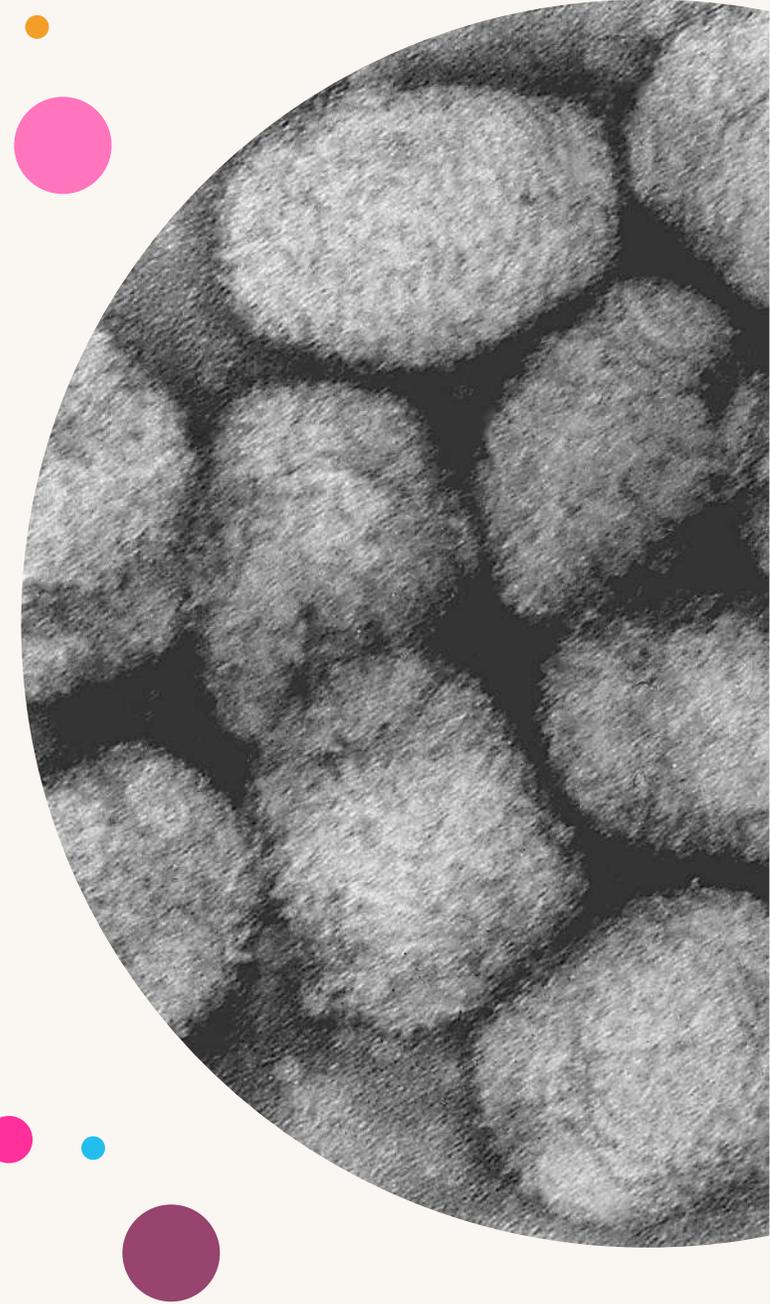


# POXVIRIDAE

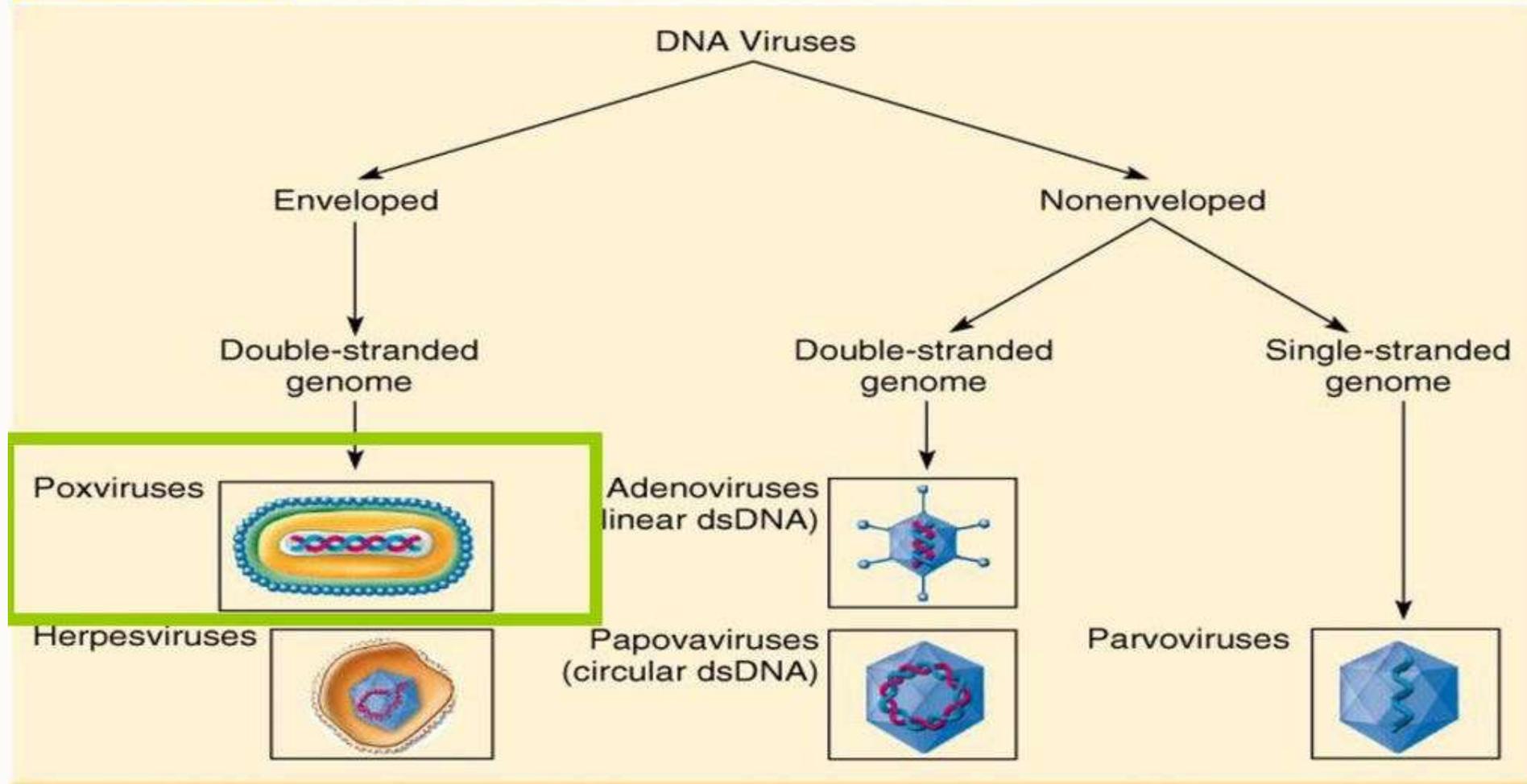
Zeynep AKKUTAY-YOLDAR, Associate Professor



