



# MSS

## Microbiology

LEC no. 2



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# Cutaneous infections that manifest in maculopapular rashes (1)

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The 2<sup>nd</sup> and the last lecture of MID's material.

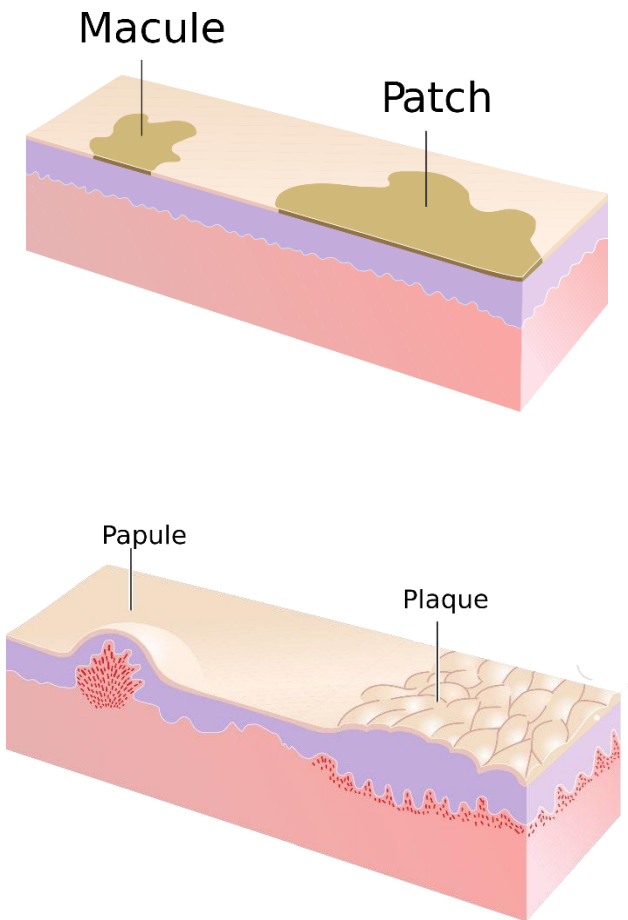
Let's rock it! ✨

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

# Macules, Papules, and Maculopapular Rashes

- **Macules** are flat lesions under 1 cm, notable for color changes. Macule colors can vary brown, blue, red, or hypopigmented.
- **Papules** are solid, raised lesions with clear borders, under 1 cm. Papules are distinct from macules by their elevation above the skin.
- **Maculopapular rashes**: Red or erythematous lesions, featuring both flat and slightly raised areas.

Usually, the 2 lesions appear together producing maculopapular rash.



# Maculopapular rashes

Caused by HHV-6 and HHV-7

The only childhood exanthem that is caused by a bacterium 'Group A hemolytic streptococci'.

Category	Diseases
Childhood Exanthems	Enteroviral rashes
	Erythema infectiosum (Fifth disease/Slapped-cheek syndrome)
	Roseola infantum (Exanthem subitum)
	Scarlet fever
	Rubeola (Measles)
Other Conditions	Rubella 'German measles'
	Infectious mononucleosis
	Secondary syphilis
	Rocky Mountain spotted fever
	Toxic shock syndrome

Caused by *Rickettsia*

Caused by bacterial toxins of *Staphylococcus aureus* and *Streptococcus pyogenes*.

Mostly caused by viruses **except** for Scarlet fever.

Exanthems = fever + rash

# Childhood exanthems

- Childhood exanthems are common diseases in children characterized by widespread lesions.
- Examples include like erythema infectiosum, scarlet fever, exanthem subitum, rubeola, rubella, and enteroviral rashes.
- Childhood exanthems are grouped together due to **similar clinical presentation and common occurrence in pediatric populations.**

Manifested in fever, malaise (generalized illness) then the maculopapular rash starts to appear.

Why do these infect children? Because they're not immune to these pathogens, on the contrary of adults that are either vaccinated or have developed immunity from a previous infection.





