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Bacterial chemical 'signatures' a sign of damaged gut microbiome in critical illness

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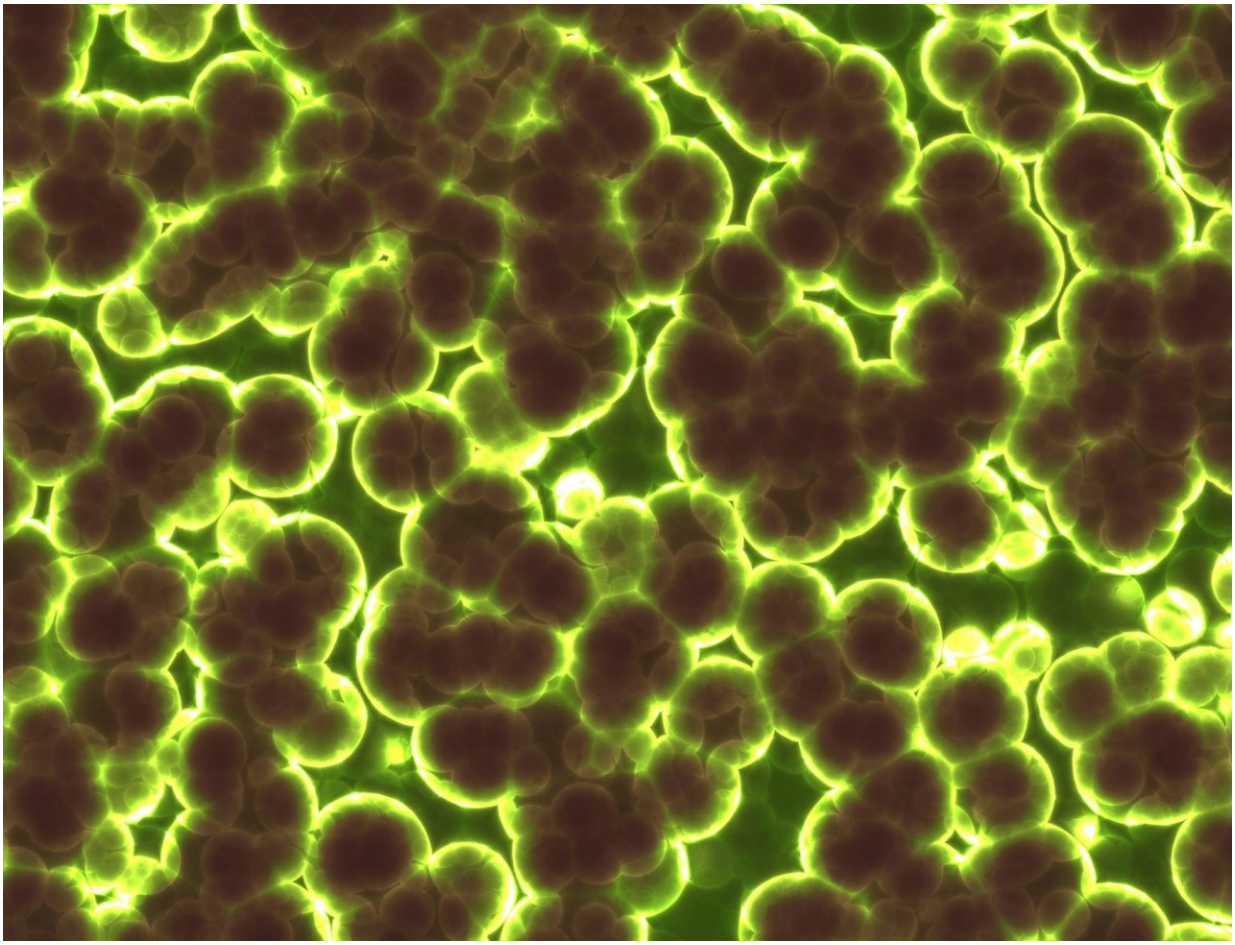

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Chemicals produced by healthy bacteria could be used to assess the

health of the gut microbiome and help identify critically-ill children at greatest risk of organ failure, a study published in *Critical Care Medicine* has found.

The gut microbiome is a trillions-strong community of healthy bacteria that live inside us. They make important contributions to our health, including fermenting the food we eat, making vitamins and regulating our appetite. In critical illness, patients often receive lots of antibiotics, and this may inadvertently damage many healthy gut bacteria.

Children have a less developed microbiome so may be at particular risk following strong antibiotic therapy. If the antibiotics damage healthy gut bacteria, this can result in the loss of important functions of the microbiome and an increase in potentially disease-causing and antibiotic-resistant bugs; in turn, these can cause complications including organ failure.

In this new study, researchers looked at how critical illness affects the functions of the gut microbiome. Researchers examined genetic profiles of gut bacteria and measured levels of chemicals these bacteria produce in 60 critically ill and 55 healthy children. They looked at gut bacterial populations by sequencing the DNA in faecal samples. They then undertook chemical analysis of urine and faecal samples from children participating in the study.

The researchers found that in seriously ill children, the numbers of 'good' bacteria were reduced compared to healthy children. Alongside this, chemicals normally produced by the healthy gut microbiome were dramatically reduced. Levels of some of these chemicals were associated with how sick the children were.

In urine, three bacterial chemicals (called hippurate, formate and 4-cresol sulphate) were dramatically depleted in samples from critically

ill patients.

In faeces, the researchers found patients had lost a group of chemicals called short chain fatty acids. These chemicals, normally produced by healthy gut bacteria, have a number of beneficial activities for the body. These include maintaining a healthy gut lining, regulating appetite and supporting the immune system.

The lead investigator, Dr. Nazima Pathan, from the Department of Paediatrics at the University of Cambridge and Cambridge University Hospitals NHS Foundation Trust, said: "Trillions of healthy bacteria live in our guts, keeping it healthy as well as supporting our digestion and metabolism. Serious illness may strike a severe blow to the ability of these bacteria to survive and continue their beneficial activities.

"Chemicals produced by healthy gut bacteria are effectively a signature of the presence of a healthy, functioning microbiome. Measuring their levels could offer doctors a way of identifying who needs treatment to restore a healthy microbiome, and for how long."

The researchers say that biochemical measures could complement the assessment of gut microbiome composition and offer an insight into the microbiome's functional capacity. The researchers are working on a rapid assay to help monitor gut health by measuring these chemicals as an indicator of gut health. It could help identify patients who need probiotics to restore the numbers of healthy bacteria in the gut.

More information: Anisha Wijeyesekera et al, Multi-Compartment Profiling of Bacterial and Host Metabolites Identifies Intestinal Dysbiosis and Its Functional Consequences in the Critically Ill Child, *Critical Care Medicine* (2019). DOI: 10.1097/CCM.0000000000003841