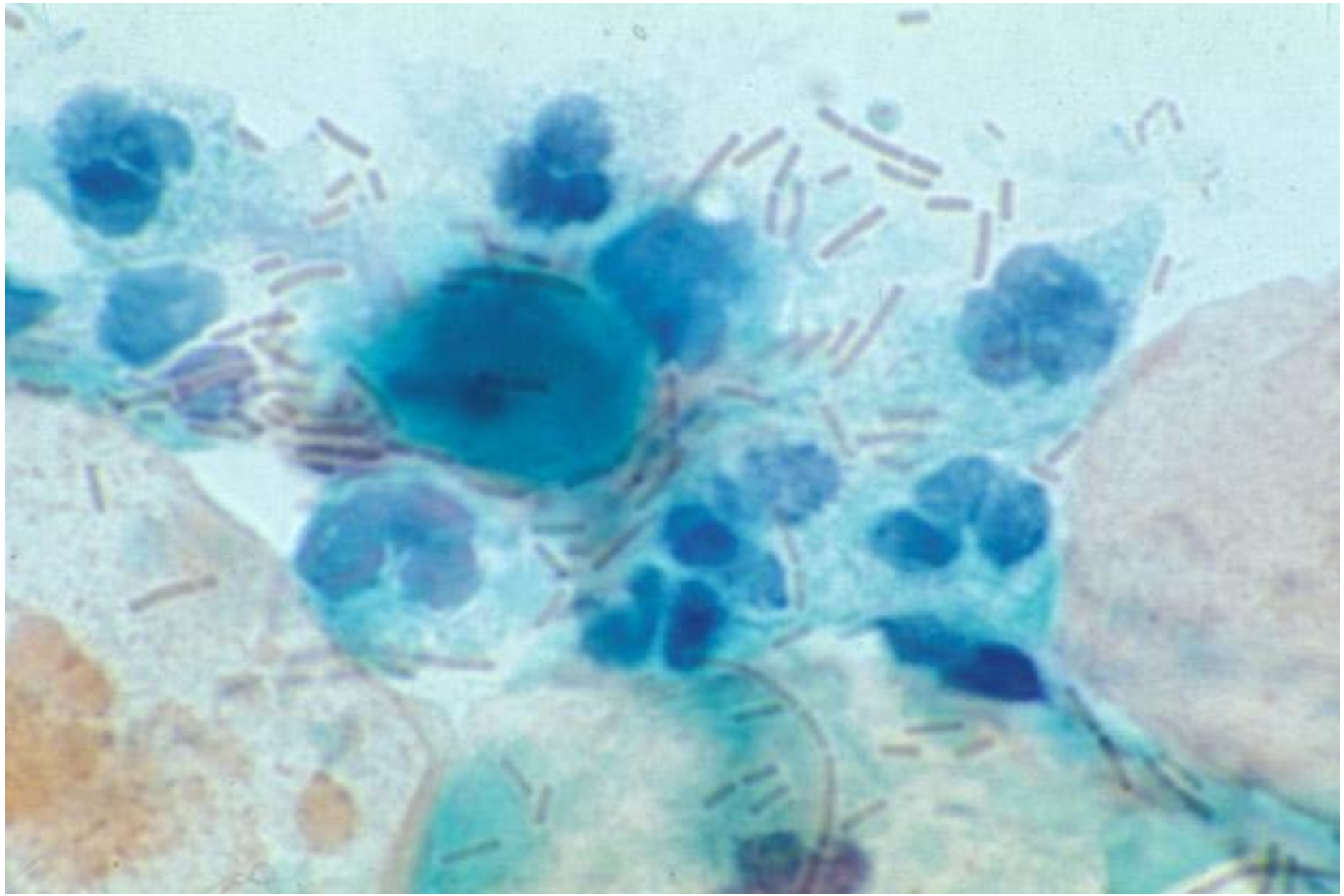
# Microbes seen in the cervical smear preparations

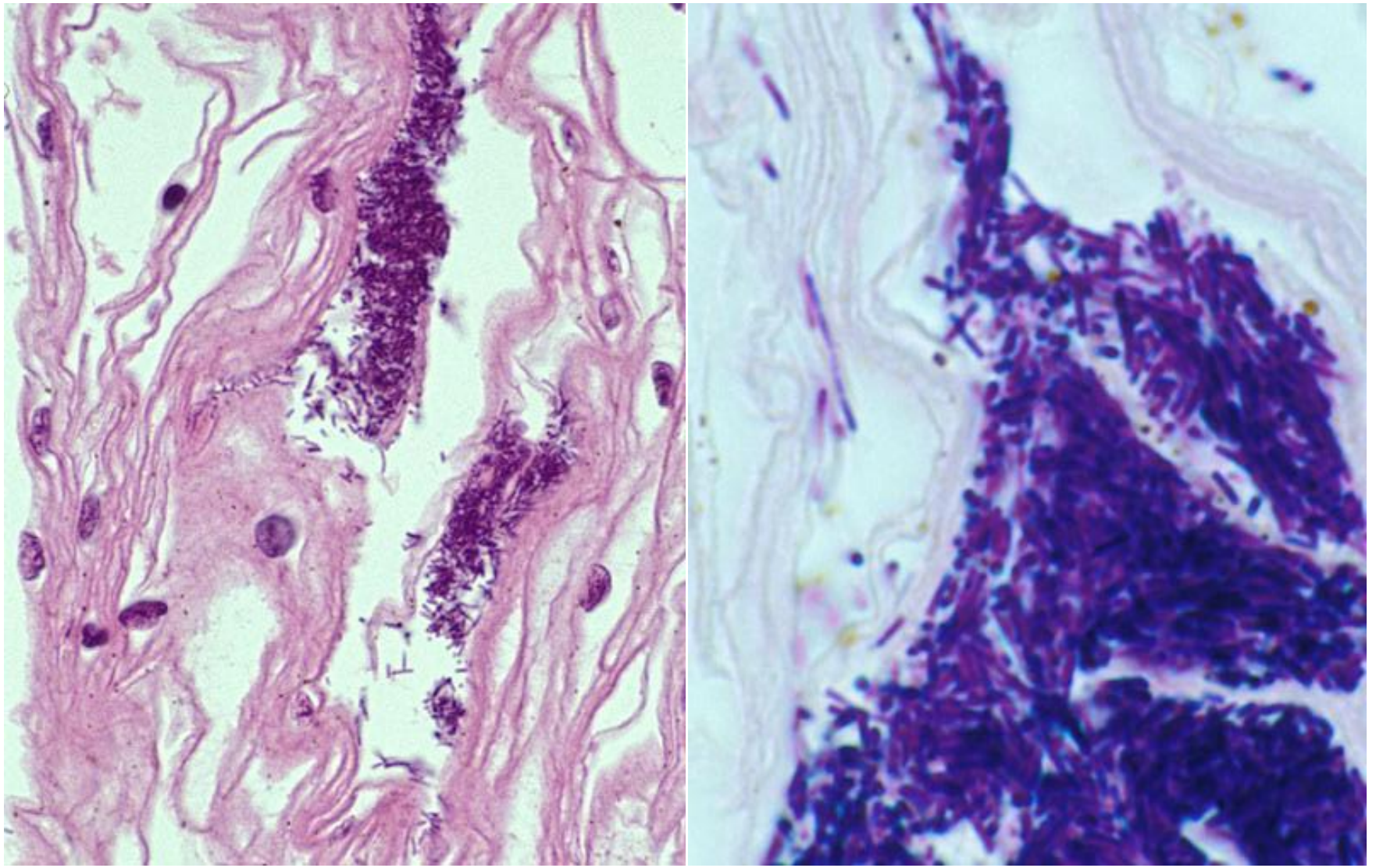
Bacterial vaginosis (bacterial vaginitis) occurs when the natural balance of bacteria in the vagina is disrupted, leading to an overgrowth of certain bacteria. *Lactobacillus* (Döderlein bacillus), the predominant species in healthy vaginal flora, is replaced by anaerobic bacteria, such as *Gardenella vaginalis*, *Mobiluncus curtisii*, *M. mulieris*, *Atopobium vaginae* and other anaerobic bacteria. *G. vaginalis* colonization forms so-called “clue cells”. The interaction between *G. vaginalis* and *A. vaginae* leads to biofilm development that promotes infection persistence and chronicity. *Corynebacterium*, *Peptostreptococcus* and *Streptococcus pneumoniae* may be detected. *E. coli*, *Klebsiella pneumoniae, Pseudomonas aeruginosa* and *Actinomyces* spp. may also be seen particularly in the postmenopausal ladies. Common symptoms include unusual vaginal discharge, a fishy odor and irritation, whereas there are no symptoms at all in a half of the patients. Causes can include factors such as douching, new or multiple sexual partners and antibiotic use. Treatment typically involves antibiotics (clindamycin or metronidazole).

Ref.-1: Mondal AS, et al. Bacterial vaginosis: a state of microbial dysbiosis. Med Microecol 2023; 16: 100082. doi: 10.1016/j.medmic.2023.100082

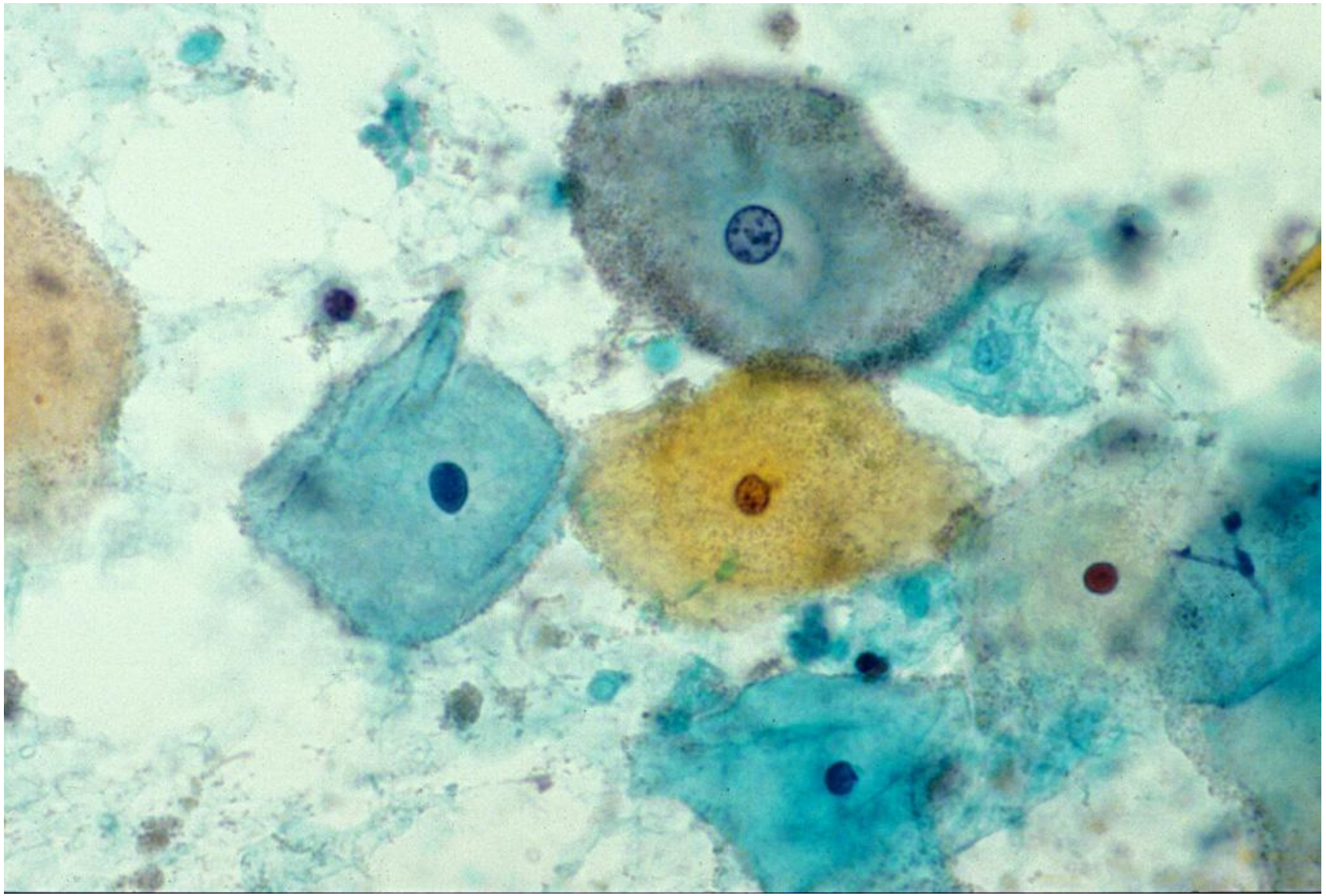
Ref.-2: Tsutsumi Y. Pathology of Infectious Diseases. 2003. https://pathos223.com/en/



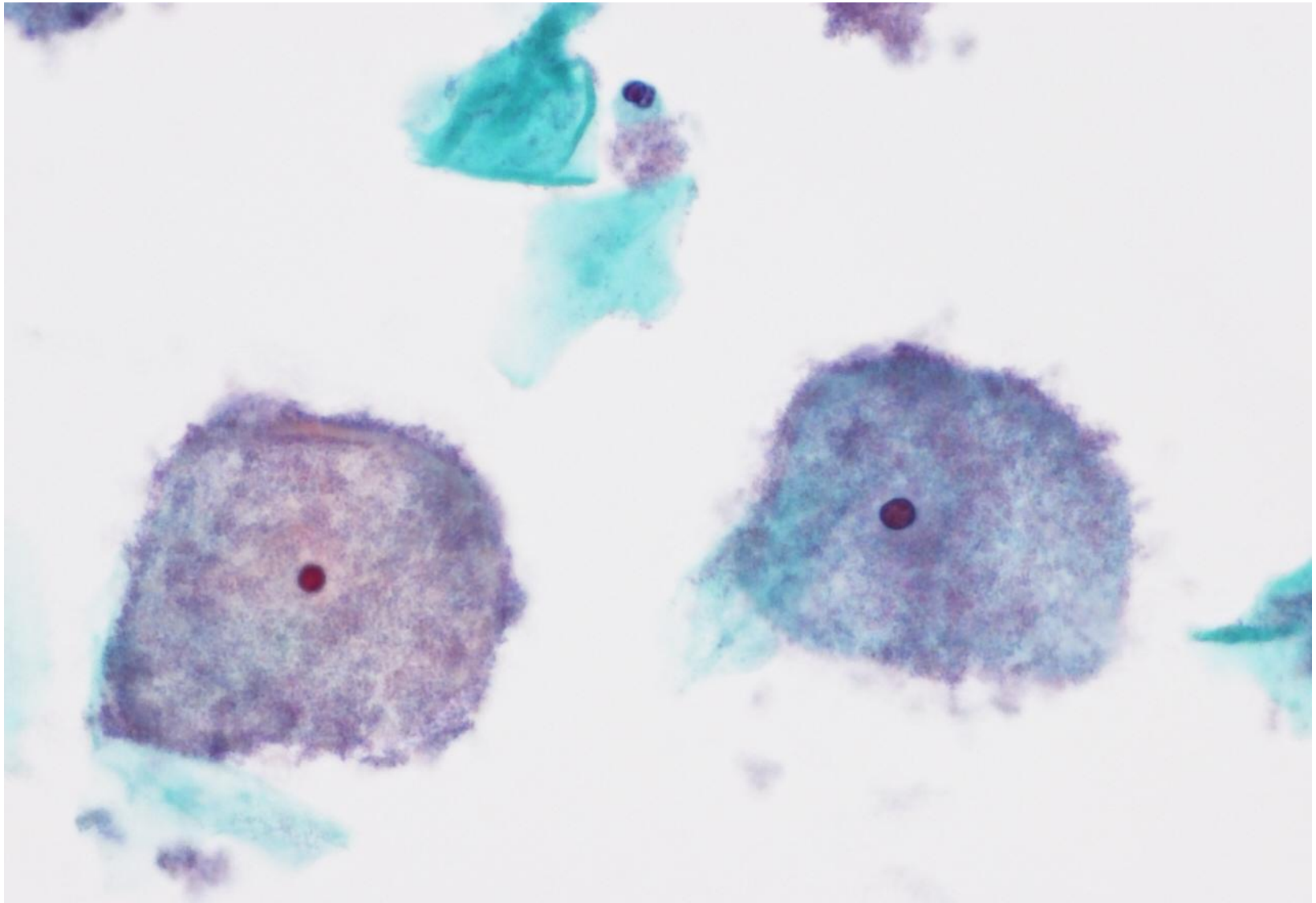
Döderlein bacilli (Lactobacilli, large-sized Gram-positive rods and a normal flora of the vaginal cavity) physiologically maintains low pH in the vaginal lumen by producing lactic acid (Papanicolaou).



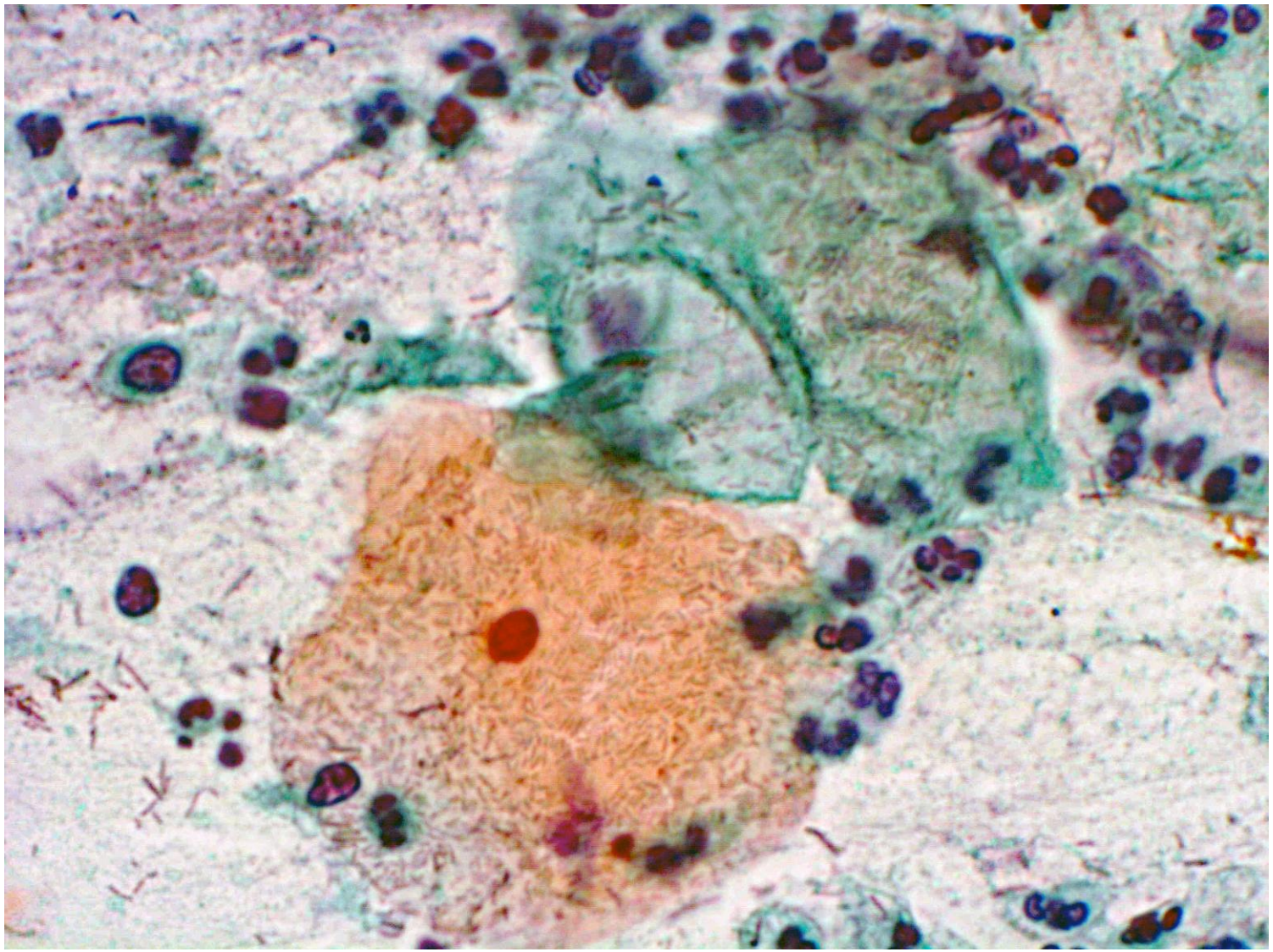
Döderlein bacilli, large Gram-positive rods, colonizing the vaginal squams, seen in a pregnant woman.  Döderlein bacilli consist of a normal microflora in the vaginal cavity (left: H&E, right: Gram).



