

Review

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Review

# Colon Cancer: Figuring out the Complicated Link for Targeted Treatments Using Microbiota

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**Abstract:** The gut microbiota's part in colon cancer has become an exciting and hopeful area of study because it shows complex links that affect how cancer starts, spreads, and responds to treatments. Dysbiosis, which is an imbalance in the community of germs in the gut, has been linked to a higher risk of colon cancer by causing inflammation and making a place where tumours can grow. Researchers have found that some kinds of bugs can either help colon cancer grow or stop it from doing so. This shows how important it is to maintain a healthy gut bacteria. In both preclinical and clinical research, therapeutic treatments that target the microbiome in the gut have shown promise. Probiotics and prebiotics can change the environment around a tumour, change the balance of microorganisms in the gut, and boost immune responses that fight the cancer. Faecal microbiota transfer (FMT) is being looked at as a new way to change the bacteria in the guts of people with colon cancer. By adding microbiota-targeted drugs to standard cancer treatments, it may be possible to make the treatment more effective and lessen side effects. Microbiota-focused treatments for colon cancer are still in their early stages, but they show promise. More research needs to be done to find out how they work and show that they work in the clinic. The link between the bacteria in the gut and colon cancer opens up new ways to help patients and give them better results. This might make a difference in how colon cancer is handled in the future.

**Keywords:** dysbiosis; faecal microbiota transfer; cancer; probiotics

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## Introduction:

Colon cancer is a big health problem all over the world, and it is one of the main reasons people die from cancer. Even though cancer research and treatment have come a long way, colon cancer is still a big problem because it has many different causes and is hard to treat. In the last few years, more and more evidence has shown that the gut microbiome is a new and interesting factor in the growth and spread of colon cancer <sup>1-2</sup>.

Gut microbiota is a group of different microorganisms that live in the digestive system. It has been known for a long time that these bacteria are important for how food is used, how the immune system works, and how the gut stays in balance. On the other hand, a recent study showed that the bacteria in the gut has a big impact on cancer, especially in the colon. The complicated links between bacteria in the gut and colon cancer have led to new ways of thinking about how cancer works and maybe even to new ways to treat it. This paper looks at the relationship between the bacteria in the gut and colon cancer. It also looks at how dysbiosis in bacteria affects how cancer starts and spreads. It looks at how different kinds of bacteria can help or hurt the growth of colon cancer, as well as how dysbiosis can cause inflammation and cancer in the gut. This paper also looks at the exciting potential of microbiota-targeted drugs like probiotics, prebiotics, and faecal microbiota transplantation (FMT) for restoring the balance of microorganisms in the gut and making traditional cancer treatments work better <sup>3-5</sup>.

As our understanding of the complicated links between gut bacteria and colon cancer grows, we can think of new ways to make medicines that are more personal and effective. This study aims to help find better ways to prevent, diagnose, and treat cancer by finding out how the gut microbiota and colon cancer work together. This could change how this terrible disease is handled if it works.

## The Gut Microbiota: A Look at the Microbes in the Colon

The big and complicated group of bacteria that live in a person's digestive tract is called the gut microbiota. Compared to the other parts of the digestive system, the microbes in the colon, which is also called the large intestine, are very busy and come from many different places. These tiny creatures are very important for the health of your gut, your immunity system, and even your mental health<sup>6-9</sup>:

1. Here are some of the many active germs that live in the colon:

The stomach is home to the gut microbiota, which is made up of trillions of living things like bacteria, archaea, viruses, and fungus. This group of different microbes is part of an ecosystem that is difficult and always changing. It is always talking to its host, changing how the body works, and responding to things in the outside world. Each person's gut microbiome is different because of things like their genes, the food they eat, their age, where they live, and their culture. Scientists have found thousands of different kinds of bacteria, which make up most of the gut flora. Each type of bacteria has its own job to do in the surroundings of the gut. Some germs are good for the person and keep them healthy, but if there are too many of them, they could be dangerous.

2. Gut microbiota's make-up and lifespan are affected by:

The microbiome in the gut is always changing because of many different factors. What you eat has a big effect on the bacteria group in your gut. Good bugs grow when you eat a lot of fibre. Short-chain fatty acids are good for gut health and are made when these bacteria break down food. On the other hand, having a lot of processed foods and sugars can hurt the variety of gut germs and make it easier for dangerous microbes to grow.

Drugs, which can change the balance of microbial communities, and lifestyle choices like how much you exercise and how stressed you are are also things that can change the gut bacteria. Also, how a baby is born (via vaginal birth or caesarean section) and what they are exposed to when they are young can have a big impact on how their gut bacteria starts to grow.

