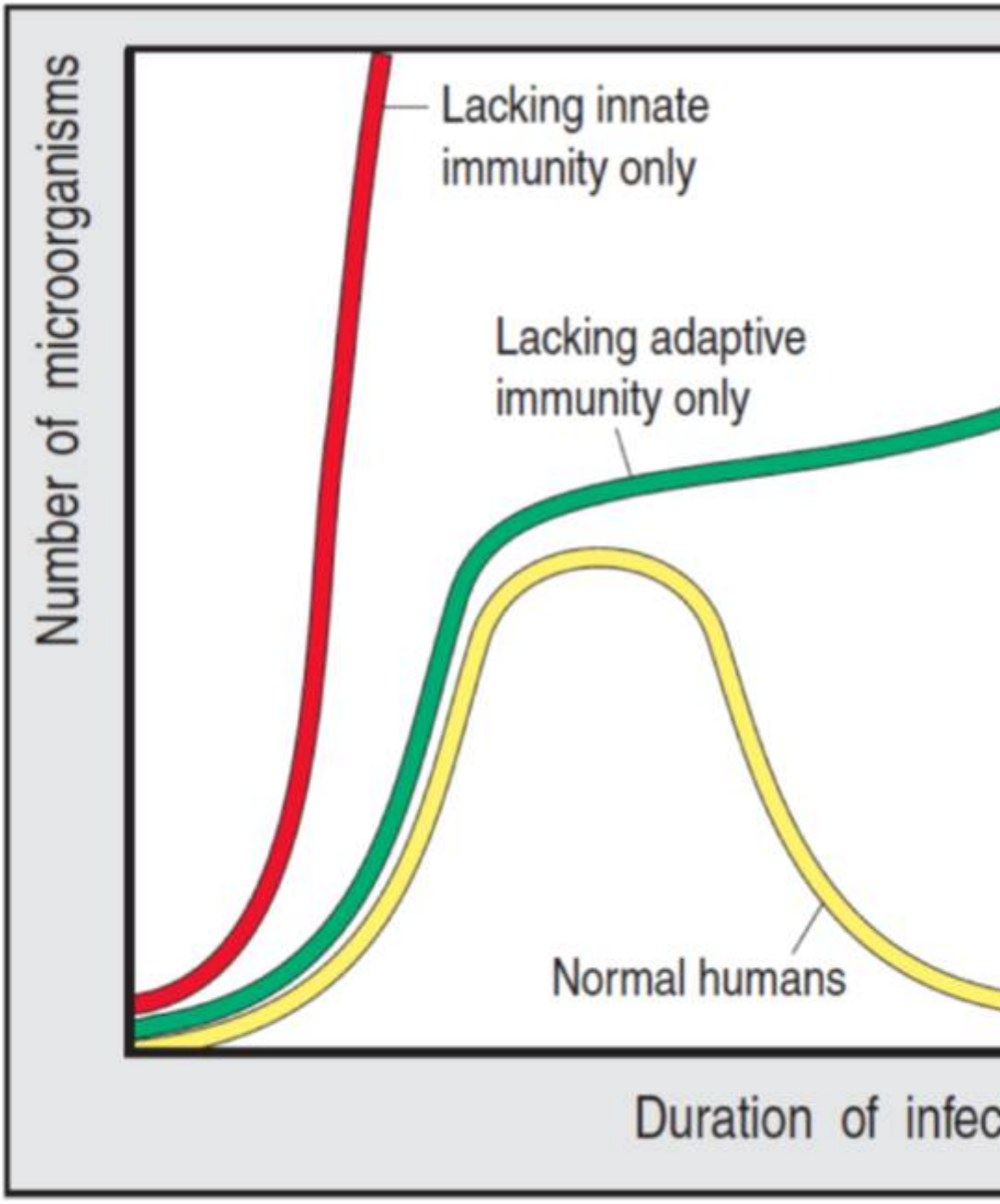
Introduction

Description

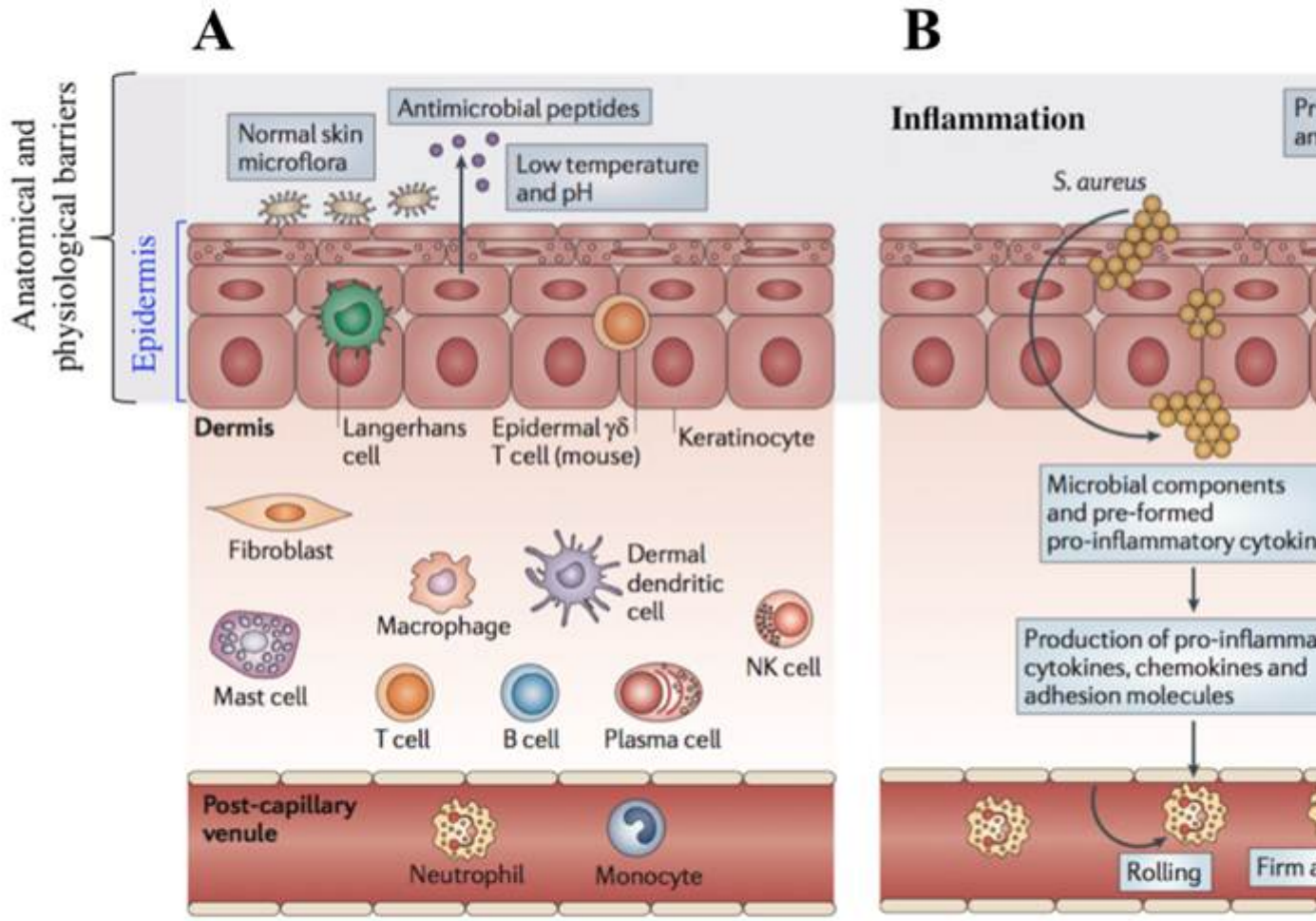
The immune system has evolved to an amazing defense mechanism against the invasion of a broad variety of pathogens and parasites. It is possessed by the majority of the living organisms including such simple beings as unicellular bacteria or invertebrates, where it exists in a rudimental form (He, J & Deem, M. W. 2010, Rowley, A. F & Powell, A. 2007). In higher vertebrates, including humans, it has evolved to an extremely sophisticated system that has the features of specificity and memory, and which is implemented by the two components – innate and adaptive immunities. The adaptive immunity is highly specific with a unique property of memory and it requires stimulation with an antigen prior to the response, whereas, innate immunity is less specific and has no memory. However, innate immunity has a crucial role (fig. 1), as it is the first line defense of the organism against the invading pathogens and its responses activate the adaptive immunity. The importance of innate immunity is also highlighted by the fact that the defects of its components are relatively rare and almost always lethal (Goldsby, R, Kindt, T, Osborne, B, & Kuby, J. 2002, Parham, P. 2009)



The importance of the innate immunityIn humans with healthy immune system the infection is almost completely cleared out of the body due to the synergistic action of innate and adaptive immunities (yellow line). If adaptive immunity is impaired, the infection is initially stopped but can’t be cleared out and persists (green line), but if innate immunity is compromised, the infection becomes uncontrolled since there are no innate immunity responses generated to activate the adaptive immunity [Parham, P. (2009)].

