract, 76
Autism spectrum disorders (ASD), 99
Azotobacter vinelandii, 16

B

Bacillus, 105
Bacillus anthracis, 14, 16
Bacillus cereus, 105
Bacteriodes, 31, 32, 102, 115
 bile secretion, 108
 and cancer, 100
 and rheumatoid arthritis, 91
Bacteriodes fragilis, 32
Bacteriodes plebeius, food factor and, 50
Bacterioidetes, 52
 adults, 48, 70
 cadmium exposure, 52
 and dental cavities, 89
 factors contributing to
 establishment of, 41
 food factor and, 49
 intestine, 69
 and irritable bowel syndrome, 95
 life-style and climate, effect of, 55
 lungs, 77
 mercury exposure, 52
 and obesity, 95, 129
 and rheumatoid arthritis, 91
 short-chain fatty acids and, 72
 skin, 63, 64
 solid foods and microbiome enhancement,
 45, 46
Bacteroides fragilis
 breast milk and, 44–45
 gastrointestinal tract, 75

- Behavior
 control, 137–139
 modification, 139f
- Bifidobacterium*, 32, 83, 104–107, 109, 115, 116
 adult human gut, 70
 ageing and, 58
 bile secretion, 108
 breast milk and, 43–44
 in elderly patients, 111
 factors contributing to establishment of, 41
 food intake and, 94
 gastrointestinal tract, 75
 intestine, 68
 and necrotizing enterocolitis, 110
 and physiological abnormalities, 110
 pre-term babies, 40
- Bifidobacterium animalis*, 105, 112
Bifidobacterium bifidum, and cancer, 113
Bifidobacterium breve, 105
Bifidobacterium fragilis, and neurobiological disorders, 99
Bifidobacterium longum, 112
- Bile, 108
 Biogenesis of microbiome, 125f
 Biological traits on demand, 133–134
 Bisphenol A, 47
 2,3-Biphosphoglycerate (2,3-BPG), 42, 51
 Blood group classification, 127f
 Body mass index (BMI), 138, 151
 Body odour, and skin microbiota, 65
 Breast milk, 43–45, 45f
 Bubonic plague, 16
 Butyrate, 72, 98, 114
- C**
- Cadaverine, 102
 Cadmium exposure, 52
Campylobacter, and neurobiological disorders, 99
 Cancer, 99–101
 colorectal, 100f
 Carbon cycle, 17, 18f
 Carbonic anhydrase, 3
 Carboxymethyl cellulose (CMC), 94
 Cardiovascular diseases, 94–97, 97f
 Cefoxilin, 83
 Cellulase, 19, 21
 Cellulose, 19, 21
 Centenarins, microbial tango with, 57–58
 Character adjustment on demand, 134–135, 136f
- Character modifying microbiome, 128, 129f
 Chemical exposure, influence on microbiome, 51–52
- Childhood
 evolution of microbiome, 46–49
- Chitinases, 22
 Chloroplast, 6
 Chronic obstructive pulmonary disease (COPD), 89, 90f
- Climate, effect on microbiome, 54–55
- Clostridia*, 52
 breast milk and, 45
 food intake and, 93
 and neurobiological disorders, 99
 and rheumatoid arthritis, 91
 solid foods and microbiome enhancement, 45
- Clostridium difficile*, 83
 ageing and, 58
 in elderly patients, 111
 and fecal transplant, 141
 food intake and, 93
- Clostridium symbiosis*, 32
- Cobalamin, *see* Vitamin B12
- Colorectal cancer, 100f
- Corynebacterium*, 150
 body odour and, 65
 skin, 64
- p*-Cresol, 99
- Crohn's disease, 95
- Culinary culture, 11–13
- Curcumin, 74
- Cystic fibrosis (CF), dysbiosis and, 89–90
- D**
- Dermal dysbiosis, 84–86
 and acne, 84, 85f
 and asthma, 90–91
 and cystic fibrosis, 89–90
 and eczema, 86
- Designer babies, 133–134, 135f
- Designer foods, 150f
- Desulfobulbus*
 and dental cavities, 87
 and gum infections, 130
- Desulfovibrio*, 93
- Dietary fibre, 71f
- Digestion, 67
- Digestive tract, microbial imbalance in, 91–92, 92f
- Disease-fighting ability, fortification of, 132–133, 133f