3. How important a healthy gut flora is for overall health and avoiding disease:

Gut bacteria health and balance are important for overall health and well-being. Gut bacteria are important for a lot of things that happen in the body, like processing, getting nutrients into the body, and making vitamins and other bioactive chemicals. It also helps train and control the immune system, making it better able to tell the difference between harmful viruses and helpful germs.

When the bacteria in the gut are out of balance, this is called dysbiosis. It's been linked to inflammatory bowel disease (IBD), irritable bowel syndrome (IBS), and colon cancer. A new study has also linked dysbiosis to health problems outside of the digestive system, such as obesity, diabetes, and even mental illnesses like depression and anxiety. In conclusion, the gut microbiome is a complex and diverse group of microorganisms that live in the stomach. These microorganisms help keep the digestive system, immune system, and overall health in good shape. Understanding what changes the makeup and stability of gut bacteria can lead to new ways to support a healthy gut microbiome and avoid diseases linked to dysbiosis. More research in this area could help make personalised plans to improve gut health and avoid many GI and systemic illnesses. Also, it's important for more than just nutrition and the immune system to have good gut bacteria. Studies have shown that the gut bacteria affect the gut-brain axis, which is a way for the gut and the central nervous system to talk to each other. Different chemicals that affect the brain are made by the bacteria in the gut. These chemicals can change how the brain works and how people act. They can also change how people feel, think, and react emotionally. People are curious about how treatments that target the microbiome in the gut could be used to treat mental health problems and diseases of the nervous system.

### Balanced bacteria in the gut

In the past few years, researchers have also found a link between the gut bacteria and how drugs and medicines are broken down. Some bacteria in the gut can change how well a drug works, how well the body can take it, and what kind of side effects it might have. Understanding how drugs

interact with the bacteria in the gut could lead to customised medicine, in which drug treatments are made for each person based on their unique gut microbial profile. Keeping good bacteria in the gut is important for staying healthy and avoiding diseases like colon cancer. The gut microbiota's effect on inflammation and immune reactions in the colon can have a big impact on how and when colon cancer starts and spreads. Studies have shown that some bugs in the gut make chemicals that either help or stop colon cancer cells from growing. So, changing the gut microbiota through food, probiotics, or faecal microbiota transplantation (FMT) could lower the risk of colon cancer or make treatment for people who already have it more effective. As research in this area gets better, more and more people are interested in the idea of making targeted treatments that change the gut bacteria to improve health. More and more people are looking at live probiotics, which are good bacteria, and prebiotics, which are fibres that can't be eaten but help good bacteria grow, as ways to support a healthy gut microbiome<sup>10-14</sup>.

In conclusion, the microbiota in the gut is a complicated and important part of the colon. It affects a lot of bodily functions that are important for staying healthy and avoiding getting sick. It is important for general health because it helps with nutrition, immune function, and two-way communication with the brain. As study in this area moves forward, we can expect to find out more about how the gut microbiota affects health and find ways to improve its balance that are best for each person. This will lead to new ways to avoid and treat a wide range of diseases, including colon cancer. If we can accept the complexity of the gut microbiome and use it to make specific treatments, the future of healthcare looks very bright.

### **Microbiota Dysbiosis and the Growth of Colon Cancer**

The gut flora is very important for keeping the gut in balance and for overall health. But a situation called dysbiosis that changes the makeup and function of the gut bacteria has been linked to many diseases, including colon cancer. Dysbiosis can have a big effect on the start and spread of colon cancer, as well as on the underlying processes that lead to inflammation and colon cancer. The facts are as follows, from <sup>15-19</sup>:

1. Learn how dysbiosis affects the start of colon cancer and how it spreads:

Dysbiosis happens when the amount of certain types of bacteria in the gut microbiota does not match up with what it should be. When dysbiosis happens in the gut, it can help colon cancer grow in that area. People with colorectal cancer have microbial changes, like fewer good bacteria and more bacteria that could be dangerous. The dysbiotic state can cause changes in the gut microenvironment, which can hurt the health of the colonic mucous barrier and make a person more likely to get cancer from outside sources. Dysbiosis can also make it harder for the bacteria in the gut to break down food, which can lead to the production of potentially dangerous chemicals that may help cancer grow.

2. How some bugs help or hurt the development of colon cancer:

A new study has found that some types of bacteria may either help colon cancer grow or stop it from doing so. For example, dangerous bacteria like *Fusobacterium nucleatum* have been found in large numbers in colon tumours. These bacteria can cause inflammation, break down the barrier in the gut, and help cancer cells grow, all of which help tumours grow and spread. On the other hand, *Bifidobacteria* and *Lactobacilli*, which are good bacteria, have shown that they might be able to stop colon cancer from growing. These good bacteria might make short-chain fatty acids (SCFAs). SCFAs can help fight cancer and lower inflammation. SCFAs can help keep the gut barrier in good shape and make it harder for cancer to grow.

