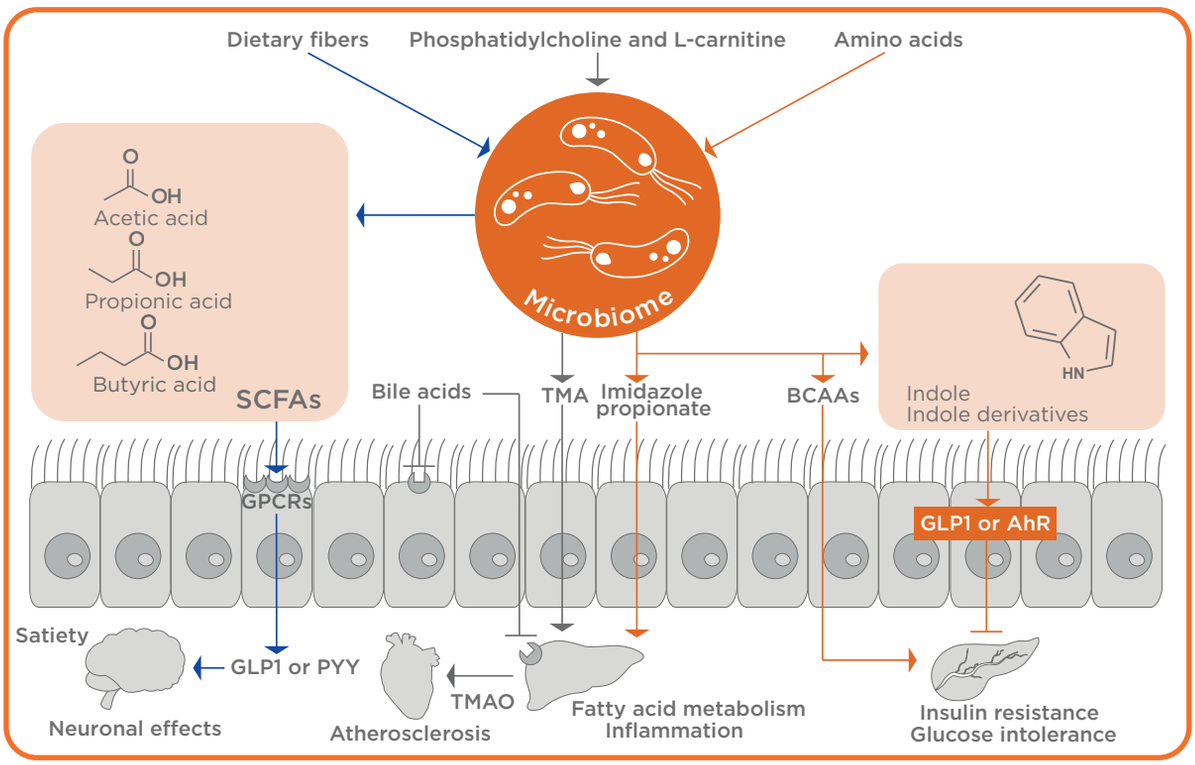
The Breath Biopsy® Microbiome Panel

BREATH® BIOPSY
MICROBIOME PANEL

Owlstone Medical have developed the Breath Biopsy® Microbiome panel that combines precise quantification of functional metabolites originating from the gut microbiome with the convenience of breath collection. These metabolites are exhaled as volatile organic compounds (VOCs) and can be reliably collected and analysed using Breath Biopsy®.



Advantages of Breath

Completely non-invasive, pain free and convenient

Breath testing can be on-demand with high frequency serial sampling

Accessible, with potential to translate to Point-of-Care or home-based testing

How does the Breath Biopsy® Microbiome Panel work?

Lease or purchase the Breath Biopsy® Collection Station, including the ReCIVA® Breath Sampler, and the CASPER® Portable Air Supply to collect high quality breath samples.

Inbuilt sensors in the ReCIVA help maximize the collection of biologically relevant VOCs, from deep within the lungs, which are then adsorbed onto sorbent tubes within the device.

Samples are then analyzed at our specialized Breath Biopsy Laboratory, where TD-GC-MS analysis is performed using high-resolution accurate mass (HRAM) Q Exactive™ Orbitrap systems.

Receive a quantitative data report in table format including compound IDs, supplemented with statistical analysis to investigate specific study objectives, delivered by Owlstone's Medical's expert breathomics team.