# Taxonomy

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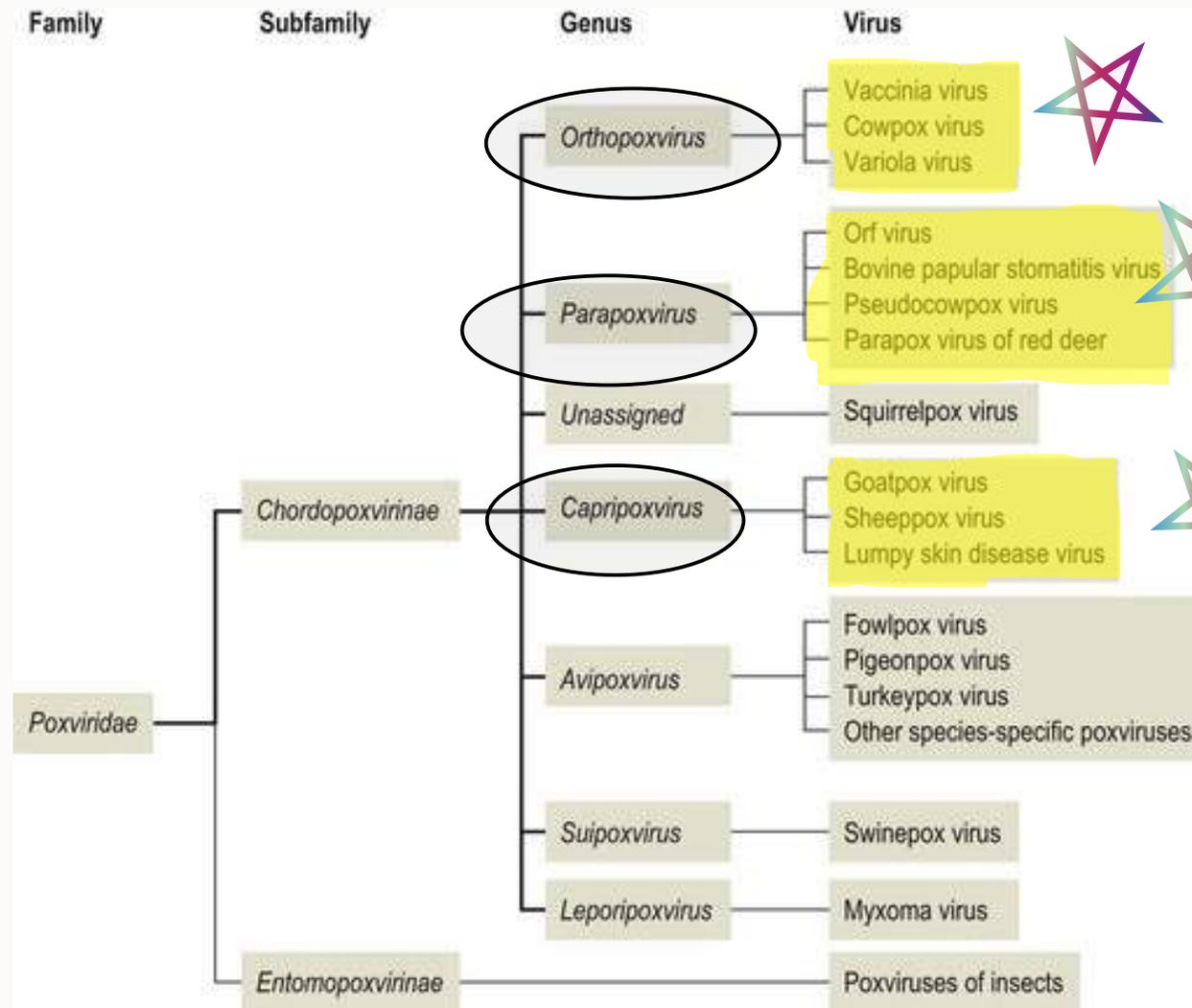
**TABLE 6.2** Medically Relevant DNA Virus Groups



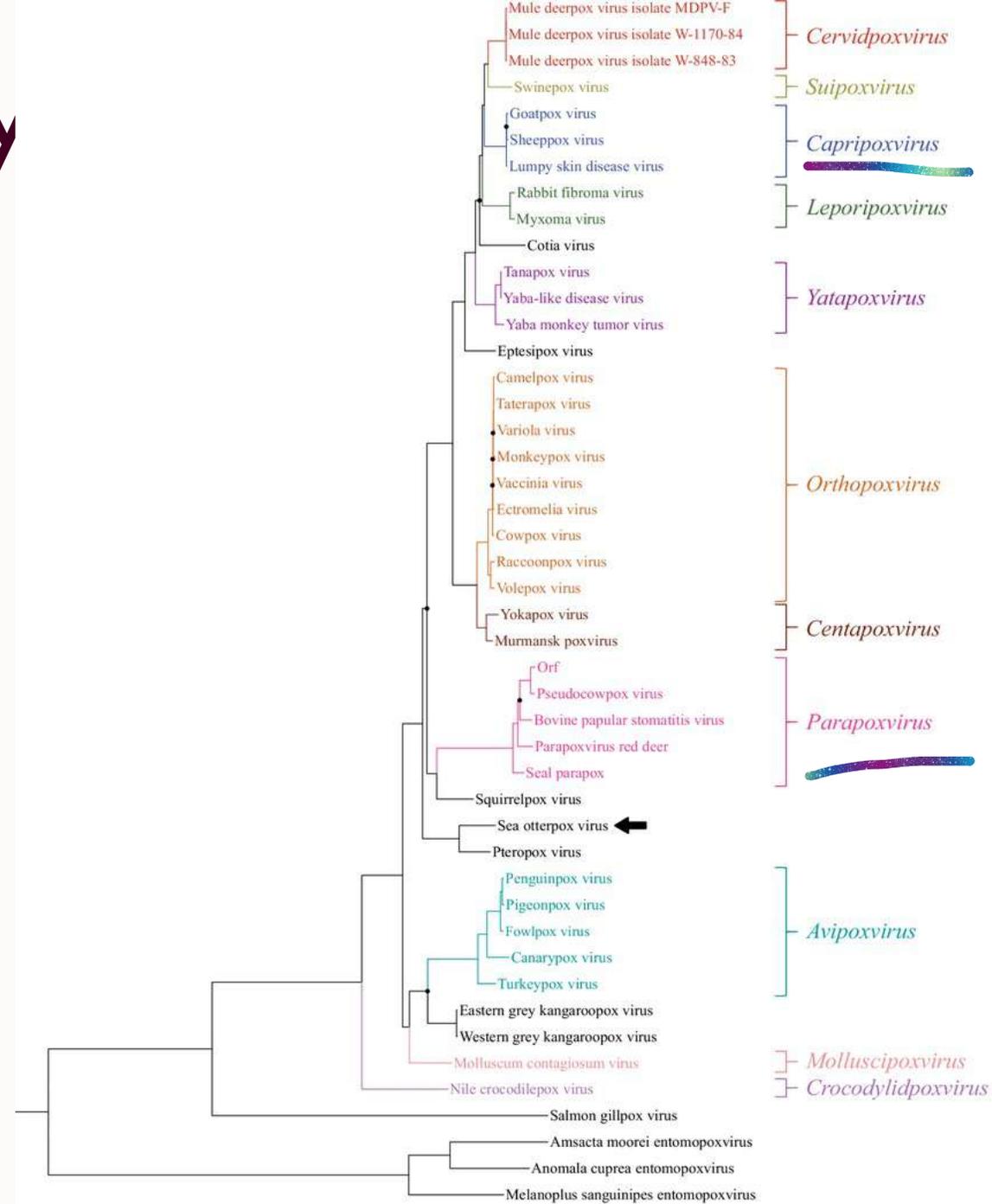
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Adapted from: *Poxviridae* from Buller et al., National Institute of Allergy & Infectious Disease, Department of Health & Human Services.