3. How dysbiosis contributes to inflammation and the growth of cancer:

Inflammation in the gut can be caused by dysbiosis. This forms a small area that helps cancer grow. When dysbiosis breaks down the barrier in the gut, bacteria and toxins can get into the muscle of the colon. This sets off defensive responses and makes the body make more cytokines that cause inflammation. Chronic inflammation can damage DNA, make cells grow, and change how cells talk to each other. All of these things can cause cancer to grow. Also, dysbiosis can change the way bile acids are broken down, which is important for gut health. Changes in the gut bacteria brought on by

dysbiosis can cause a change in the way bile acids are used in the body. This can cause bile acid species that are linked to a higher chance of colon cancer to build up. In the end, it was found that dysbiosis of the gut bacteria is a major cause of colon cancer. When the bacteria in the stomach are out of balance, it can lead to inflammation, break down the barrier in the gut, and change how the body works. All of these things can cause colon cancer to start and spread. By focusing on dysbiosis, doctors can learn more about the difficult link between the bacteria in the gut and colon cancer. This will help them come up with ways to treat and prevent this common and life-threatening disease. Future research in this area could lead to personalised medicines based on microbiota that can improve gut health and lower the risk of colon cancer.

### **The microbiota and the surroundings around a tumour work together**

Inside a tumour, there are many different kinds of cells, extracellular tissue, and hormones that cancer cells use to talk to each other. New research shows that the bacteria in the gut have a big effect on how a tumour grows and how it reacts to treatments. Understanding how the bacteria in the gut and the surroundings around the tumour work together is important for finding new therapeutic targets and making colon cancer treatments work better. Here are the facts, from <sup>12-15,20</sup>:

#### **1. Compounds made by microbiota and how they affect the area around a tumour:**

Parts of the food we eat are fermented by the bacteria in our guts. This makes a wide range of chemicals that can change the environment around a tumour. Some of the most important molecules that gut bacteria make when they break down food fibre are short-chain fatty acids (SCFAs) like acetate, propionate, and butyrate. SCFAs are known to lower inflammation and can change how the immune system reacts. These chemicals can change how cancer cells and immune cells behave in a tumor's surroundings. This can change how the cancer grows, spreads, and spreads to other parts of the body.

Also, some bacteria in the gut make secondary bile acids, which can cause inflammation and help cancers grow. In the microenvironment of a tumour, these molecules come from the microbiome and can change how cells talk to each other and how genes are produced. This can change how cancer cells act and help the tumour grow.

#### **2. How microbes in the gut affect the immune system and what this means for the immune system's tracking of colon cancer:**

The gut microbiota has a big effect on how the immune system works, and changes in the gut microbiota can change how the immune system looks for cancer cells in the colon. Microbes in the gut can talk to immune cells and change how they change, get triggered, and work. For instance, it has been shown that certain gut bacteria help make regulatory T cells (Tregs), which stop the immune system from fighting the tumour. This makes it harder for the immune system to work inside the cancer.

On the other hand, some good bacteria in the gut can make cytotoxic T cells and natural killer (NK) cells work better. Both of these types of cells are important for killing cancer cells. These connections between the microbiota in the gut and the immune system are important for immune tracking of colon cancer, controlling tumour growth, and figuring out how well immunotherapy works.

#### **3. How germs and immune cells that have moved into a tumour work together:**

Cancer grows and reacts to treatment in large part because immune cells get into tumours. The bacteria in the gut can change how immune cells are found, triggered, and used near a tumour. For example, certain gut bugs can bring myeloid-derived suppressor cells (MDSCs) to the cancer site, where they stop the immune system from fighting the tumour and help it grow.

The bacteria in the gut can also change how well chemotherapy works. Recent research has shown that the gut microbiota changes how the immune system reacts to immunotherapies that use checkpoint inhibitors. In particular, it was found that certain types of germs made these treatments work better or worse. Changing the gut bacteria with things like probiotics or FMT could be a way to make colon cancer treatment work better <sup>11</sup>.

In conclusion, the interaction between the gut bacteria and the tumour microenvironment is a complicated and changing process that affects how colon cancer starts, spreads, and reacts to treatments. Metabolites made by microbiota can change the environment around a tumour, which can change how the tumour works and how the immune system responds to it. The way bacteria in the gut change the immune system affects how colon cancer is tracked and treated. Understanding these connections could lead to new microbiota-targeted medicines that can change the microenvironment of tumours and make it easier to treat colon cancer. As research in this area moves forward, we can expect to see the development of personalised methods that use the gut bacteria to improve the immune system's ability to fight tumours and change the way colon cancer is treated.