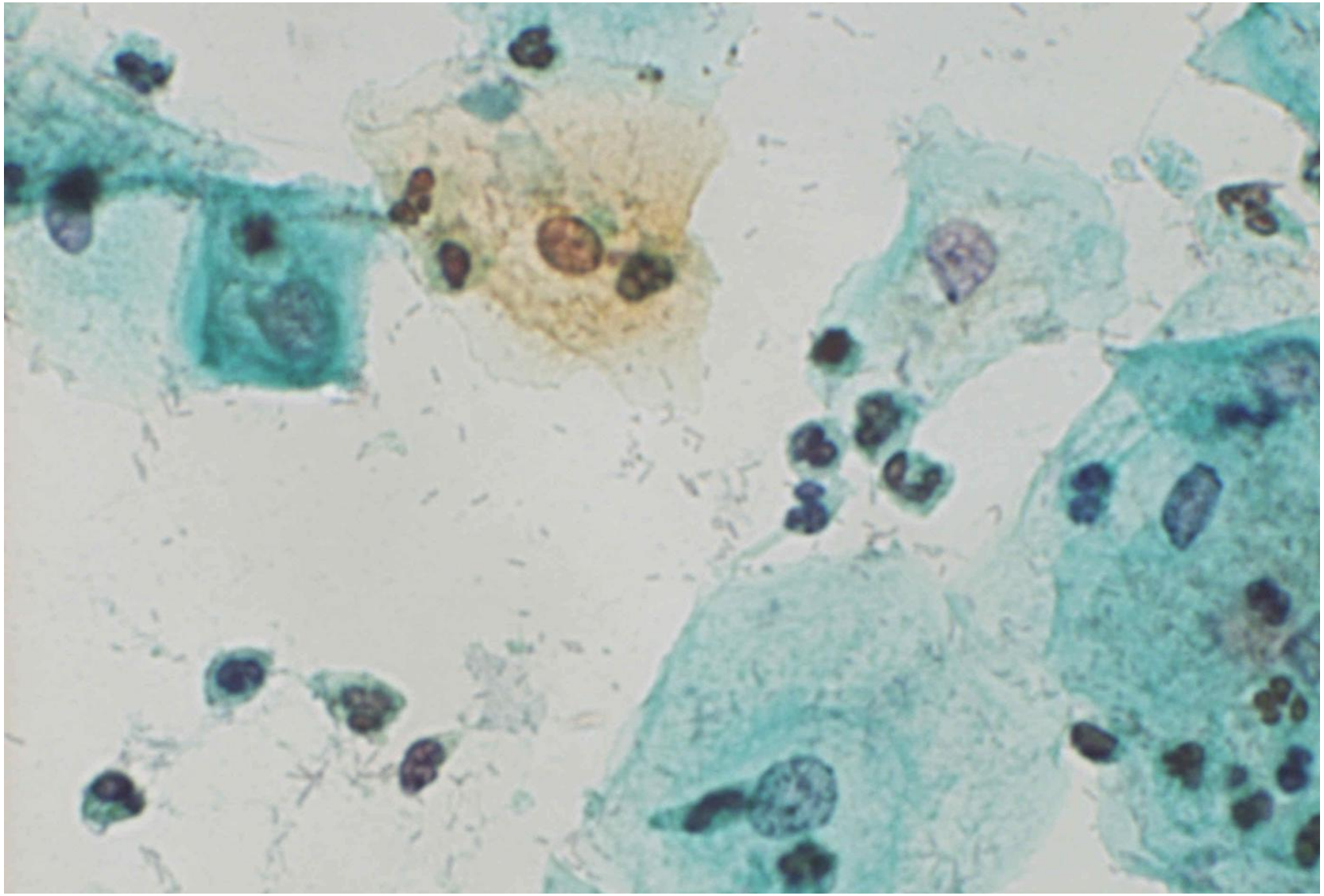
Bacterial vaginosis with *Gardnerella vaginalis* colonization. The clue cells are characteristic. Döderlein bacilli are no longer seen. *G. vaginalis* is a facultative anaerobic small rod with unstable Gram reactivity (Papanicolaou).



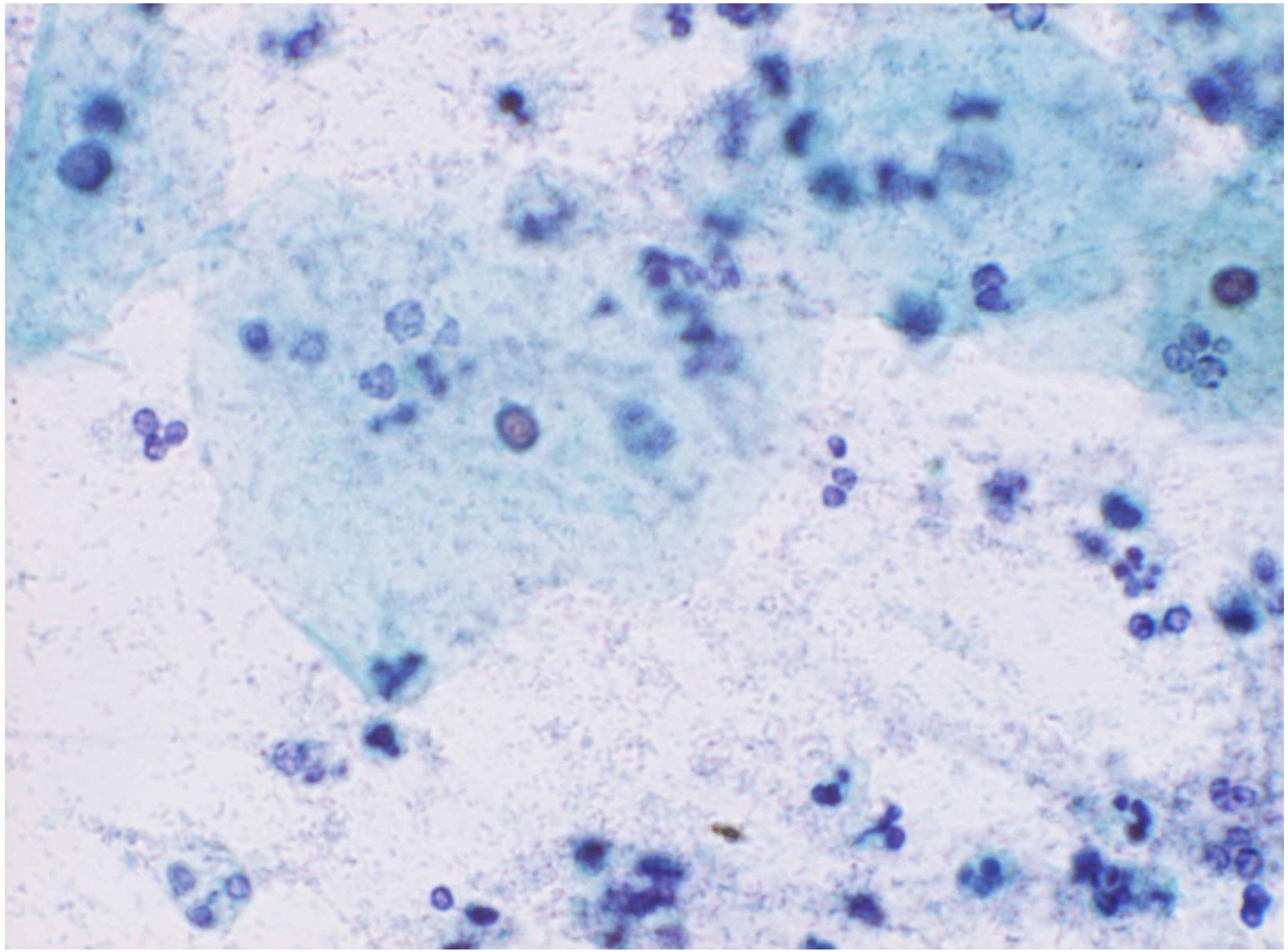
Bacterial vaginosis with *Gardnerella vaginalis* colonization. The clue cells are characteristic. Döderlein bacilli are no longer seen (Papanicolaou).



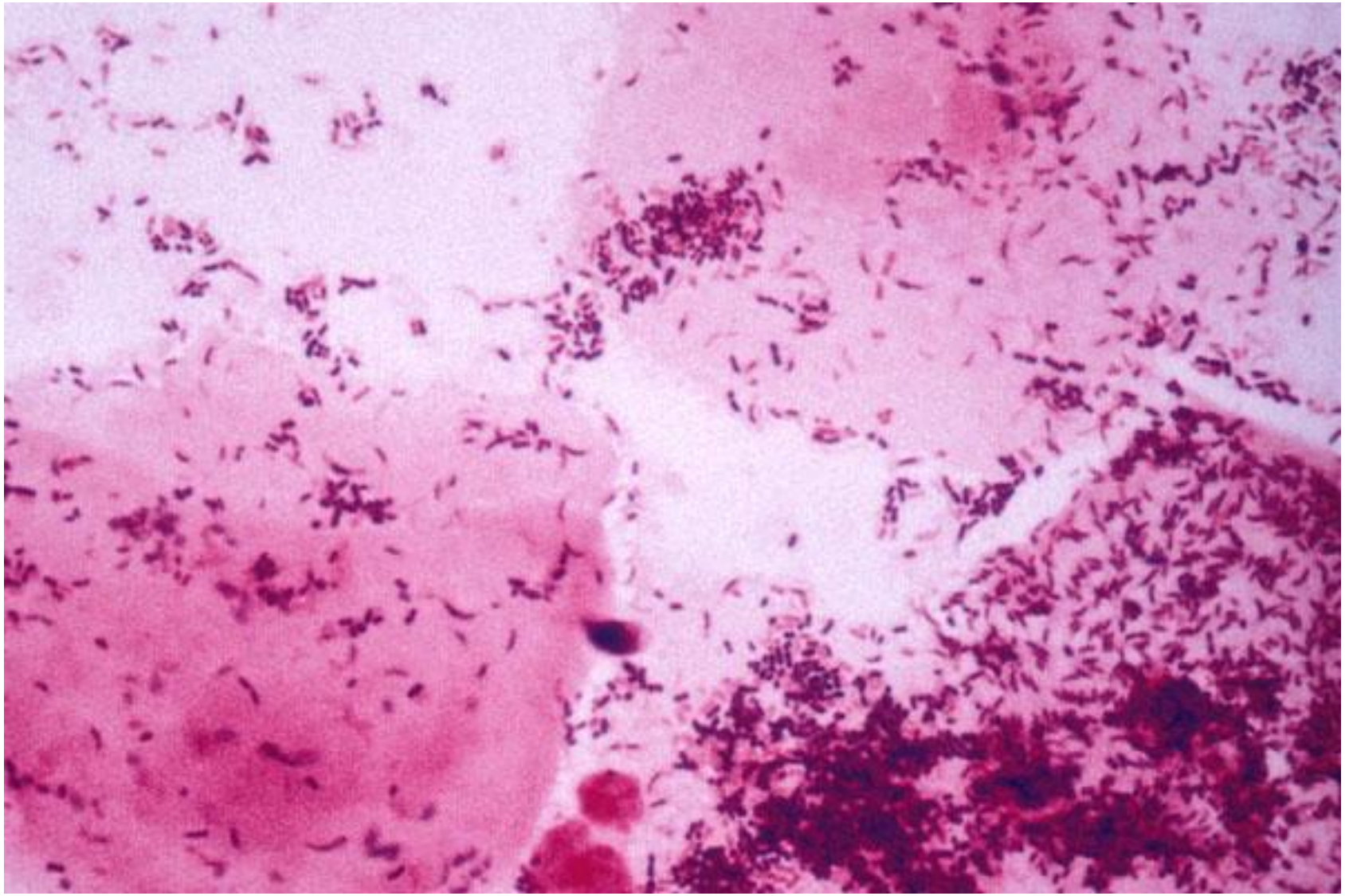
Co-localization of Döderlein bacilli and *Gardneralla vaginalis*. In this cervical smear preparation sampled from a 24 y-o pregnant female patient, both Döderlein bacilli and *G. vaginalis* co-exist (Papanicolaou).



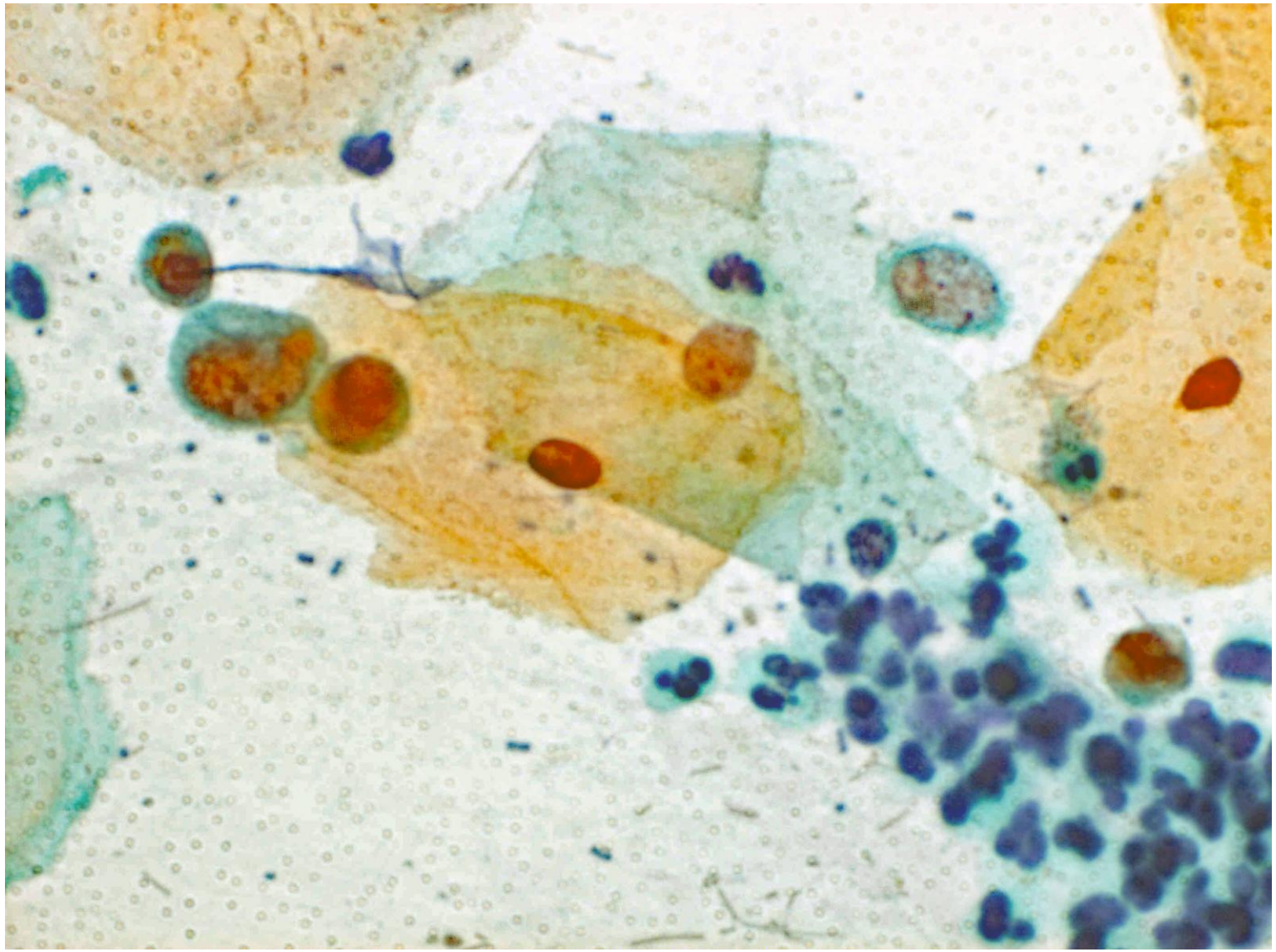
Bacterial vaginosis with *Mobiluncus* spp. colonization. Small thin needle-like and curved rods are dispersed. *Mobiluncus* is a Gram-unstable highly mobile anaerobe. Döderlein bacilli are no longer seen (Papanicolaou).



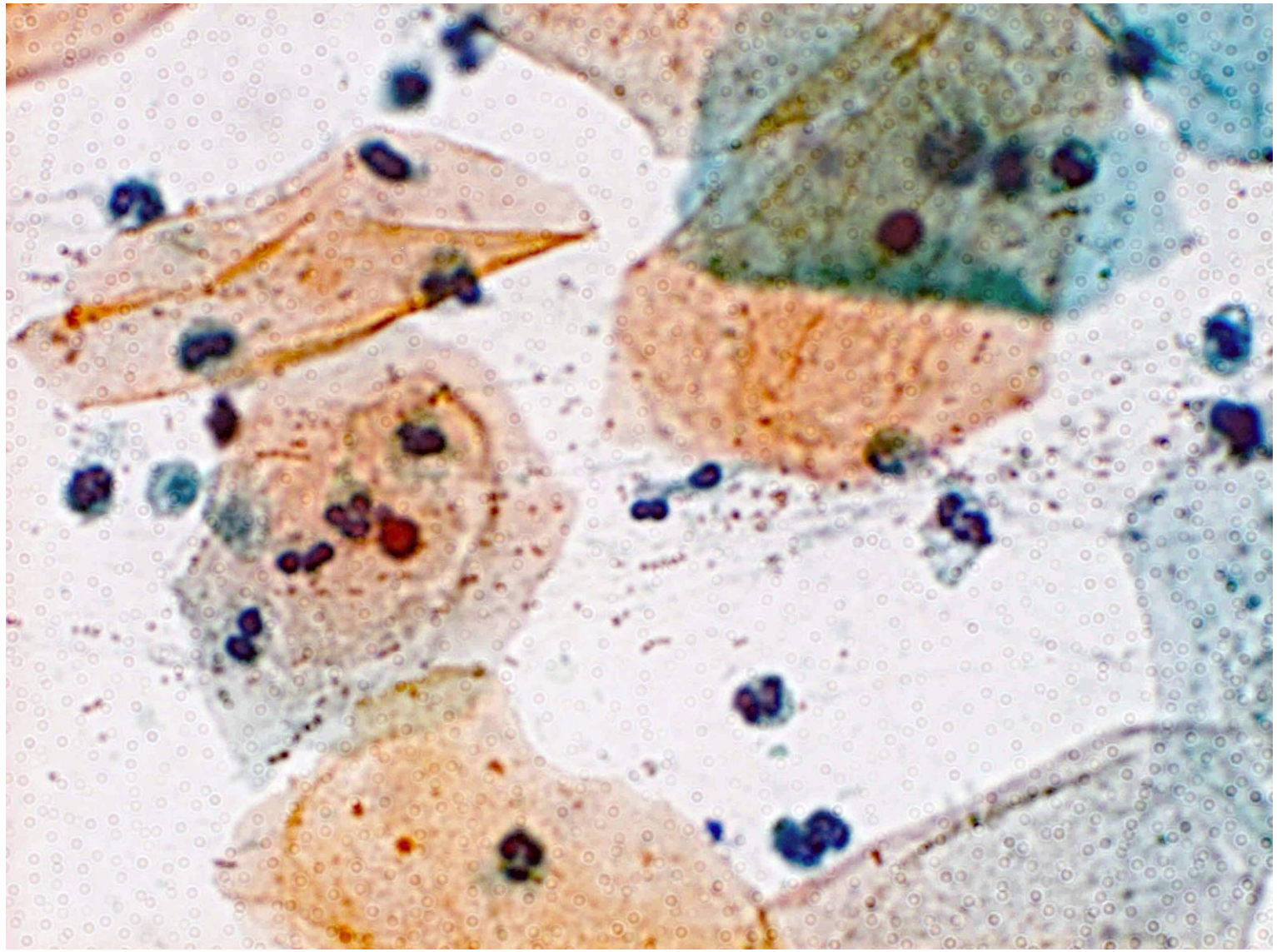
Bacterial vaginosis with *Mobiluncus* spp. colonization. Small thin needle-like and curved rods are dispersed. *Mobiluncus* is a Gram-unstable highly mobile anaerobe. Döderlein bacilli are no longer seen (Papanicolaou).