# Taxonomy

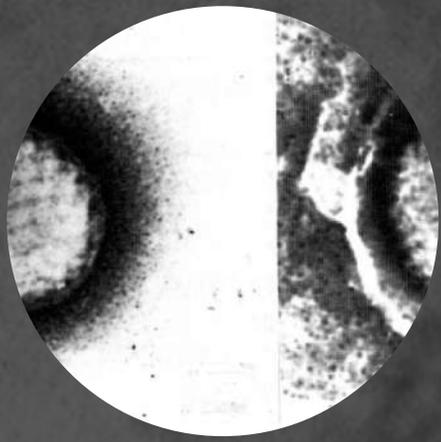


# Taxonomy



# Poxviridae In Fenner's Veterinary Virology (Fifth Edition), 2017

Genus	Virus	Major Hosts	Host Range	Geographic Distribution
<i>Orthopoxvirus</i>	Variola (smallpox) virus	Humans	Narrow	Eradicated globally 
	Vaccinia virus	Numerous: humans, cattle, buffalo, swine, rabbits	Broad	Worldwide 
	Cowpox virus	Numerous: rodents, domestic cats and large felids, cattle, humans, elephants, rhinoceros, okapi, mongoose, alpaca	Broad	Europe, Asia
	Camelpox virus	Camels	Narrow	Asia, Africa
	Ectromelia virus	Mice, voles	Narrow	Europe
	Monkeypox virus	Numerous: squirrels, monkeys, anteaters, great apes, humans	Broad	Western and central Africa
	Uasin Gishu disease virus	Horses	?	Eastern Africa
	Tatera poxvirus	Gerbils ( <i>Tatera kempi</i> )	?	Western Africa
	Raccoon poxvirus	Raccoons	Broad	North America
	Volepox virus	Voles ( <i>Microtus californicus</i> )	?	California
<i>Capripoxvirus</i>	Skunkpox virus	Skunks ( <i>Mephitis mephitis</i> )	?	North America
	Sheeppox virus	Sheep, goats	Narrow	Africa, Asia
<i>Cervidpoxvirus</i>	Goatpox virus	Goats, sheep	Narrow	Africa, Asia
	Lumpy skin disease virus	Cattle, Cape buffalo	Narrow	Africa
<i>Suipoxvirus</i>	Deerpox virus	Deer including reindeer, gazelle	Broad	North America
	Swinepox virus	Swine	Narrow	Worldwide
<i>Leporipoxvirus</i>	Myxoma virus, rabbit fibroma virus	Rabbits ( <i>Oryctolagus</i> and <i>Sylvilagus</i> spp.)	Narrow	Americas, Europe, Australia
	Hare fibroma virus	European hare ( <i>Lepus europaeus</i> )	Narrow	Europe
	Squirrel fibroma virus	Eastern gray squirrel ( <i>Sciurus carolinensis</i> ),	Narrow	North America
<i>Molluscipoxvirus</i>	Molluscum contagiosum virus	Humans, nonhuman primates, birds, kangaroos, dogs and equids	Broad	Worldwide
<i>Yatapoxvirus</i>	Yabapox virus and tanapox virus	Monkeys, humans	Narrow	West Africa
<i>Avipoxvirus</i>	Fowlpox virus, canarypox, crowpox, juncopox, mynahpox, pigeonpox, psittacinepox, quailpox, sparrowpox, starlingpox, turkeypox (etc.) viruses	Chickens, turkeys, and many other bird species from different orders	Narrow	Worldwide
<i>Crocodylidpoxvirus</i>	Crocodylepox virus	Crocodiles	Narrow	Africa
<i>Parapoxvirus</i>	Orf virus	Sheep, goats, humans (related viruses of camels and chamois)	Broad	Worldwide
	Pseudocowpox virus	Cattle, humans	Narrow	Worldwide
	Bovine papular stomatitis virus	Cattle, humans	Narrow	Worldwide
	Ausdyk virus	Camels	Narrow	Africa, Asia
	Sealpox virus	Seals, humans	Narrow	Worldwide
	Parapoxvirus of red deer	Red deer	Narrow	New Zealand
	Currently unclassified	Carp edema virus	Common and koi carp ( <i>Cyprinus carpio</i> )	Narrow
	Salmonid gill poxvirus	Atlantic salmon ( <i>Salmo salar</i> )	Narrow	Norway
	Squirrel Poxvirus	Red and gray squirrels	Narrow	Europe and North America



- *Entomopoxvirinae* members infect invertebrates
- *Chordopoxvirinae* subfamily infect vertebrates, including humans.

# History

- The finding of smallpox-like rashes on Egyptian mummies suggests that smallpox has existed for at least 3,000 years.
- Traces of smallpox pustules found on the head of the 3000-year-old mummy of the Pharaoh Ramses V. Photo courtesy of World Health Organization (WHO)





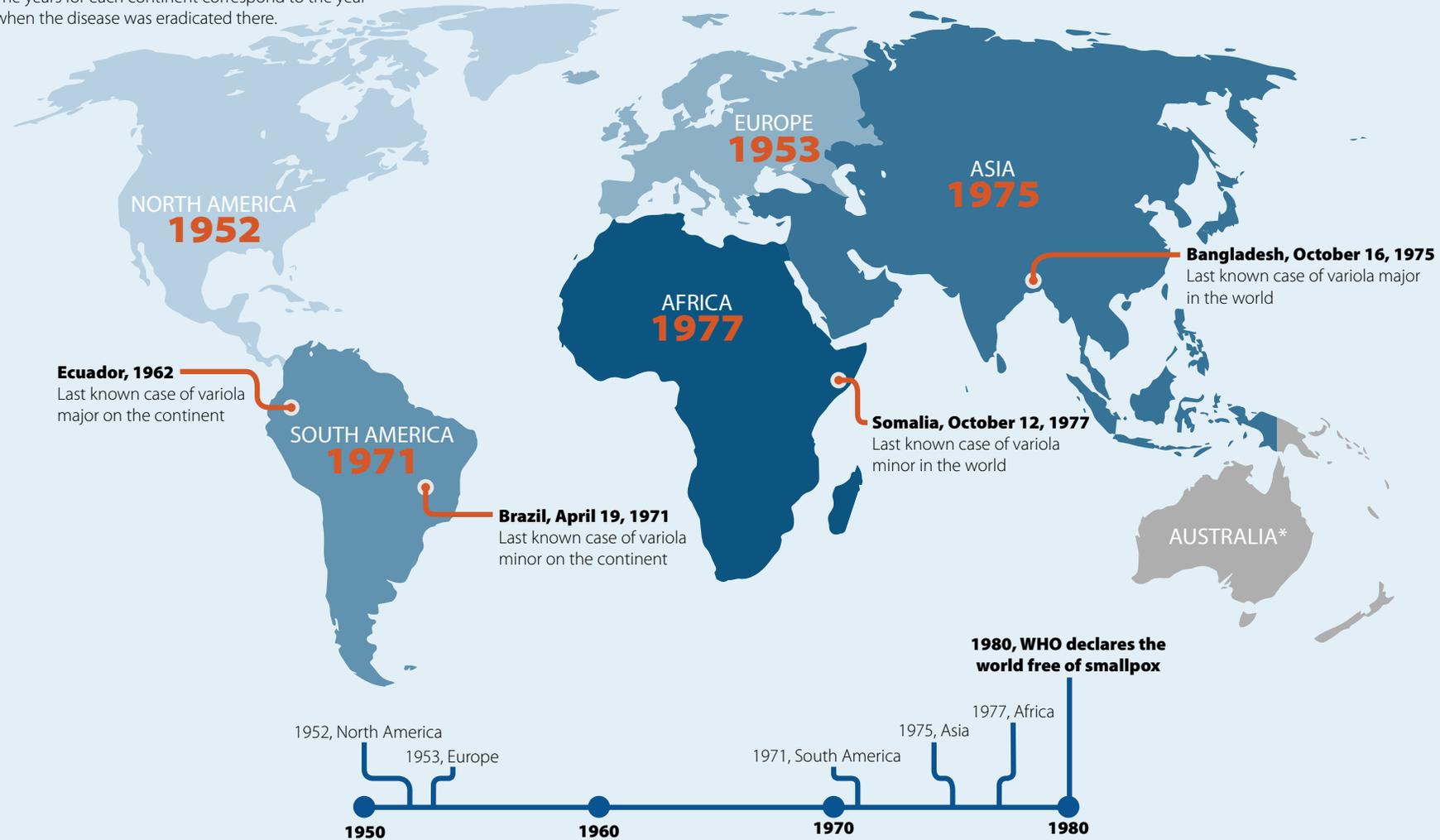
# Development of first vaccine against smallpox

- He noticed that milkmaids infected with cowpox prevented against smallpox.
- With this discovery the field of vaccinology was come out.
- Vacca= cow (latin).
- Variola virus=The cause of smallpox
- Vaccinia virus=The smallpox vaccine, origin uncertain

# GLOBAL SMALLPOX ERADICATION

The historically important dates highlighted in the map show countries in which the last naturally acquired cases of smallpox occurred.