### **Treatments for colon cancer that focus on the microbiota**

It has become interesting to look for ways to treat colon cancer in the gut bacteria. Changing the mix of microbes in the gut in different ways could improve the effectiveness of treatment, make the immune system respond better to tumours, and reduce the side effects of treatment. Here are three important ways to treat colon cancer that focus on the bacteria<sup>5,8,15,20</sup>:

#### **1. Using probiotics and prebiotics to fix the balance of gut bacteria:**

Probiotics are live bugs that are good for your health if you take enough of them. These good bacteria can help reset the balance of the gut microbiota by helping good species grow and stopping the growth of bacteria that could be harmful. Probiotics have shown potential as a way to help treat colon cancer in both lab tests and clinical trials.

Researchers have found that some types of probiotics make anti-inflammatory metabolites, like SCFAs, which can help change the environment around a tumour and lower inflammation in the gut. Also, probiotics can help the immune system work well, which can boost the immune system's response to tumours and make chemotherapy work better.

Prebiotics, on the other hand, are nutrients that can't be digested and only feed the good bacteria in the gut. Prebiotics can help reset the balance of bacteria in the gut and improve bowel health by making it easier for good bacteria to grow. Taking prebiotics as a supplement could help lower inflammation in the gut and make treatment work better against cancer.

#### **2. Colon cancer could be treated with faecal microbiota transfer (FMT).**

FMT is when a person with dysbiosis or other health problems gets the poop of a healthy host. Most of the time, this treatment is used to help people whose *Clostridium difficile* infections keep coming back get their gut bugs back in balance. On the other hand, a new study suggests that FMT could be used to treat colon cancer.

Animal models have shown that FMT from healthy donors can stop colon cancers from growing and reduce inflammation in the colon. The relocated gut bacteria can connect with the immune system of the host and change the environment around the tumour, which makes treatment work better. FMT is still being studied for colon cancer, but ongoing research may make it possible to use it to treat cancer in the future.

#### **3. Therapies that focus on microbiota to improve how well traditional cancer drugs work:**

Adding microbiota-targeted medicines to standard cancer treatments like chemotherapy and radiation therapy is an interesting way to make treatment more effective. Certain bugs in the gut can change how cancer drugs work and hurt people, according to studies that didn't involve people. By changing the gut flora carefully with probiotics, prebiotics, or FMT before and during cancer treatment, it may be possible to improve the tumour microenvironment and make cancer cells more sensitive to standard medicines. Using microbiota-targeted measures to lessen treatment side effects can also improve patients' quality of life and help them stick with their treatment.

### **Conclusion:**

In conclusion, treatments that focus on the bacteria in the gut show a lot of promise for making colon cancer easier to treat. Using probiotics, prebiotics, and FMT can change the environment

around the tumour, help the immune system fight cancer cells better, and reset the balance of bacteria in the gut. Combining these microbiota-targeted medicines with standard cancer treatments could lead to more personalised and effective ways to treat colon cancer. As research in this area moves forward, we can expect to see new ways to treat colon cancer that use the power of gut bacteria to make patients' lives better.

In conclusion, the new field of research on how the gut microbiota and colon cancer affect each other has shown how much microbial communities affect how cancer starts, spreads, and reacts to treatment. The dynamic and complicated connections between the gut microbiota, the tumour microenvironment, and the immune system have shown that it could be a new therapeutic target for treating colon cancer. Microbiota dysbiosis has been linked to a higher risk of colon cancer because it causes ongoing inflammation and makes the body a good place for tumours to start and grow. Researchers have found that some kinds of bugs can either help colon cancer grow or stop it from doing so. This shows how important it is to have a good mix of bacteria in your gut.

In both lab and real-world studies, therapeutic methods that target the microbiome in the gut have shown promise. Resetting the balance of gut bacteria with probiotics and prebiotics can change the environment around a tumour, boost immune responses, and possibly make treatment work better. Also, Faecal bacteria transplantation (FMT) could be a new way to change the gut bacteria in people with colon cancer, but more research is needed to find out if it is safe and useful in this situation. Combining medicines that target microbiota with normal cancer treatments could make the treatments work better and reduce their side effects. A personalised and effective way to treat cancer is to change the gut microbiome to make cancer cells more sensitive to chemotherapy or radiation treatment. As our understanding of how the gut microbiota affects colon cancer grows, so does the chance that we will be able to make personalised treatments based on the bacteria that can change the way cancer is managed. But it's important to remember that the field is still young, and more research is needed to fully understand how gut bacteria and colon cancer work together. In conclusion, studying the link between the bacteria in the gut and colon cancer could lead to more personalised treatments and better outcomes for patients. As research goes forward, harnessing the power of gut bacteria may be the key to changing how colon cancer is treated, bringing in a new era of targeted treatments and precision medicine to fight this dangerous disease.

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