Inflammation is a response of a tissue to injury, often caused by invading microorganisms. The suffix which indicates inflammation is "-itis" (the plural is "-itides"). Inflammation can lead reactive changes in epithelium. Such changes can also be lead by other processes that cause cellular damages (i.e. dystrophy, I.U.D., radiation therapy and repair).
ACUTE INFLAMMATION

• Is a response to recent or ongoing injury.
• Although the process is complex, the principal features are dilatation and leaking of vessels, and involvement of circulating granulocytes, that you can recognize in smear by their segmented nuclei.
• The role of granulocytes is to “eat” bacteria (phagocytosis)
• Pus is a substance made by granulocytes, necrotic (death) cells and bacteria; the cell necrosis is mainly caused by the action of granulocytes itself.
CHRONIC INFLAMMATION

• Also known as "late-phase inflammation", is a response to prolonged problems. Again, the process is complex.
• In this phase, granulocytes decreases and lymphocytes and histiocytes or macrophages ("big cells eating necrotic tissue and fragmented bacteria") increase.
• Lymphocytes are little, round cells with scanty cytoplasm and central round and regular nucleus. They can attack bacteria directly or differentiate into plasma cells, that are however very uncommon in pap smears.

• Plasma cells made antibodies, proteins that can kill bacteria attaching and destroying their membrane.
INFLAMMATION IN CERVIX

• Some granulocytes are always present in cervical smears, mainly during childhood or after menopause, and in the progestinistic phase of menstrual cycle.

• The amount of granulocytes in cervix can increase in some pathological conditions, such as infections, traumas, chemical or sore agents.

• Each of these agents could excite erosion and ulceration of the epithelium, so that epithelial cells undergoes some morphological changes.

• The tissue damage is a stimulus for a new growth, that could turn out to some growing alterations.
An important concept to apply at every kind of cellular changes: the “N/C ratio”

“N/C ratio” is the ratio it achieves through a comparison between the nuclear (“N”) and the cytoplasmatic (“C”) size.

A “normal” cell has a “normal” N/C ratio.
When in a cell the size of the nucleus increase as regards to cytoplasmatic size, we say that the N/C ratio of that cell is increased: it means that cell has an "high N/C ratio" because the value of "N" is increased. This occurs more or less in every cellular change, from inflammatory to dysplastic or neoplastic changes.
• On the contrary, we have a “low N/C ratio” every time that the nuclear size of a cell decreases as regards to cytoplasmatic size.
• This is a less significative cellular change, almost always non pathologic (i.e. nuclear pyknosis in superficial squamous cell).
...By the way, what is the “background”?

- We call “background” as a whole all frames in a pap smear apart from epithelial cells (i.e. microorganisms, granulocytes, fragments of destroyed cells, mucus, red blood cells).
- So, we want to stress here the fact that we can find in a smear other kind of cells than epithelial, the most important of which are:
  - GRANULOCYTES
  - LYMPHOCYTES
  - MACROPHAGES (or HISTIOCYTES)
  - RED BLOOD CELLS
The background: granulocytes/1

- Granulocytes are cells smaller than epithelial, with a typical irregular nucleus.
- They are more or less present in all smears, but their amount change according to the menstrual cycle (increasing around the menstrual phase, decreasing around ovulation).
- As pointed before, their amount greatly increase during inflammation.
The background: granulocytes/2
Their name means “big eating cells”, being their task to swallow up foreign bodies (i.e. bacteria) or cellular debris from erosive processes.

They are more or less large than a intermediate or superficial squamous cells, with central round or cleaved nucleus, with one or two nucleoli, and eosinophilic (blue) cytoplasm.

Usually present around the menstrual period, their number can increase during chronic inflammation and after cervical biopsy or an abortion.
The background: macrophages/2
Sometimes, some macrophages merge one another, giving rise to so-called “multinucleated giant cell”, than can reach a very large size, with abundant cytoplasm and even 100 nuclei. It happens, i.e., after radiation therapy.
The background: lymphocytes

As pointed before, lymphocytes can increase during chronic inflammation. They greatly increase during a particular chronic cervical inflammation named **follicular cervicitis**, where the pap smear shows many lymphocytes of different sizes together with macrophages filled by cellular debris.
NON-SPECIFIC INFLAMMATORY CHANGES IN EPITHELIAL CELLS

CHANGES IN EXOCERVICAL EPITHELIUM:
• Nuclear enlargement, but without condensation of chromatin, and/or multinucleation
• Nucleolar enlargement and/or multinucleolation
• Fragmentation of nucleus.
• Perinuclear clear halo.
• Altered cytoplasmatic staining properties
• Cytoplasmatic vacuolization.
• Loosing of cytoplasm (cytolysis)

CHANGES IN ENDOCERVICAL EPITHELIUM:
• Cellular enlargement.
• More evident nucleoli
• Multinucleation
• Complete disintegration of cytoplasms, with sheets of “bare nuclei”.
Changes in squamous cells
Sheets of metaplastic cells with nuclear changes and granulocytic spreading over epithelial cells.
Atrophic squamous cells with inflammation ("atrophic vaginitis")
Parabasal and intermediate squamous cells with nuclear enlargement and orangiophilia. Many granulocytes in background.
Other examples of squamous changes