- DNA (deoxyribonucleic acid), 2, 3
 profiling, 27
 technology, 124
- Dopamine, 75, 97, 99, 129, 138
- Dysbiosis, 83, 83f, 84f, 103f
 dermal, 84–86, 85f
 food additives and, 94
 link between probiotics,
 prebiotics and, 120f
 and neurological disorders, 98f
 pulmonary, 89–91
- E**
- Ear wax transplant, 110f, 112f
- Ebola virus, 155
- Eczema, dysbiosis and, 86
- Eggerthella lenta*, 74
- Energy, 9
 expenditure, gut microbiome and, 71–72
- Enterobacteriaceae*, and physiological
 abnormalities, 110–112
- Enterobacteriae*
 and irritable bowel syndrome, 95
 and neurobiological disorders, 99
- Enterococcus*, 32, 105
 bile secretion, 108
- Enterotype I, 127
- Enterotype II, 127
- Enterotype III, 127
- EPO, 148
- Escherich, T., 25
- Escherichia coli*, 25, 83, 105, 118
 Nissle, 105, 112
 sex hormones, 54
- Essential amino acids, 26
- 4-Ethyl sulphate (4-EPS), 99
- Eubacterium ramulus*, and weight loss, 71
- Evolution of microbiome, 46–49, 47f
- Exercise enthusiasts, 56
- F**
- Faecalibacterium*, and rheumatoid
 arthritis, 91
- Fecal transplant, 141, 141f
- Fermentation, 11–13
 history of, 12
 primordial, 12
- Firmicutes*, 31
 adults, 48, 70
 ageing and, 58
 and dental cavities, 89
 factors contributing to establishment of, 41
 food factor and, 49
 intestine, 69
 and irritable bowel syndrome, 95
 life-style and climate, effect of, 55
 lungs, 77
 and obesity, 129
 pollution, effect of, 52
 and psoriasis, 86
 and rheumatoid arthritis, 91
 short-chain fatty acids and, 72
 skin, 63
 solid foods and microbiome
 enhancement, 46
- First colonizers of planet earth, 2–4
- Flavanoids, 71
- Flavanone reductase, 71
- Food additives, and dysbiosis, 94
- Food factor, 49–50
- Food intake, and microbial perturbation,
 92–94, 93f
- Fortification
 of disease-fighting ability, 132–133, 133f
 of immune system, 64–67
- Fucosylated oligosaccharides (FOS), 43, 45f
- Fusobacteria*, 31, 48
- G**
- Gamma-aminobutyric acid (GABA), 75, 97
- Ganaderma lucidum*, 130
- Gardnerella vaginalis*, 102
- Gastrin, 3
- Gastroduodenal ulcers, 113
- Gastrointestinal microbiota, 75, 75f
- Geography, and organ development,
 42, 43f
- Germ theory, 16–18
- Global positioning system (GPS), 27
- Granulicella*, dental cavities and, 69
- Grass grazers, and microbial connection,
 19–21
- Gum diseases, 129–130
- Gutless worm, 22–23, 23f
- Gut microbiome, 70–75
 and energy expenditure, 71–72
 physiological significance of, 73f
 and weight loss, 71–72
- Gut pharmacy, 73–74
- H**
- Hadza (hunter-gatherer community), 51
- Hailtosis, 88f
- Heart diseases, 129–130

Helicobacter, digestive tract, 91
Helicobacter pylori, 32
 acidic stomach, 69
 and gastroduodenal ulcers, 113
 and lymphomas, 113
 Hippocrates, 115
 Histone deacetylase (HDAC), 72
 Hormonal fluctuations, 53, 54f
 Human–microbe bonding, 23–24
 Human Microbiome Project (HMP), 25,
 29–30
 goals and potentials of, 30
 Human tick, 2–3
 Hydrochloric acid, 3

I
 Immune system, fortification of, 64–67
 Indispensable invisible partners, 18–19
 Indispensable organ, 77–78
 Infants
 vulnerable diseases, rescue of, 110–112
 Influenza, 90
 Interleukin-1, 66
 Interleukin-12, 72
 Invisible organ, 124–126
 Invisible organ, 24, 39–40
 distress of, 82–83
 functions of, 60–63, 61–63f
 rejuvenation of, 119f
 Invisible soldiers in the gut, 67–69, 68f
 Invisible world, 11–13
 unmasking, 13–15
 Irritable bowel syndrome (IBS), 93f, 95, 105,
 111–112

K
 Kellogg, 115

L
Lactobacillus, 38, 52, 82, 105–107, 112, 118
 adult human gut, 70
 bile secretion, 108
 breast milk and, 44
 and chronic obstructive pulmonary
 disease, 89
 food intake and, 94
 intestine, 68
 and necrotizing enterocolitis, 110
 and obesity, 95
 pre-term babies, 40
 sex hormones, 53, 54
 urogenital tract, 76

