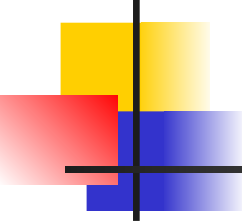
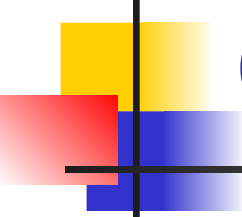


CORONAVIRUSES



Viruses Causing Respiratory Illnesses

- Rhinoviruses
- Respiratory syncytial virus
- Parainfluenza virus
- Adenovirus
- Influenza A virus
- Influenza B virus
- Enterovirus
- Herpes simplex virus
- Human metapneumovirus
- *Coronavirus*



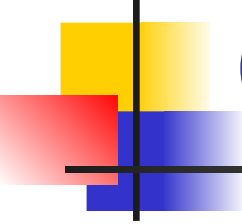
CORONAVIRUSES

- Corona= Crown like structure

A circle of light around a luminous body like sun or moon

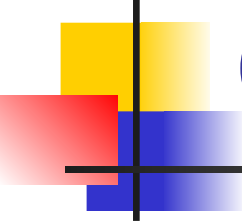
About a dozen host specific pathogens of mammals and bird

- Respiratory
- Intestinal tracts
- Severe Acute Respiratory Syndrome SARS
2003 China



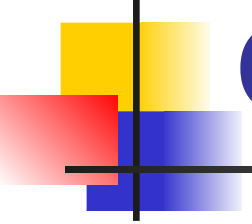
CORONAVIRUSES

- first isolated from chickens in 1937
- There are now approximately 15 species in this family infecting – man, cattle, pigs, rodents, cats, dogs and birds



Classification

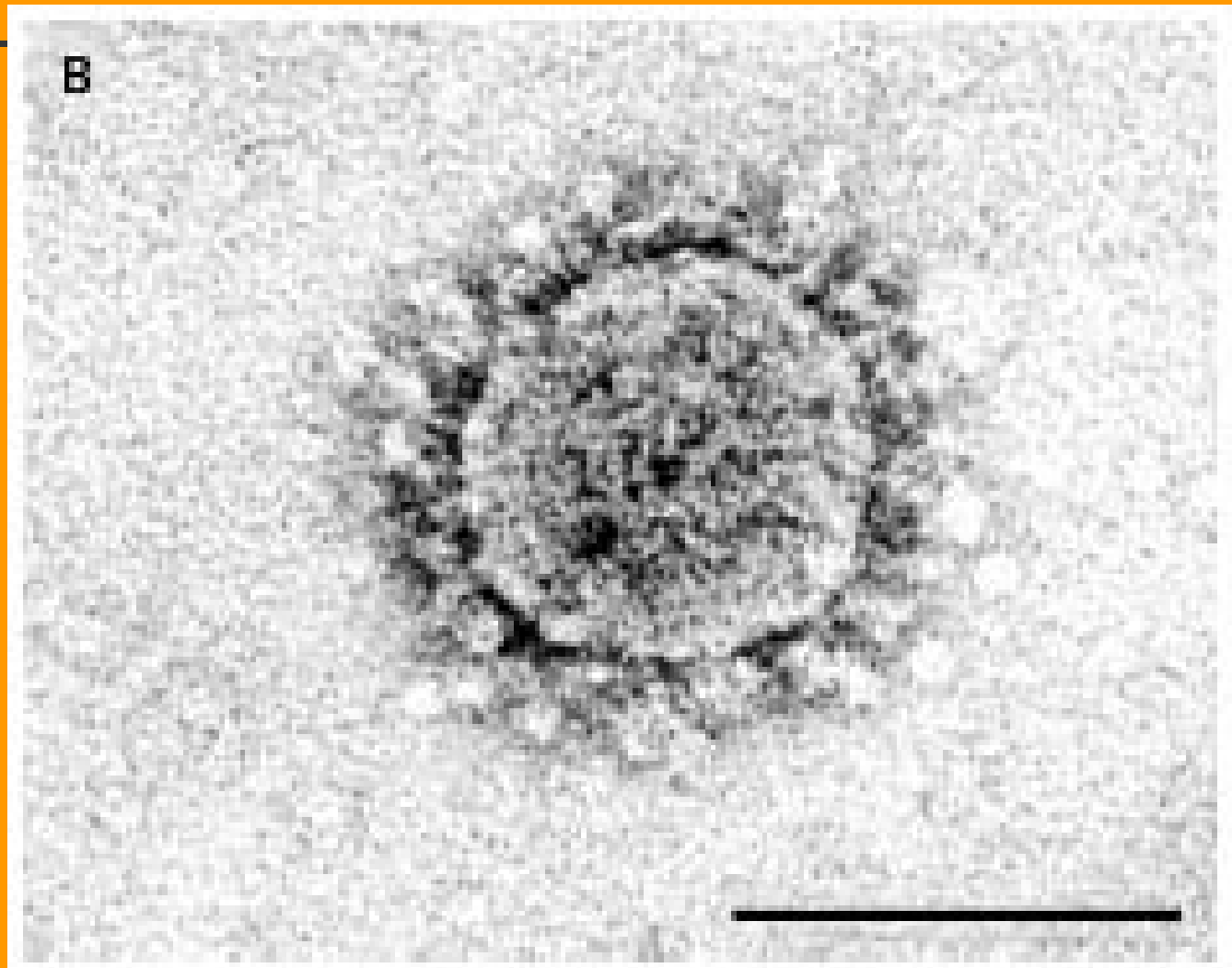
- *Family* *Coronaviridae*
- *Genera and* 1 *Coronavirus - Man, animals and birds*
 2 *Torovirus - Ungulates-associated with diarrhea*