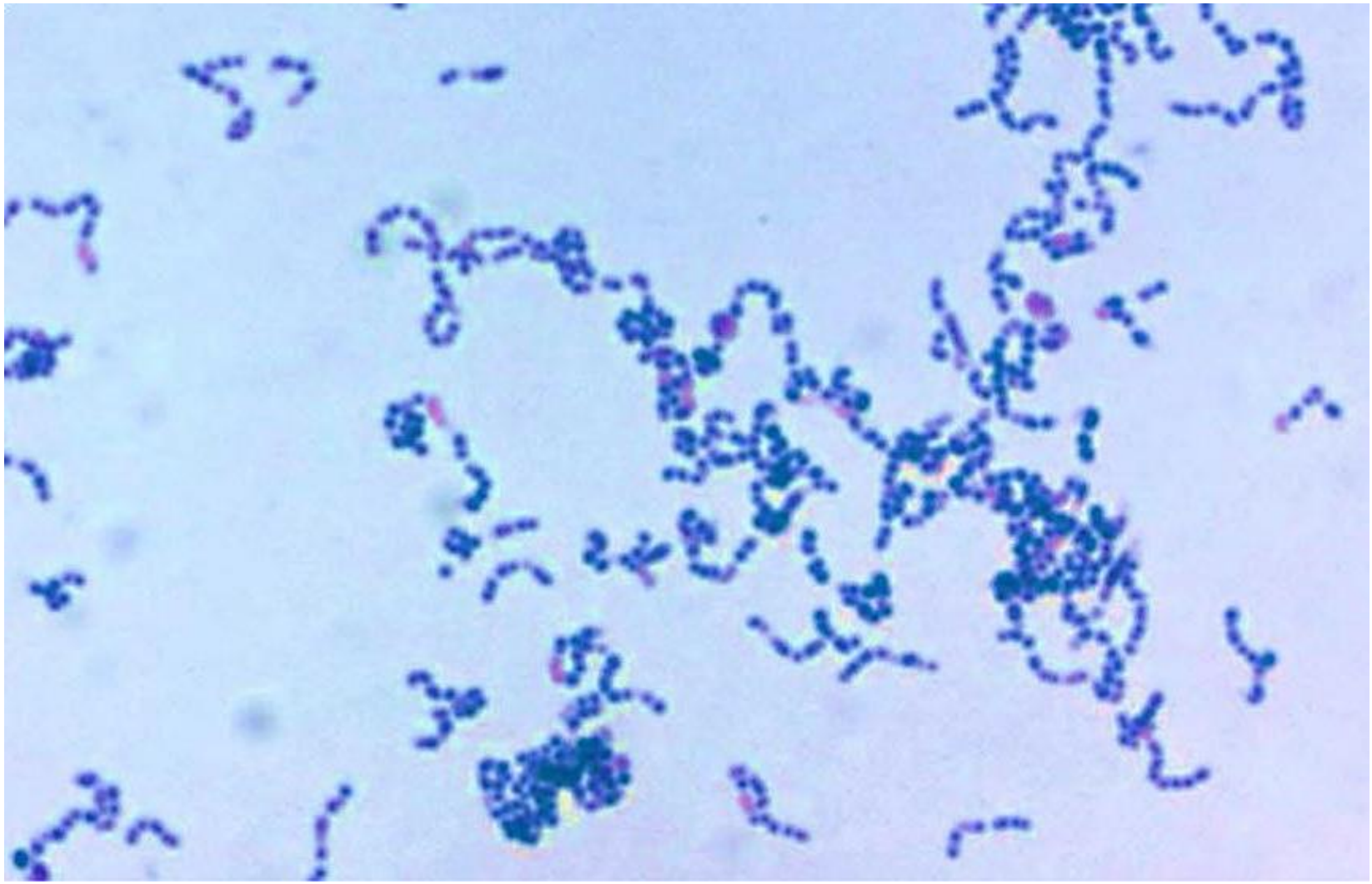
Bacterial vaginosis with *Mobiluncus* spp. colonization. Small thin needle-like and curved rods are clustered. *Mobiluncus* is a Gram-positive or Gram-unstable. Döderlein bacilli are no longer seen (Gram).



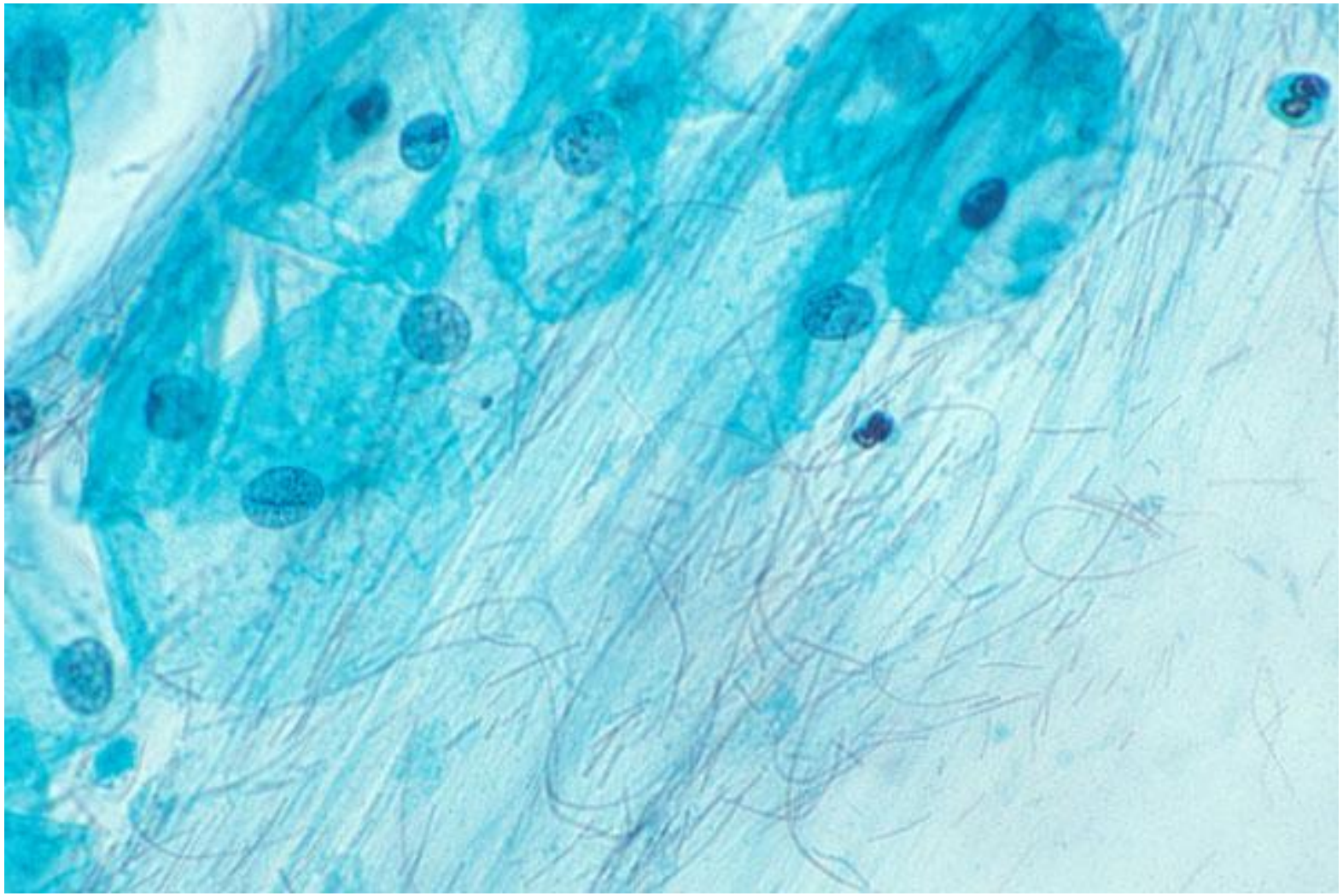
*Atopobium vaginae* on cervical smear sampled from a 28 y-o female patient with severe dysplasia (HSIL). Paired coccobacilli are dispersed in the inflammatory background (Papanicolaou).



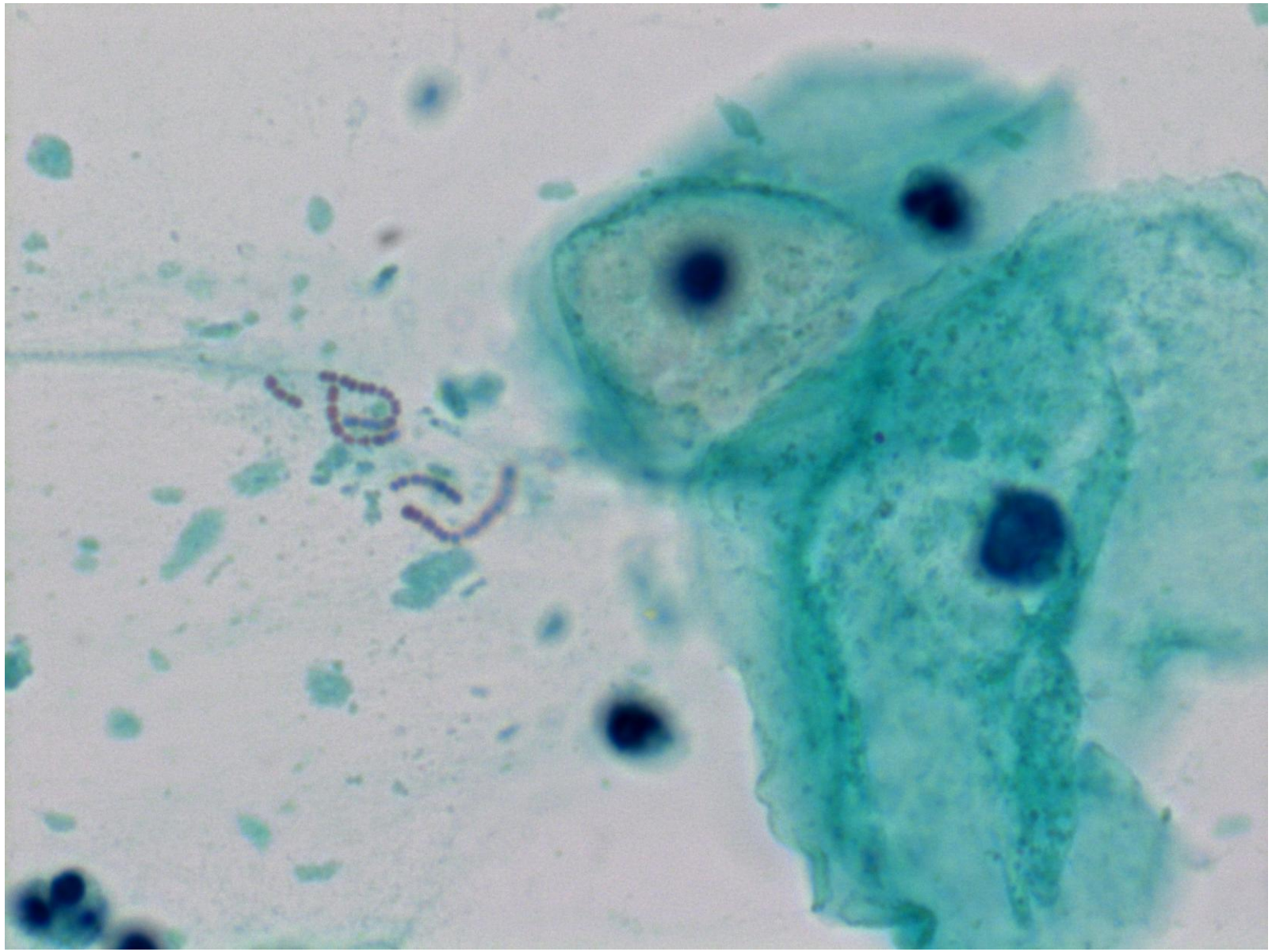
*Atopobium vaginae* on cervical smear sampled from a 41 y-o female patient. Paired and chained coccobacilli are dispersed in the mildly inflammatory background (Papanicolaou).



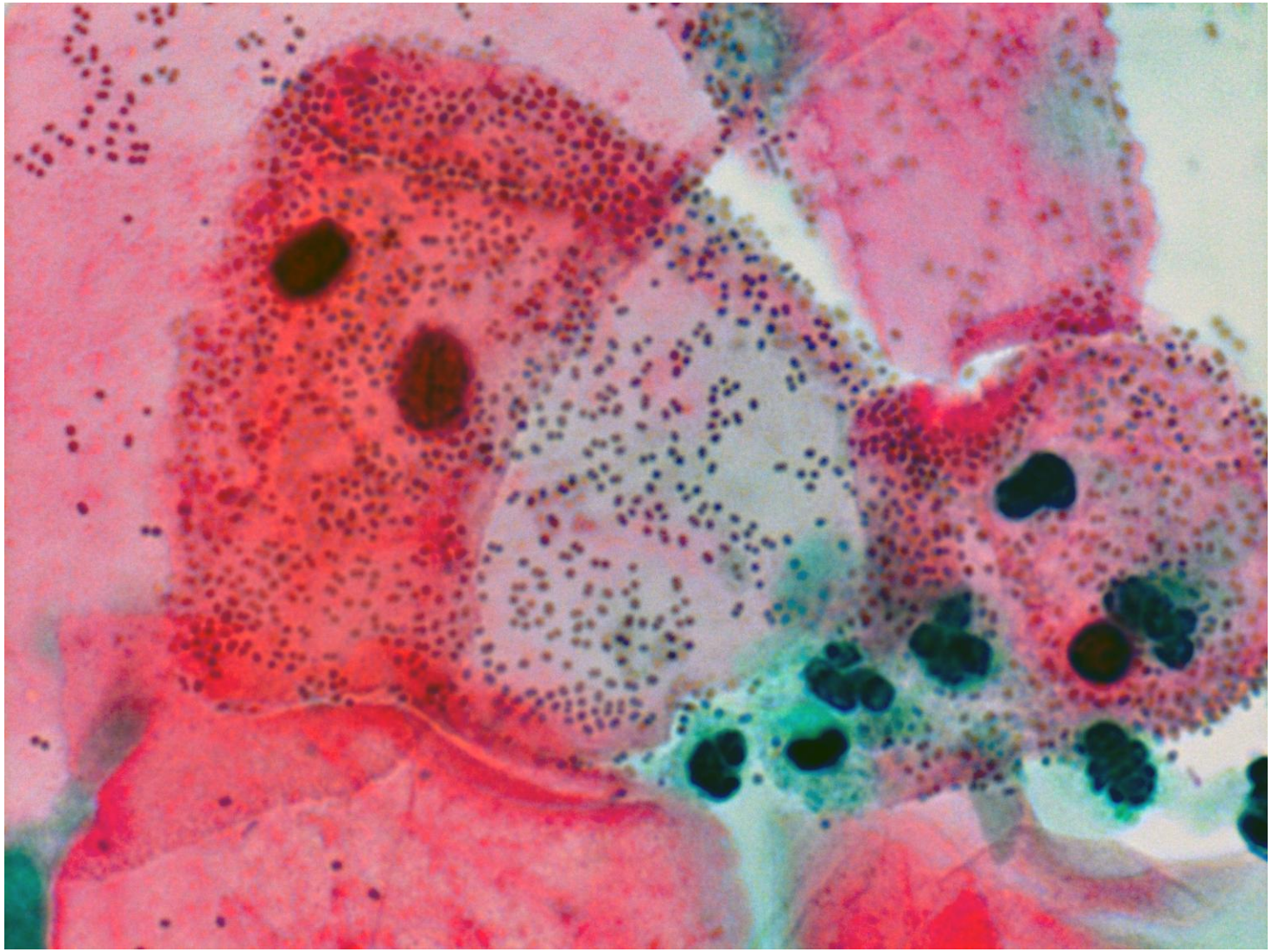
*Atopobium vaginae* is a Gram-positive, facultative anaerobic coccobacillus forming pairs or short chains.  It caused bacterial vaginosis.  Cultured bacteria (Gram).
Borrowed from: Creative Biolabs (Live Biotherapeutics)



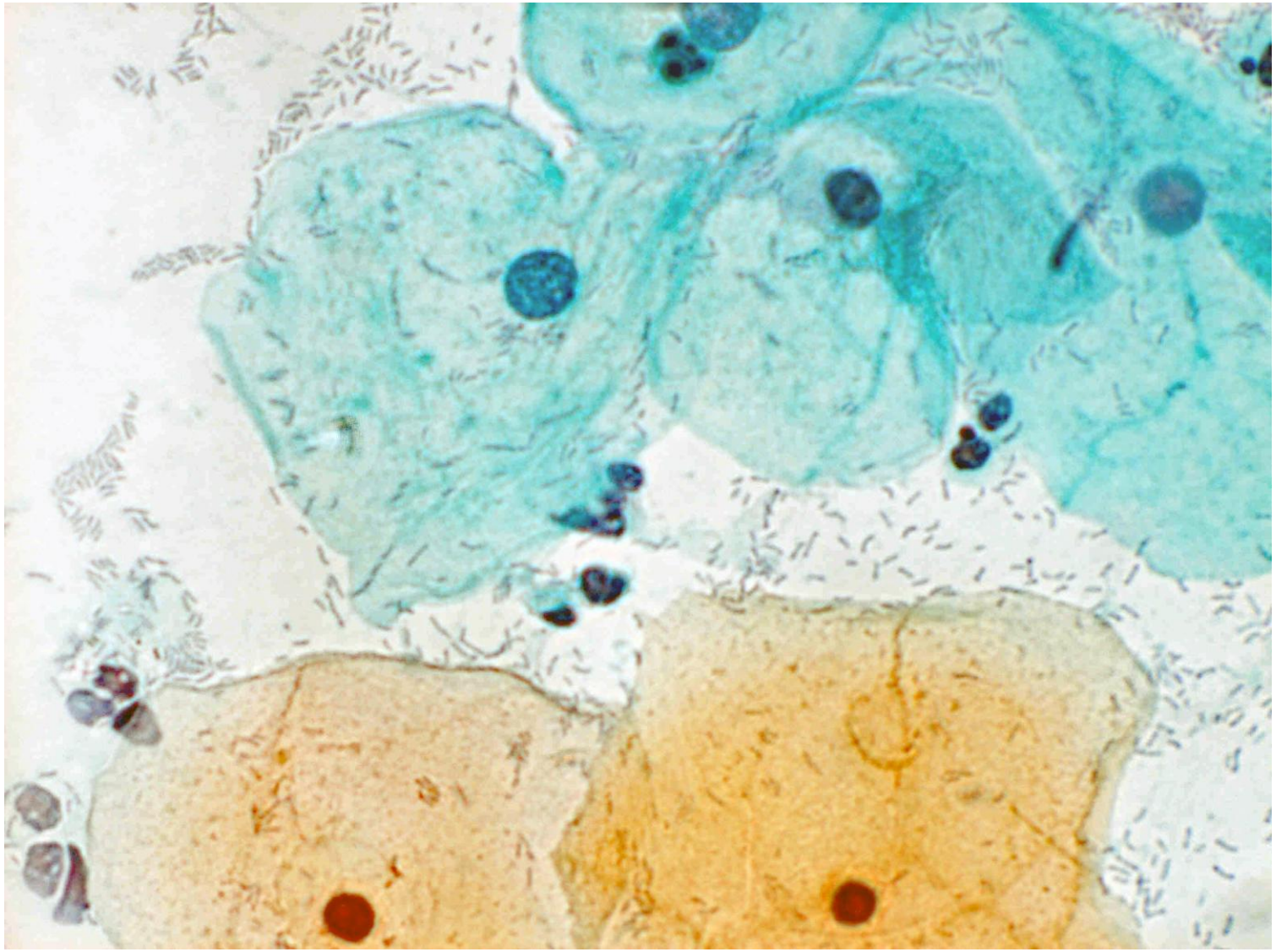
*Leptothrix* spp. Mildly curved, hair-like filamentous non-pathogenic bacteria. Leptothrix is widely distributed in the iron-rich environment (Papanicolaou).



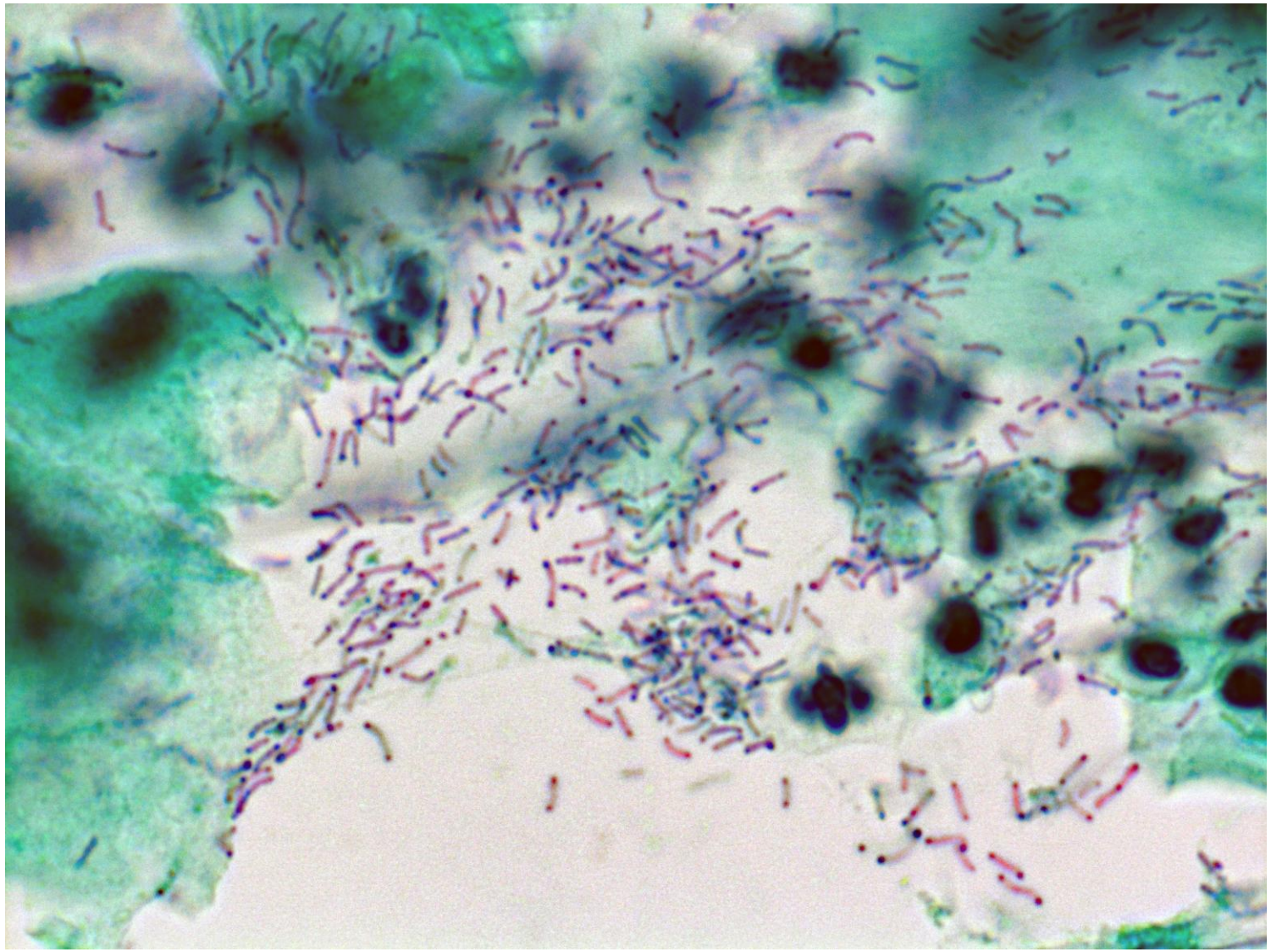
*Streptococcus agalactiae* (group B *Streptococcus*) seen on the cervical smear sampled from a 60 y-o female patient. *S. agalactiae* is a part of normal flora of the vaginal cavity.



