

# Difference Between Cytokines and Chemokines

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## Key Difference - Cytokines vs Chemokines

Immunity can be either innate or adaptive. Within them, immune responses are of different types. Inflammation is an immune response observed in both innate and adaptive immunity. Inflammation occurs through protein molecules known as cytokines. Cytokines are secretory small proteins. They are secreted as an inflammatory response. They are classified into a broader class which includes chemokines, cytokines, interleukins, and interferons. Chemokines are a type of cytokines that participate in inducing chemotaxis. The key difference between cytokines and chemokines is, **cytokines belong to a broader group of chemical molecules that act on inflammation, whereas chemokines are a subset of that large group which has the ability induce chemotaxis.**

## What are Cytokines?

Cytokines are inflammatory molecules which are small proteins secreted by cells. They have a variety of functions. Cytokines also act as hormones. Cytokines are initially produced by specialized cells such as T Helper cells and macrophages. They bind to a specific receptor and initiate a cascade of reactions to trigger an immune response. among them, the receptor – cytokine complex is very specific. Mostly cytokines result in altering gene expression at a transcriptional level. Cytokines are also a broader group of signaling molecules. This group includes chemokines, lymphokines, adipokines, interferons, and interleukins.

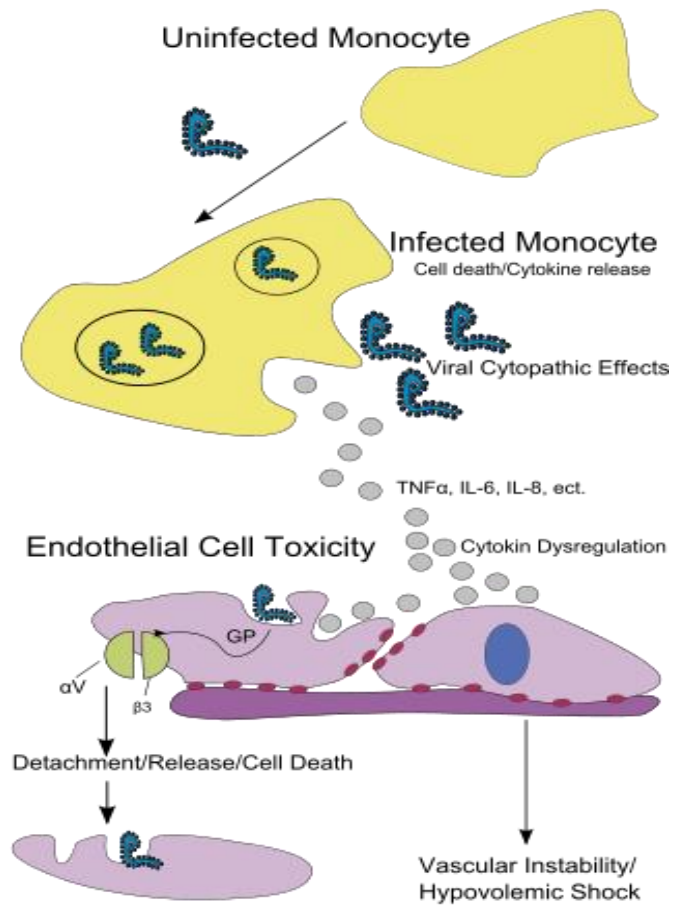


Figure 01: Cytokines

Cytokines have three main ways in which they act;

- Autocrine - acts on the same cell in which it is been secreted
- Paracrine - acts on a close-by cell in which it is been secreted
- Endocrine- acts on a distant cell in which it is been secreted.

Cytokines are Pleiotropic in nature. Pleiotropy is the phenomenon in which different cell types are capable of secreting a single cytokine or where one cytokine is capable of acting on different cell types. Cytokines can act synergistically or antagonistically. This is due to the fact that more than one cytokine is involved in producing an inflammatory reaction. Cytokines can be further classified as pro-inflammatory cytokines and anti-inflammatory cytokines.