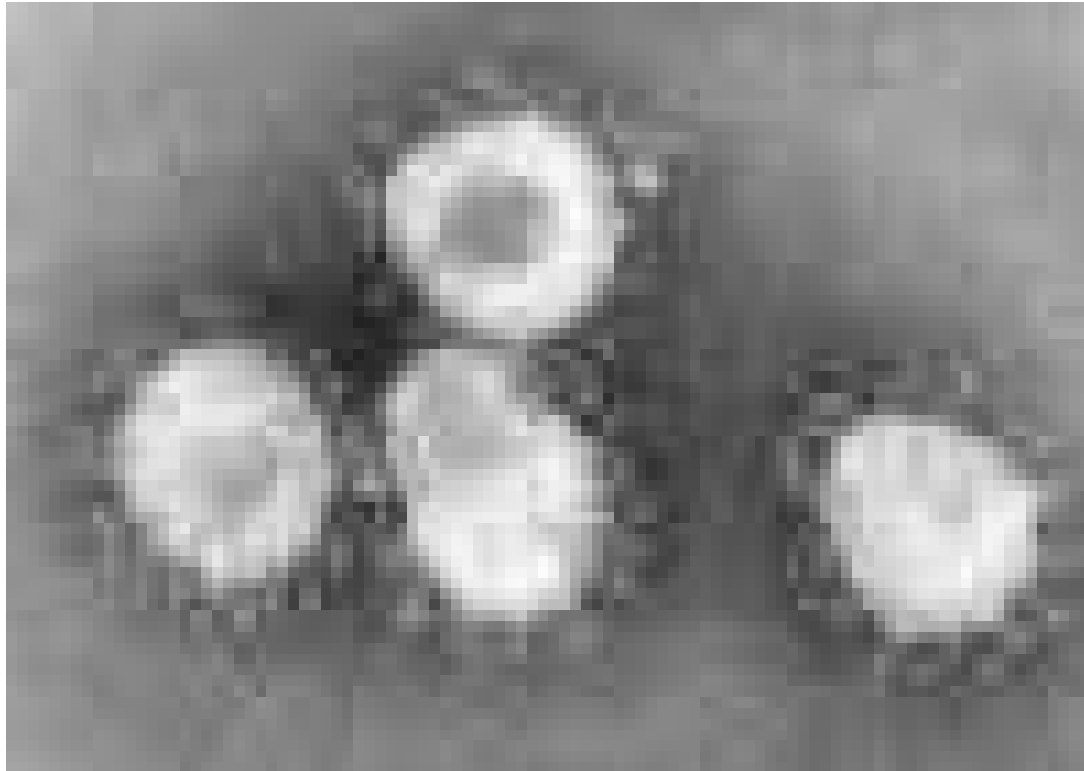
Properties of Coronaviruses

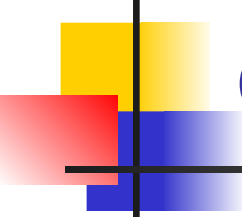
- Spherical/ irregularly-shaped
- ~120-160 nm dia
- Envelope bearing distinctive, 'club-shaped' peplomers (~20nm long x 10nm at wide distal end)- 'crown-like' appearance (Latin, *corona*) 2 gp → make peplomer
- **Human OC43 third gp (HE) → hemagglutination**
- ss RNA, linear, non segmented, positive sense, 27-32 kb- the **longest** of any RNA virus

Coronavirus



Coronavirus

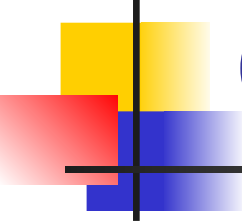




Properties of Coronaviruses- con'd

The envelope carries three glycoproteins:

- **S** - Spike protein: receptor binding, cell fusion, major antigen
- **E** - Envelope protein: small, envelope-associated protein- E1 and E2
- **M** - Membrane protein: transmembrane - budding & envelope formation In a few types, in some coronaviruses there is another glycoprotein:
- **HE** - Hemagglutinin-esterase

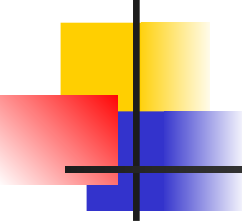


CORONAVIRUSES

Antigenic groups

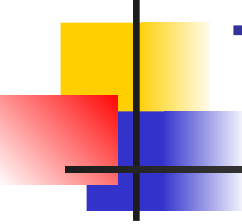
Two serogroups of human coronaviruses

