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Comic

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GRAPHIC MEDICINE REVIEW

The Gut: The Body's Second Brain

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Abstract

The term "gut health" has become popular in medical literature and the food industry. Gut health includes a variety of aspects of the gastrointestinal (GI) tract, which include proper digestion and absorption of nutrients, absence of GI illness, normal intestinal microbiota, and adequate immune status (Bischoff 2011). The gut microbiome has become a potential therapeutic target for mental illness because gut bacteria has been shown to play a crucial role in gut-brain communication through the influence on neural, immune, and endocrine pathways (Butler et al. 2019). Studies have shown that various environmental factors related to diet, drugs, and anthropometric measures are more significant determinants of gut microbiota than heritable components. This comic provides an overview of the gut microbiome and gut-brain communication. We summarize the current evidence-based solutions that can improve gut-microbiome diversity and provide practical advice for patients seeking probiotic elements for mental health benefits.

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Introduction

The gastrointestinal (GI) tract plays an important role not only in the digestion and absorption of food but also the mucosal immune system (Geng et al. 2022). The GI tract is colonized by a range of microorganisms and is densely packed with a network of hundreds of millions of neurons, which is known as the enteric nervous system (ENS). The ENS is an extensive network of neurons that lines the walls of the gastrointestinal (GI) tract (Mungovan & Ratcliffe, 2016). Additionally, the ENS works cooperatively with intestinal microbes, the intestinal immune system, and endocrine systems which all overlap to form a complex that is required to maintain a stable intestinal microenvironment (Geng et al. 2022). There is a current interest in understanding how gut microbes influence the ENS and the central nervous system (CNS) as recent studies have revealed the association between microbial changes and the development of neurological disorders like depression, Alzheimer's Disease, and Parkinson's disease (Calvani et al. 2018).

Gut microbes-brain bidirectional communication is regulated by the vagus nerve and conveys information from the GI tract to the CNS to maintain intestinal motility, control the release of neurotransmitters and immune cells (Forsythe et al. 2014). Thus, it is no surprise that the alteration in the gut microbiota could impact our emotions, sleep quality, metabolism, and overall well-being.

The composition of gut microbiota has been associated with habitual diets (Ferraris et al. 2020). The complexity of the food composition and their interactions, it is very difficult to identify the effects of single dietary nutrients in habitual diets. Although, there are studies that show that there are many dietary elements that will be useful to depict the pictures. It is thought that a diet with high intake of fermentable fibers and plant polyphenols regulate gut microbial activities. In other words, increased consumption of whole-plant foods, like fruit, vegetables, and wholegrain cereals, are encouraged to support gut health (Sidhu et al. 2023). This provides a scientific rationale of eating prebiotic foods. Studies have also shown that omega-3 polyunsaturated fatty acids found in nuts and fish can improve the intestinal barrier integrity (Seethaler et al. 2023; Fu et al., 2021). Additionally, highly processed western-style diets high in sugar, fat, and cholesterol are rapidly absorbed in the small intestine with a very small amount reaching the colon. When consuming such foods, the gut microbiota is deprived of essential nutrients required for bacterial growth, promoting gut dysbiosis (Kang et al. 2023). Therefore, limiting the consumption of highly processed foods can improve gut health. Additionally, the role of probiotic microorganisms are important for gut health sustainability and the consumption of fermented milk, yogurt, fermented food, functional foods, probiotic drinks, and lacto-bacilli probiotic supplements can maintain gut health (Dahiya & Nigam 2022). Additionally, recent studies show that environmental factors like exercise and not smoking can enhance the number of beneficial microbial species.