The years for each continent correspond to the year when the disease was eradicated there.



\* Smallpox was never endemic (widespread) in Australia  
CS265471-A

# Pox viruses can be zoonotic

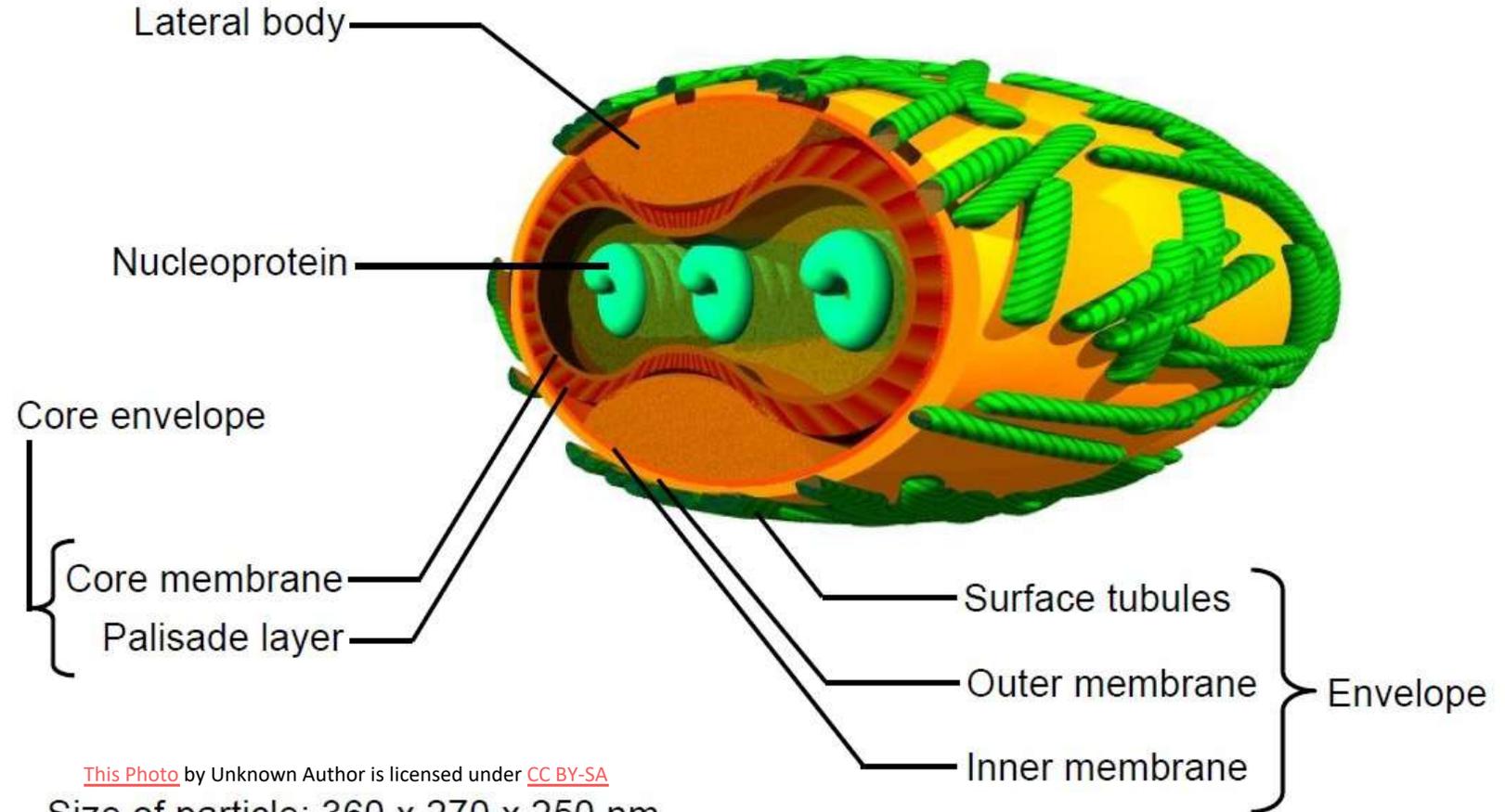
Genus	Virus	Geographic location	Reservoir	Primary zoonotic source	Clinical features in animals	Clinical features in humans
Orthopoxvirus	Cowpox	Europe & Western Asia	small rodents (voles & wood mice)	domestic cats	single bite like lesion on head or extremity that develops into a generalized papular rash; upper respiratory signs	painful, large, ulcerative lesion on hand or face with inflammation and edema; thick, hard, black crust; flu-like symptoms
	Monkeypox	Western & Central African rainforests	UNK; suspect rodents	rodent species	sudden death; upper respiratory signs, anorexia, lymphadenopathy, blepharitis; +/- generalized papular rash	2-4 day prodrome of headache and fever; generalized rash and lymphadenopathy; single nodule with focal hemorrhagic necrosis at inoculation site (hand)
Parapoxvirus	Orf	World-wide	sheep & goats	sheep & goats	large proliferative lesions with raised crust primarily around comissures and muzzle	Single or multiple lesions on upper extremities (especially hands) or face; vesicle has "target" appearance (red center, white ring, red halo), papillomas over surface prior to crusting
	Bovine Papular Stomatitis	World-wide	cattle	cattle	primarily young feedlot cattle ; lesions usually on muzzle, nose & hard palate; erosions & ulcers common	see Orf
	Pseudocowpox (Paravaccinia)	World-wide	cattle	cattle	primarily dairy cows; lesions usually on teats, udder & perineum	see Orf