The notes between brackets() in blue are the doctor's comments 📌

# Childhood exanthems

- Childhood exanthems can be defined as rashes that are often accompanied by fever, malaise , and headache.
- These exanthems can be related to the effect of microbial toxins (like in scarlet fever), direct microbial effect on the skin, or an immune/inflammatory reaction in response to an infection (like the rash that persists in erythema infectiosum).
- Viruses are the primary etiologic agents of exanthems, **except for scarlet fever (bacterial)**.
- Childhood exanthems are usually similar, which makes accurate diagnosis difficult. However, some distinct features for each disease can aid to reach the correct diagnosis.

Viruses are the primary etiologic agents of exanthems, **except for scarlet fever (bacterial)**.

This knowledge affects the treatment significantly as if the etiological organism is bacterial, then it must be treated with antibiotics .

Childhood exanthems are usually similar, which makes accurate diagnosis difficult. However, some distinct features for each disease can aid to reach the correct diagnosis.

In general, all the cases of childhood exanthems have maculopapular rash, but with some distinctive characteristics that are used to discriminate accurately.

# Common Viral Childhood Exanthems

The characteristic lesion is (vesicular), not maculopapular so it won't be discussed in this lecture.

Virus	Disease
Coxsackie viruses	Enteroviral rash
Echoviruses	Enteroviral rash
Erythrovirus <b>B19</b>	Erythema infectiosum (Slapped-cheek syndrome/Fifth disease)
Human herpesvirus 6B (HHV-6B) and HHV-7	Roseola or Exanthem subitum
There are 2 types of HHV-6 : HHV-6A and HHV-6B The majority of cases are due to HHV-6B.	
Varicella-zoster virus	Chickenpox and Zoster (Shingles)
Measles virus	Rubeola (Hard measles)
Rubellavirus	Rubella (German measles)



# Erythema Infectiosum: Stages of Skin Lesions

- Before the rash, a prodromal phase (**nonspecific symptoms**) with headache, coryza, low-grade fever, pharyngitis, and malaise.
- Stage 1: **Slapped-cheek rash**: Bright red erythema suddenly appearing on the cheeks, sparing the nose, mouth, and eyes area (so it's only on the cheeks). This rash resembles a sunburn and fades within 2-4 days (then it gradually fades away).
- Stage 2: 1-4 days post-slapped-cheek rash, an **erythematous macular-to-morbilliform** (looks like the rash accompanied with **measles**) **rash** appears, primarily on extremities and sometimes affecting palms and soles.
- Stage 3: The rash evolves into a **lacy, net-like pattern**, especially on proximal extremities, distinctive to erythema infectiosum. This stage can last 3 days to 3 weeks.

# Erythema Infectiosum: Stages of Skin Lesions

Slapped cheek rash and macular rash on the proximal extremities.



Credit: DR H.C.ROBINSON /SCIENCE PHOTO LIBRARY /Universal Images Group

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Lacy, net-like-rash, it may last up to 3 weeks



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<https://www.childrensmn.org/educationmaterials/parents/article/8311/fifth-disease/>

# Roseola Infantum

- Prodrome: a high fever (opposite to the fever in erythema infectiosum) ( $40^{\circ}\text{C}$ ), followed by a sudden decrease in temperature. Early signs also include lethargy and irritability. Patients may also experience seizures and cough.
- Rash: Appears after the fever subsides, presenting as a macular or maculopapular erythematous rash.
- The rash begins on the trunk and moves to the extremities. The lesions do not merge (opposite to the rash in erythema infectiosum). The rash disappears within 2 days.

# Roseola Infantum

This pic shows maculopapular rash on the trunk of a baby.