Lactobacillus acidophilus, 104, 105, 107
 and cancer, 113
 and dental cavities, 87
 in elderly patients, 111
 healing of injuries, 113
Lactobacillus bulgaricus, 104
Lactobacillus casei, and rheumatoid
 arthritis, 91
Lactobacillus johnsonii, 132
Lactobacillus lactis, 107
Lactobacillus reuteri, 118
Lactobacillus rhamnosus, 105
 and dental cavities, 107
 in elderly patients, 111
Lactobacillus salivarius, and dental
 cavities, 87
Lactococcus, 14, 106, 107
 Lactoferrin, 43
 Lead exposure, 52
 Leprosy, 16
Leucomostoc, 105, 107
 Life-style, effect on microbiome, 54–55
 Lignin, 22
 Lima syndrome, 147
 Lipopolysaccharide (LPS), 45, 96, 116, 129
 Location of microbiome, 39–40
 Location-specific microbiomes, 154–156
 Luciferin, 22
 Lucine, 26
 Lungs, 77
 development, 48f
 Lymphomas, 113

M
 Malleability, 58–60
 Maturation of microbiome, 51–52, 53f
 Melamine, 132–133
 Melanin, 43
 Mercury exposure, 52
 Metabolite, 3
 Metchnikoff, Eli, 103–104
 Microbes
 in ancient civilizations, 10, 10f
 cooking with, 12
 discovery of, 15–16
 friendly, 16–18
 glimpse at, 31–35, 31–35f
 and human, bonding between, 23–24
 as harvester and provider of energy, 9
 origin of, 6–8, 7f, 8f
 at the service of humankind, 17, 18f
 ubiquitously, 4–5, 6f
 visualization of, 14f, 24–29

Microbial discovery, historical perspective on, 35f

Microbial fingerprinting, 126–128

Microbial imbalance, in digestive tract, 91–92, 92f

Microbial life, diversity of, 4, 5f

Microbial rejuvenation
 of invisible organ, 119f
 of old age, 135–137, 137f

Microbiome
 bank, 139–143, 140–143f
 classification of, 32f
 diversity of, 4, 5f
 factors contributing to establishment of, 41
 genesis and functions of, 37–78
 as health revolution, 143–145, 144–146f
 initiation and development of, 38–39
 nurturing of, 104f
 origin of, 1–35
 prospecting, 149–151, 152f
 screening, 145f
 tracking of, 153–154
See also individual entries

Milk production, 21

Mitochondrion, 6

Molecular elucidation of the microbiome, 126f

Molecular imaging technologies, 27f, 28f, 29

Molecular machines, 4

Mood changes, 97–99

Moraxella, 77

Mouth, 69
 distressed microbial communities in, 86–89, 87f

Mycobacteria leprae, 16

N

Nanofactories, 151–153

National Institute of Health, 30

Necrotizing enterocolitis, 110

Neurobiological disorders, 99

Next generation sequencing (NGS), 26, 27, 29, 124, 157

Nitric oxide (NO), 42

Nitrogen cycle, 17, 18f

Nitrogen-fixers, 18–19

Non-alcoholic fatty acid disease (NAFLD), 96

Nutrition, 43

O

Obesity, 94–97, 97f, 129–130
 anthocyanins and, 117f

Old age, microbial rejuvenation of, 135–137, 137f

Omnipresence of microbes, 6, 11

Organ development, geography and, 42, 43f

Organic pollutants, exposure of, 52

Origin of human microbiome, 1–35
Oxalobacter formigenes, 74

P

Parents microbiome, 39–40

Parkinson's disease, 98, 99

Pasteur, Louis, 12, 14, 15

Peptidoglycan, 45

Peptoniphilus, 54

Pernicious anemia, vitamin B12 and, 25

Pet lovers, 56

Phosphorus, 47

Pollution, effect on microbiome, 52

Polymerase chain reaction (PCR), 26, 27, 29

Polyunsaturated fatty acids (PUFA), 136

Porphyra, 50

Porphyra tenera, 50

Porphyra yezoensis, 50

Porphyromonas gingivalis, 88

Prebiotics, 85, 113–118, 119f, 130, 140
 designer, 149
 fertilizers, 114f
 in everyday foods, 115–118, 115f, 117f
 health impact of, 114f
 link between dysbiosis, probiotics and, 120f

Prevotella, 38, 52
 acidic stomach, 69–70
 ageing and, 58
 breast milk and, 44
 and dental cavities, 87
 food factor and, 49
 and gum infections, 130
 life-style and climate, effect of, 55
 lungs, 77
 pre-term babies, 40
 sex hormones, 53
 urogenital tract, 76

Primary bile acids (PBA), 68

Probiotics, 103–113, 119f
 adjustment with microbial community, 107–109, 108f, 109f
 consumption of, 104f
 as disease fighters, 112–113
 functionality of, 105–107, 107f
 infant's and senior's vulnerable diseases, rescue of, 110–112
 link between dysbiosis, probiotics and, 120f
 occurrence of, 105
 uses of, 105