The innate immunity comprises several levels : anatomic, chemical-physiological (temperature, pH, soluble factors), cellular, and inflammatory barriers (fig. 2), which are closely related and work together

to provide the effective protection.



Different levels of innate immunity : an example of skin infection by Staphylococcus aureusA, An intact skin protects the body from pathogen invasion : the tightly packed epidermis with the uppermost corneal layer of dead keratinocytes provides a physical barrier ; normal skin microflora covers the skin and thus fills the niches preventing pathogen attachment and growth, which is also inhibited by low temperature and pH at the skin surface ; antimicrobial peptides, secreted to the surface by underlying keratinocytes, provide an additional defense. The innate immunity cells in dermis survey their environment for invaded pathogens. B, Once this physical barrier is breached, an inflammation occurs :

epidermal and dermal immune cells produce pro-inflammatory cytokines, chemokines and adhesion molecules, which recruit more neutrophils from blood stream to control the infection by formation of the abscess. Pro-inflammatory cytokines also induce the production of antimicrobial peptides. [Adapted from Miller, L. S & Cho, J. S. (2011)]

The anatomical barrier includes the skin and mucosa, and provides a physical obstacle for the pathogen invasion. Its importance is obvious as in the case of the loss of the integrity of the body’s internal epithelia, infection is a major cause of mortality and morbidity (Murphy, K, Geha, R, & Notarangelo, L. 2011).