Process

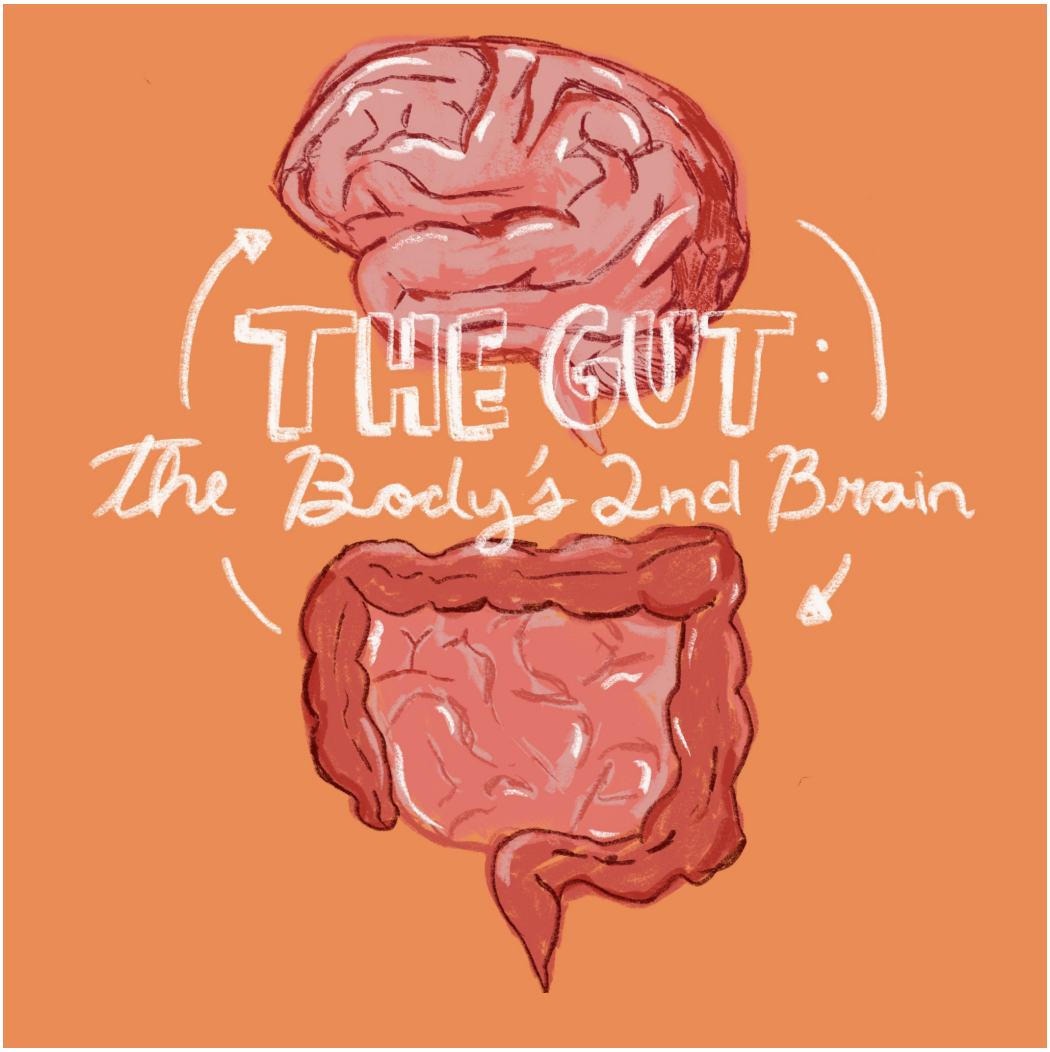
In creating this comic, the artist used a limited color palette of oranges and reds, graphic style, and contrasting colors to create imagery of the gastrointestinal lining. Warm tones were chosen as the primary colors when drawing the intestinal tracts; the colors blended in with the background. However, when the artist wanted certain elements to stand out, she contrasted these oranges with blue to highlight the important connection between the brain and gut. Furthermore, she created enlarged visuals

