

INCLUSION BODIES

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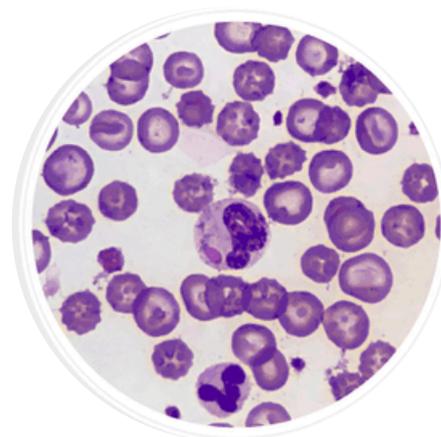
Nuclear or cytoplasmic aggregates known as inclusion bodies are stainable materials, typically proteins, that form when an infectious agent or foreign gene is introduced into a cell. The complementary DNA translated from a messenger RNA may code for a protein that is not modified further, transported, or condensed, resulting in inclusion bodies. Cells in certain diseases get modified and may become pathognomonic for that specific disease.

Physiological Inclusion bodies

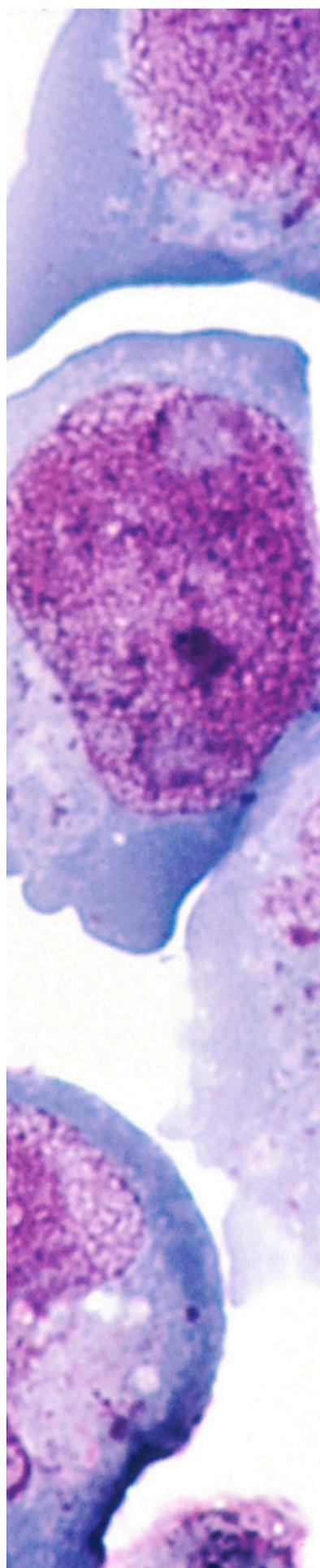
- **Odland bodies:** Odland bodies are membrane-coating granules found in keratinized stratified squamous epithelium. It is sometimes referred to as keratinosomes or lamellar bodies. These can be found in the glycolipid-rich stratum granular and higher stratum spinosum cell layers. The extracellular release of these lipids creates a permeability barrier that stops aqueous fluids from being absorbed.
- **Weibel-Palade bodies:** These are endothelial cells' storage granules. The body stores two key molecules, von Willebrand factor and P-selectin, which are released when required. Therefore, they significantly impact inflammation and hemostasis.
- **Toto bodies:** They are homogeneous, eosinophilic pools of material seen in the superficial spinous layer of the surface epithelium in diseases like epulis fissuratum.