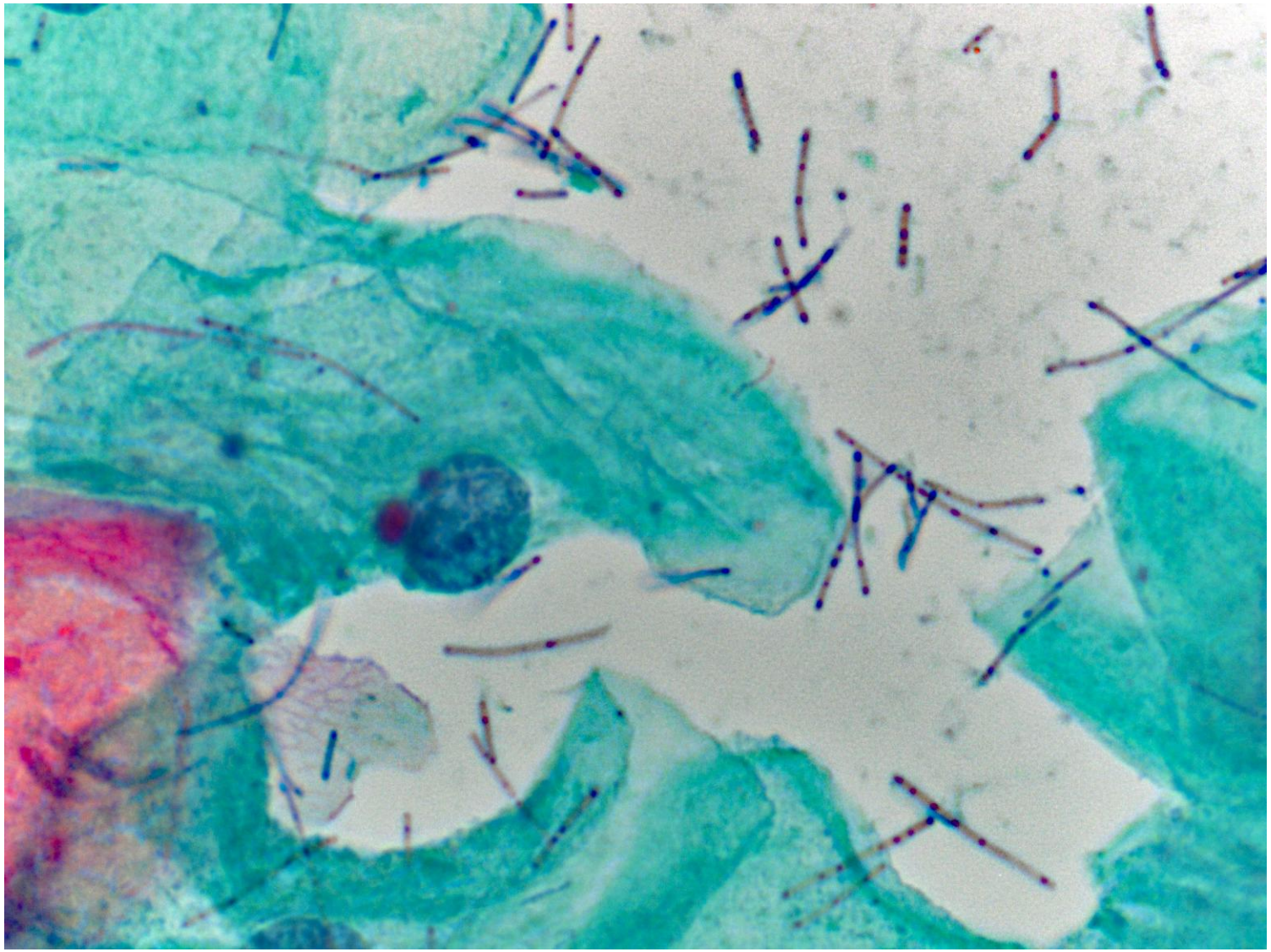
*Streptococcus pneumoniae* (Pneumococcus) seen in the cervical smear sampled from a 26 y-o female patient. Diplococci with capsule formation are seen mainly on the keratinocytes. Neutrophilic reaction is associated (Papanicolaou).



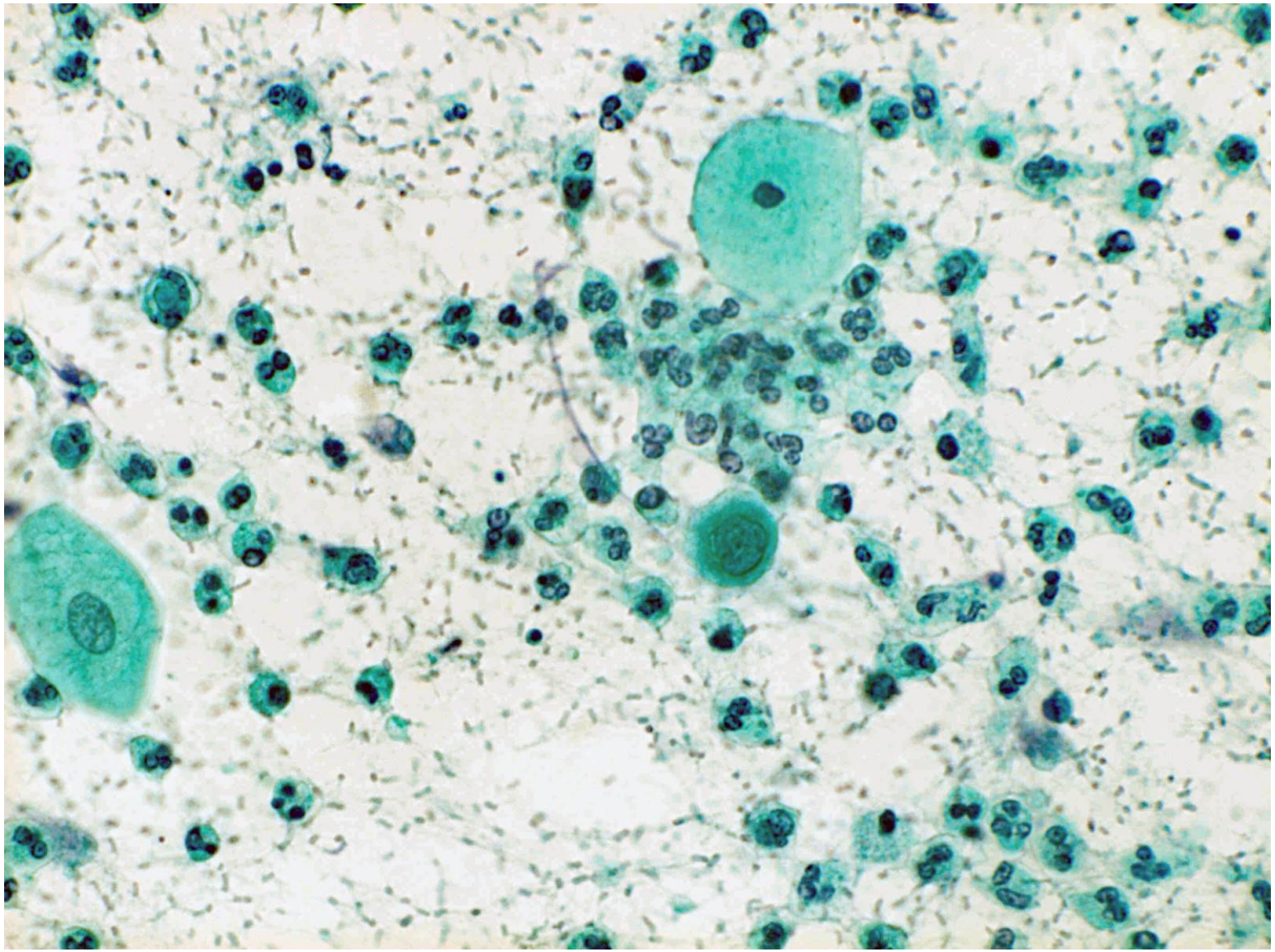
*Peptostreptococcus* spp. in the cervical smear sampled from a 32 y-o female patient. Small-sized chained cocci are observed. *Peptostreptococcus* is an anaerobic, Gram-positive, small-sized spherical bacteria. Compare the size with that of the previous two panels (Papanicolaou).



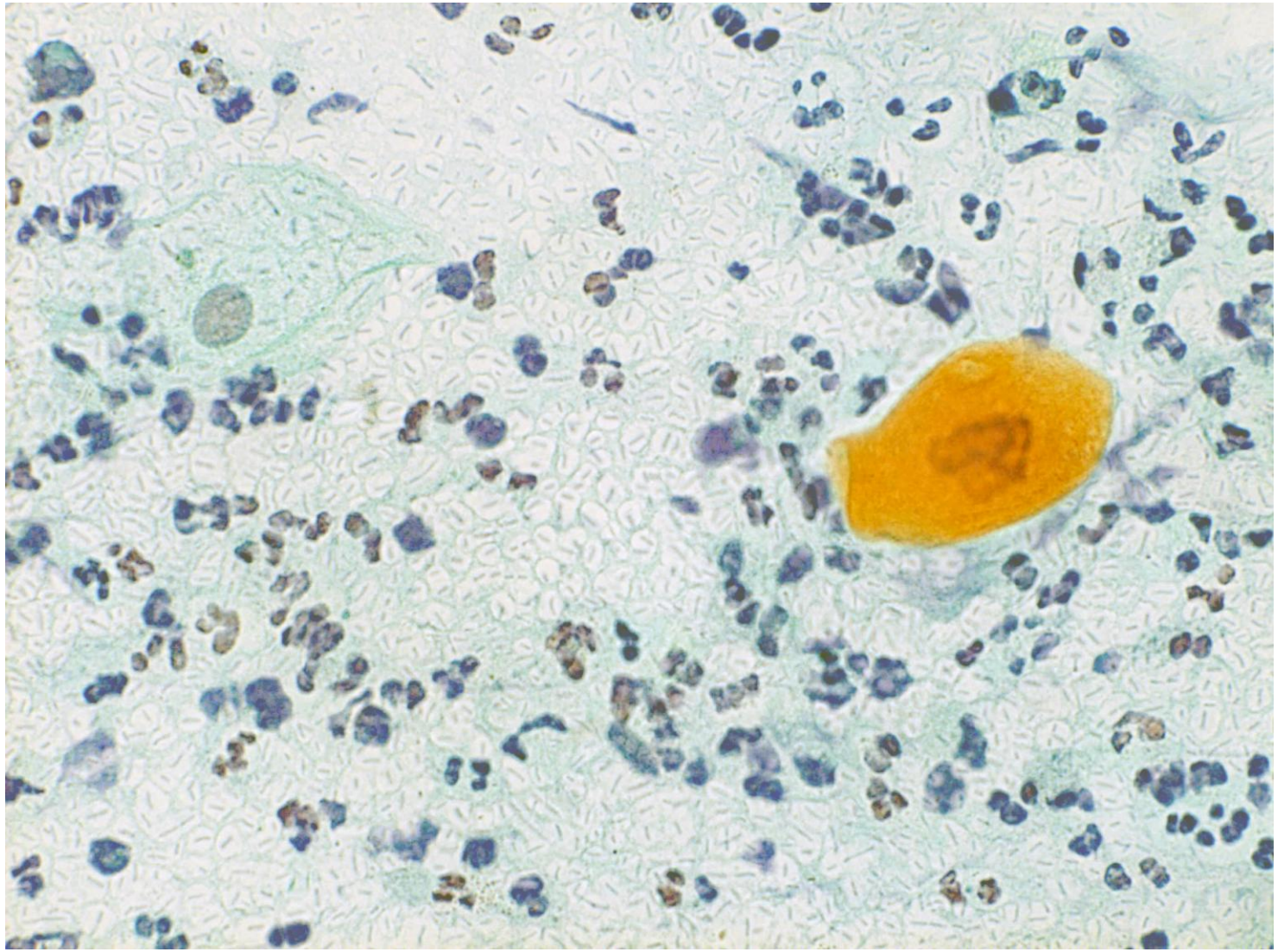
*Corynebacterium* spp. seen in the cervical smear sampled from a 41 y-o female patient.  Large straight or slightly curved rods possess characteristic club-shaped ends (Papanicolaou).



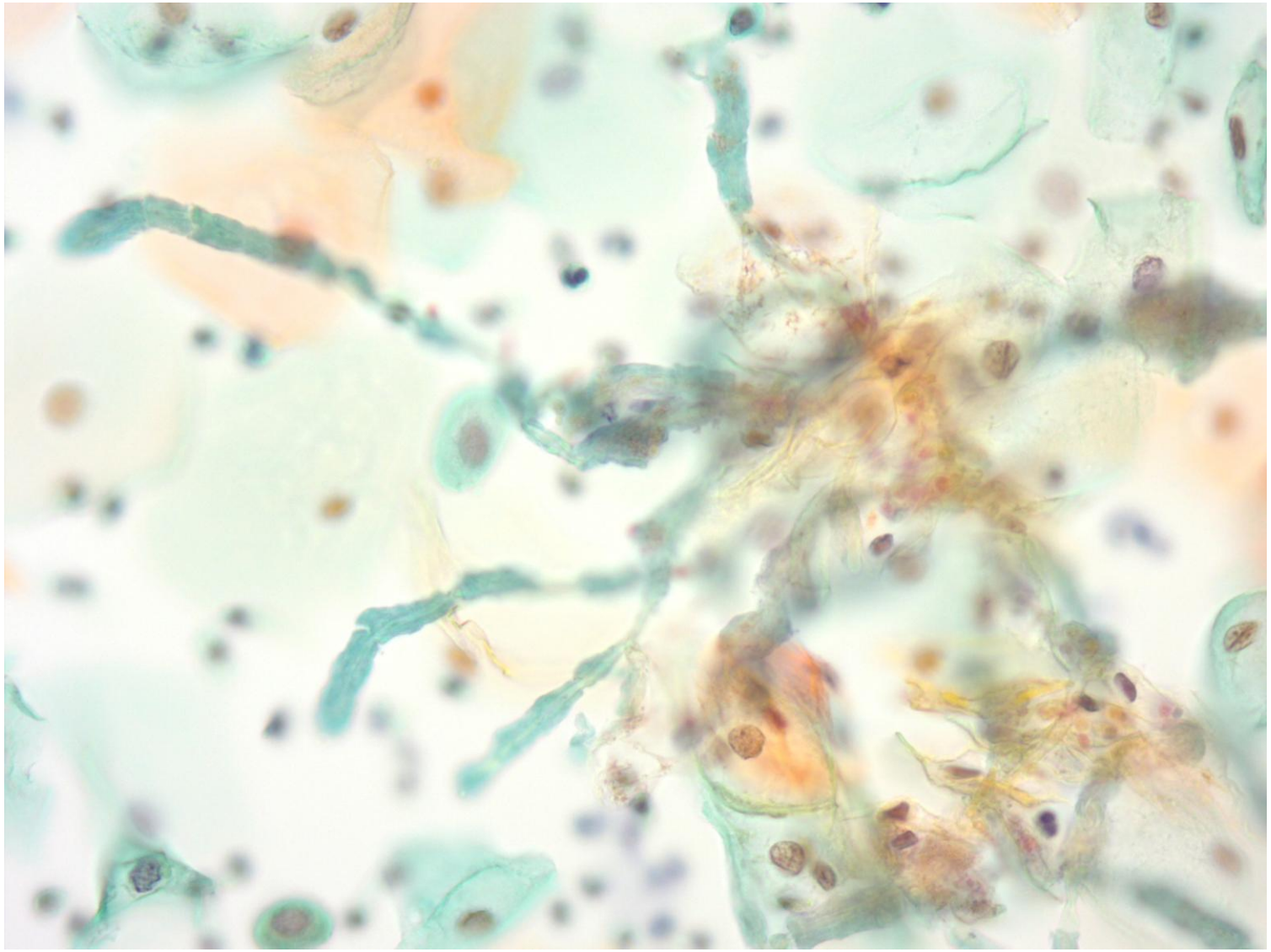
*Corynebacterium* spp. seen in the cervical smear sampled from a 58 y-o female patient. Longitudinal chains are formed by several large straight rods with club-shaped ends (Papanicolaou).



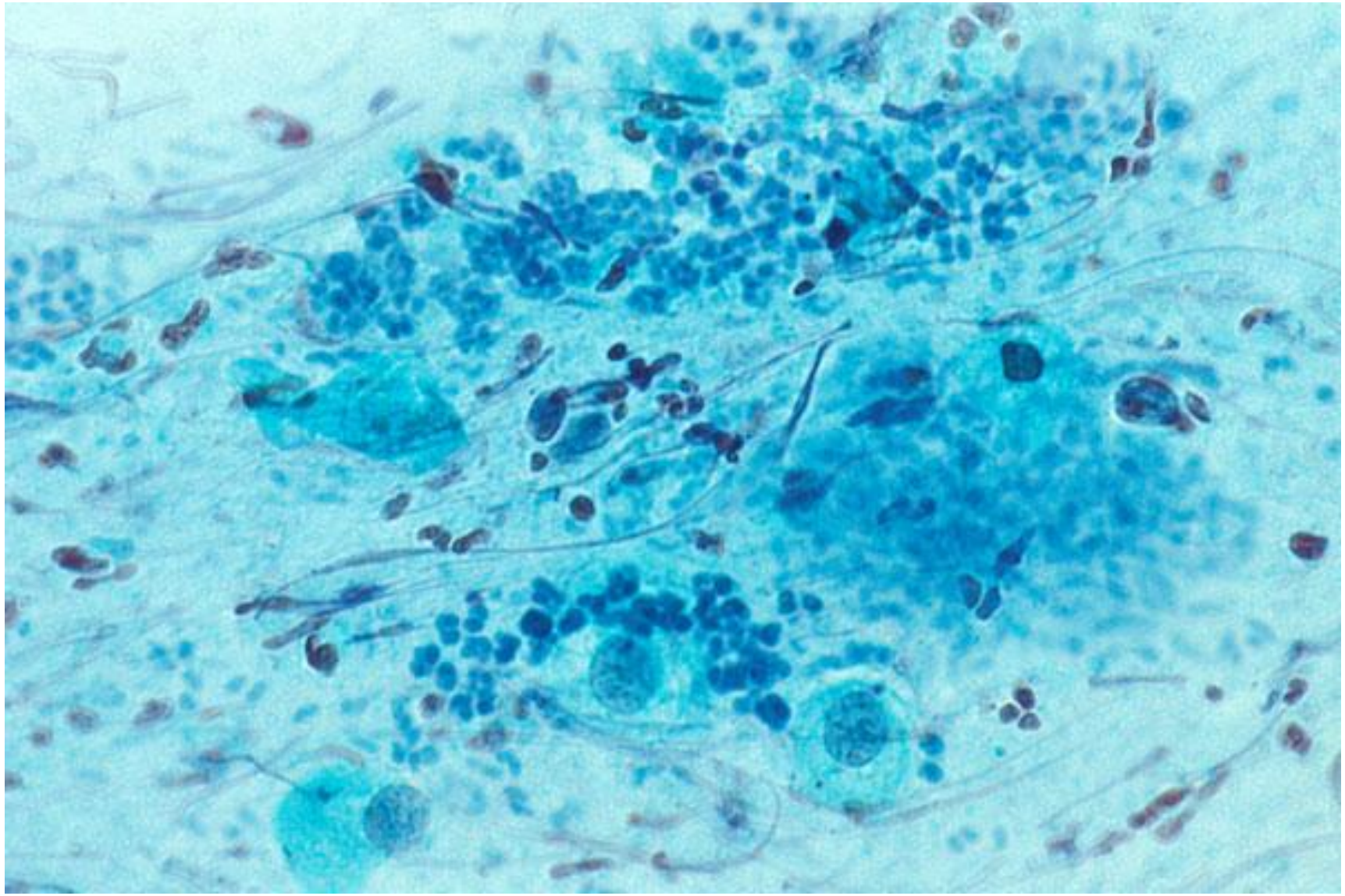
*E. coli* seen on the cervical smear sampled from a 58 y-o female postmenopausal lady.  Neutrophilic reactions are observed in the background of senile colpitis (Papanicolaou).