Credit: Scott Camazine / Photo Researchers / Universal Images Group

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# Scarlet Fever

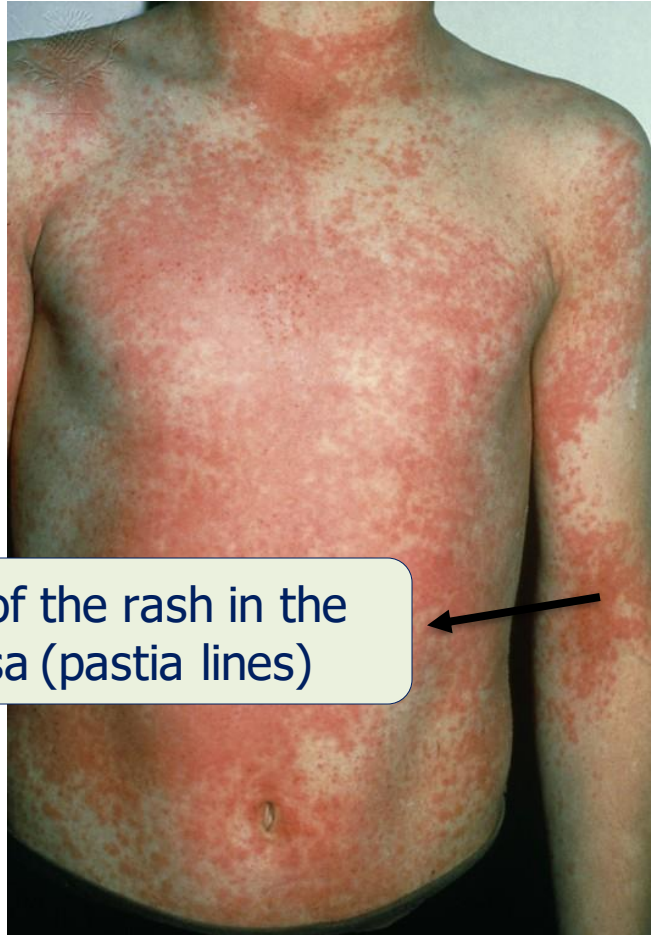
- The prodrome starts with pharyngitis, fever, and headache.
- 1-2 days after the prodrome, the rash starts on the neck, spreading to the trunk and extremities. The rash is erythematous, sandpaper-like (scarletina rash).
- Distinctive features include the intensification of rash in skin folds, forming **Pastia lines** (also called the Thompson sign). Initially, the tongue appears has a white coating and swollen red papillae (**white strawberry tongue**).
- The rash is followed by a desquamation phase, where the rash fades 3-4 days after onset, followed by peeling, starting from the face. Tongue peeling occurs 2 days post-rash, resulting in a red, swollen tongue with prominent papillae (**strawberry tongue**).

## Additional pics:





# Scarlet Fever



Intensification of the rash in the antecubital fossa (pastia lines)

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Strawberry tongue

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# Rubeola (Measles)

- The prodromal phase is characterized by Coryza, Conjunctivitis, non-productive Cough (the "three Cs"), and fever. This is followed by the pathognomonic Koplik spots that are blue-gray macules on an erythematous base on the buccal mucosa. (This is diagnostic and characteristic of measles.)
- The measles rash starts at the hairline, spreading to the trunk and extremities. The rash is most concentrated above the shoulders, often merging (morbilliform rash). (This rash is characteristic of measles but may arise in other diseases as well)
- The rash lasts 4-6 days, fading from the head down, with full recovery (if no fatal complications occur) within 7-10 days.
- The disease is highly contagious from four days before to four days after the rash appears.

# Rubeola (Measles)



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**Koplik spots**



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# Rubella (German Measles)

- The prodromal symptoms include fever, malaise, headache, coryza, and mild conjunctivitis without cough (cough persists in Rubeola (Measles) ).
- The rash is maculopapular that emerges 1-5 days post-prodrome, starting from the forehead and face, then spreading to the trunk and extremities. The rash may merge into a scarlatiniform (sandpaper-like) appearance (another difference between Rubella and Rubeola) and fades within 3 days, starting from the forehead and face and moving downward.
- Additional signs include **Forchheimer spots (distinctive)** (petechial lesions on the soft palate) in addition to **postauricular and suboccipital lymphadenopathy**.
- The disease is contagious from 1 week before the symptoms start and for 5 days after the rash first appears.