# Etiology

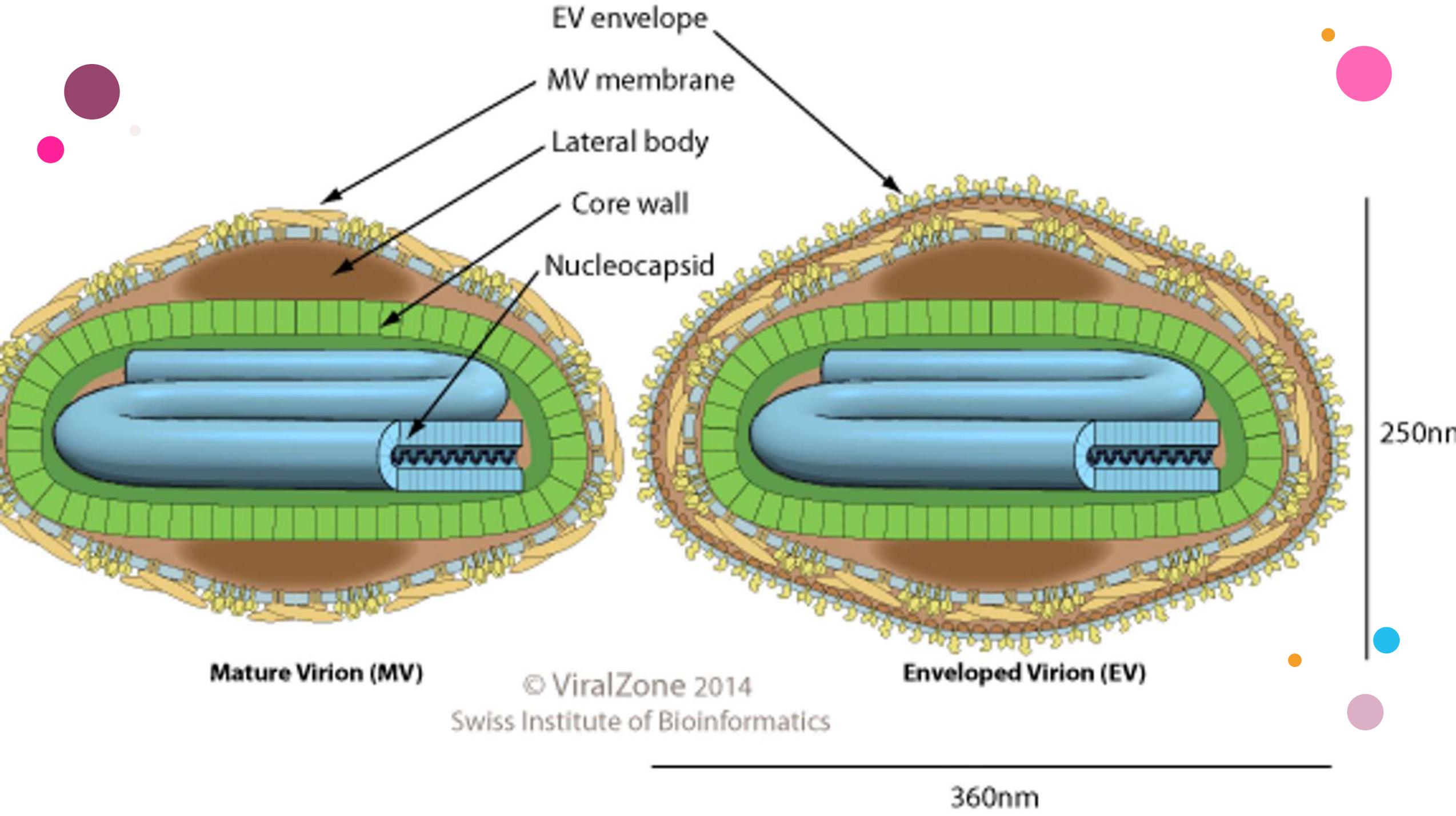
- Enveloped, brick-shaped or ovoid virion, complex capsid symmetry.
- The surface membrane displays surface tubules or surface filaments.
- Linear, dsDNA genome of 130-375kb
- Poxvirus genomes are huge DNA molecules that contain genes for all proteins required for DNA synthesis and viral mRNA translation.

## Cut-away structure of a Poxvirus (e.g. Vaccinia)



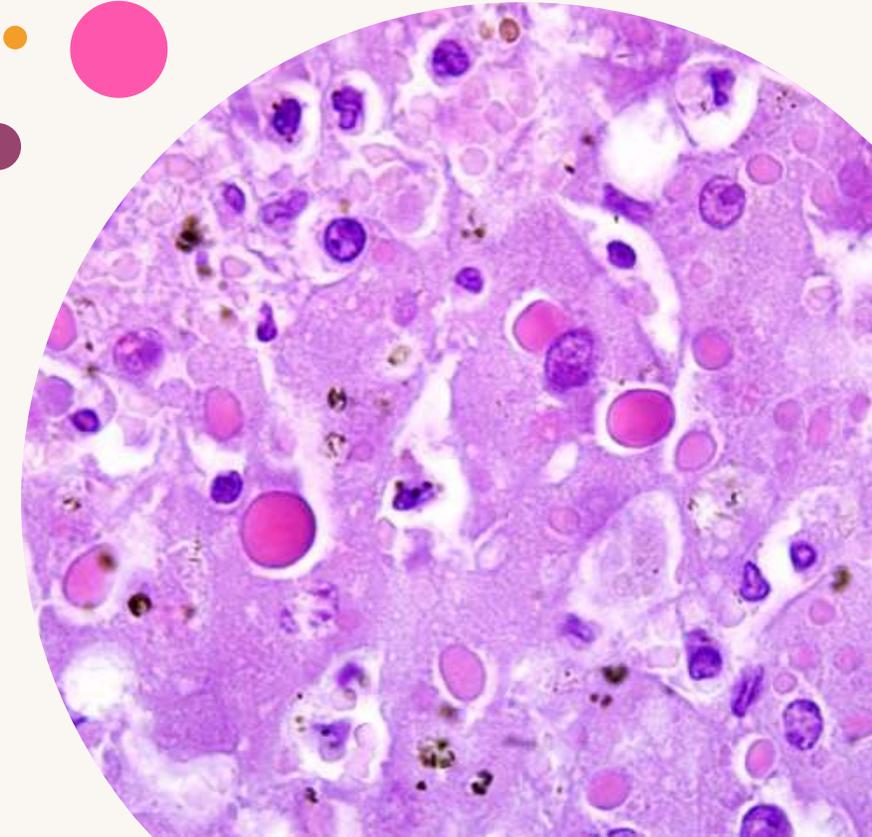
[This Photo](#) by Unknown Author is licensed under [CC BY-SA](#)