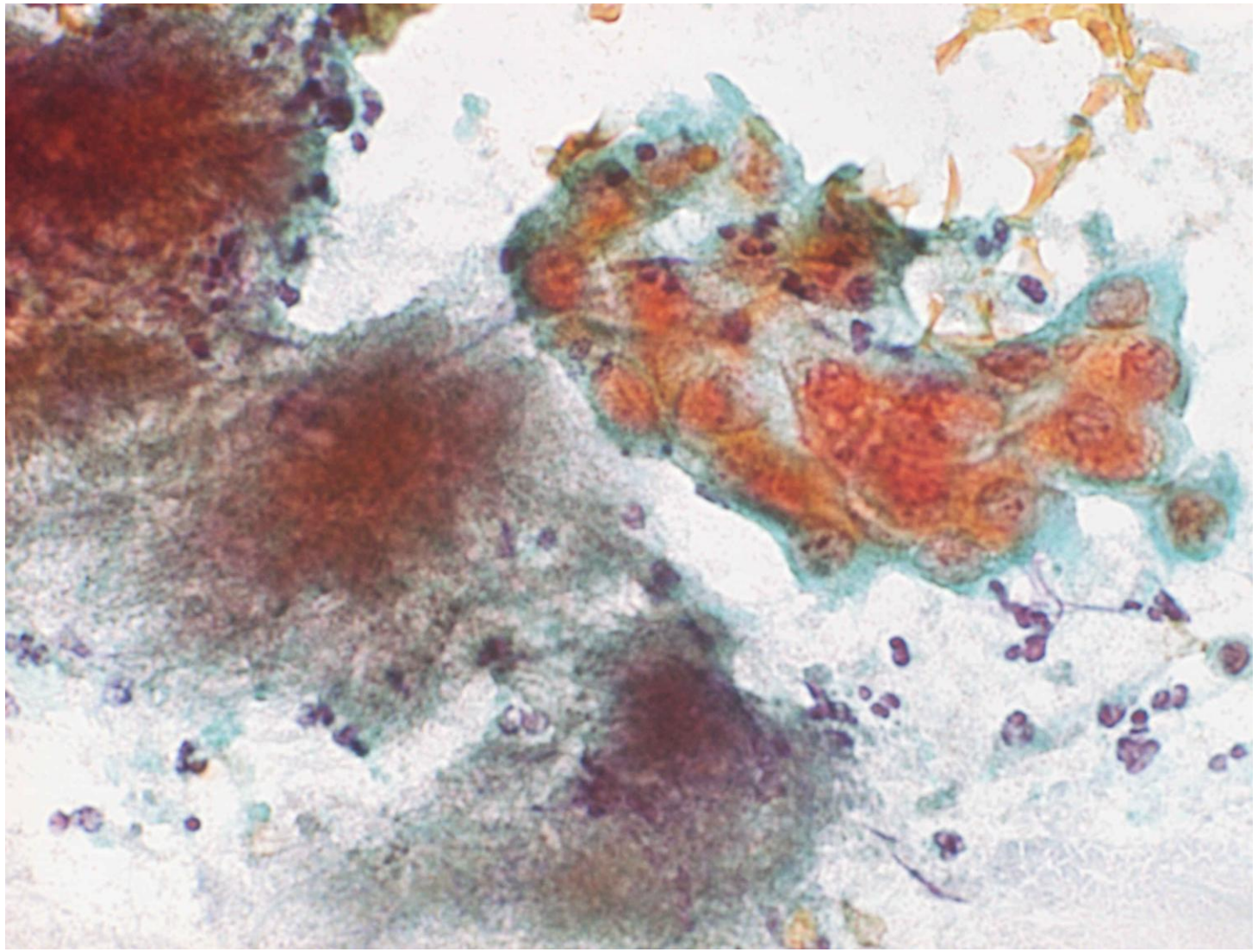
*Klebsiella pneumoniae* seen on the cervical smear sampled from a 60 y-o lady. Rods forming thick translucent capsules grow in association with neutrophilic reactions (Papanicolaou).



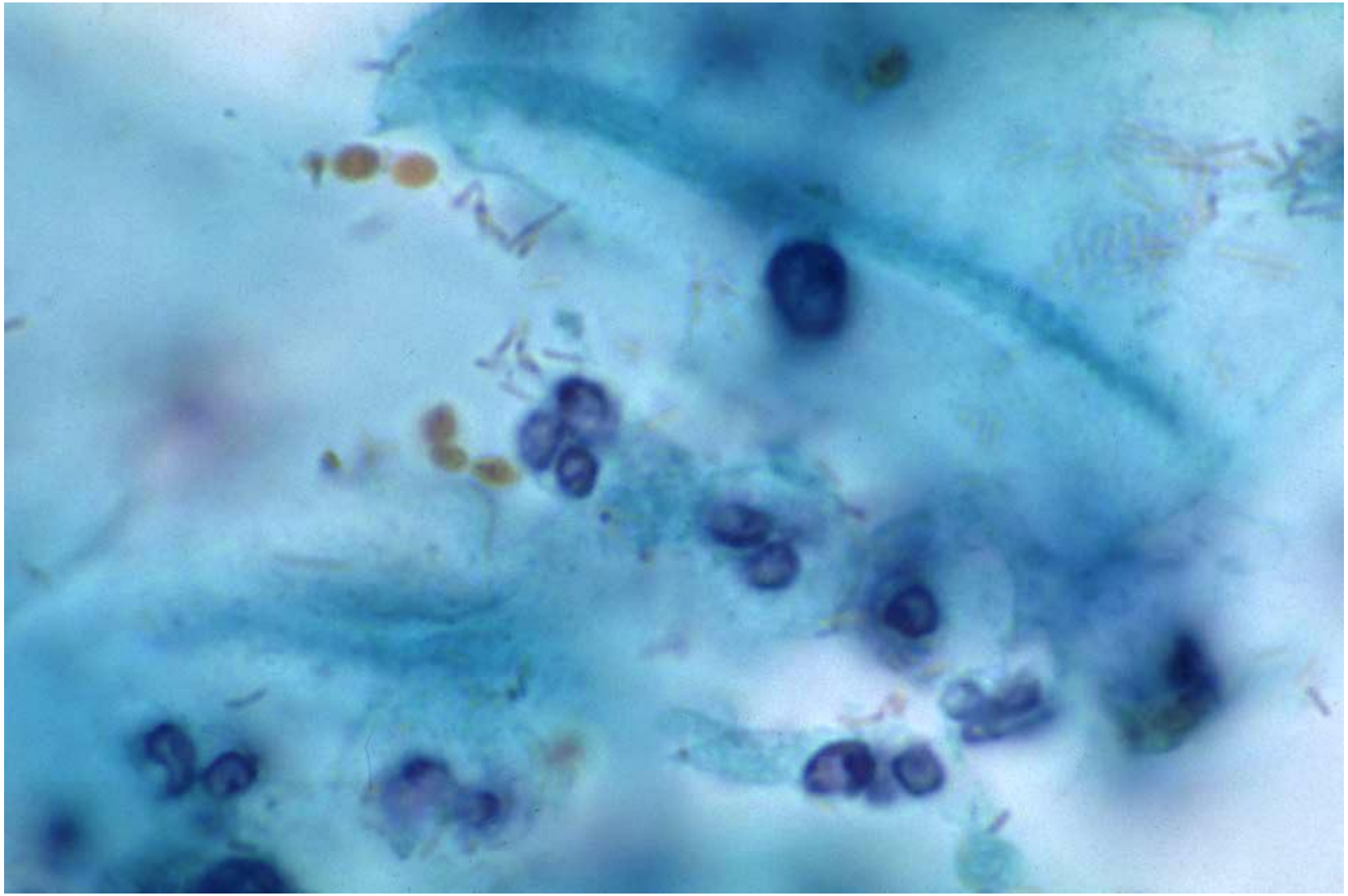
*Klebsiella pneumoniae* seen on the cervical smear sampled from a 41 y-o lady.  Rods forming thick green-colored capsules are connected toward a long axis direction (Papanicolaou).



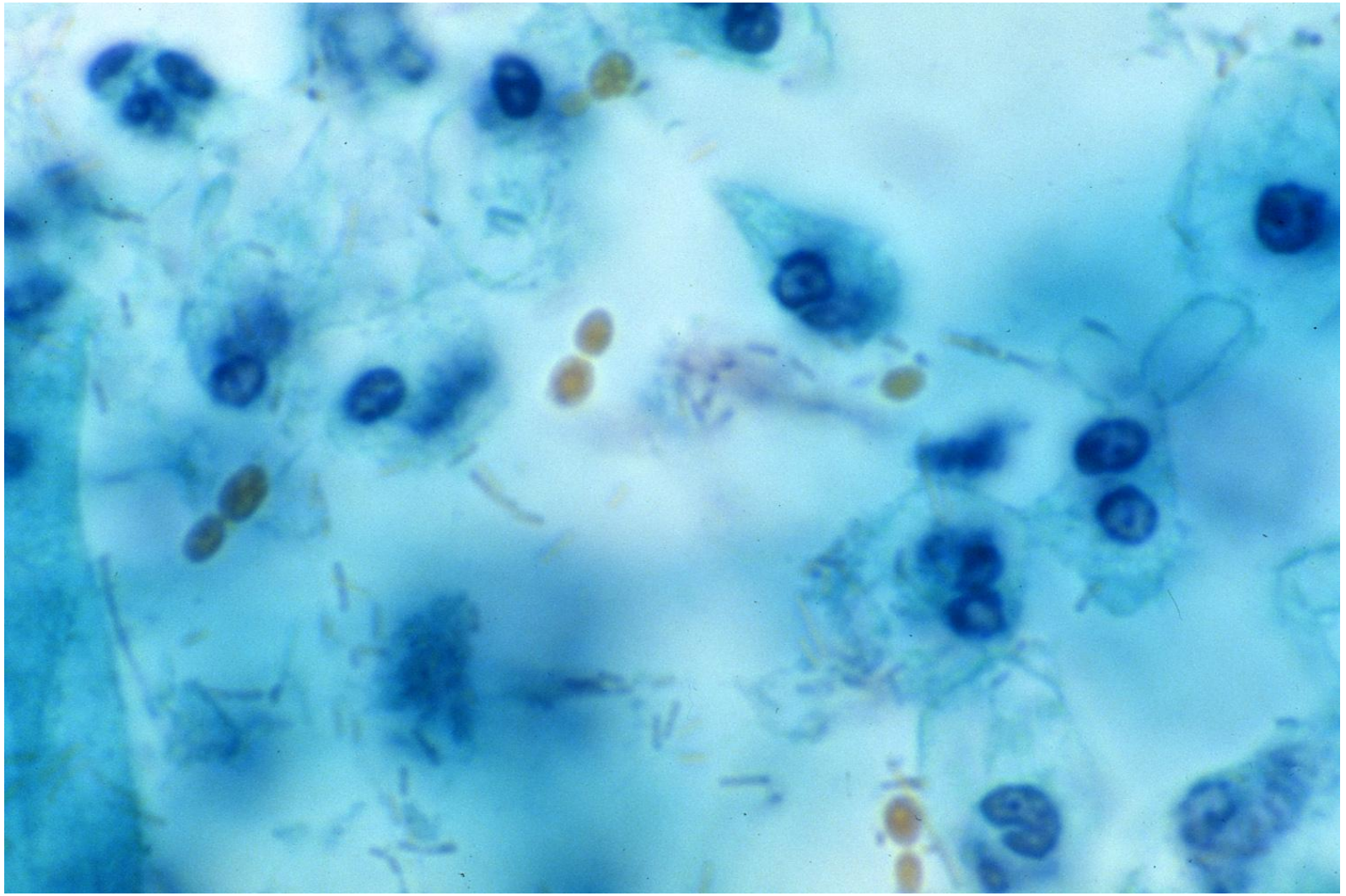
*Pseudomonas aeruginosa* is seen on the cervical smear sampled from a 70 y-o lady after hysterectomy for cervical cancer. Mucoid-type colonies represent biofilm infection provoking chronic persistent (intractable) infection. Nuclear lines are associated (Papanicolaou).



Actinomycotic grains in the cervical smear sampled from a 57 y-o postmenopausal lady.  Repair cells are observed (Papanicolaou).



*Torulopsis glabrata* colonization. A pair of capsule-forming yeasts (blastospores) stained yellowish orange are seen in the mildly inflamed background. Döderlein bacilli are retained, so that they represent a normal flora. This must not be confused with *Candida albicans* colpitis (Papanicolaou).



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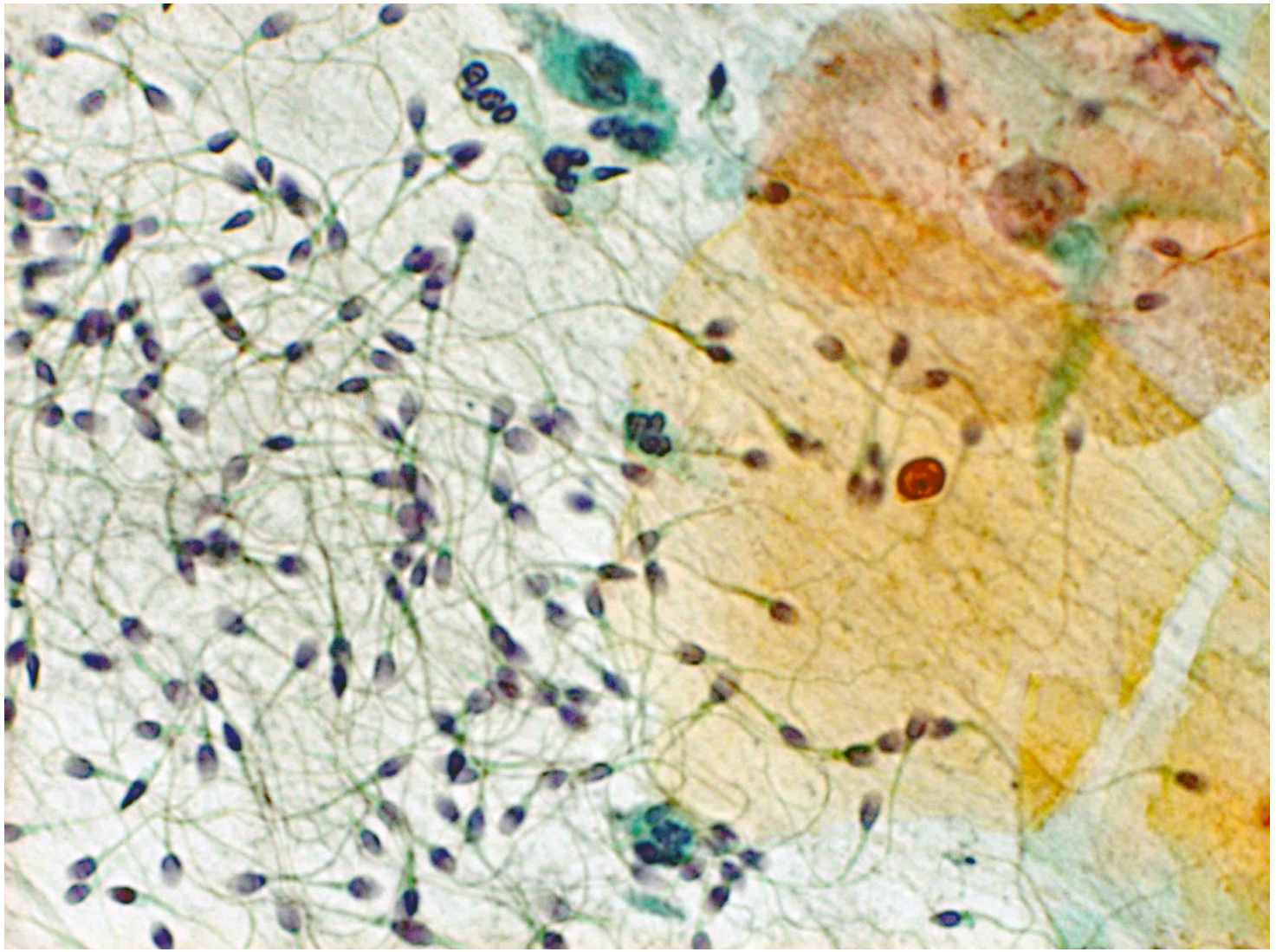
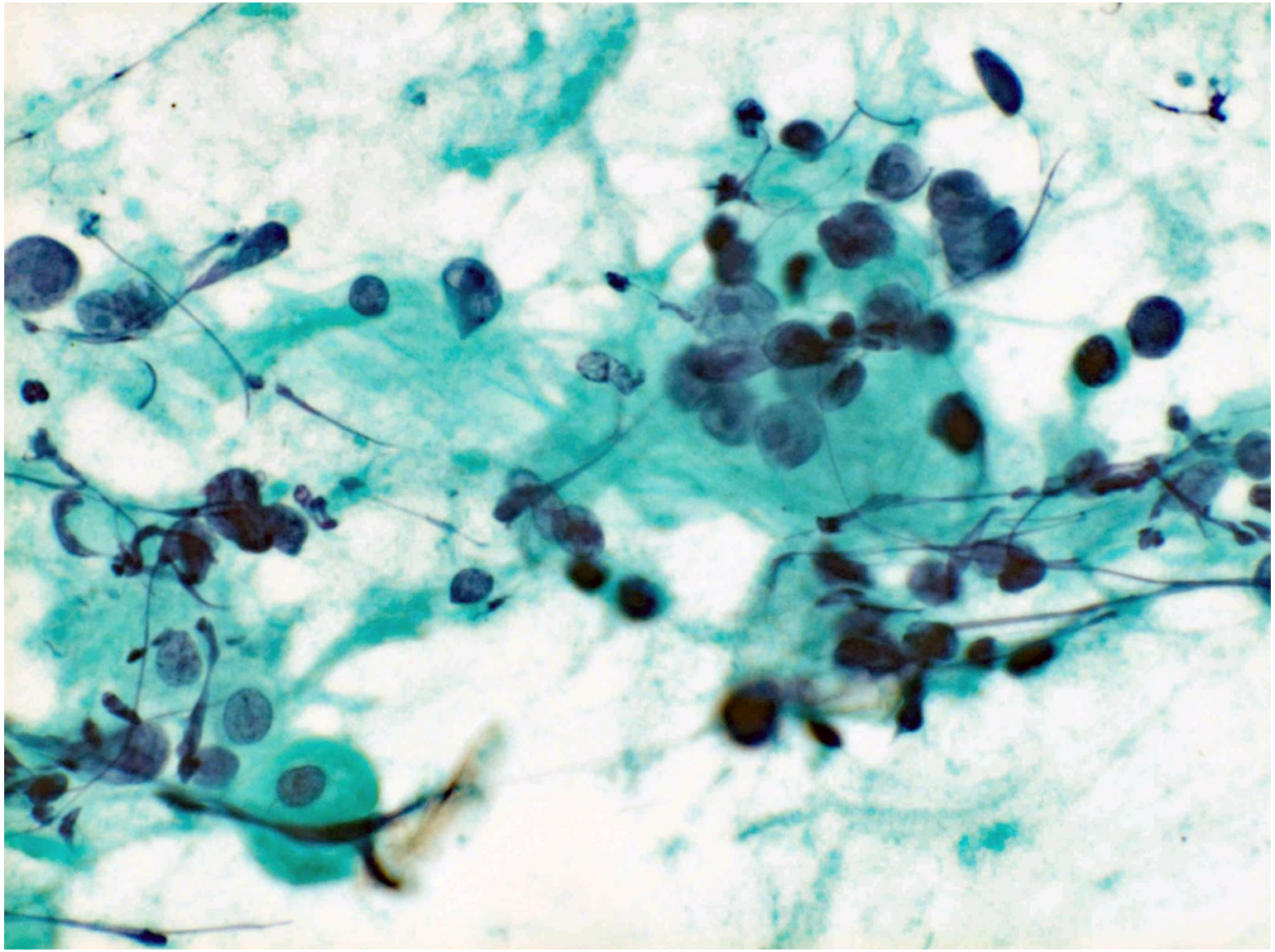
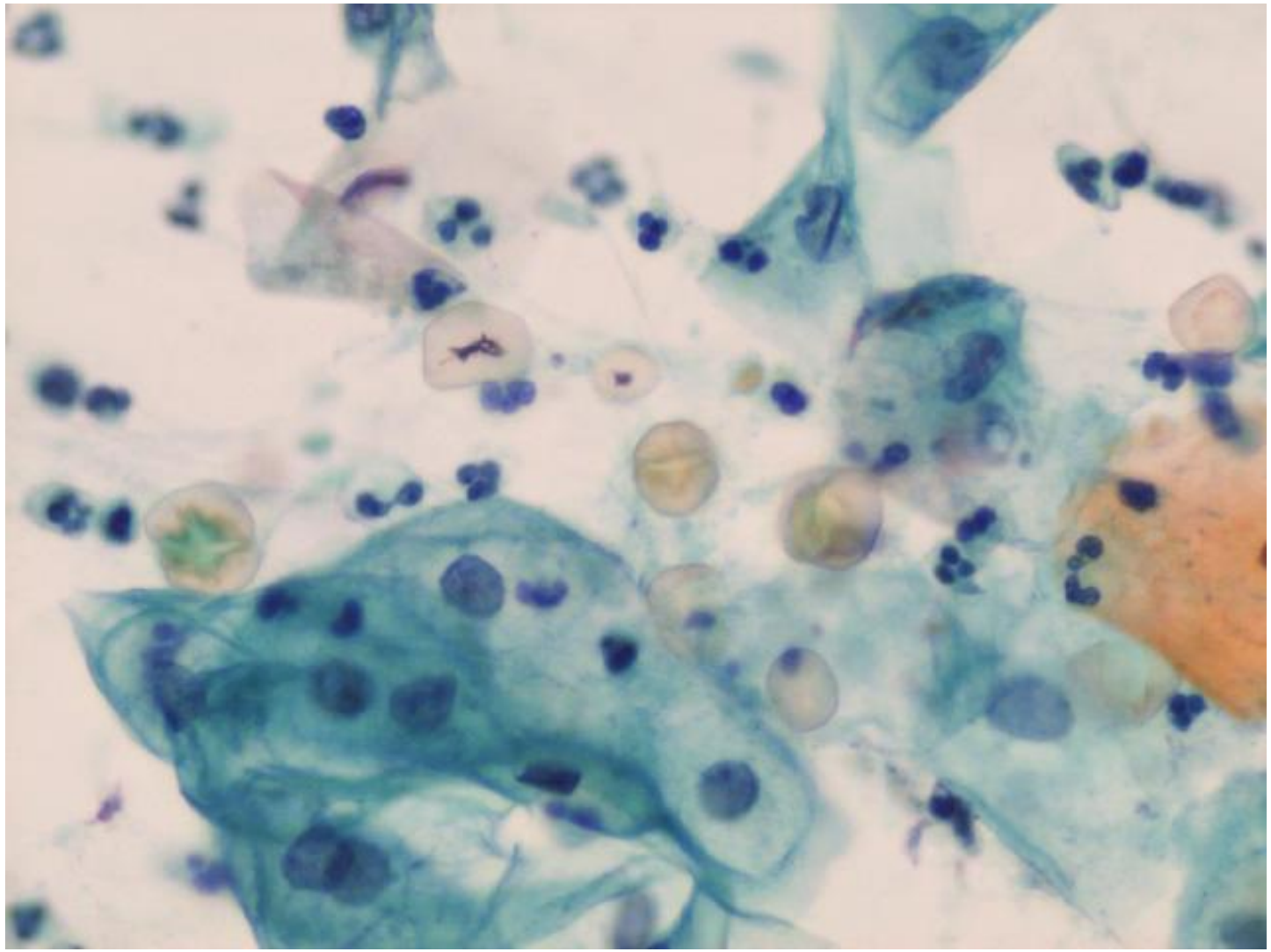


