

## ANTIBIOTICS (lesson 8)

Read the article and complete the assignments that follow:

### **Antibiotics could be repurposed as a treatment for depression**

Depression is common, affecting an estimated 264 million people of all ages worldwide. While the causes of depression are varied and complex, genetics, changes in brain chemistry, and environmental factors (such as stress or traumatic events) all play a part.

Historically, depression was thought to result from a chemical imbalance in the brain. But researchers now think that this is actually a symptom of depression – not the cause. Alongside a potential chemical imbalance, depressed people may also show changes in how their brain networks connect and alterations in their function and anatomy. This means that depressed people have differences in volume, metabolism, and activity in certain areas of their brain.

A number of studies have now begun looking into the presence of inflammation in the blood and brains of some depressed people. Knowing inflammation is present in depression could lead to new treatments.

#### **Brain inflammation**

Inflammation is not always a bad thing, since it's the way in which the body's immune system protects against a threat. But chronic and severe inflammation can change different systems in the body. For example, brain inflammation can eventually alter its chemical balance, including how the brain's nerve cells communicate with each other. This in turn can change how the brain functions.

People with chronic inflammatory diseases such as diabetes, cardiovascular disease and autoimmune disorders are shown to be at greater risk of developing depression. Depression can also be one of the symptoms of many inflammatory neurological conditions, such as multiple sclerosis and Parkinson's disease. Depression may even be a risk in developing Alzheimer's disease later in life. Although not certain, brain inflammation is thought to be the cause.

Studies have even shown that the brains of patients with depression have higher levels of inflammation. Their microglia – the brain's immune system cells – are also more active. This increased activity could end up being detrimental, leading to changes in how the brain's cells function and communicate.

Another study found that people with depression had more neutrophils, lymphocytes, and monocytes (types of white blood cells) and inflammatory proteins in their blood compared to those without depression, which indicates inflammation in the body in general.

Most treatments for depression still focus on either helping patients understand their behaviours, or increasing levels of certain neurotransmitters (such as serotonin) in the

brain. But these aren't always successful in treating depression. And although antidepressants have been found to be more effective than a placebo, not all patients respond to them.

## Repurposing antibiotics

Researchers have recently been looking into whether existing drugs can be repurposed to treat depression. One study found that minocycline, an antibiotic used to treat conditions such as urinary tract infections, skin infections and chlamydia, could stop mice from developing depressive behaviour and depression-related cognitive deficits (such as memory issues).

Minocycline might be able to prevent depressive behaviours as it's able to suppress the inflammatory response of microglia. Although targeting microglia has been discussed as a future focus for depression studies, this study showed that minocycline stops both the microglia and the brain neurons from releasing a stress-induced inflammatory protein called HMGB1 into the brain.

Not only does minocycline stop bacteria from growing, it has also shown promise in modifying the immune system's response and acting as an anti-inflammatory. As it can easily cross the blood-brain barrier and get into the brain, it has been found to have neuroprotective properties and is shown to be useful in reducing the severity of diseases such as Huntington's disease, and amyotrophic lateral sclerosis.

But, as with other medications, minocycline has its limitations. Long-term use has been shown to affect the "good" bacteria in the body, and may cause darkening of skin and teeth.

Previous animal studies looking at minocycline for depression have also shown limitations in that it only had antidepressant effects in male animals. Although the reason for this isn't fully understood, it has been repeatedly shown that immune responses differ between males and females, including microglia responses. However, animals and humans may have different immune responses.

In human studies, minocycline has been shown to have antidepressant effects. One study showed improvement of the depressive symptoms (including low mood) in mild to moderate depression in HIV patients when minocycline was used on its own. Other studies have focused on minocycline as an add-on to antidepressants – and also found encouraging results.

Although few large-scale human studies have been carried out on the effects of minocycline on depression, the ones that have been conducted confirm the antidepressant effects. But more studies are needed to look at whether minocycline is only a useful treatment for certain groups. Researchers will also need to look at whether relapse occurs after use, if it has any side effects, and whether it can be effective in treating depression where brain inflammation isn't observed.

Nevertheless, this antibiotic, as well as other medications that can alter the immune system's response may be potential candidates for treating depression – especially in patients who don't respond to current treatment options.

### Assignments:

#### Task 1. Choose the statement that best expresses the article's central idea.

◆ Read the whole article title carefully. Which option summarises *what the research is about*, not details or examples?

- A. The article explores the negative side effects of antibiotics on mood and cognition.
- B. The article claims that vaccines are more effective than antidepressants.
- C. The article describes how certain antibiotics may influence brain inflammation linked to depression.
- D. The article focuses mainly on chemical imbalance as the cause of depression.

#### Task 2. What is the primary goal of the author?

◆ Think: *Why* was the article written — to argue, to inform, or to warn? Identify its **purpose**, not its topic.