Size of particle: 360 x 270 x 250 nm



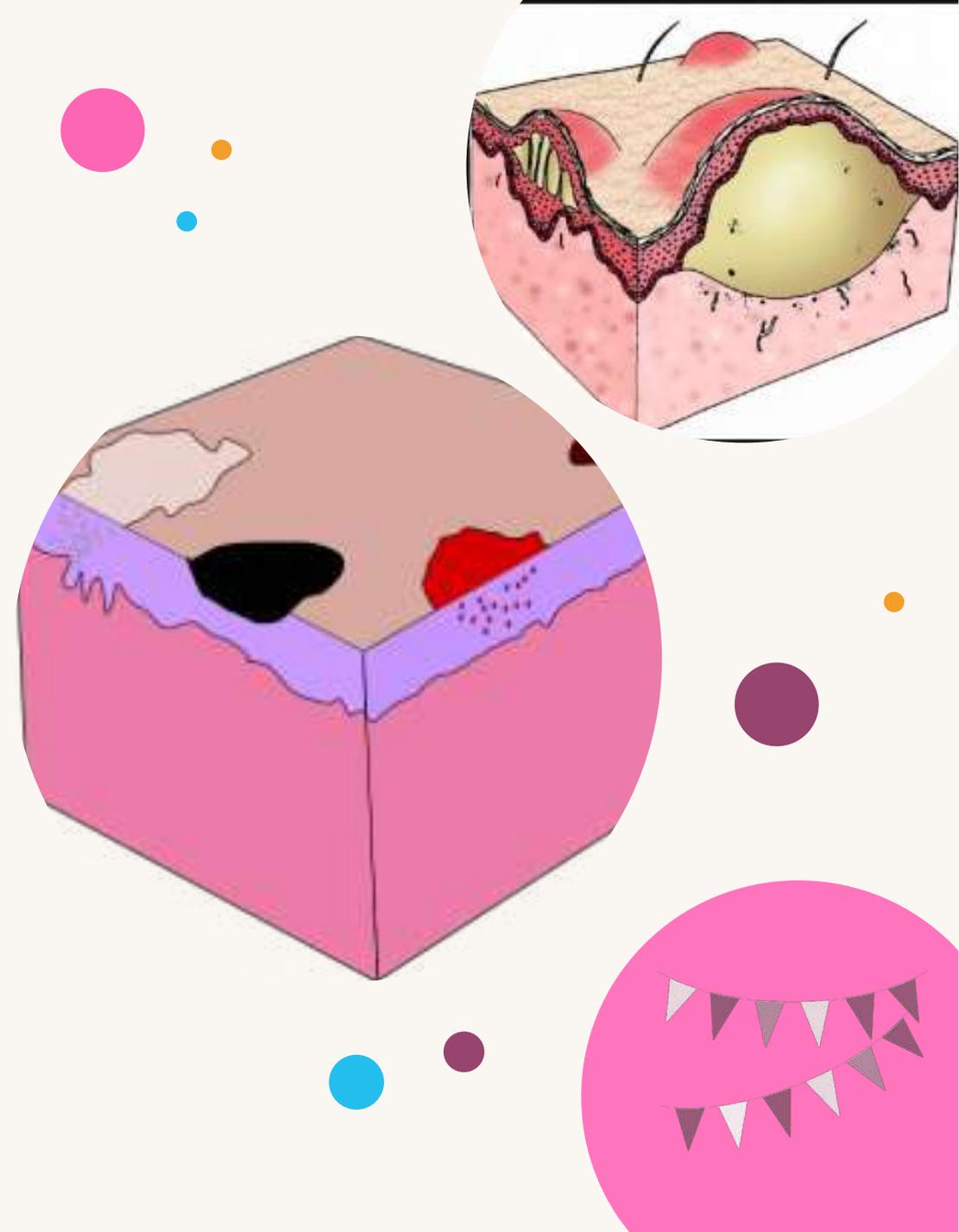
# Etiology

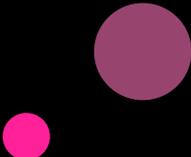
- Some of the poxviruses can propagate chorioallantoic membrane of ECE, causing nodular lesions known as "pocks."
- Parapoxviruses, yatapoxviruses and molluscipoxviruses, that can infect humans, do not form pocks.
- Round or oval inclusion bodies in the cytoplasm, called Guarnieri's bodies.
- Some poxviruses can make acidophilic inclusion bodies in the cytoplasm.



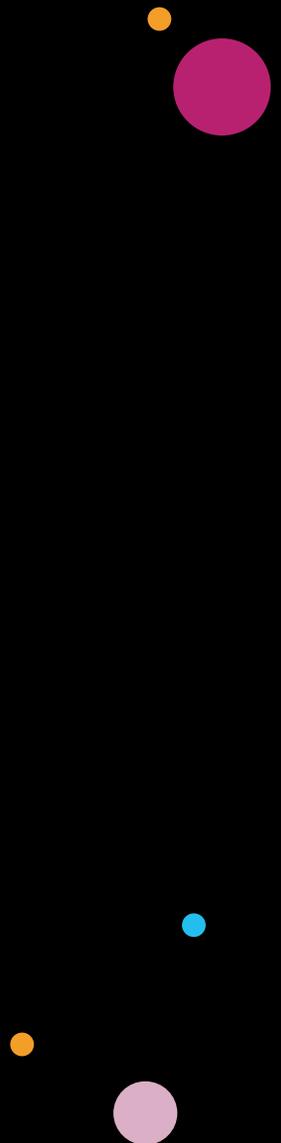
# Pathogenesis

- **Virus invades through broken skin**, replicates at the site of inoculation, and causes dermal hyperplasia and leukocyte infiltration. Some of the poxviruses transmits via contact or by airborne transmission.





# Pathogenesis

- Some poxviruses express an epidermal growth factor.
  - Epidermal cells balloon in response to epidermal growth factor encoded by the virus, followed by necrosis and proliferation of neighboring epidermal cells.
    - The virus gains new host cells as a result of this multiplication.
- 

# The typical pattern of lesions recognized as:

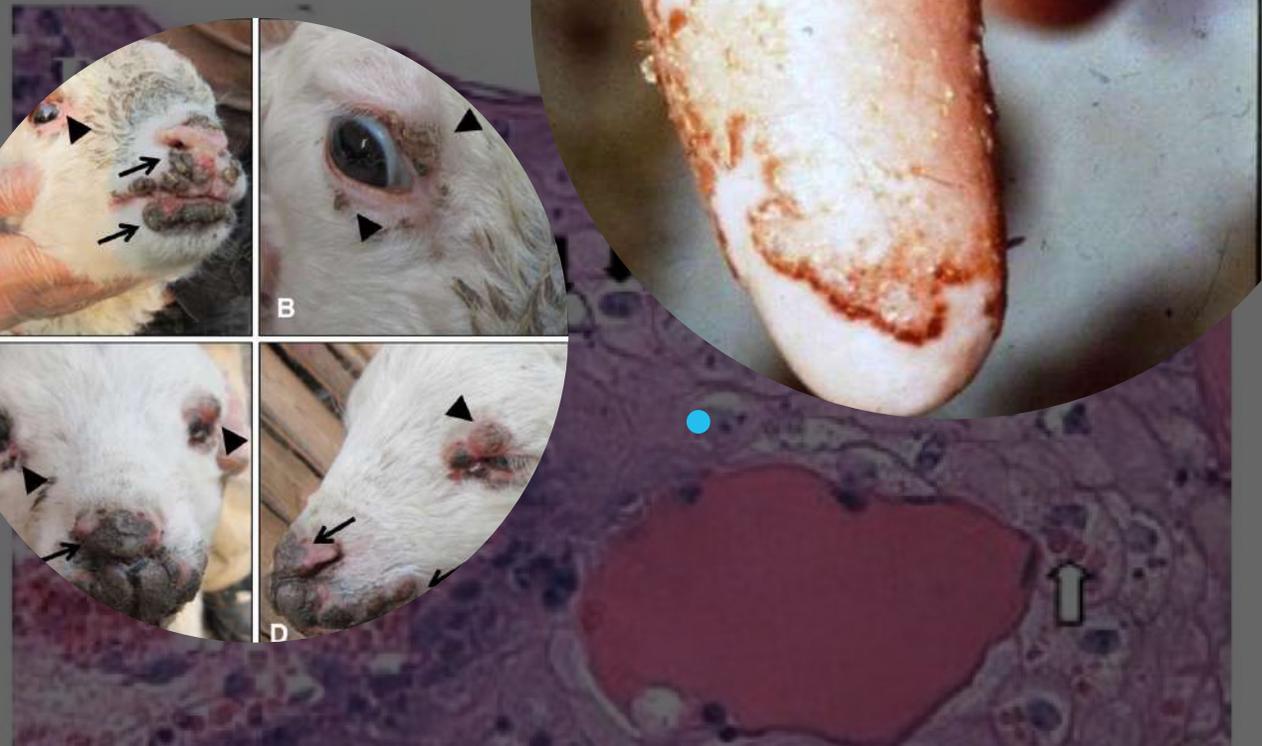
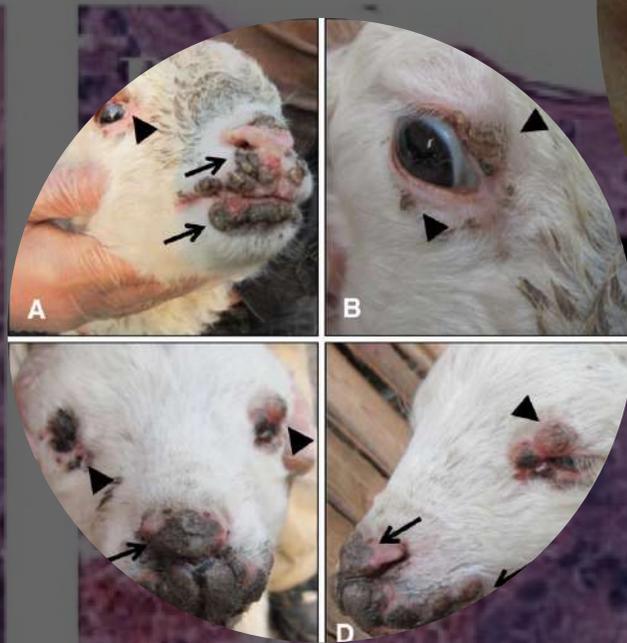
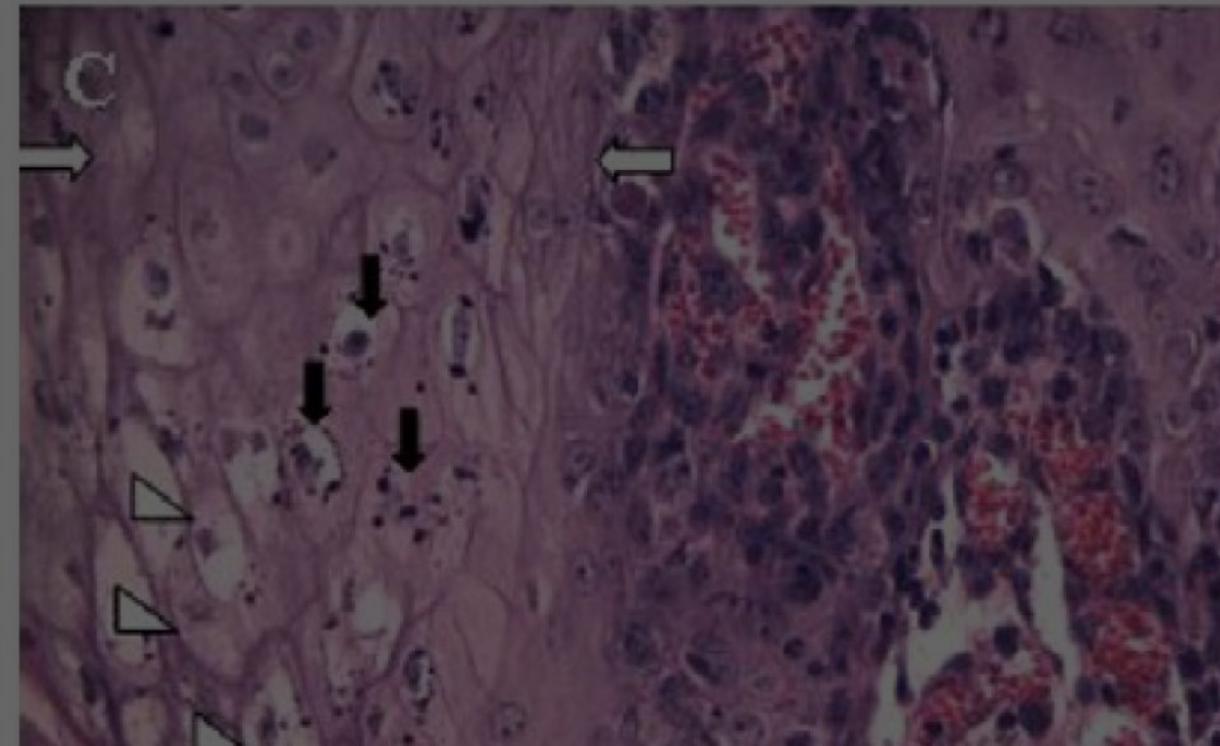
**Macule:** A non-palpable, flat lesion that is different in color, and less than 0.5cm in size. Erythema formation.