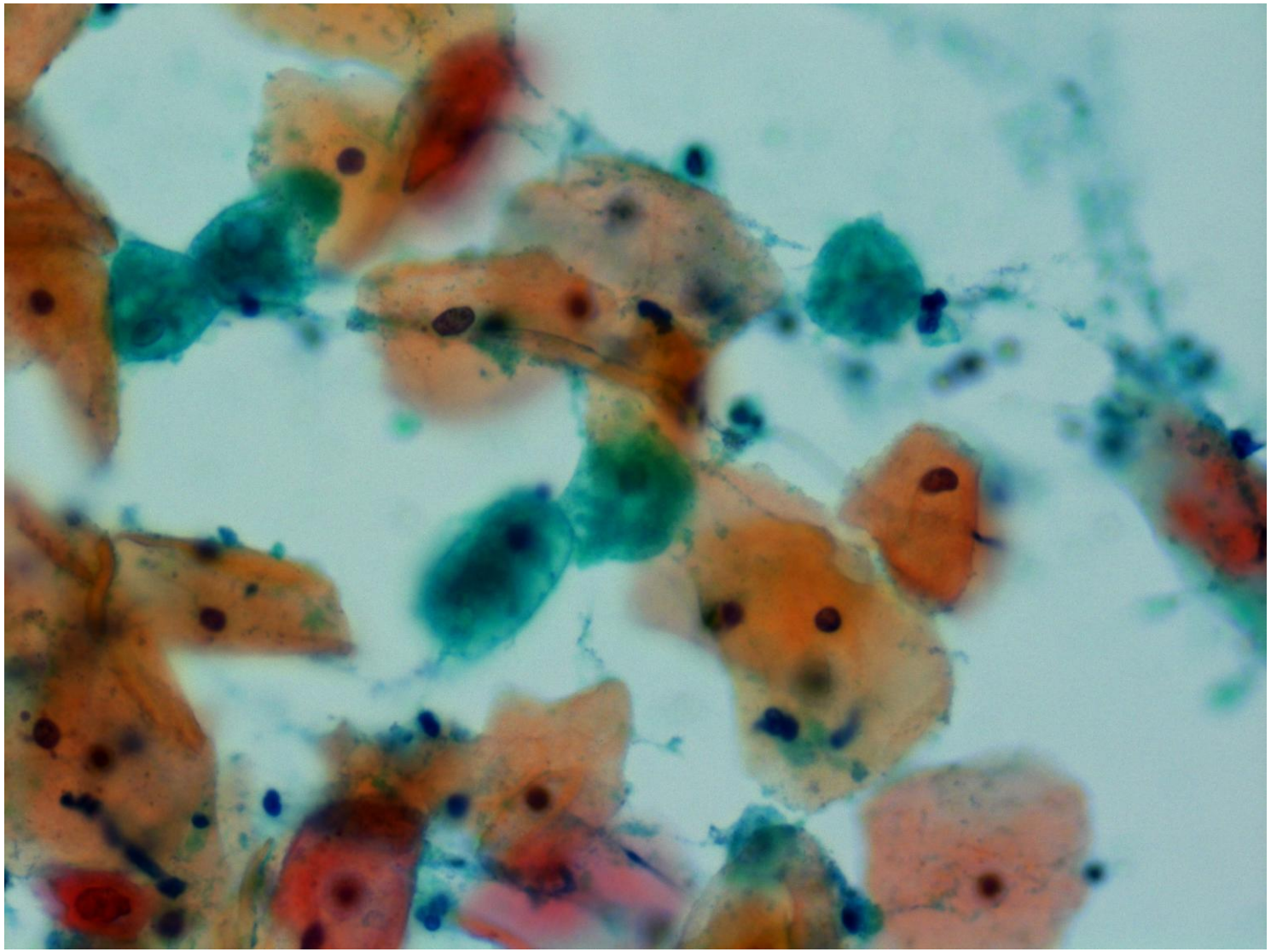
Sperms in the cervical smear of 35 y-o female patient.  The head and tail of the sperm cells cane be recognized (Papanicolaou).



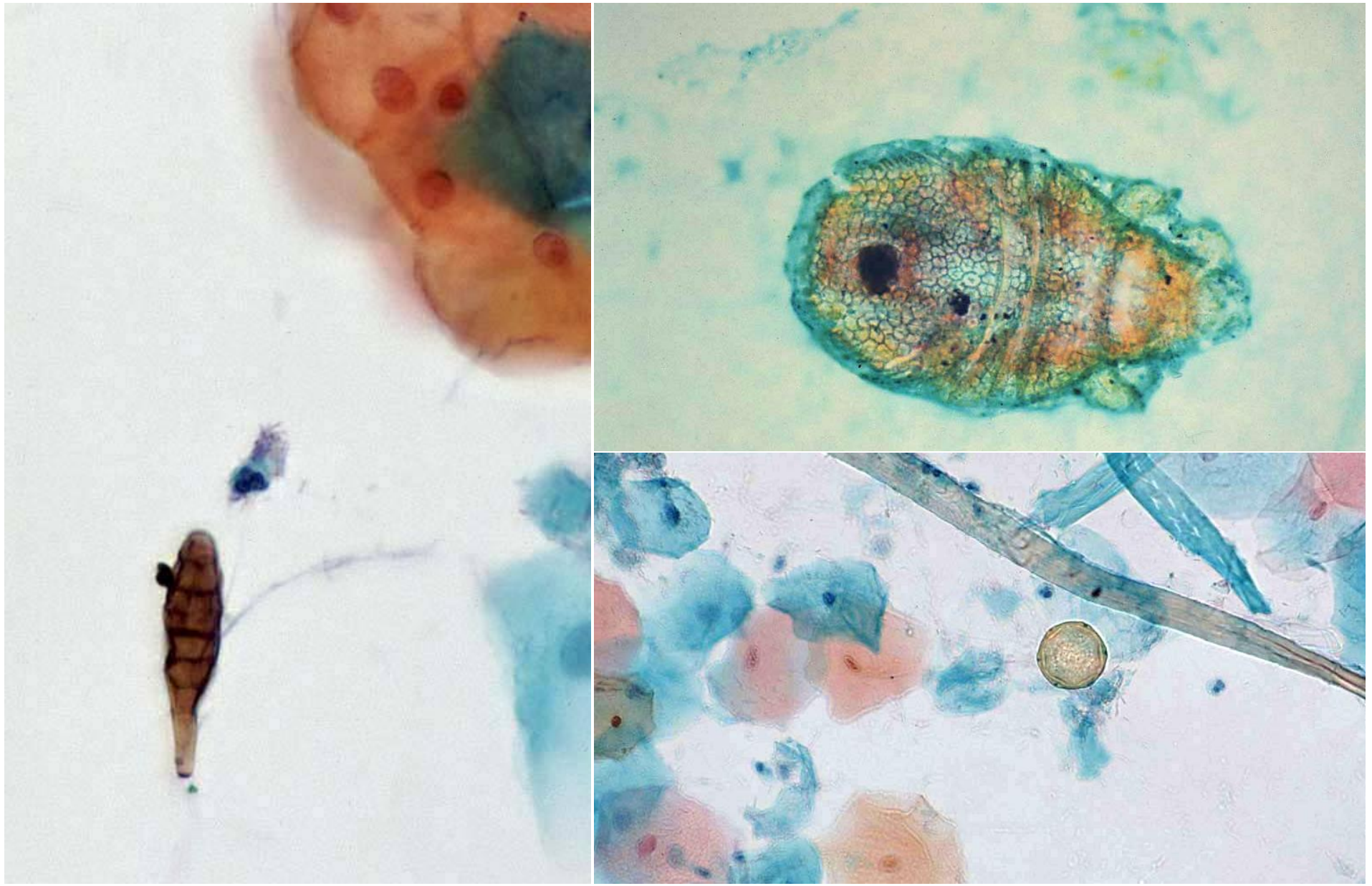
Nuclear lines (smeared DNA) in the cervical smear of a 65 y-o female patient.  The nuclear lines somewhat resemble sperms (Papanicolaou).



Yellowish-colored round granules of the ointment for treating vaginal candidosis (Papanicolaou).

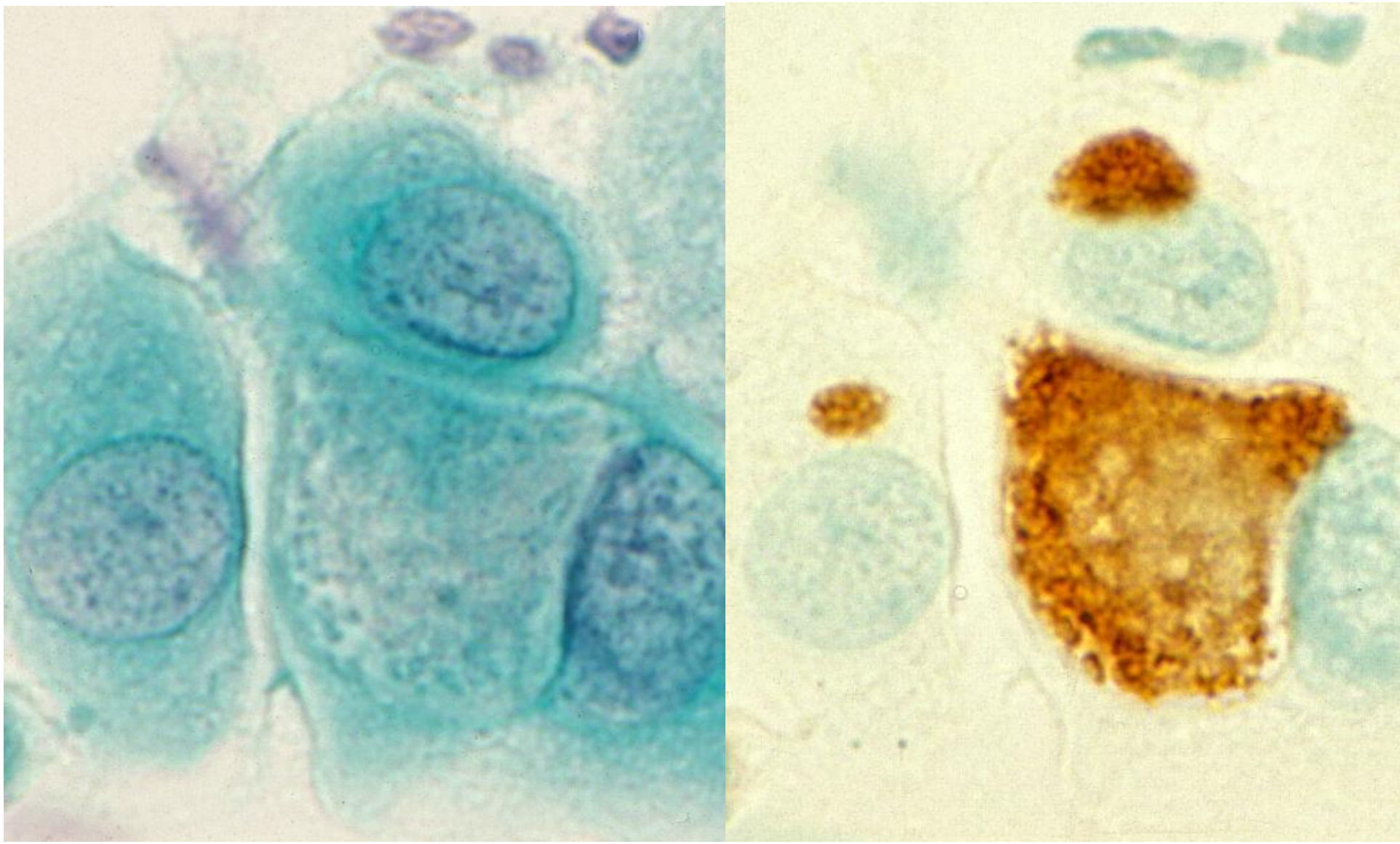


*Entamoeba gingivalis* incidentally seen in the cervical smear sampled from a 38 y-o female patient.  The amoebae phagocytizing neutrophils derive from the oral cavity of the sex partner, as a result of oral sex (Papanicolaou).

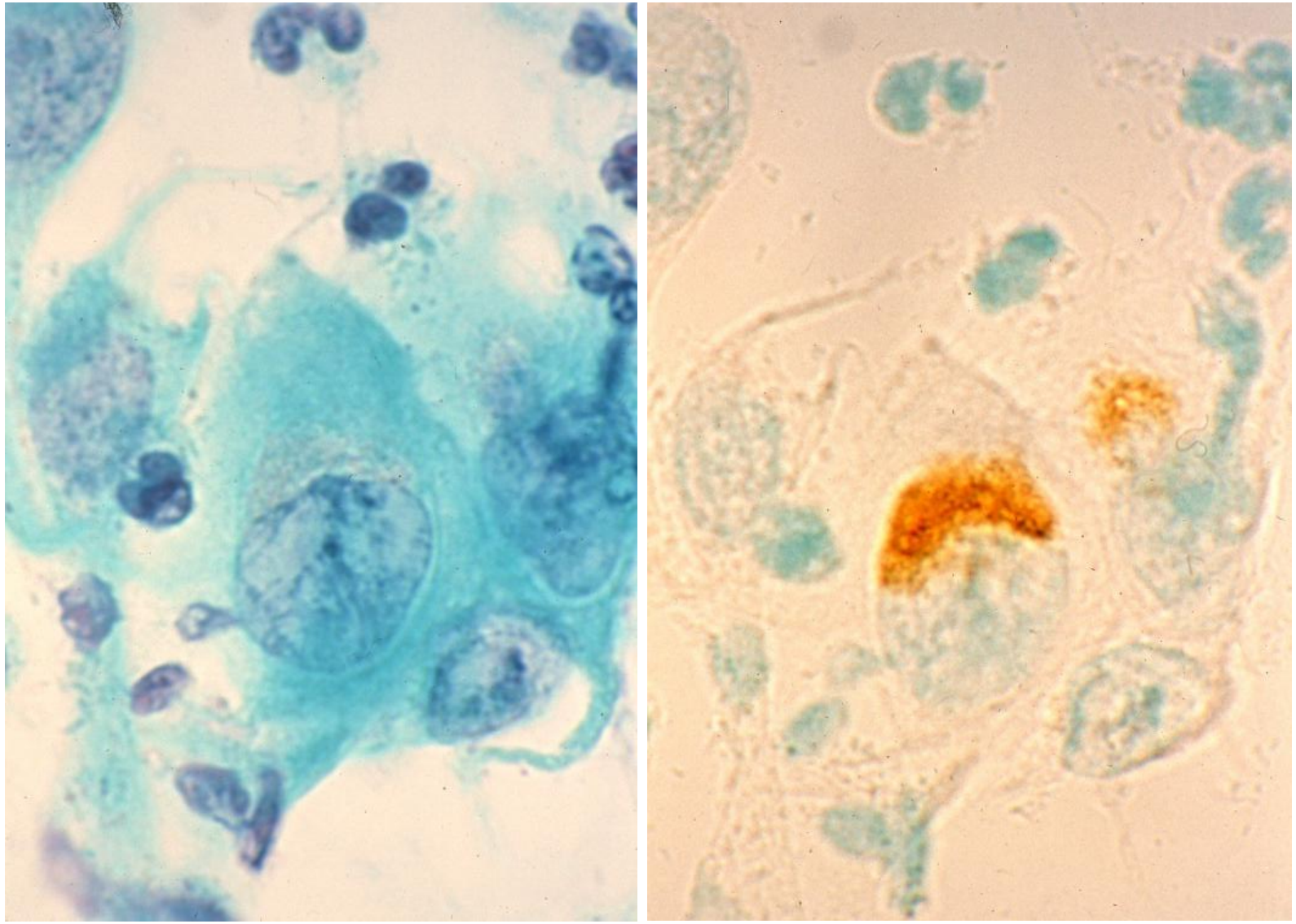


Incidental contamination of pathogen-like organisms (Papanicolaou). Left: *Alternatria alternata* (air-floating black fungus), right top: mite in house dust, right bottom: pollen

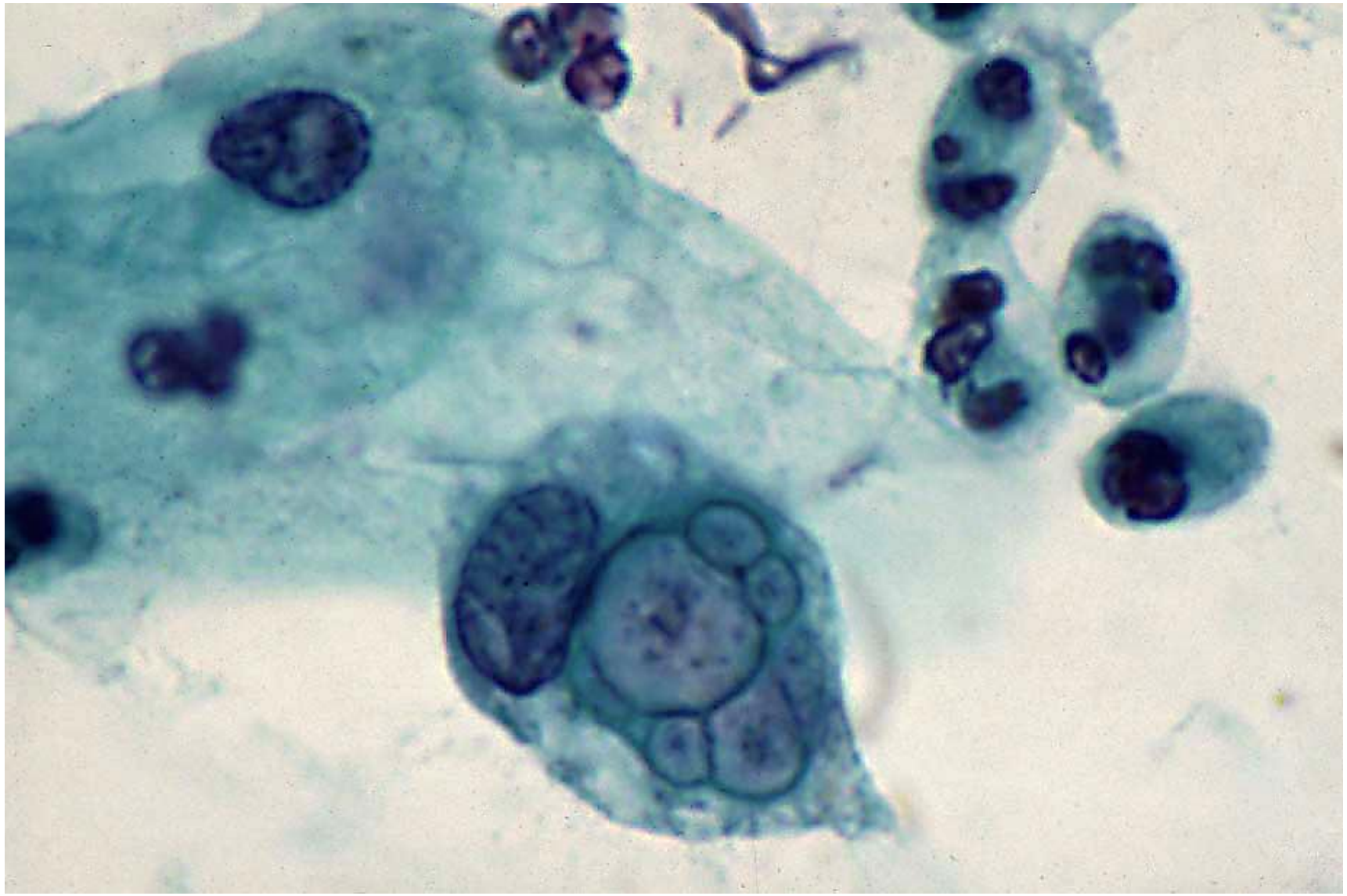
A contaminated small insect measuring 2.2 mm on the cervical smear sampled from a 49 y-o female patient (Papanicolaou).



