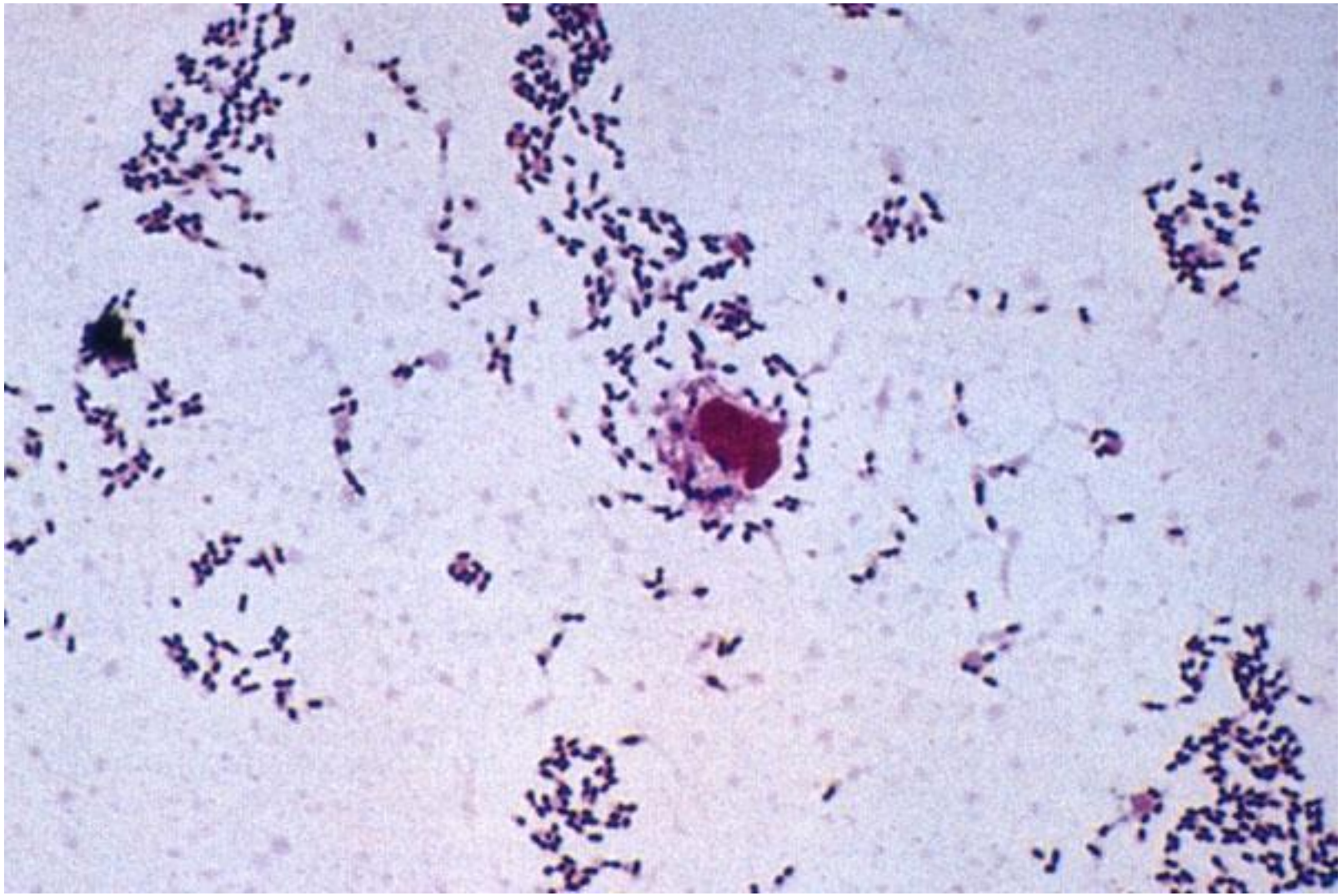
Bacteria seen in cerebrospinal fluid

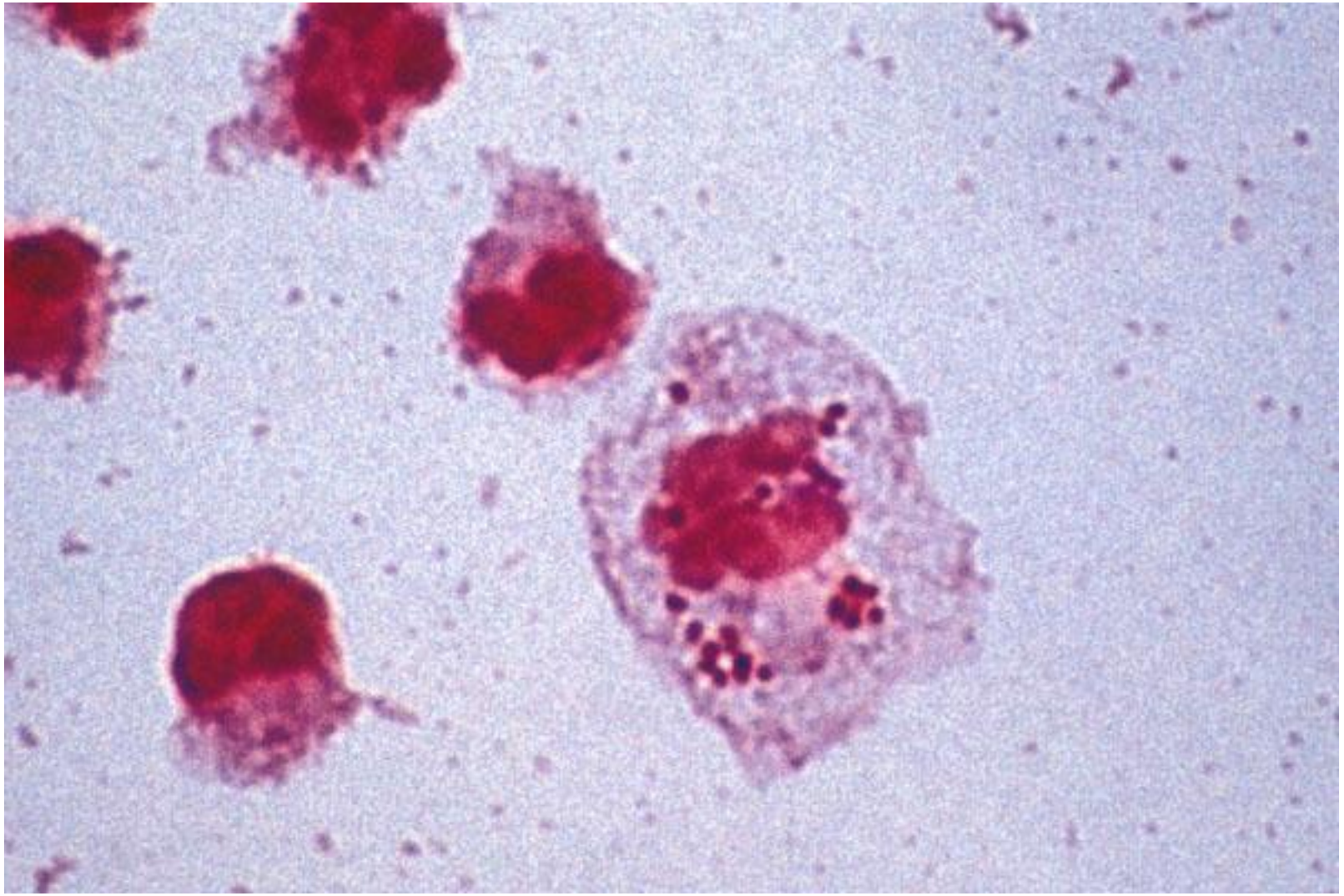
Bacterial meningitis is common in childhood and adolescence. Three major meningitis pathogens include *Neisseria meningitidis*, *Haemophilus influenzae* and *Streptococcus pneumoniae*. All of them produce capsules and IgA1 protease. Neonatal meningitis is caused by *E. coli* with K1 capsule, *Streptococcus agalactiae* (group B Streptococcus) and *Staphylococcus aureus*. Common features of these bacteria are the formation of capsules containing polysialic acids. It should be noted that polysialic acid is specifically expressed on the cell surface of neurons, neuronal cell adhesion molecule (NCAM or CD56), and that NCAM shows homophilic molecular binding on the plasma membrane. It is reasonable for the capsule-forming bacteria that they utilize the homophilic binding capacity of the capsule to NCAM to colonize the meningeal space. The bacteria also protect themselves from secretory IgA on the mucosal surface by producing IgA1 protease. Vaccines against the capsular components are effective to protect the young people from bacterial meningitis.