**Papule:** An elevated solid lesion, up to 0.5 cm in size, circumscribed and firm. Proliferation and subepidermal papule formation (red colored lentil-sized hard knot formation on the skin)

**Vesicle:** A fluid-filled blister less than 0.5 cm in size. From the 4th day of the papule, vesicles filled with clear fluid and with hyperemic areas are formed. The vesicles mature in 10 days.

**Pustule:** Like a vesicle but filled with pus instead of fluid. Papules are filled with fibrin and neutrophils. The pustular period lasts 8-10 days. These lesions are darker in the infection caused by cowpoxvirus.

**Scab:** A dry, rough protective crust that forms over a cut or wound during healing.





# Lesions again

macule

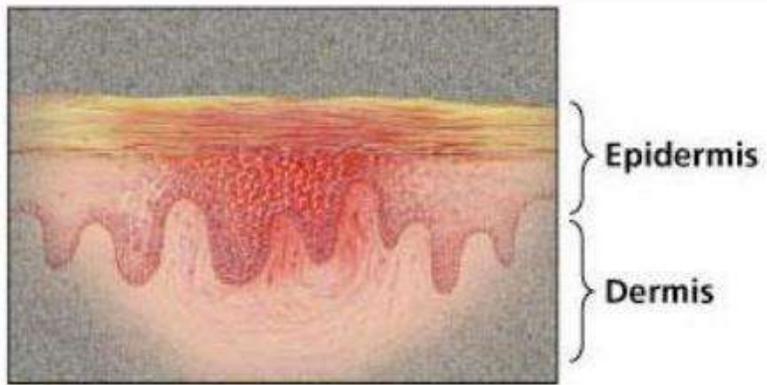
papule

vesicle

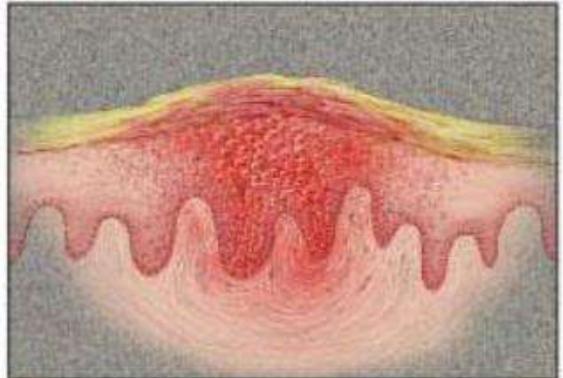
pustule

scab

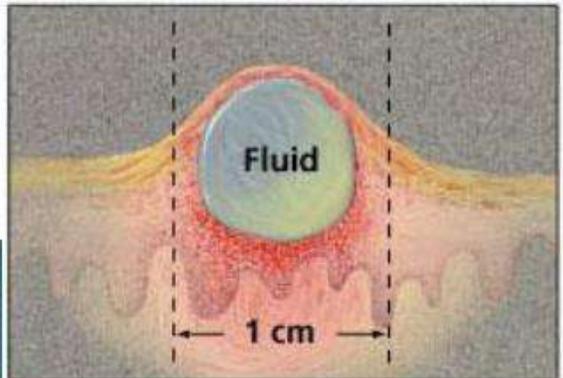
- Secret information: It is always an exam question!