Probiotics, 130, 140
 Propionate, 72, 98
Propionibacterium, 105, 150
 body odour and, 65
 hormonal fluctuations and, 53
 and necrotizing enterocolitis, 110
 pre-term babies, 40
 skin, 64
Propionibacterium acnes, 84
 Protein, 3
Proteobacteria, 31, 32
 adult human gut, 70
 adults, 48
 ageing and, 58
 factors contributing to establishment of, 41
 food factor and, 49
 intestine, 69
 lungs, 77
 and rheumatoid arthritis, 91
 skin, 63, 64
Provetella
 and cancer, 100
 food intake and, 93
 and neurobiological disorders, 99
 and rheumatoid arthritis, 91
Provetella copri, and rheumatoid arthritis, 91
Pseudomonas aeruginosa, 113
 and cystic fibrosis, 89–90
Pseudomonas fluorescens, 5f, 14
 Psoriasis, 86

R

Recommended dietary allowance (RDA), 26
 Regulation of microbiome, 125f
 Resveratrol, 74
 Rheumatoid arthritis (RA), 91
 RNA (ribonucleic acid), 3
Roseburia, 32
 intestine, 68
Rothia, and rheumatoid arthritis, 91
Ruminococcus
 ageing and, 58
 intestine, 68
Ruminococcus gnavus, 32

S

Salicylazosulfapyridine, 73
 Salivary microbiome, health impact of, 88–89
 SARS, 90
 Secondary bile acids (SBA), 68
 Seniors
 microbial tango with, 57–58
 vulnerable diseases, rescue of, 110–112

Sentinel, 21, 45
 Sex hormones, 53–54
 Short-chain fatty acids (SCFA), 71f, 72, 83,
 93, 97, 98, 105, 114
 Sialic acid, 116
 16S ribosomal RNA (rRNA) fingerprinting, 27
 Skin, 63, 64f, 131, 132f
 cartography, 128, 128f
 distribution of microbes, 64
 microbes, and wound healing, 64–67, 66f
 microbiome, disruptors of, 85
 Solid foods, and microbiome enhancement,
 45–46
 Sorivudine, 132
 Squids, 21
Staphylococcus, 38
 body odour and, 65
 mouth, 69
 pre-term babies, 40
 and psoriasis, 86
 skin, 64
Staphylococcus aureus
 and chronic pruritic inflammatory
 disorder, 85
 and eczema, 86
 sex hormones, 54
Staphylococcus epidermis
 and dysbiosis, 85
 wound healing, 65
Staphylococcus horminis, 65
 Stockholm syndrome, 147
Streptococcus, 38, 105
 and dental cavities, 107
 and eczema, 86
 lungs, 77
 urogenital tract, 76
Streptococcus lactis, 113
Streptococcus mutans, 87, 89
Streptococcus thermophilus, 104, 113
Streptomyces griseus, 16
 Sulfasalazine, 74
 Symbiosis, 20f
 Synbiotics, 118, 118f

T

Teeth development, 48f
Thiobacillus denificans, 16
 Tracking of microbiome, 153–154
Treponema, 50
 Triclosan, 85
 Triglycerides, 96
 Trimethylamine (TMA), 96, 97
 Trimethylamine oxide (TMAO), 97, 130

U

Ulcerative colitis, 95
Uncoupling protein-1 (UCP), 71
Urogenital tract, 76

V

Vaginal health, 76f
Vaginosis, 102f
Van Leeuwenhoek, Antonie, 10, 14, 144
Veillonella, 32, 102
 and dental cavities, 87
 lungs, 77
 mouth, 69
 and neurobiological disorders, 99
 and rheumatoid arthritis, 91
Verucomicrobia, 31
 adults, 48
 intestine, 69
Visible organ, rejuvenation of, 119f
Visualization of microbes, 14f, 24–29
Vitamin A, 47
Vitamin B, 25, 61, 72, 110
Vitamin B1 (thiamine), 68
Vitamin B2 (riboflavin), 68, 118
Vitamin B3 (niacin), 68

Vitamin B7 (biotin), 68
Vitamin B12, 26, 145
 and pernicious anemia, 25
Vitamin C, 47
Vitamin D, 47
Vitamin K, 24, 25, 60, 68, 142

W

Waste management, 17, 18f
Weight loss, gut microbiome and, 71–72
Well-being, 101–103
World Health Organization (WHO),
 104–105
Wound healing, skin microbes and, 64–67, 66f

X

Xenomicrobiomes, 146–147, 148f

Y

Yersina pestis, 16

Z

Zika virus, 155