- A. To argue that antidepressants should be replaced by antibiotics.
- B. To summarise research suggesting that anti-inflammatory antibiotics could help treat mental disorders.
- C. To warn readers about the misuse of medical drugs in psychiatry.
- D. To present evidence that depression is purely a biological phenomenon.

#### Task 3. Which best summarises the overall structure of the article?

◆ Remember that scientific articles usually start with background → research → results → conclusion. Choose the sequence that follows this logic.

- A. Introduction of causes → focus on inflammation → evidence → limitations → conclusion.
- B. Results → hypothesis → literature review → final remarks.
- C. Historical background → statistical data → case study → references.
- D. Observation → personal opinion → therapy instructions → evaluation.

#### Task 4. Select the three ideas that are *essential* for a concise scientific summary.

◆ Select only the ideas that express the **core discovery and its importance**, not historical or side information.

- A. Chronic inflammation may change neuron communication.
- B. Depression is influenced by biological, genetic, and environmental factors.
- C. Minocycline affects the microglia and can reduce inflammatory proteins in the brain.
- D. Some patients responded positively to minocycline in clinical trials.
- E. Minocycline was first synthesised by Lederle Laboratories in 1967.
- F. Repurposing drugs could accelerate mental health treatment development.

### **Task 5. Choose the sentence that best represents the *topic sentence* for a summary.**

◆ Look for a sentence that introduces the whole article's focus — it should be broad enough to include all main points.

- A.** Depression is a serious disease that causes low mood and hopelessness.
- B.** Recent studies show that antibiotics may have potential to treat inflammation-related depression.
- C.** Scientists warn that antibiotics can damage the body's natural microbiome.
- D.** The link between inflammation and mental illness has not been proven.

### **Task 6. Which of the following details would be *excluded* from a scientific summary?**

◆ Ask yourself: "Would this detail help a reader understand the discovery?" If not, it doesn't belong to a summary.

- A.** The experiment showed increased activity of microglia in depressed patients.
- B.** Long-term antibiotic use may darken the skin or teeth.
- C.** Depression may appear in people with autoimmune or cardiovascular diseases.
- D.** Researchers found antidepressant effects of minocycline in both animal and human studies.

### **Task 7. Choose the sentence that best paraphrases the original idea.**

◆ A good paraphrase keeps the same meaning but changes structure or vocabulary. Avoid answers that twist or oversimplify the idea.

**1.** Original: "Inflammation is not always harmful, but if it becomes chronic, it may damage brain function."

- A.** Chronic inflammation always protects the body from damage.
- B.** The brain is unaffected by inflammation in most cases.
- C.** The only harmful type of inflammation is mental stress.
- D.** Inflammation can be beneficial, yet its prolonged form can negatively influence the brain.

**2.** Original: "Minocycline reduces inflammatory response of microglia and may protect neurons."

- A.** The antibiotic minimises inflammation and enhances the immune reaction.
- B.** The drug can lessen brain inflammation, shielding nerve cells from damage.
- C.** Microglia destroy neurons during inflammation caused by minocycline.
- D.** Minocycline worsens inflammation in the brain.

### **Task 8. Choose the best linking word to create logical flow.**

**1.** Chronic inflammation disrupts brain communication; \_\_\_\_\_, mood and behaviour may change.

- A.** consequently   **B.** whereas   **C.** for example   **D.** despite

2. Researchers have observed this connection in several diseases; \_\_\_\_\_, the exact mechanism remains unclear.

A. similarly B. however C. therefore D. in contrast

3. Minocycline has shown positive results; \_\_\_\_\_, more large-scale studies are needed.

A. thus B. although C. nonetheless D. in addition

### Task 9. Which paraphrase of the main idea is most concise and accurate?

◊ Pick the option that delivers the same information using the fewest, most precise words.

A. The article explores how inflammation and brain chemistry are connected and how antibiotics might help.

B. The article describes many different medicines that could treat infections and depression together.

C. The article explains the mechanism of action of antidepressants and compares them to antibiotics.

D. The article mainly lists side effects of antibiotics used for mental health.

### Task 10. Arrange the ideas into a coherent summary structure.

◊ Start with the general problem, then the evidence, the solution, and finish with what still needs research.

A. Minocycline, an antibiotic, can cross the blood–brain barrier and act as an anti-inflammatory agent.

B. Inflammation has been linked to depression through its effects on neurons and brain chemistry.

C. Researchers suggest that using existing drugs could provide new treatment options for mental disorders.

D. Further studies are required to confirm the safety and effectiveness of such drugs.

Correct order: \_\_\_ → \_\_\_ → \_\_\_ → \_\_\_

### Task 11. Select the best concluding sentence.

◊ A good conclusion sums up what the results *suggest* — not an absolute claim or unrelated statement.

A. These findings indicate that modifying the immune response could help in treating depression.

B. This research proves that antibiotics are the most reliable cure for depression.

C. The study shows that minocycline has no effect on the human brain.

D. Scientists believe that depression cannot be prevented or treated.