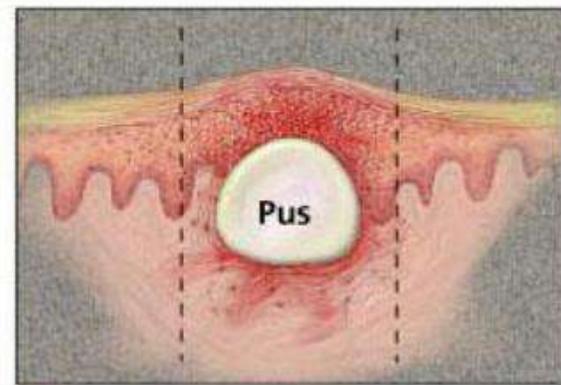
1 Macule



2 Papule



3 Vesicle



4 Pustule



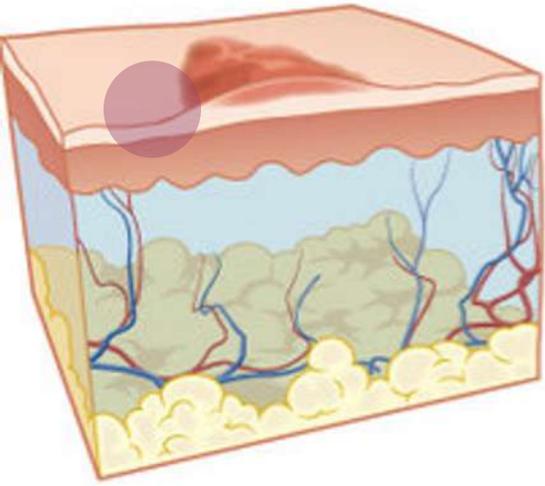
5 Crust



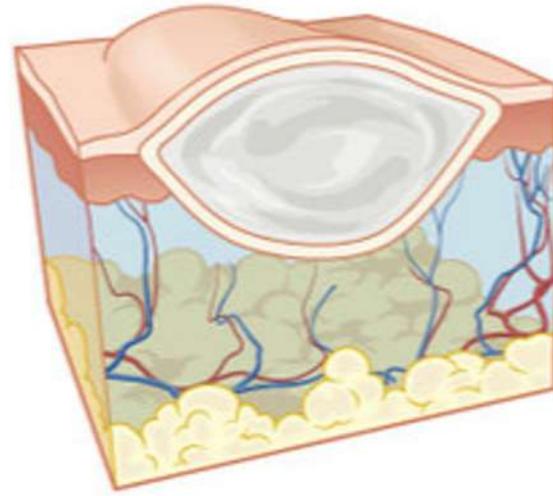
6 Scar

Figure 24.2 42

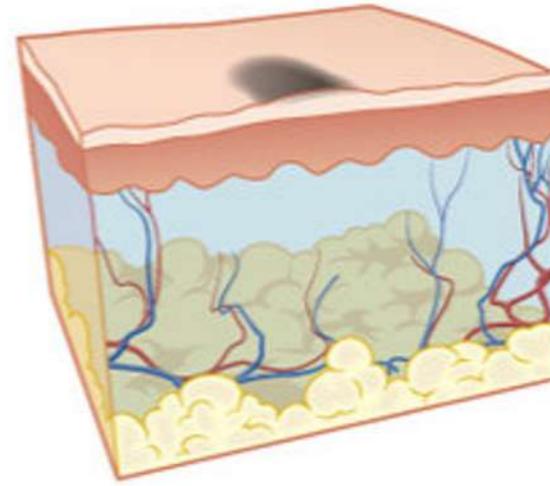
# Types of Skin Lesions



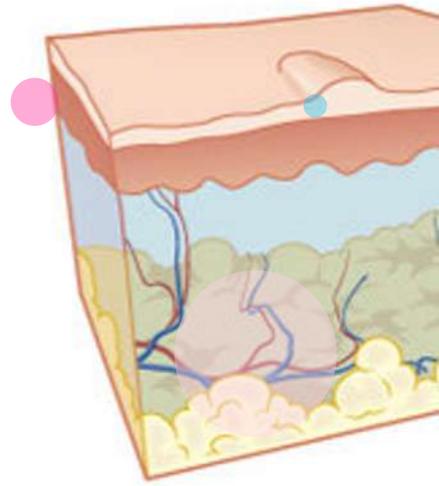
crust



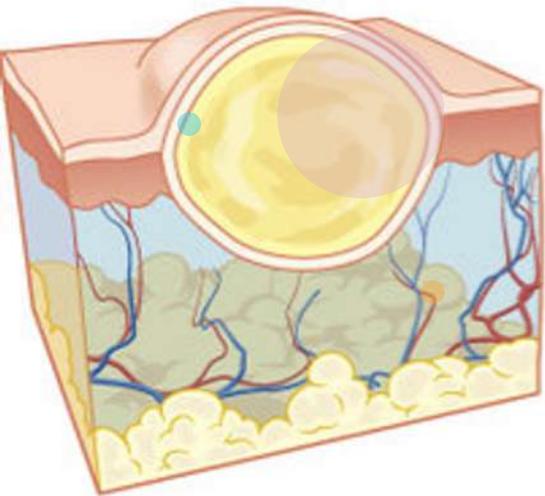
cyst



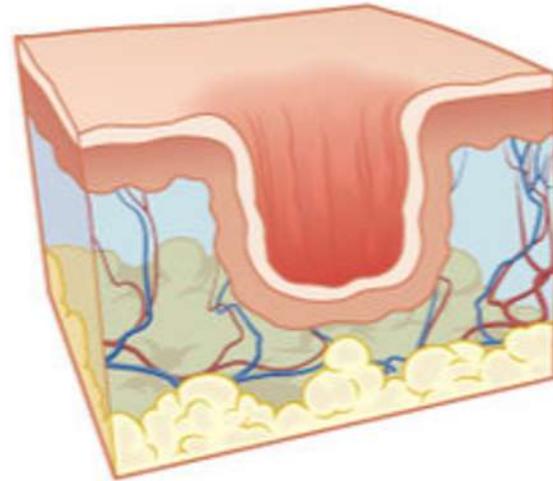
macule



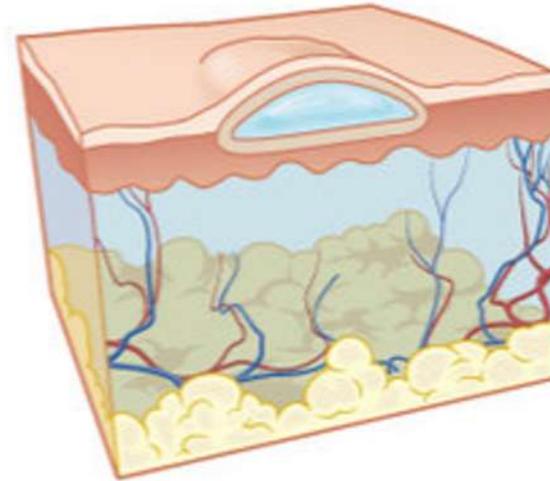
papule



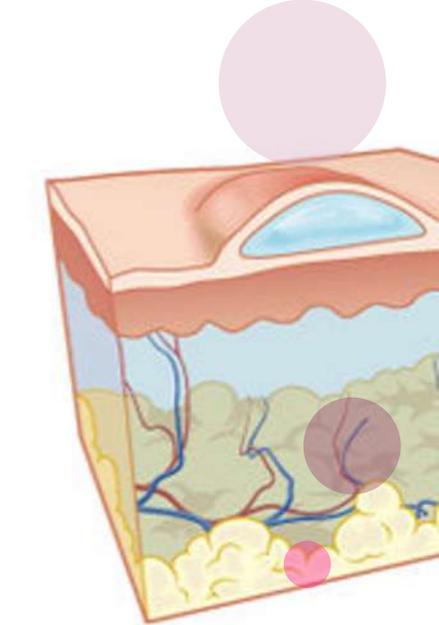
pustule



ulcer

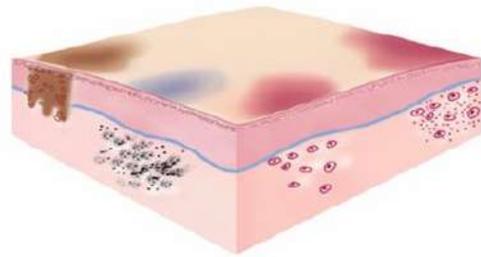


vesicle

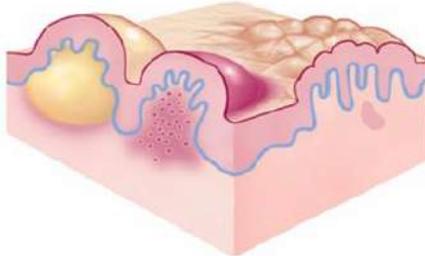


wheal

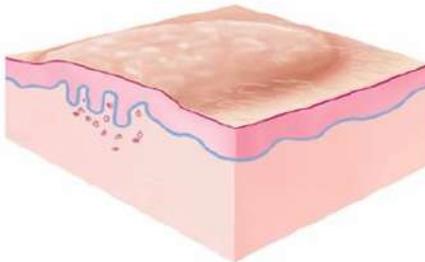
<https://www.holdingorders.com/ddx-skin-lesions>



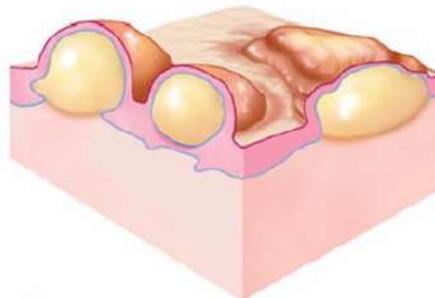
**Macule**



**Papule**



**Plaque**



**Vesicle**