Ref.: Tsutsumi Y. Pathology of Infectious Diseases. 2003.
https://pathos223.com/en/case/case100.htm

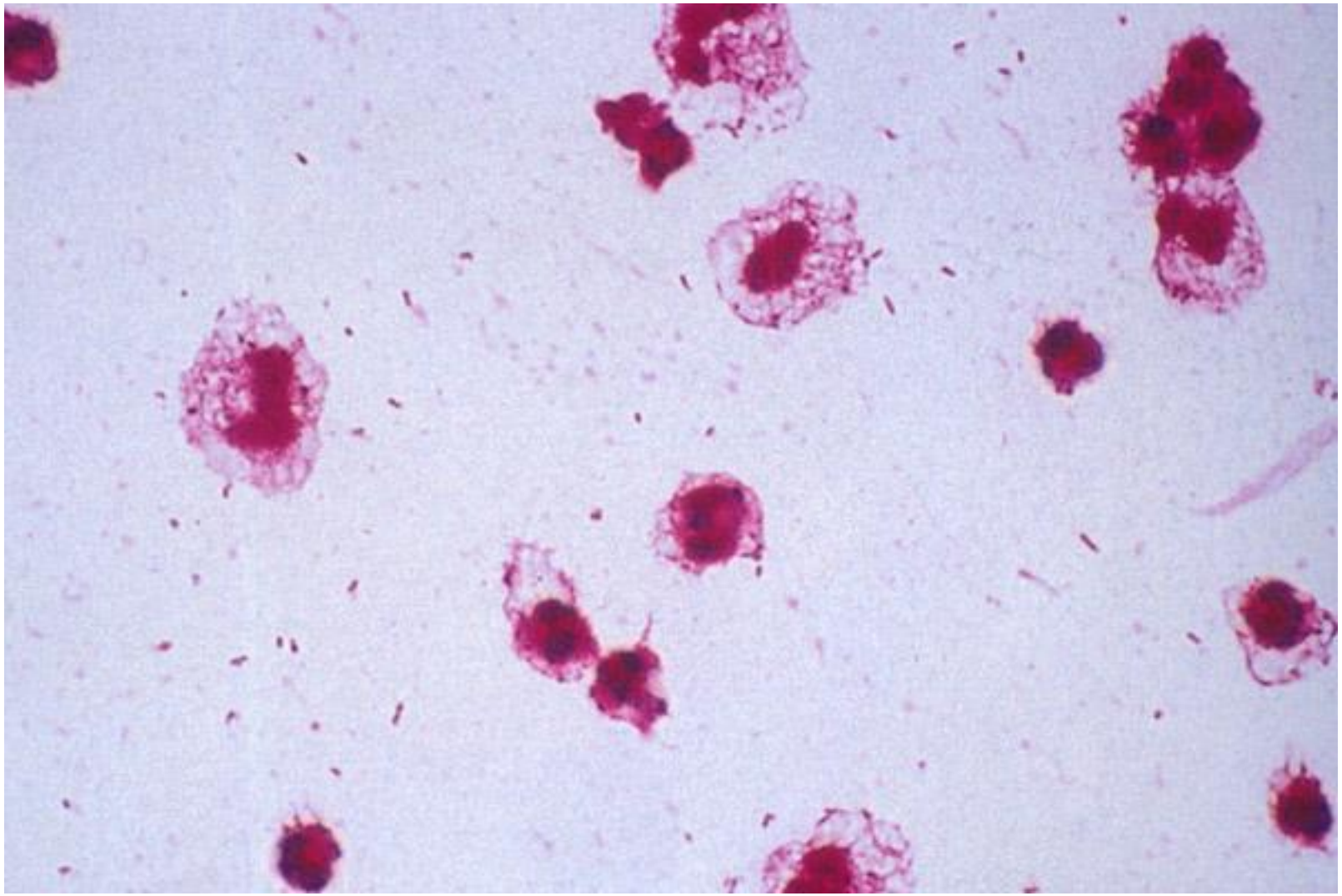


Streptococcus pneumoniae (Gram). Gram-positive diplococci are located outside neutrophils. Penicillin-resistant *S. pneumoniae* makes a clinical problem.