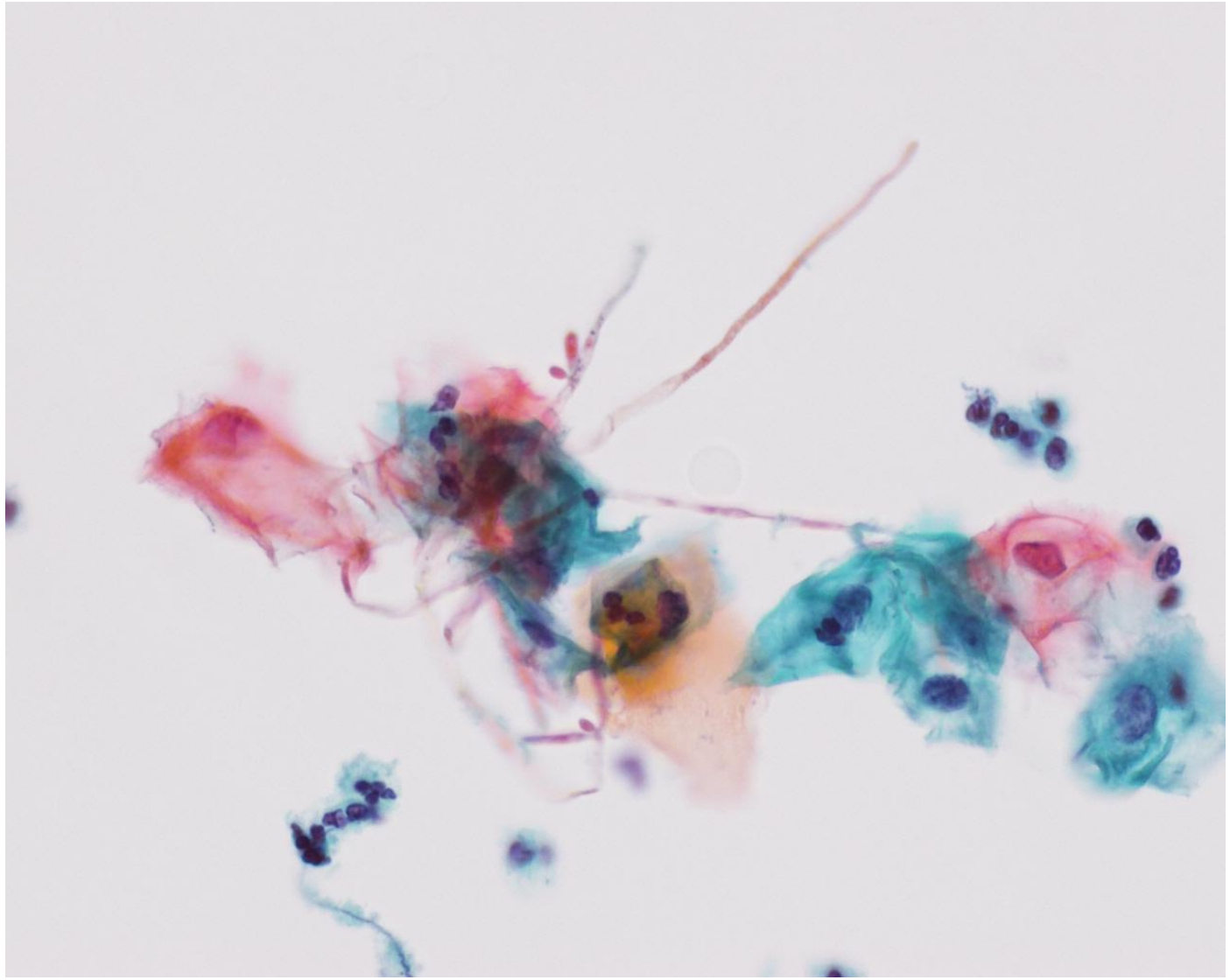
*Chlamydia trachomatis* infection in the cervical smear sampled from a lady aged 30's. Re-staining method demonstrates *C. trachomatis* antigen in the nevular inclusion bodies (left: Papanicolaou, right: immunostaining for CT antigen).



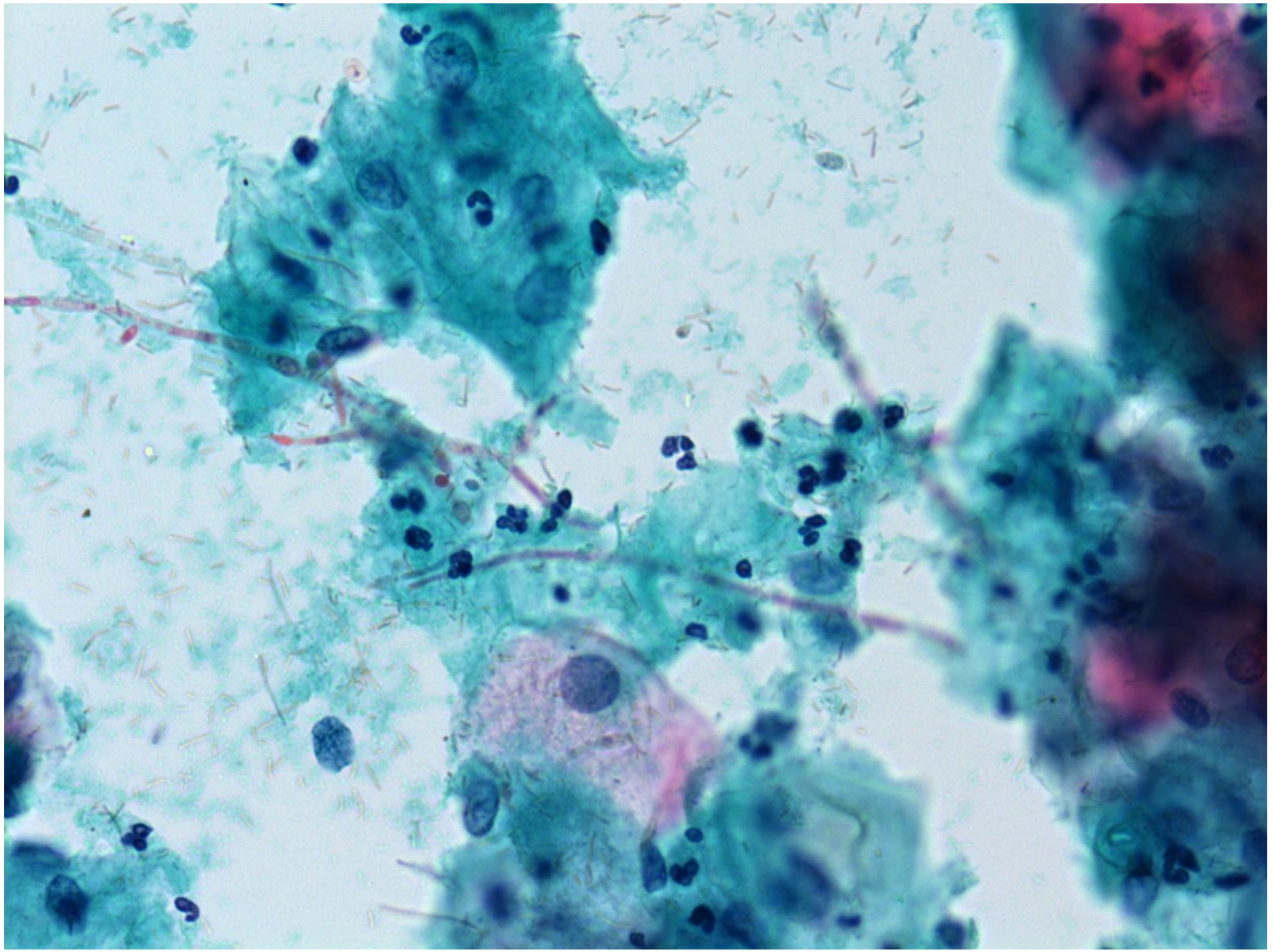
*Chlamydia trachomatis* infection in the cervical smear sampled from a lady aged 20's. Re-staining method demonstrates *C. trachomatis* antigen in the nevular inclusion bodies. It is difficult to recognize the inclusions in Pap smear in the present case (left: Papanicolaou, right: immunostaining for CT antigen).



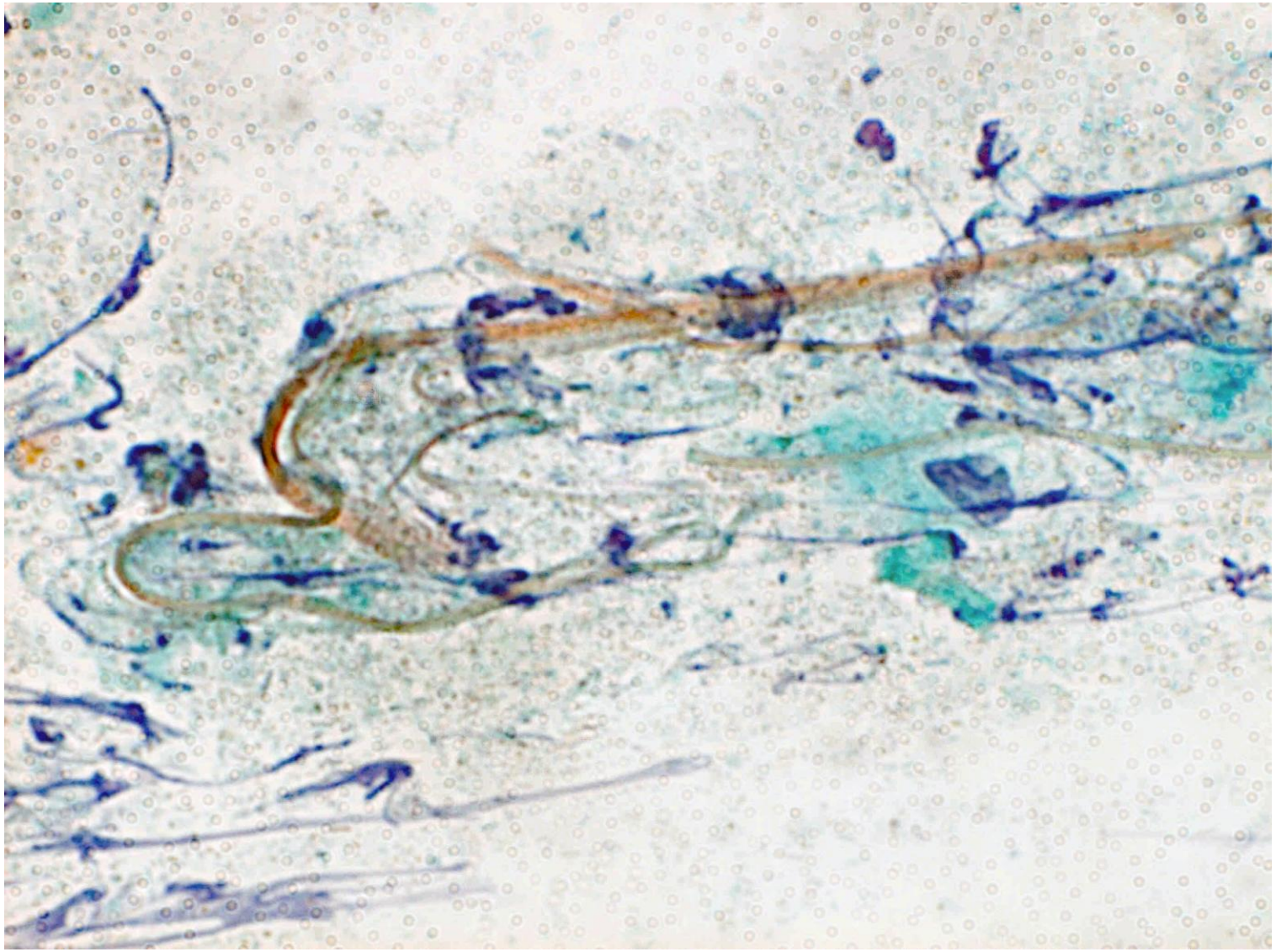
Vacuoles in the cytoplasm of the columnar epithelial cell somewhat resemble chlamydial inclusion bodies.  They should not be confused with chlamydiasis (Papanicolaou).



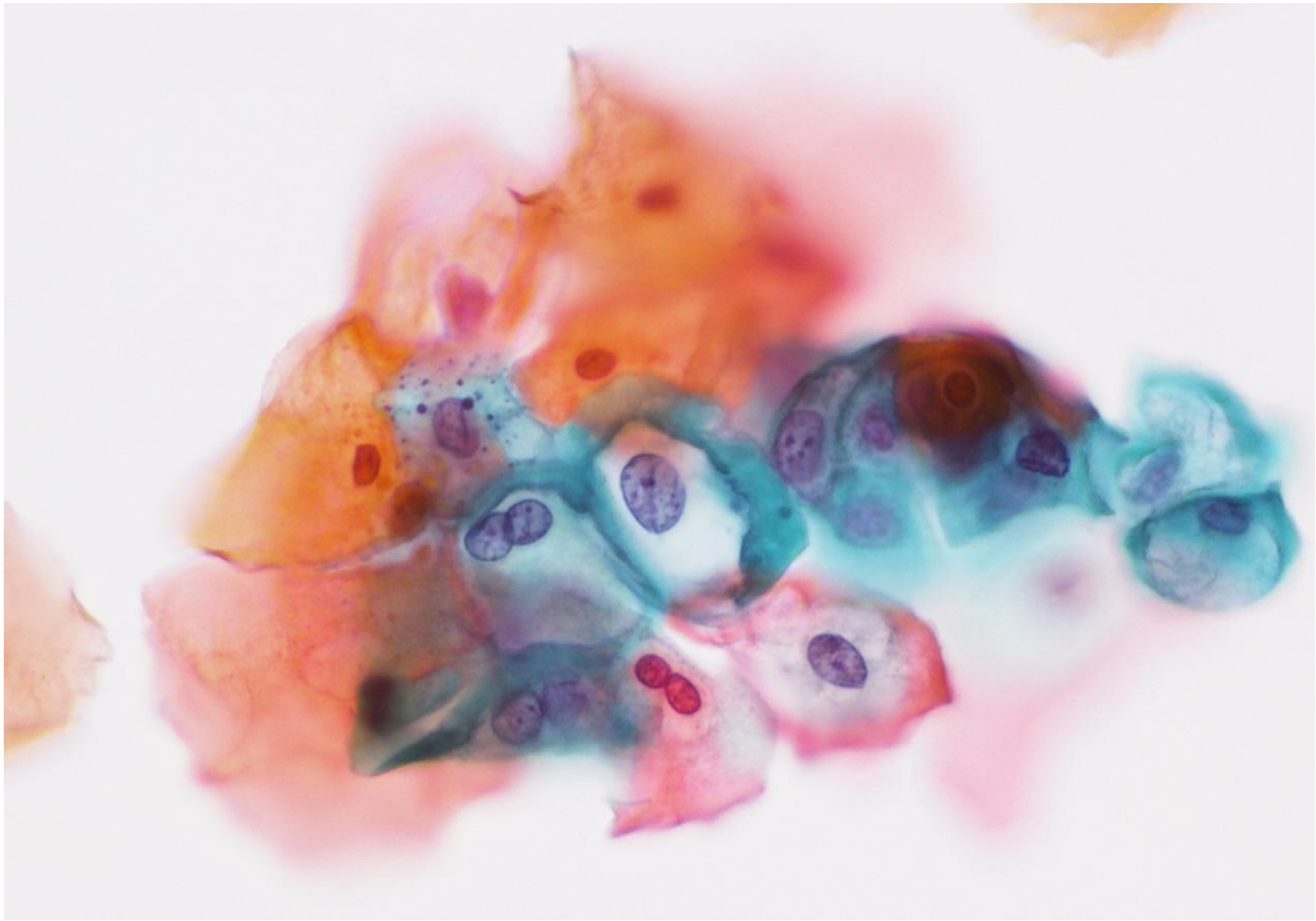
Vaginal candidosis seen in a lady aged 30’s.  Pseudohyphae grow around the keratinocytes (Papanicolaou).



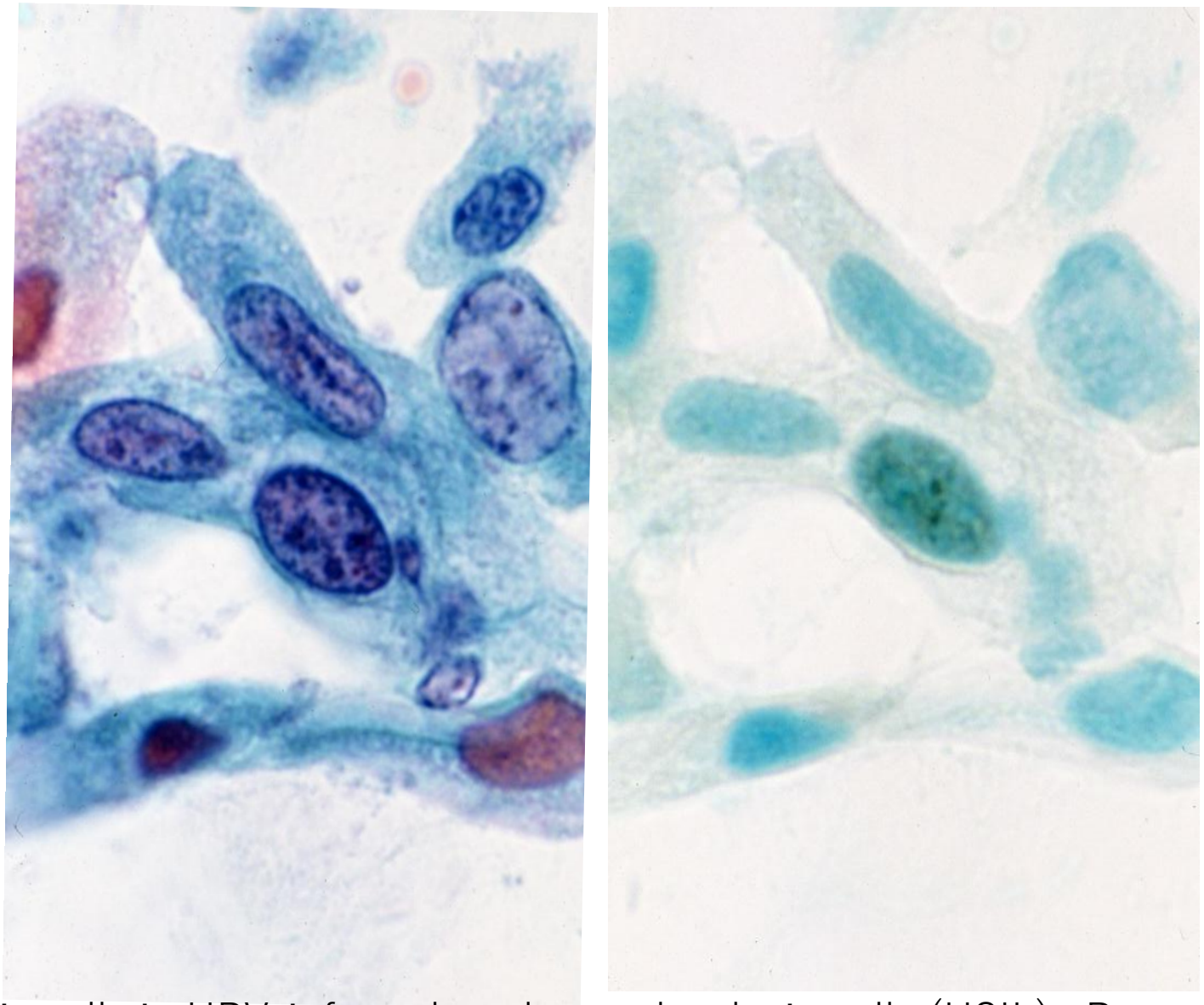
Vaginal candidosis seen in a lady aged 40’s.  Pseudohyphae grow around the keratinocytes.  Yeast-type blastospores are focally associated (Papanicolaou).