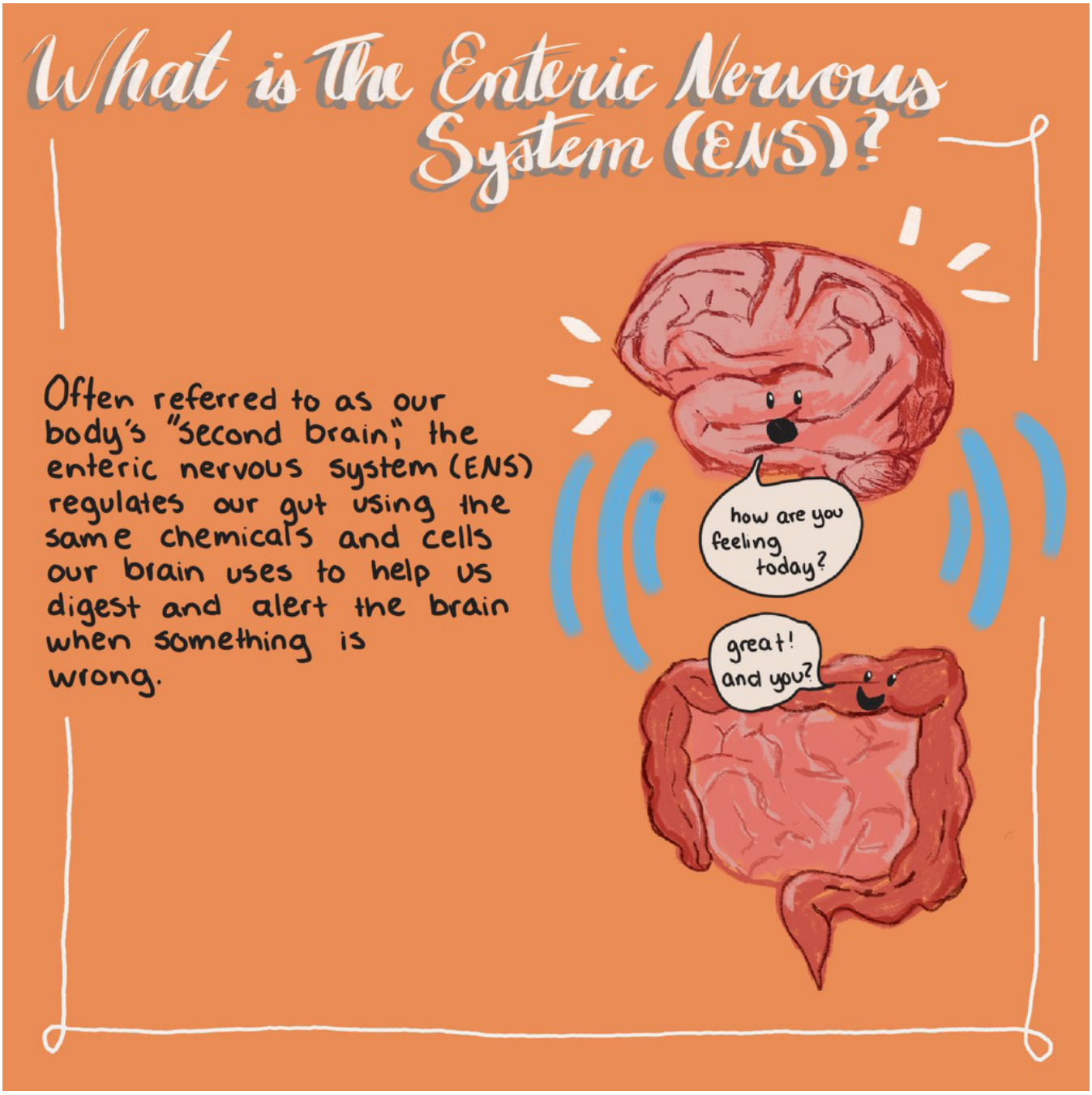
of the processes to help emphasize important details about the communicative process that the brain and gut undergo.