Reference datasets for each VOC are available to you in the Breath Biopsy VOC Atlas®. The Atlas is a rich repository of high-confidence breath-related VOCs alongside their clinical, chemical, and biological context.

The Breath Biopsy Microbiome panel offers precise quantification of key metabolites in exhaled breath originating from the gut microbiome previously reported in the literature to have a range of associations with health and disease. You can learn more about the constituents of this panel in the table below:

Bacterial Tryptophan Metabolism	Indole	Indole is a bacterial metabolite of tryptophan and serotonin, and is associated with diseases including depression and liver cirrhosis. A microbial metabolite, it can be produced in a number of bacterial species including Alcaligenes, Aspergillus, Escherichia, and Pseudomonas. Indole has also been identified as a fecal biomarker of Clostridium difficile infection. Indole is thought to play a role in bacterial biofilm formation, bacterial motility, bacterial virulence, plasmid stability, and antibiotic resistance.
	3-methylindole	3-Methylindole, also known as skatole, is produced from tryptophan by microbiota in the mammalian digestive tract. 3-Methylindole has been found to be a bacterial metabolite of members of the Clostridium and Lactobacillus families.
Bacterial Tyrosine Metabolism	4-ethylphenol	4-ethylphenol is produced by intestinal bacterial fermentation of tyrosine. It has been associated with autism spectrum disorder and anxiety.
	p-cresol	p-cresol is a microbial metabolite of tyrosine which is thought to be linked to autism
Organic Sulfur Compounds	dimethyl sulfide	Dimethyl sulfide is an organosulfur compound thought to have dietary and microbial origins.
	dimethyl sulfone	Dimethyl sulfone is a product of the microbial metabolism of methionine and other sulfur containing compounds.
	methyl thiocyanate	VOC produced by pseudomonas aeroginosa and other pseudomonas strains.
	dimethyl disulfide	Dimethyl disulfide, is an organic disulfide and is thought to have a microbial, dietary, and endogenous origin. Dimethyl disulfide is the predominant volatile sulfur compound in breath malodor. In vapor form, it is produced by cooking certain vegetables, notably corn and cabbage, and seafood. It is also an indication of bacterial infection in malt production and brewing. It is a breakdown product of dimethylsulfoniopropionate and is also produced by the bacterial metabolism of methanethiol. This is a microbial metabolite that can be found in Bradyrhizobium, Cyanothece, Escherichia, Pseudomonas aeruginosa, and Rhizobiaceae cultures and is associated with many disease states including kidney and liver disease.
Short Chain Fatty Acids (SCFAs)	acetic acid	Acetic acid is a short chain fatty acid (SCFA) associated with metabolic disease. It is otherwise known as vinegar, and is a component of many dietary substances. On top of this, certain anaerobic bacteria, including Clostridium and Acetobacterium species, can convert sugars directly into acetic acid.
	propionic acid	Propionic acid belongs to the class of short-chain fatty acids (SCFAs) and is thought to have a microbial origin. Propionic acid is present naturally at low levels in dairy products and occurs in the gastrointestinal tract of humans and other mammals as an end-product of microbial carbohydrate digestion. Since propionic acid has three carbons, it cannot directly enter either beta-oxidation or the citric acid cycles for metabolism. Propionic acid is a metabolite of Bacteroides, Clostridium, Dialister, Megasphaera, Phascolarctobacterium, Propionibacterium, Propionigenum, Salmonella, Selenomonas and Veillonella, bacteria found in the gut microbiome. Propionic acid has been associated with various gastrointestinal diseases, including Crohn's disease, colorectal cancer, ulcerative colitis, and irritable bowel syndrome (IBS). It has also been associated with other diseases, such as tuberculosis and chronic obstructive pulmonary disorder (COPD).
	butyric acid	Butyric acid is a short-chain fatty acid (SCFA) produced in the mammalian colon through bacterial fermentation of carbohydrates, including dietary fibre. Butyrate is also found in animal milk and fat as well as plant oils. Butyrate has significant biological roles. In humans, it is thought to act as one of the primary endogenous agonists of the hydroxycarboxylic acid receptor 2 (HCA2), promoting intestinal regulatory T-cells in vitro and showing importance for immune homeostasis. It may also function as an agonist at free fatty acid receptors FFAR2 and FFAR3, which help regulate energy balance.