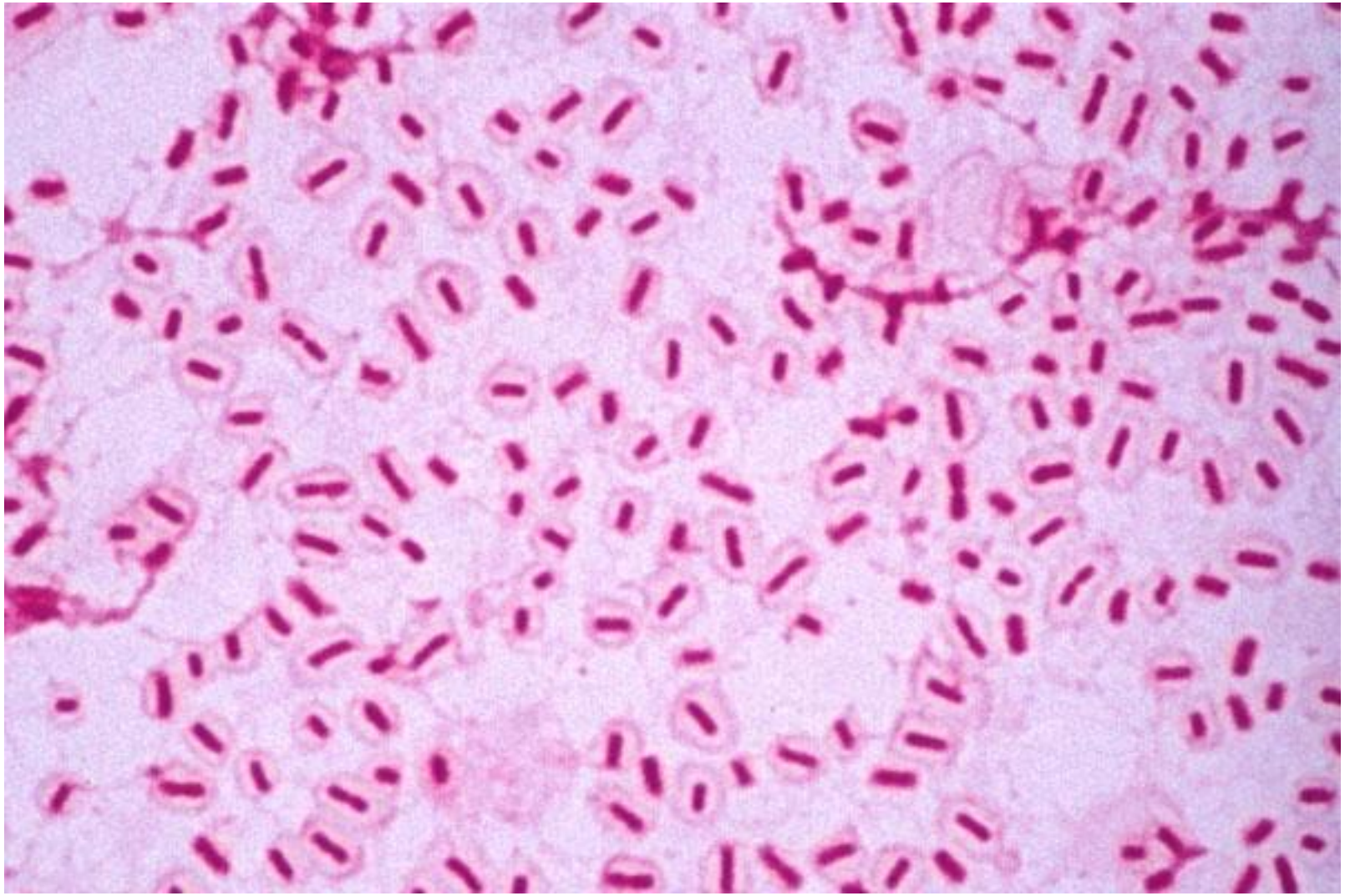
Streptococcus agalactiae (group B *Streptococcus*) (Gram). Gram-positive cocci are phagocytized by neutrophils, and cause neonatal meningitis. *S. agalactiae* is a normal flora of the vagina.