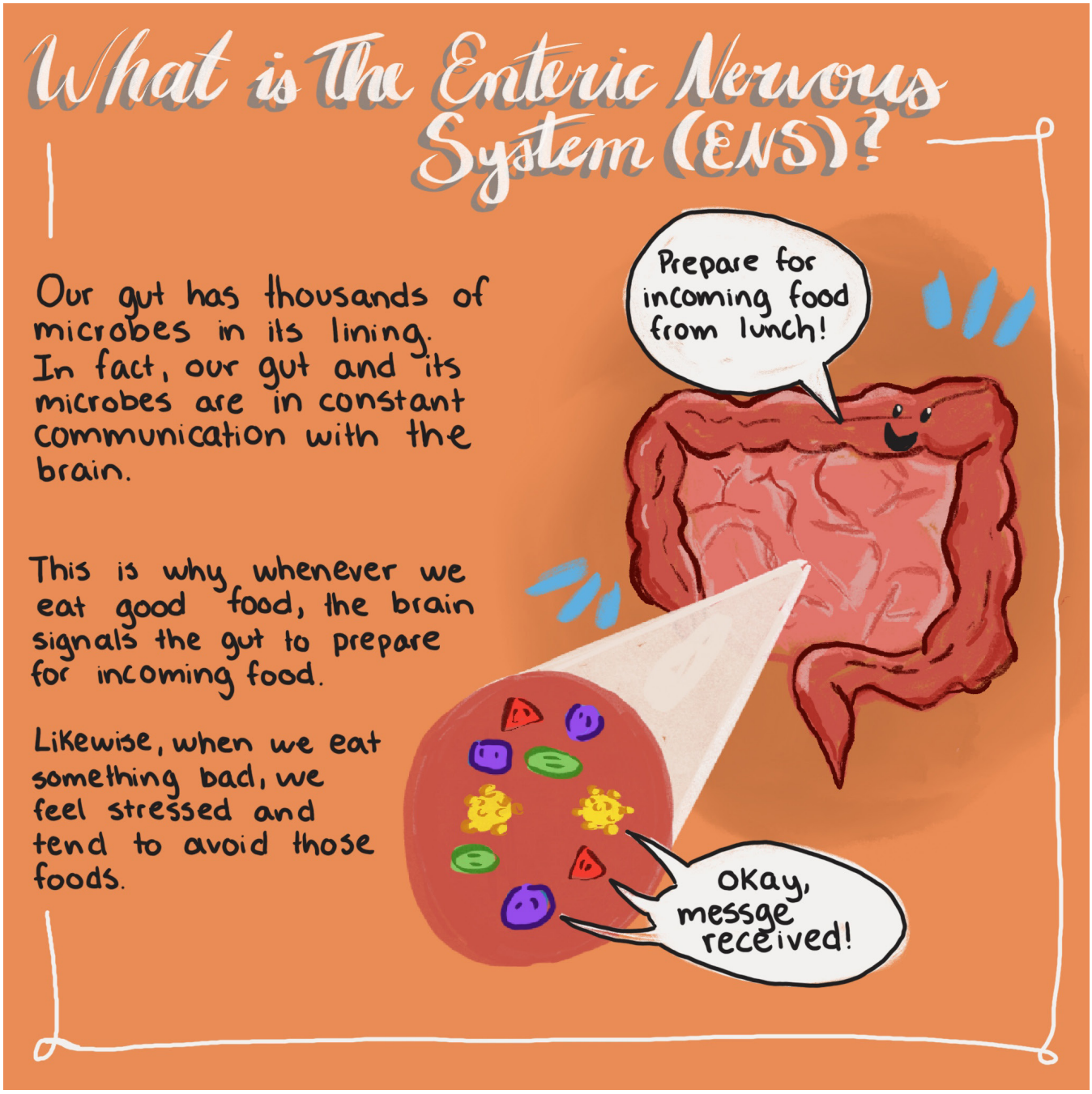
The graphic style further enforces this connection by providing a common visual that the general public can easily grasp to understand a more complex idea. In conjunction with GMC, the artist worked to create this comic and this comprehensible imagery of gut health. With a graphic style and warm tone color palette to promote medical information and raise awareness about gut health for the general public in an engaging manner to not only show the problem but display the solution.