Branched Chain Fatty Acids (BCFAs)	isovaleric acid	Isovaleric acid is a branched-chain fatty acid derived from the bacterial fermentation of leucine in the colon. It has been suggested to induce colonic smooth muscle relaxation via the cAMP/PKA signaling pathway. Clinically, Isovaleric acid is associated with isovaleric acidemia, a rare genetic disorder resulting from a deficiency of the enzyme isovaleryl-CoA dehydrogenase. This metabolic condition can lead to the accumulation of toxic levels of IVA, causing symptoms such as metabolic acidosis, developmental delays, and a characteristic odor of sweaty feet.
	2-methylbutanoic acid	2-methylbutanoic acid is a branched chain fatty acid produced by the gut microbiota, which has putative positive effects on the gut.
	4-methylpentanoic acid	Also known as isocaproic acid. Produced by Clostridium difficile metabolism of amino acids.
	methyl 2-methylbutyrate	Methyl 2-methylbutyrate is a branched chain fatty acid ester produced by gut bacteria, which could be linked to ulcerative colitis and Crohn's disease.
	isobutyric acid	Isobutyric acid, a branched chain fatty acid, has been suggested to play critical roles in gut health and metabolic regulation. Small amounts of isobutyrate are generated via microbial (gut) metabolism. Isobutyrate may help lower inflammation and improve intestinal barrier function in diabetes. Additionally, the biosynthesis of iso-bile acids such as isobutyrate, linked to the activity of Ruminococcus gnavus, may aid in detoxifying deoxycholic acid and promote expansion of beneficial gut microbes such as the *Bacteroides* species. Small amounts of isobutyrate may also be found in certain foods or fermented beverages.
Bacterial Choline Metabolism	trimethylamine	Trimethylamine (TMA) belongs to the chemical class of amines and is thought to have a microbial origin. Trimethylamine is predominately produced through microbial metabolism of dietary-derived compounds like choline, carnitine, and betaine in the gut. TMA is converted to trimethylamine N-oxide (TMAO) in the liver, and high levels of serum TMAO have been associated with an increased risk of cardiovascular metabolic disease.
Bacterial Acetoin Metabolism	2,3-butanediol	2,3-Butanediol is a glycol, thought to have endogenous and microbial origins. 2,3-Butanediol is metabolized to 2,3-butanedione, with acetoin as an intermediate.
	2,3-butanedione	2,3-Butanedione is an alpha-diketone which can be produced through microbial fermentation, and is also commonly found in processed foods and e-cigarettes. It may be predominantly produced by respiratory tract and pathogenic species, but is also thought to be produced in the gut.
Microbial Alcohols	1-propanol	1-propanol, also known as propyl alcohol, n-propanol, or simply propanol, belongs to the class of organic compounds known as primary alcohols and is thought to have endogenous, microbial, and exposure origins. 1-propanol exists in all living species, ranging from bacteria to plants to humans. Propanol can be produced through the fermentation of sugars by bacteria and yeast, and is significant in biofilm production. Small amounts are produced by gut microflora, and it has been identified as a fecal biomarker of Clostridium difficile infection. When ingested, 1-propanol is metabolised by alcohol dehydrogenase to propionic acid, and this may lead to metabolic acidosis. It can be found in small amounts in alcoholic beverages such as wine. Industrially, the major use of 1-propanol is as a solvent as well as an intermediate in forming other industrially important compounds. It is used as a carrier and extraction solvent for natural products, such as flavorings, vegetable oils, resins, waxes, and gums, and as a solvent for synthetic polymers, such as polyvinyl butyral, cellulose esters, lacquers, and PVC adhesives.
	1-butanol	Produced in trace amounts from butanoate by the gut microbiota.
Other Microbiome Metabolites	gamma-valerolactone	GVL is a metabolite produced by microbial metabolism of polyphenols. They are mooted to have antioxidant properties.
	Isovaleramide	Produced by Ruminococcaceae in the gut, and has been suggested to induce cognitive impairment via microglial apoptosis
	3-methyl-2-butanone	Produced by gut microbiome and linked to dysbiosis.
	2-heptanone	2-Heptanone can be produced by the human microbiome and has been linked to various diseases, including ulcerative colitis, nonalcoholic

For more information about the Microbiome Panel, head over to our dedicated page via the QR code on the right.

If you would like to discuss incorporating the Breath Biopsy® Microbiome Panel in your biomarker research, please contact us at:

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