# Rubella (German Measles)



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Medicine

[https://doi.org/10.2169%2Fintern  
almedicine.4368-19](https://doi.org/10.2169%2Fintern<br/>almedicine.4368-19)

Affect children and adults.

# Enteroviral rashes

- Typical symptoms: Fever, general discomfort (malaise), and headache.
- The rash may appear with the fever or after the fever has declined.
- The rash appearance is variable depending on the specific enterovirus involved.
- Echoviruses can cause rashes like rubella, measles, or roseola.
- Echovirus 16 specifically leads to a **(distinctive)** roseola-type rash, referred to as **Boston exanthem**.
- Coxsackie A viruses result in pustular stomatitis and extensive **vesicular** lesions.

There is variability in Enteroviral rashes, they may be maculopapular as in Boston exanthem or vesicular lesions.



# Epidemiology of childhood exanthems

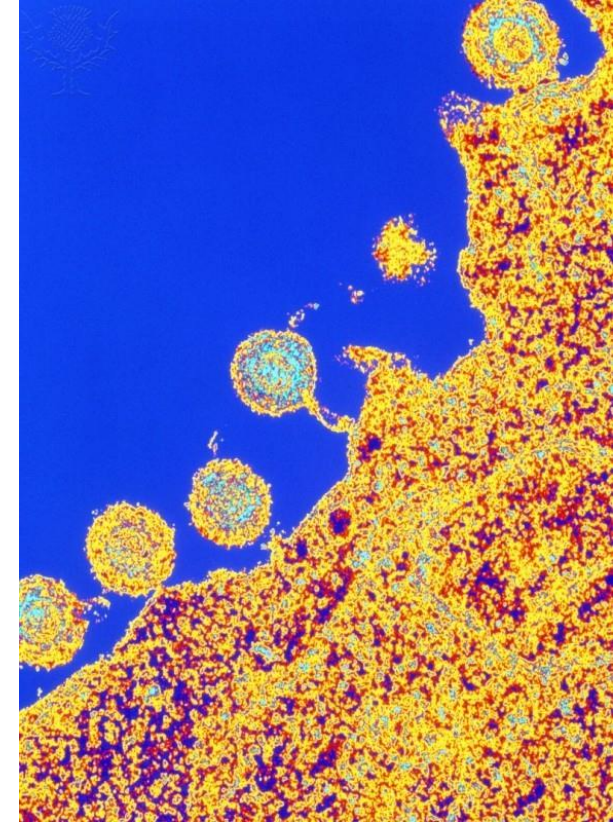
- Exanthems are prevalent worldwide (especially for the diseases that have no vaccinations; erythema infectiosum, Roseola Infantum) , mostly in children.
- **Transmission routes:**
- Primarily spread through aerosolized respiratory droplets.
- Virus particles can become airborne from skin contact, leading to infection.



# Roseola infantum: Epidemiology and transmission

- The peak seasons are spring and fall.
- Common in children aged 6 months to 3 years.
- By age 4 years, almost all children are seropositive (have been infected).
- The roseola viruses are spread through saliva, often from latently infected adults to children.

The etiological agents are Herpes viruses (HHV-6, HHV-7) which are characterized by establishing lifelong latency, so even if the person develops a primary infection, the virus will stay in the body with periodic intermittent shedding.