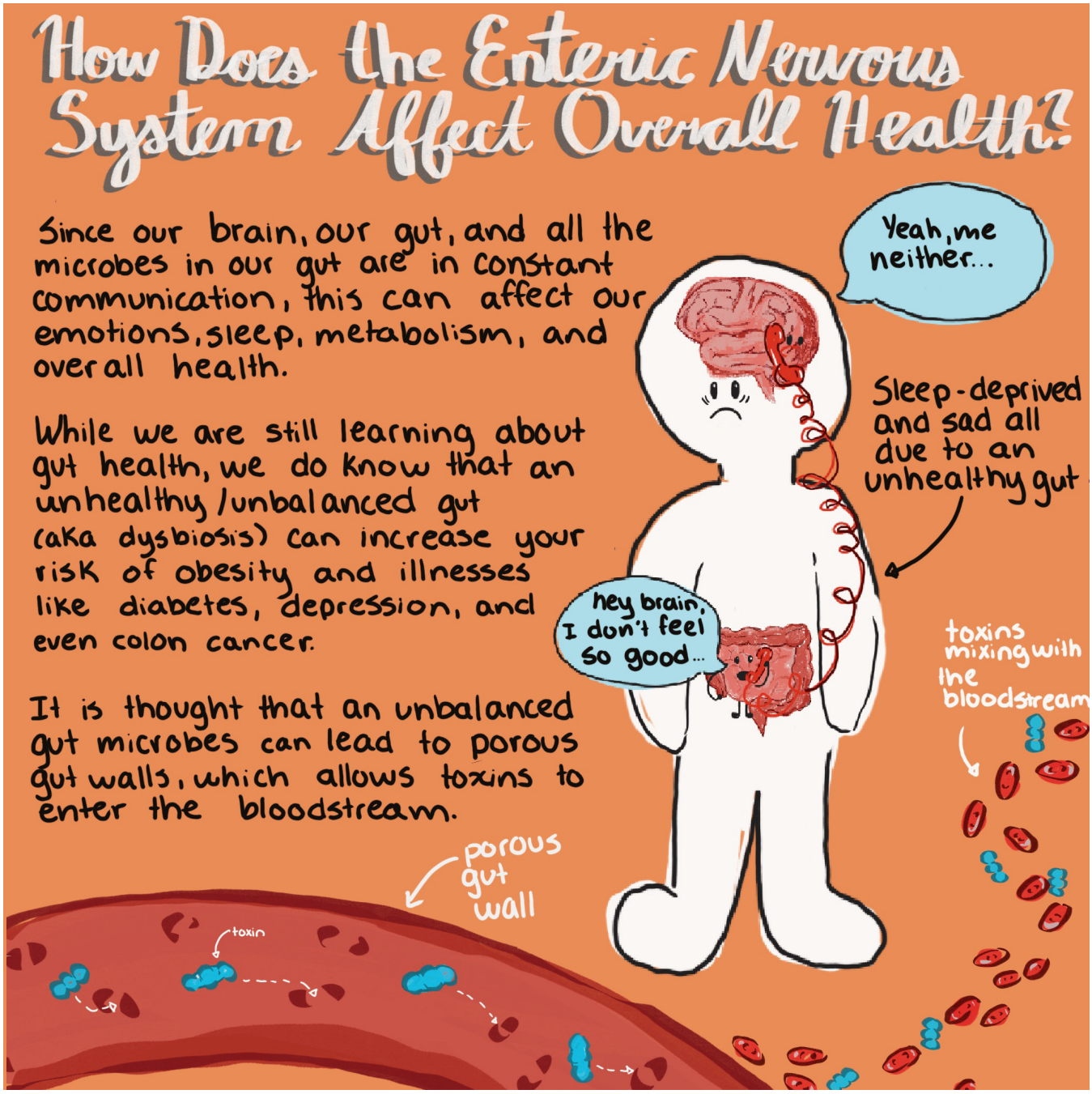
Conclusion

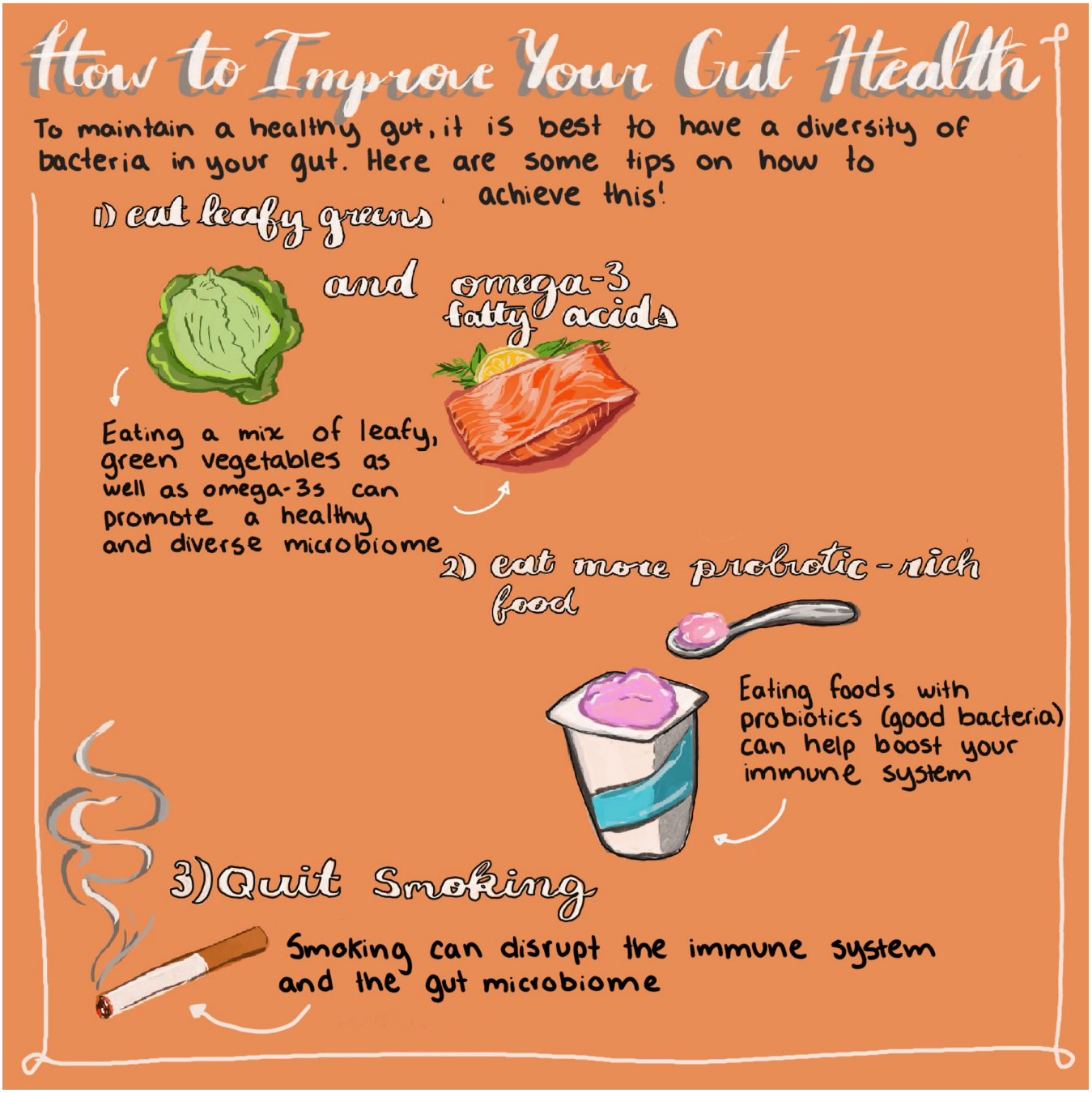
This comic provides information regarding the gut microbiota and its association with both the immune system and the central nervous system. Dietary changes, exercise, and abstinence from smoking can enrich gut microflora diversity and provide benefits of improved mental health and neurological disease prevention. For accurate diagnosis and suitable treatment, individuals who may exhibit bowel problems or symptoms of poor mental health should consult a licensed healthcare provider.