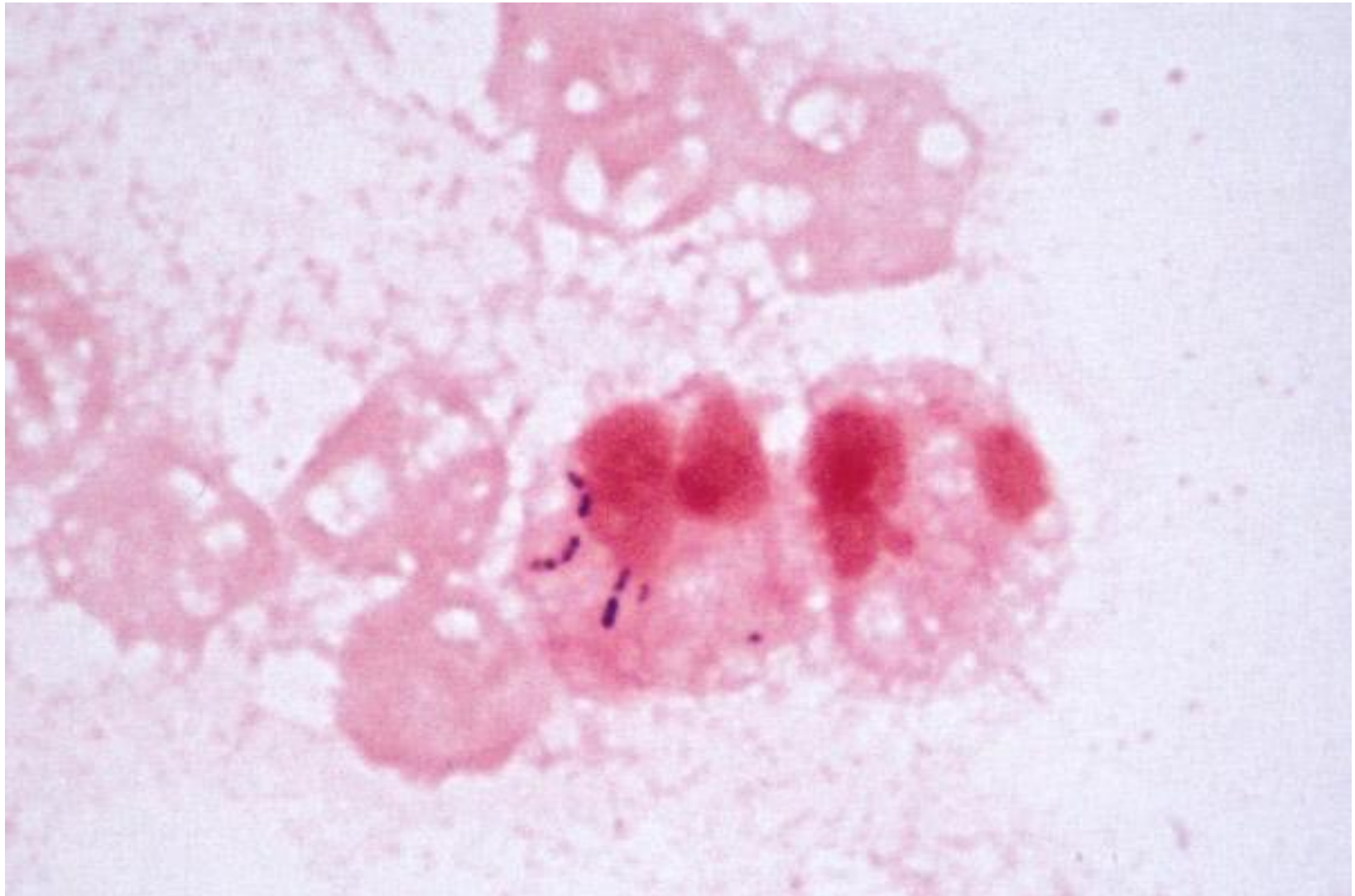
Neisseria meningitidis (Gram). Gram-negative diplococci are phagocytized by neutrophils. Fulminant meningitis is common in the African meningitis belt along the equator.



Haemophilus influenzae (Gram). Gram-negative short rods are seen mainly outside neutrophils. Anti-capsule vaccine is effective.



Klebsiella pneumoniae (Gram). Gram-negative large rods are associated with thick capsule formation, and occasionally cause meningitis in the aged.



Listeria monocytogenes (Gram).　Gram-positive rods are phagocytized by neutrophils, and tend to cause transplacental infection to the neonate.