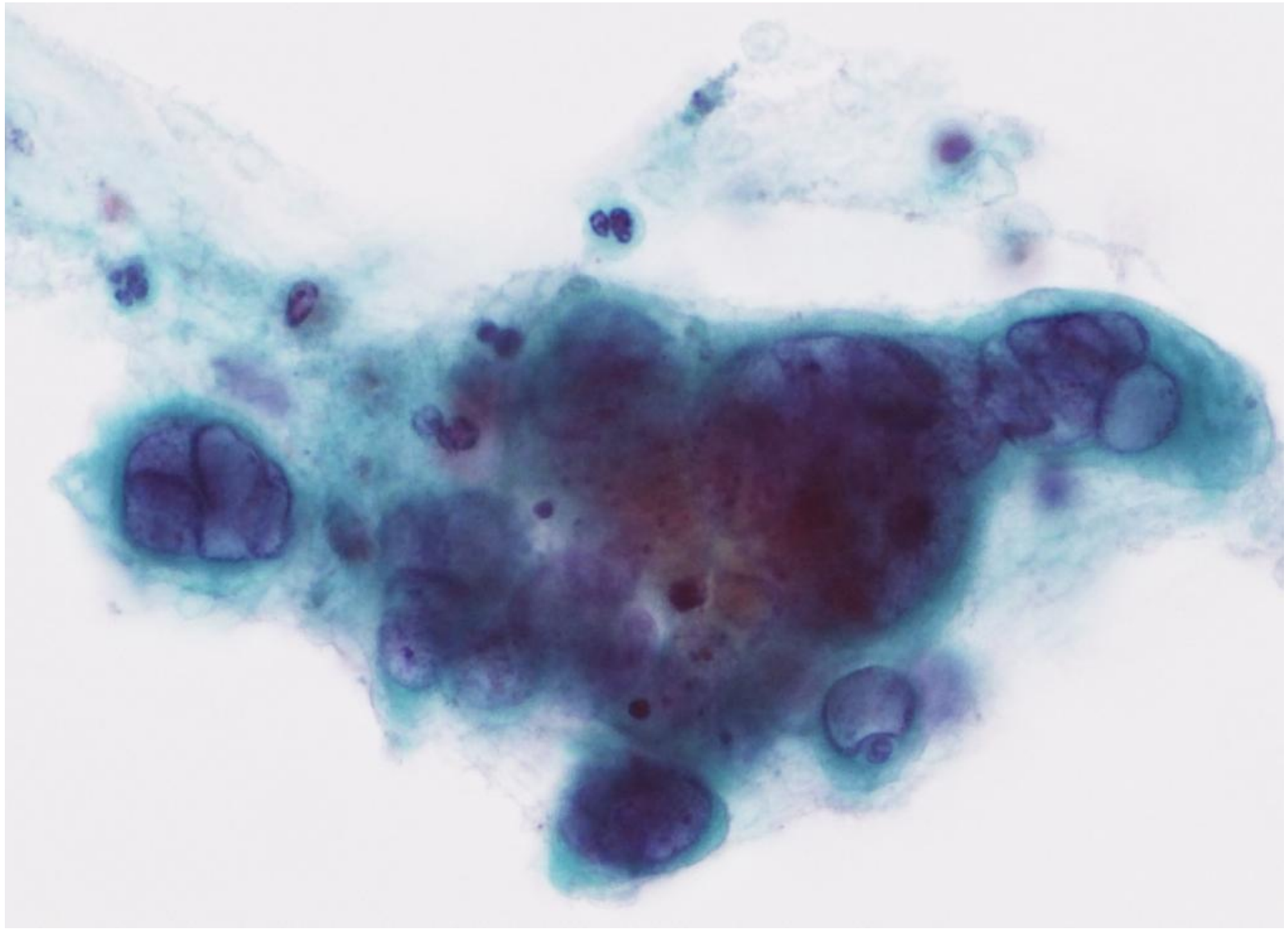
Infection of thick hypha-forming fungi in cervical smear of a 76 y-o female patient with squamous cell carcinoma of the vulva (Papanicolaou).



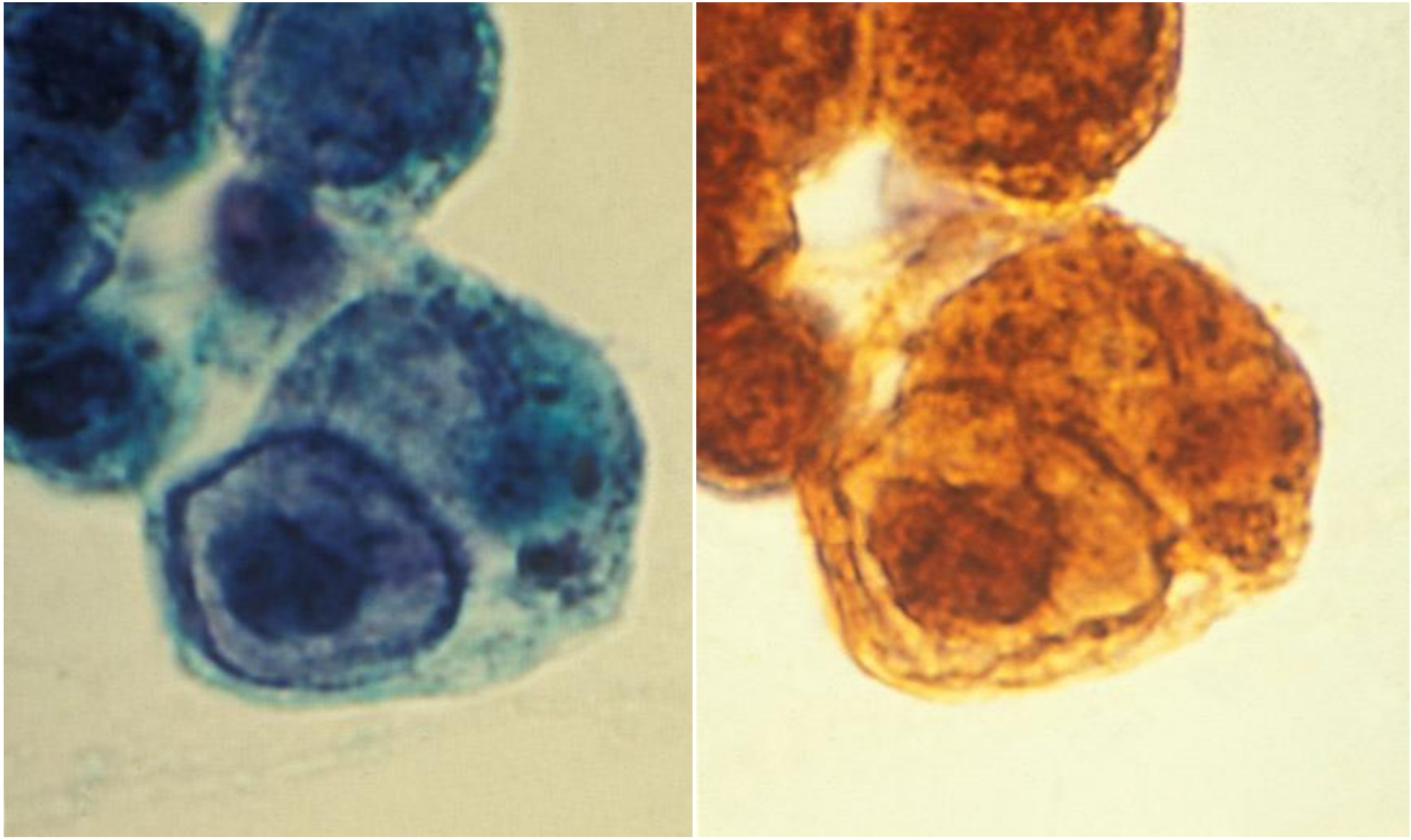
Koilocytic cells in HPV-infected mild dysplasia cells (LSIL) (Papanicolaou).



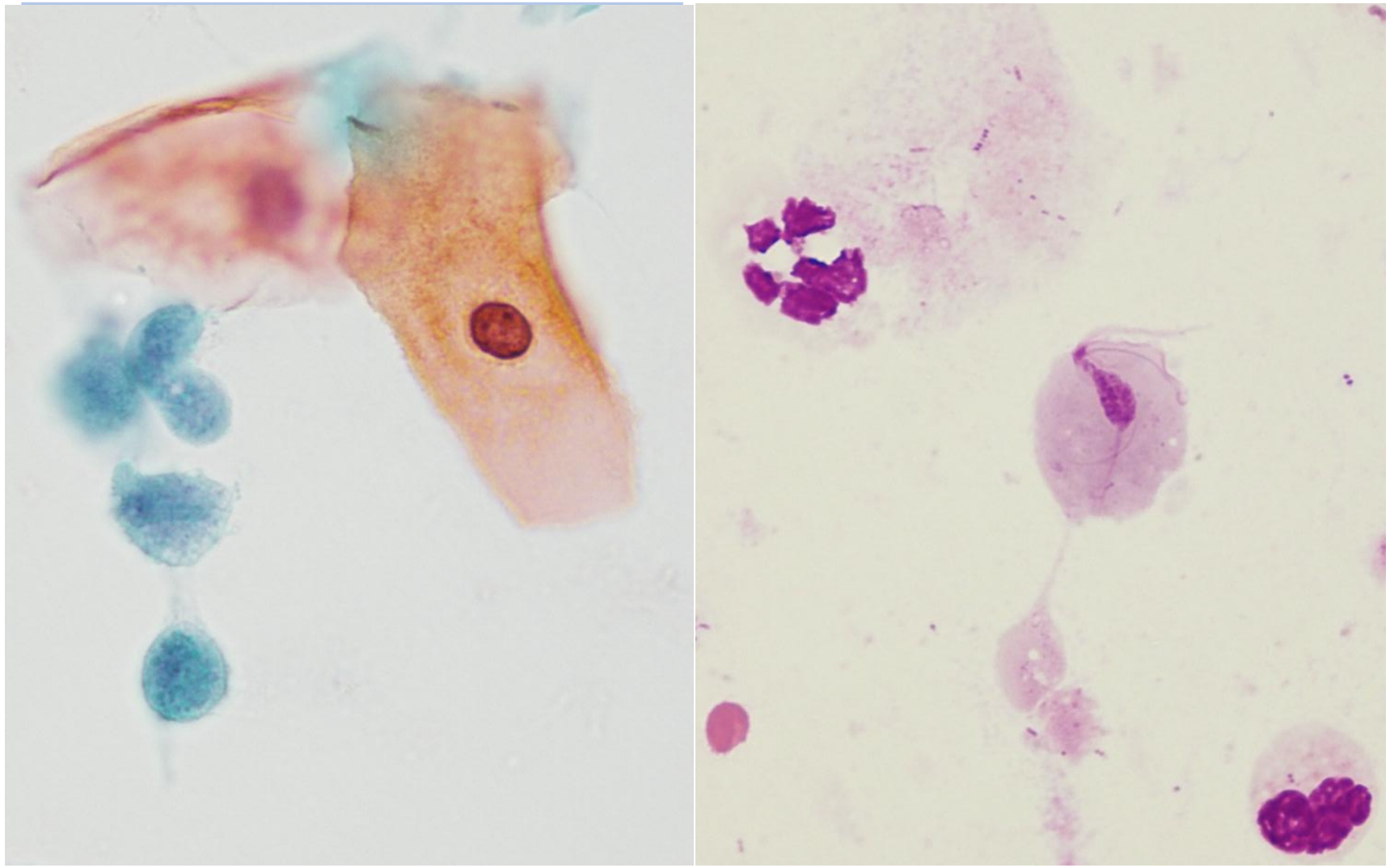
Dyskaryotic cells in HPV-infected moderate dysplasia cells (HSIL). Re-staining method demonstrates dot-like HPV type 16 genome signals in the nucleus of the dyskaryotic cell (left: Papanicolaou, right: in situ hybridization for HPV16 genome).



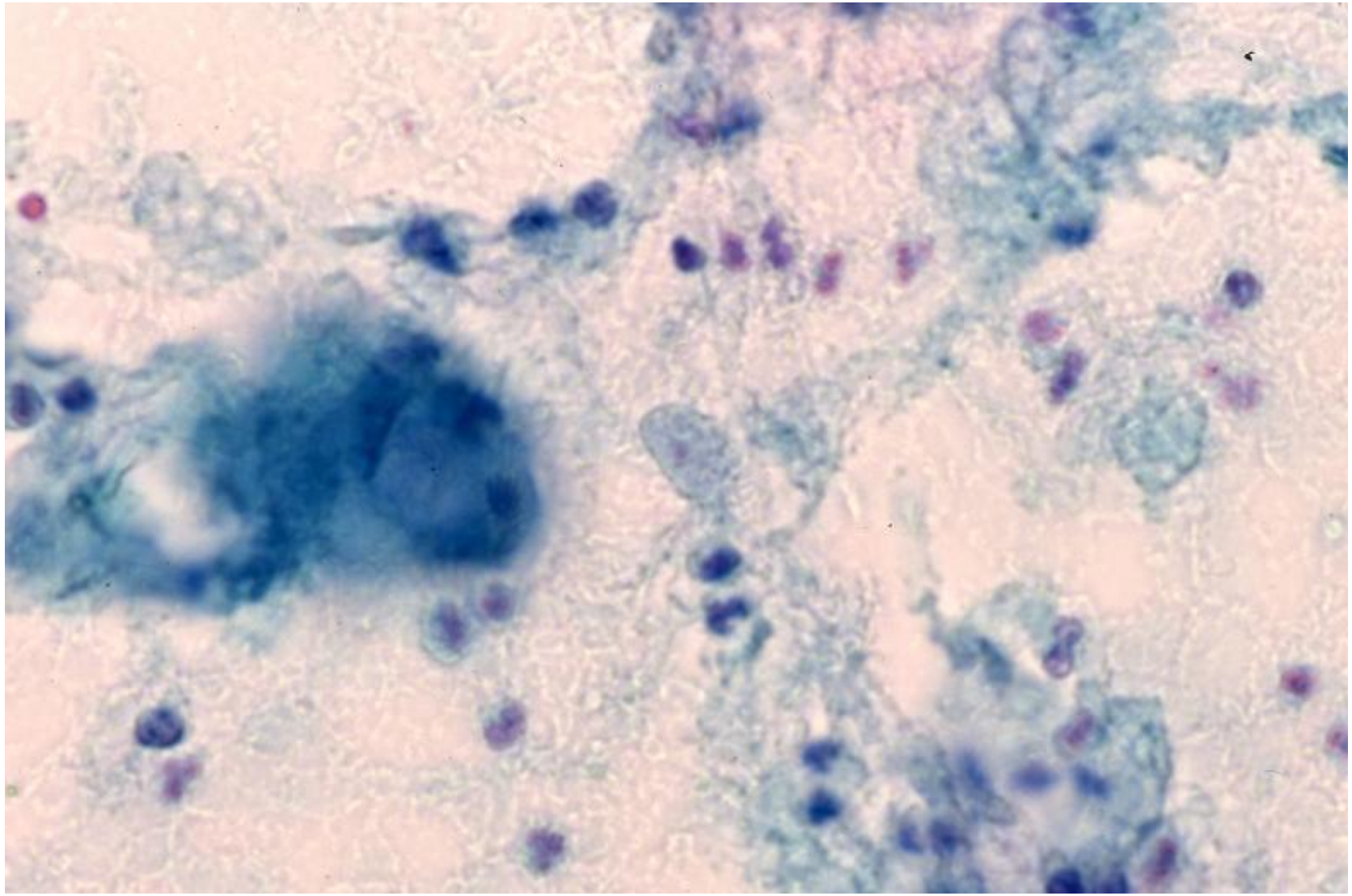
Herpes simplex virus type 2 infection seen on the cervical smear sampled from a lady aged 20's. Intranuclear inclusions with multinucleation are observed (Papaniucolaou).



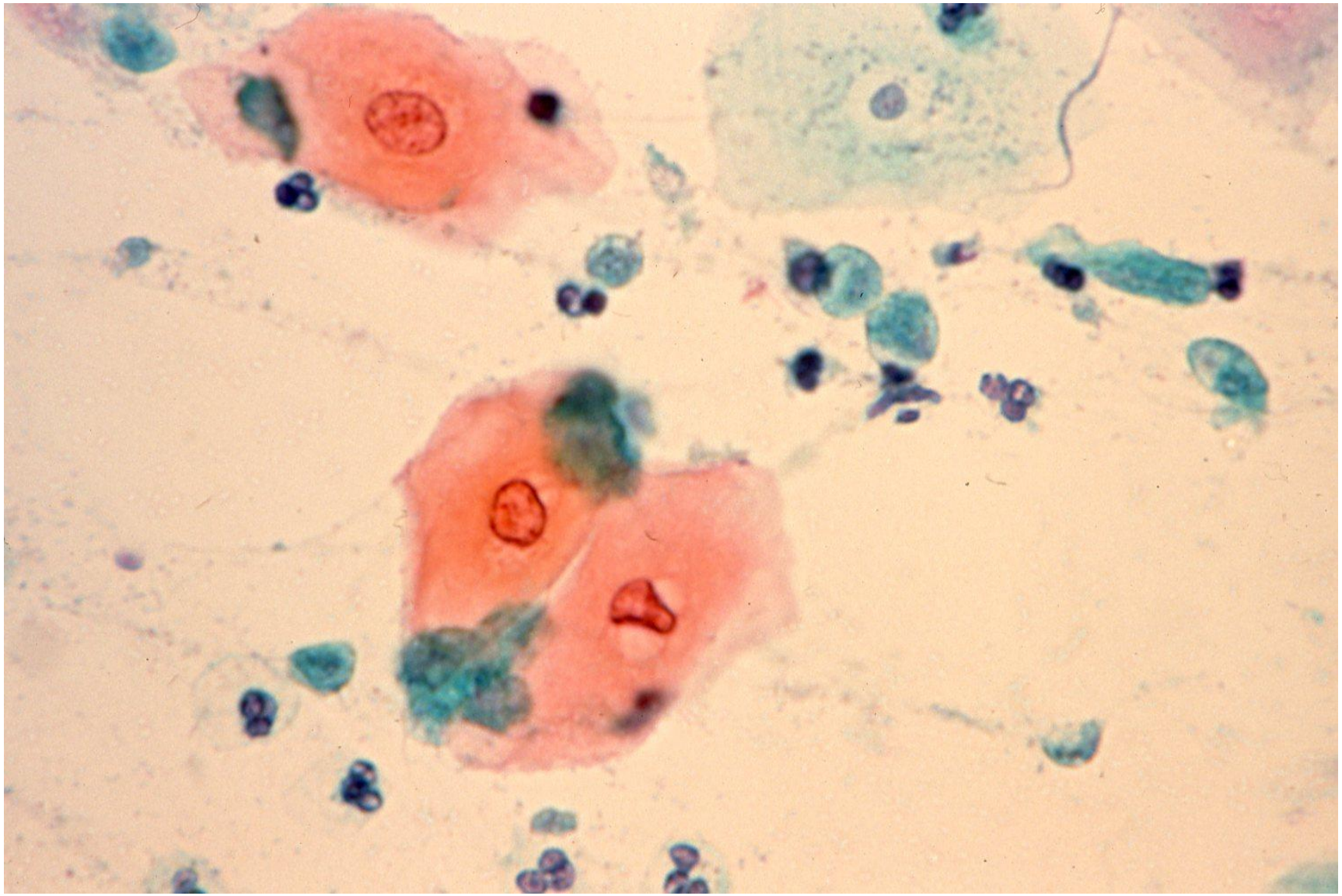
Herpes simplex virus type 2 infection seen on the cervical smear sampled from a lady aged 20's. Re-staining method demonstrates HSV antigen in the intranuclear and intracytoplasmic inclusions (left: Papaniucolaou, right: immunostaining for HSV Ag).



*Trichomonas vaginalis* infection on the cervical smear of a lady aged 30's. Inflammatory reaction is minimal here (left: Papanicolaou, right: May-Giemsa).



*Trichomonas vaginalis* infection on the cervical smear of a lady aged 40's. Finely-stained protozoan bodies are seen in the inflammatory background (Papanicolaou).



*Trichomonas vaginalis* infection on the cervical smear of a lady aged 40's. Green-stained protozoan bodies attach onto the superficial keratinocytes rich in glycogen. *T. vaginalis* is an anaerobic microbe without mitochondria (Papanicolaou).