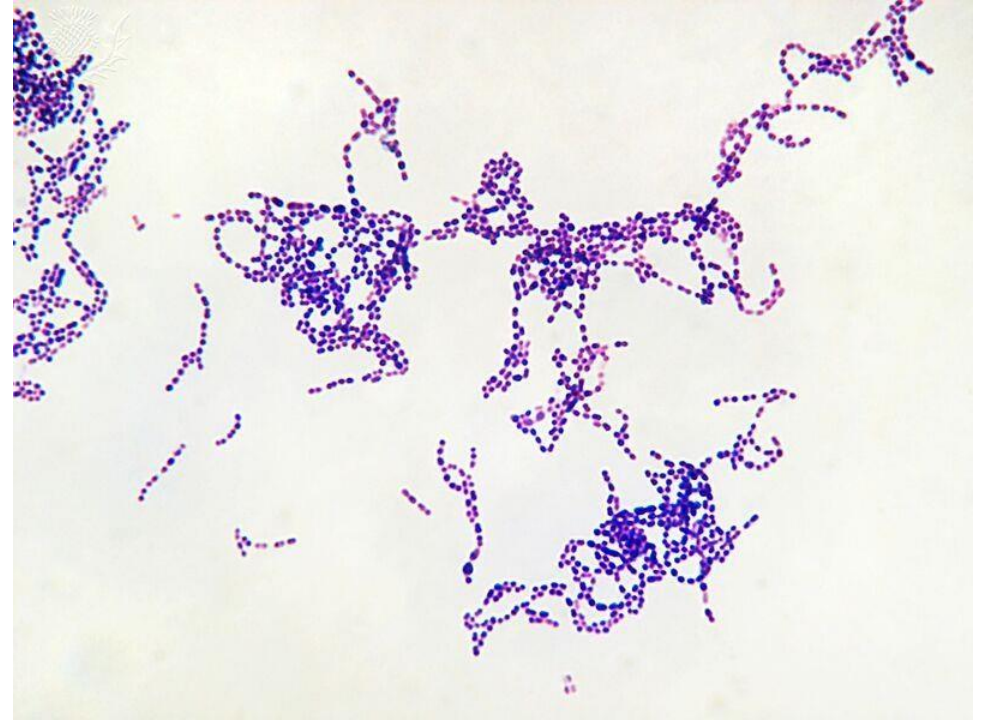


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# Scarlet fever: Epidemiology and transmission

- Mainly affects children.
- Develops 12-24 hours following a pharyngeal infection with a toxin-producing Group A *Streptococcus*. The carriers can be the source of infection with toxin-producing Group A *Streptococcus* present in the oropharynx of 15-20% of healthy children and adults.
- The disease spreads via airborne respiratory droplets from both symptomatic patients and asymptomatic carriers.

So it can be transmitted from either carriers or infected individuals.



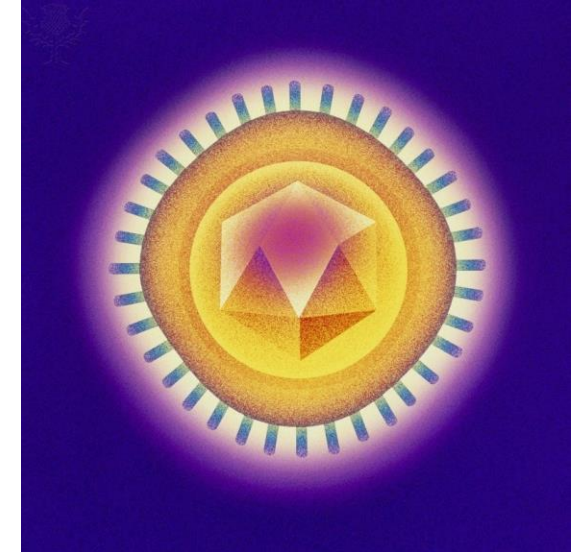
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# Measles and German Measles (Rubella): Epidemiology and transmission

- Measles spread through direct contact, contaminated objects, or inhalation of droplets. **It is highly contagious**, with a 90-95% transmission rate among close contacts. Universal vaccination significantly reduced cases.
- Rubella spread through respiratory droplets, primarily among unvaccinated children. Universal vaccination has led to a decrease in cases.



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# Enteroviral rashes: Transmission and prevalence

- Enteroviruses spread from person to person through contact with saliva or feces of infected individuals.
- Enteroviral rashes are seen most in infants during the summer.
- About 10-15 million cases are reported yearly in the US.
- Enterovirus infections are very common and endemic worldwide.

# Pathogenesis: Erythema infectiosum

- The disease is caused by an immune reaction to viral infection.
- Erythrovirus B19 infection leads to the production of specific IgM antibodies, leading to immune complex formation.
- The symptoms arise from immune complex deposition in the skin and joints.