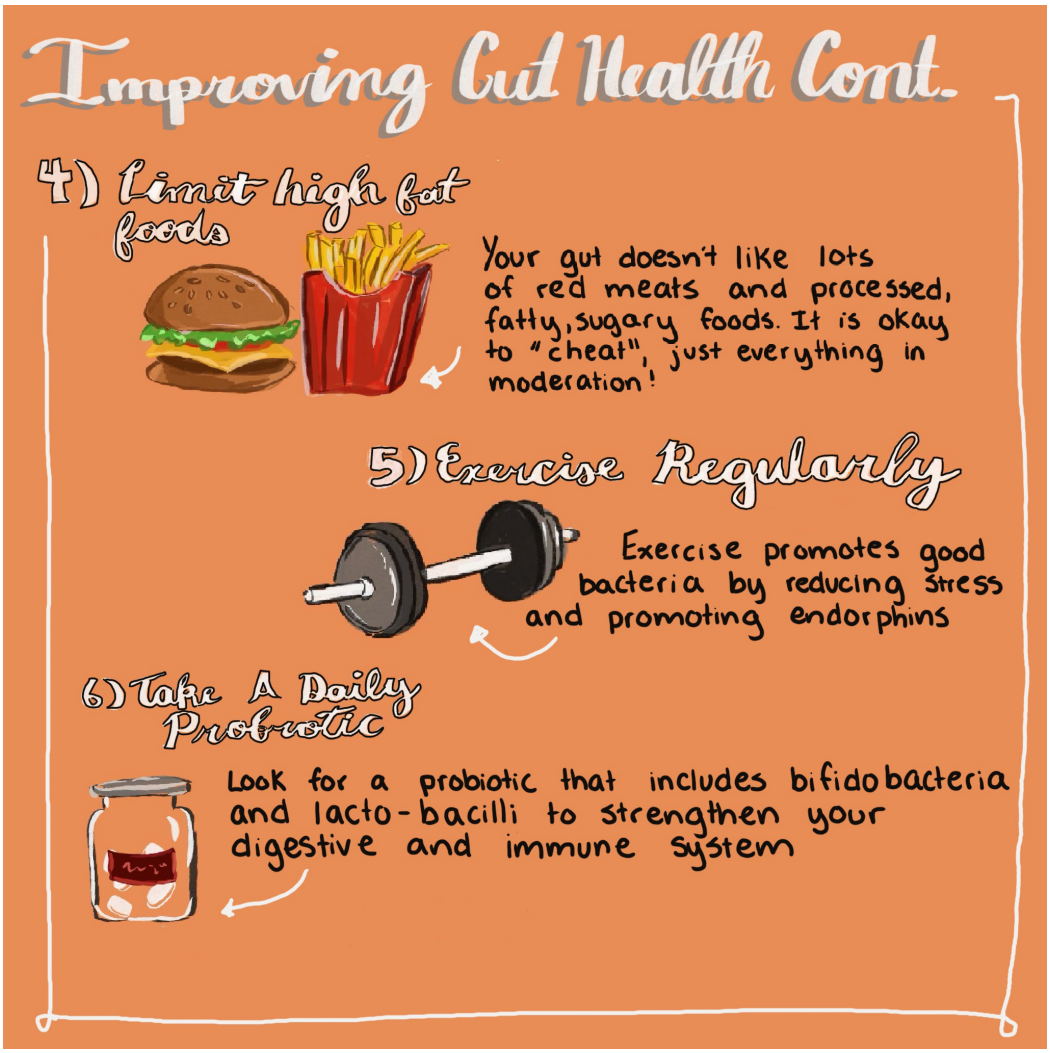



What is The Enteric Nervous System (ENS)?
Often referred to as our body's "second brain", the enteric nervous system (ENS) regulates our gut using the same chemicals and cells our brain uses to help us digest and alert the brain when something is wrong.
how are you feeling today?
great! and you?


What is The Enteric Nervous System (ENS)?
Our gut has thousands of microbes in its lining. In fact, our gut and its microbes are in constant communication with the brain.
This is why whenever we eat good food, the brain signals the gut to prepare for incoming food.
Likewise, when we eat something bad, we feel stressed and tend to avoid those foods.
Prepare for incoming food from lunch!
Okay, message received!


How Does the Enteric Nervous System Affect Overall Health?
Since our brain, our gut, and all the microbes in our gut are in constant communication, this can affect our emotions, sleep, metabolism, and overall health.
While we are still learning about gut health, we do know that an unhealthy/unbalanced gut (aka dysbiosis) can increase your risk of obesity and illnesses like diabetes, depression, and even colon cancer.
It is thought that an unbalanced gut microbes can lead to porous gut walls, which allows toxins to enter the bloodstream.
Yeah, me neither...
Sleep-deprived and sad all due to an unhealthy gut
hey brain, I don't feel so good...
toxins mixing with the bloodstream
porous gut wall
toxin


How to Improve Your Gut Health
To maintain a healthy gut, it is best to have a diversity of bacteria in your gut. Here are some tips on how to achieve this!
1) eat leafy greens and omega-3 fatty acids
Eating a mix of leafy, green vegetables as well as omega-3s can promote a healthy and diverse microbiome
2) eat more probiotic-rich food
Eating foods with probiotics (good bacteria) can help boost your immune system
3) Quit Smoking
Smoking can disrupt the immune system and the gut microbiome



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