

## Human Polymorphonuclear Neutrophil Apoptosis is Inhibited by *Treponema Pallidum* Through Both Intrinsic and Extrinsic Mechanisms

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### Abstract

*Treponema pallidum* is a “stealth pathogen” responsible for infectious sexually transmitted diseases. Although neutrophils are usually present in skin lesions of early syphilis the role of these cells in infection has

### Introduction

Neutrophils are the most abundant type of white blood cells in the human body. They are part of the innate immune system and are responsible for the first response to infection. Neutrophils are attracted to the site of infection by chemokines and other signaling molecules. Once at the site, they engulf and kill the invading pathogens. Neutrophils also release antimicrobial peptides and reactive oxygen species to kill the pathogens. In addition, neutrophils can form neutrophil extracellular traps (NETs) to trap and kill the pathogens. Neutrophils are also involved in the resolution of inflammation and tissue repair. In this study, we investigated the role of neutrophils in the early stage of syphilis. We found that neutrophils are present in the skin lesions of early syphilis. However, their role in the infection is unclear. We hypothesized that neutrophils might be inhibited by *T. pallidum*, which would allow the bacteria to evade the immune system and establish a chronic infection. To test this hypothesis, we cultured neutrophils in the presence of *T. pallidum* and measured their apoptosis. We found that *T. pallidum* significantly inhibited neutrophil apoptosis. This inhibition was mediated by both intrinsic and extrinsic mechanisms. The intrinsic mechanism involved the inhibition of mitochondrial cytochrome c release and caspase activation. The extrinsic mechanism involved the inhibition of death receptor signaling. Our findings suggest that neutrophils play a role in the early stage of syphilis and that *T. pallidum* evades the immune system by inhibiting neutrophil apoptosis.

### Subjective heading

Neutrophils are the most abundant type of white blood cells in the human body. They are part of the innate immune system and are responsible for the first response to infection. Neutrophils are attracted to the site of infection by chemokines and other signaling molecules. Once at the site, they engulf and kill the invading pathogens. Neutrophils also release antimicrobial peptides and reactive oxygen species to kill the pathogens. In addition, neutrophils can form neutrophil extracellular traps (NETs) to trap and kill the pathogens. Neutrophils are also involved in the resolution of inflammation and tissue repair. In this study, we investigated the role of neutrophils in the early stage of syphilis. We found that neutrophils are present in the skin lesions of early syphilis. However, their role in the infection is unclear. We hypothesized that neutrophils might be inhibited by *T. pallidum*, which would allow the bacteria to evade the immune system and establish a chronic infection. To test this hypothesis, we cultured neutrophils in the presence of *T. pallidum* and measured their apoptosis. We found that *T. pallidum* significantly inhibited neutrophil apoptosis. This inhibition was mediated by both intrinsic and extrinsic mechanisms. The intrinsic mechanism involved the inhibition of mitochondrial cytochrome c release and caspase activation. The extrinsic mechanism involved the inhibition of death receptor signaling. Our findings suggest that neutrophils play a role in the early stage of syphilis and that *T. pallidum* evades the immune system by inhibiting neutrophil apoptosis.

### Discussion

Neutrophils are the most abundant type of white blood cells in the human body. They are part of the innate immune system and are responsible for the first response to infection. Neutrophils are attracted to the site of infection by chemokines and other signaling molecules. Once at the site, they engulf and kill the invading pathogens. Neutrophils also release antimicrobial peptides and reactive oxygen species to kill the pathogens. In addition, neutrophils can form neutrophil extracellular traps (NETs) to trap and kill the pathogens. Neutrophils are also involved in the resolution of inflammation and tissue repair. In this study, we investigated the role of neutrophils in the early stage of syphilis. We found that neutrophils are present in the skin lesions of early syphilis. However, their role in the infection is unclear. We hypothesized that neutrophils might be inhibited by *T. pallidum*, which would allow the bacteria to evade the immune system and establish a chronic infection. To test this hypothesis, we cultured neutrophils in the presence of *T. pallidum* and measured their apoptosis. We found that *T. pallidum* significantly inhibited neutrophil apoptosis. This inhibition was mediated by both intrinsic and extrinsic mechanisms. The intrinsic mechanism involved the inhibition of mitochondrial cytochrome c release and caspase activation. The extrinsic mechanism involved the inhibition of death receptor signaling. Our findings suggest that neutrophils play a role in the early stage of syphilis and that *T. pallidum* evades the immune system by inhibiting neutrophil apoptosis.

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500, 30  
1 107 // L 2 107 // L,  
N HPMN  
G  
PMN 98

A. (N<sub>2</sub>)  
5 107  
3-5  
R 10 14  
10 L N Cl 10%  
30

### Infection of neutrophils

RPMI 1640 2 M L (G<sub>1</sub>,  
G<sub>2</sub> L, N, A), 10 M HEPE (, F<sub>1</sub>),  
1 106/ L. (M<sub>1</sub>, B, MA, A).  
(NH<sub>4</sub>) RPMI 1640 50  
34 C 1.5 O<sub>2</sub>  
PMN 24 (O<sub>2</sub>)  
(MOI) 10:1