Giving rise to arthralgia or skin rash.



# Pathogenesis: Roseola infantum

- The disease is caused by HHV-6 and HHV-7 (roseola viruses) replication in WBCs and salivary glands resulting in virus presence in saliva.
- Possible early invasion of the CNS occurs, which may result in seizures (besides the high fever) and other neurological complications (aseptic meningitis).
- After initial infection, roseola viruses become latent in lymphocytes and monocytes.



# Pathogenesis: Scarlet fever

- Following pharyngeal infections, or less commonly infections in the skin, surgical wounds, or uterus caused by *Streptococcus pyogenes*, scarlet fever can occur.
- The rash is a result of erythrogenic toxins (pyrogenic exotoxins) (SPE A, B, C, and F) produced by *Streptococcus pyogenes*.

# Pathogenesis: Measles

- Measles virus gains access to the body through the upper respiratory tract or conjunctivae, replicating initially in the oral mucosa and regional lymph nodes.
- The virus spreads to all lymph nodes and major organs. (Viremia)
- The emergence of circulating antibodies stops viremia, leading to symptom resolution.
- The rash is **not** immune-complex mediated (doesn't result from immune complex desposition as in erythema infectiosum) but rather result from immune reaction (through cellular and humoral immunity) to the virus manifesting in the skin.

# Pathogenesis: Rubella

- Rubella virus initially replicates in the upper respiratory tract and in the cervical lymph nodes and is carried in the bloodstream (viremia) to the skin, other lymph nodes, spleen, liver, joints, and CNS.
- Viremia can be detected several days before the rash appears.
- Neutralizing antibodies (protective) are detectable in the bloodstream, and the exanthem results the immune reaction in the skin (not immune complex deposition).

# Pathogenesis: Enteroviral rashes

- Enteroviral rashes occur following ingestion of the virus.

Spreads through feco-oral route or through respiratory aerosols and droplets that contain the virus.

- The virus attaches to epithelial cells in the gut (also in the respiratory tract) and invades and replicates in the Peyer patches (in the gut).
- Viremia occurs seeding many organ systems, including the CNS (that's why they're the most common cause of aseptic meningitis), heart, lungs, heart, and skin.

# Diagnosis of childhood exanthems

- Usually clinical diagnosis.
- The distribution and the type of rash can be valuable in achieving an accurate diagnosis.
- Serologic tests can also be helpful to confirm the diagnosis
- Scarlet fever can be detected by culturing for *S. pyogenes* or with a rapid strep antigen test (throat swap).
- *S. pyogenes* produces beta hemolysis on sheep blood agar plates and is sensitive to bacitracin.

## Usually clinical diagnosis.

The distribution and the type of rash can be valuable in achieving an accurate diagnosis.



Relying on the distinctive characteristics of each type, for example:

- Maculopapular rash that appears on the face toward downwards in **Measles and German measles.**

- Koplik spots are diagnostic of **Measles.**

- Slapped cheek rash indicates **Erythema Infectiosum.**

- Strawberry tongue refers to **Scarlet Fever.**



Serologic tests can also be helpful to confirm the diagnosis



In **German Measles, Measles or Erythrovirus B19:** detection of IgM antibodies helps to reach a specific diagnosis.

In **HHV-6 and HHV-7:** PCR tests can be used to confirm the diagnosis.

# Treatment and prevention of childhood exanthems

- **Supportive care is used in the treatment.**
- Mumps-measles-rubella (MMR) vaccine (**live-attenuated**) is effective in preventing measles and rubella. Testing pregnant women for the presence antibodies to rubella is important to determine if the fetus is at risk of infection following exposure to a person with rubella (**if not immune, the fetus may develop congenital rubella syndrome**).
- Patients with **scarlet fever** are usually treated with **antibiotics**. Treatment within 10 days of the appearance of symptoms can significantly reduce the chances of the patient developing rheumatic fever.

# Thanks for listening!

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Slide 8

Erythrovirus B19