## What are Chemokines?

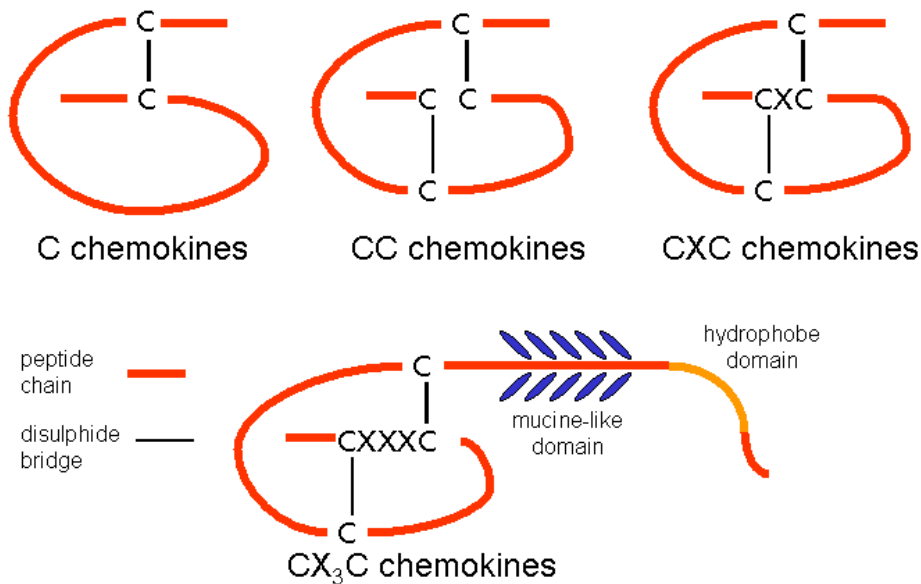
Chemotactic cytokines are referred to as Chemokines. It is a diverse group of different types of protein molecules. Chemokines have low molecular weight protein particles. Its main function is to activate [leukocytes](#) and facilitate its migration to the target site. Chemokines are divided into 4 main

groups. This categorization is based on the characteristic in conserved cysteine residues present in chemokines. The four groups are;

- CC chemokines
  - RANTES, monocyte chemoattractant protein or MCP-1, monocyte inflammatory protein or MIP-1 $\alpha$ , and MIP-1 $\beta$
- CXC chemokine
- C chemokines (lymphotactin)
- CXXXC chemokines (fractalkine)

Chemokines bind to a specific protein receptor to initiate the cascade reactions. These receptors belong to the G protein-coupled receptors and result in activation of small GTPases. This will result in preparing the cells for movement by the development of [actin](#) and actin polymerization and by the development of pseudopods and integrins.

### Structure of chemokine classes



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**Figure 02: Chemokines**

Depending upon the functionality, chemokines consist of two different types; Inflammatory chemokines and [homeostatic](#) chemokines. Inflammatory chemokines induce inflammation whereas homeostatic chemokines are involved in lymphocyte migration, the development of lymphoid organs such as the [spleen](#) and angiogenesis.

## What are the Similarities Between Cytokines and Chemokines?

- Both are biomolecules composed of proteins.
- Both are secreted upon inflammation.
- Both have the ability to act as markers of inflammation in specific clinical scenarios.
- Both bind to specific receptors to form receptor – protein (cytokine / chemokine) complex.
- Both have the ability to initiate a cascade of reactions.

## What is the Difference Between Cytokines and Chemokines?

Cytokines vs Chemokines	
Cytokines are small proteins secreted by cells in response to inflammation and they include many types including chemokines, interleukins, and interferons.	Chemokines are proteins which induce chemotaxis of leukocytes.
Effects	
Cytokines can affect many cells in the body.	Chemokines mainly affect leukocytes and lymphocytes.
Conserved Cysteine residues	
Present in cytokines.	Absent in chemokines.
Types	
Chemokines, Interleukins, Interferons are the types of cytokines.	C-C chemokines, C-X-C chemokines, C chemokines, CXXXC chemokines are the types of chemokines.
Function	
Mainly pro-inflammatory or anti-inflammatory.	Mainly inflammatory or homeostatic.

## Summary - Cytokines vs Chemokines

Cytokines and chemokines are small molecular weight proteins which participate in immune reactions. Chemokines belong to the major group of cytokines but specifically function as a chemotactic cytokine. Thereby, it drives the activation of leukocytes and its migration to the target. Cytokines and chemokines act similar to hormones in giving rise to a cascade of reactions upon binding to its receptor. This can be taken as the difference between Cytokines and Chemokines. At

present; both these protein molecules are used as early biomarkers to identify diseases and to analyze the body's response to clinical conditions such as [atherosclerosis](#), [diabetes](#), and infections.

#### Reference:

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