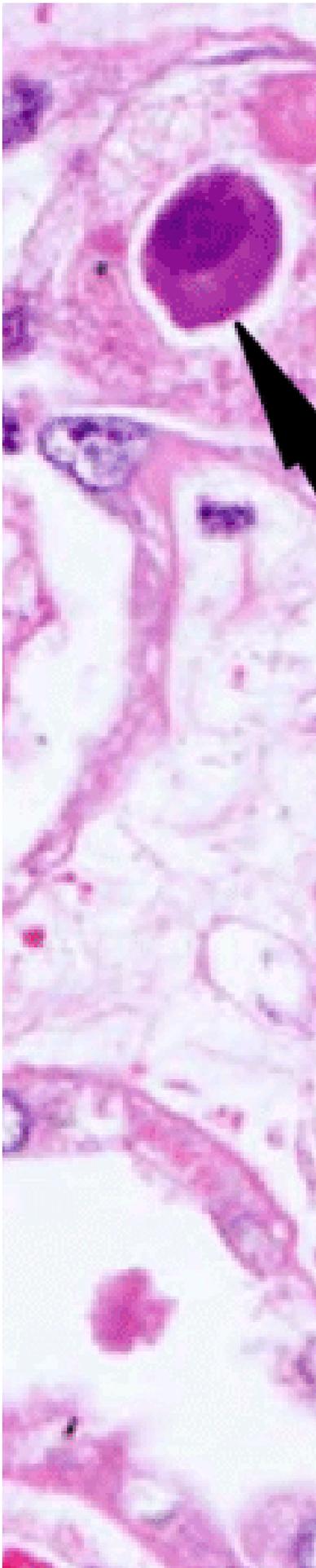
Classification of Inclusion bodies

- Physiological inclusion bodies
- Infection inclusion bodies
 - Inclusion bodies in viral conditions
 - Intracytoplasmic inclusions
 - Intranuclear inclusions
 - Both nuclear and cytoplasmic inclusions
 - Inclusion bodies in bacterial infections
 - Inclusion bodies in fungal diseases
 - Inclusion bodies in neoplasms
 - Inclusion bodies in autoimmune diseases
 - Inclusion bodies in blood dyscrasias
 - Inclusion bodies in cystic lesions



Inclusion bodies is an important diagnostic-aid in identifying the underlying disease





Infection inclusion bodies

- **Inclusion bodies in viral conditions**

1. Intracytoplasmic inclusions

- Henderson-Paterson bodies - Molluscum contagiosum
- Councilman bodies - Viral hepatitis, Yellow fever
- Guarnieri bodies (Type A, Type B) - Smallpox
- Paschen bodies - Smallpox
- Downie bodies - Cowpox
- Negri bodies - Rabies

2. Intranuclear inclusions

- Lipshutz bodies - Herpes simplex
- Owl's Eye - CMV, HHV-5
- Cowdry bodies (Type A, Type B) - Herpes simplex, Varicella zoster
- Torres bodies - Yellow fever

3. Both nuclear and cytoplasmic inclusions

- Warthin-Finkeldey cells - Measles
- Mitosoid bodies - Heck's disease

- **Inclusion bodies in bacterial infections**

Dohle bodies [seen in peripheral blood smear (PBS)] - Tuberculosis, Diphtheria, Typhoid, Erysipelas, Oral sepsis, Physical trauma, Fanconi syndrome, May-Hegglin anomaly, Chediak-Higashi syndrome, Leukemoid reaction

- **Inclusion bodies in fungal diseases**

Asteroid bodies (Splendore-Hoeppli phenomenon) - Sarcoidosis, Tuberculosis, Leprosy, Actinomycosis, Berylliosis, Foreign body giant cell reaction, Sporotrichosis, Lobomycosis, Parasitic infections

Inclusion bodies are seen in blood dyscrasias

- Heinz bodies- Glucose-6-phosphate dehydrogenase deficiency, hemolytic anemias, hemolytic anemias
- Howell-Jolly bodies- Pernicious anemia and Leukemia with megaloblastic anemia

Inclusion bodies in neoplasm

- Wagner-Meissner body- von Recklinghausen's disease of the skin, neurofibroma
- Verocay bodies- benign nerve sheath tumor, Schwannoma
- Psammoma bodies- numerous benign and malignant epithelial and connective tissue tumors such as psammomatoid meningioma, psammomatoid juvenile ossifying fibroma, psammomatoid melanotic schwannoma, cystadenocarcinoma.
- Russell bodies- chronic inflammatory granulomata, multiple myeloma, plasmacytoma, helicobacter pylori infection, periapical granuloma.
- Pustulo- Ovoid bodies- granular cell tumors
- Kamino bodies-pigmented spindle cell nevus, Spitz nevus
- Dutcher bodies- chronic synovitis and large B- cell lymphoma and multiple myeloma.

Inclusion bodies in autoimmune diseases

- Civatte bodies- discoid lupus erythematosus and lichen planus
- Hematoxylin bodies- systemic lupus erythematosus
- Schaumann bodies- Sarcoidosis, tuberculosis, hypersensitive pneumonitis

Inclusion bodies seen in cystic lesions

- Rushton bodies/ Hyaline bodies- Plexiform Ameloblastoma, Residual Cyst, and Radicular Cyst.
- Cholesterol crystals- Radicular cyst, Residual cyst, inflamed developmental cysts.
- Liesegang's Rings -Calcifying epithelial odontogenic cyst.

This is an effort to enlist these inclusion bodies for a rapid read.