- HCV 229 E
- HCV OC 43
- Coronaviruses of domestic animals and rodents included in these two groups
- Third group includes Avian strains cause Avian infectious bronchitis
- **High frequency of mutation** → Evolution of new virus strains
- Cross reaction between some human and some animal strains



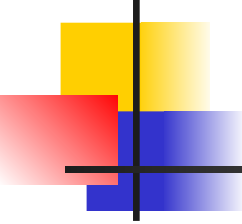
Replication

- Human coronaviruses do not grow well in cell culture- little is known
- Replication in cytoplasm of cell
- Mature budding endoplasmic reticulum and Golgi
- High frequency of mutation
- High frequency of recombination during replication-unusual for non segmented RNA virus-evolution of new strains



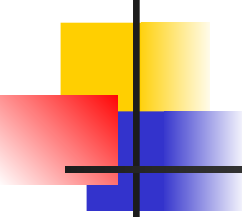
Transmission

- ❖ Aerosols of respiratory secretions
- ❖ Fecal-oral route
- ❖ Mechanical transmission



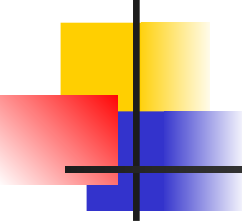
Pathogenesis

- Mammals & birds
- In humans, they cause:
 - Respiratory infections (common), including Severe Acute Respiratory Syndrome (SARS)
 - Enteric infections (occasional - mostly in infants <12 months)
 - Neurological syndromes (rare)



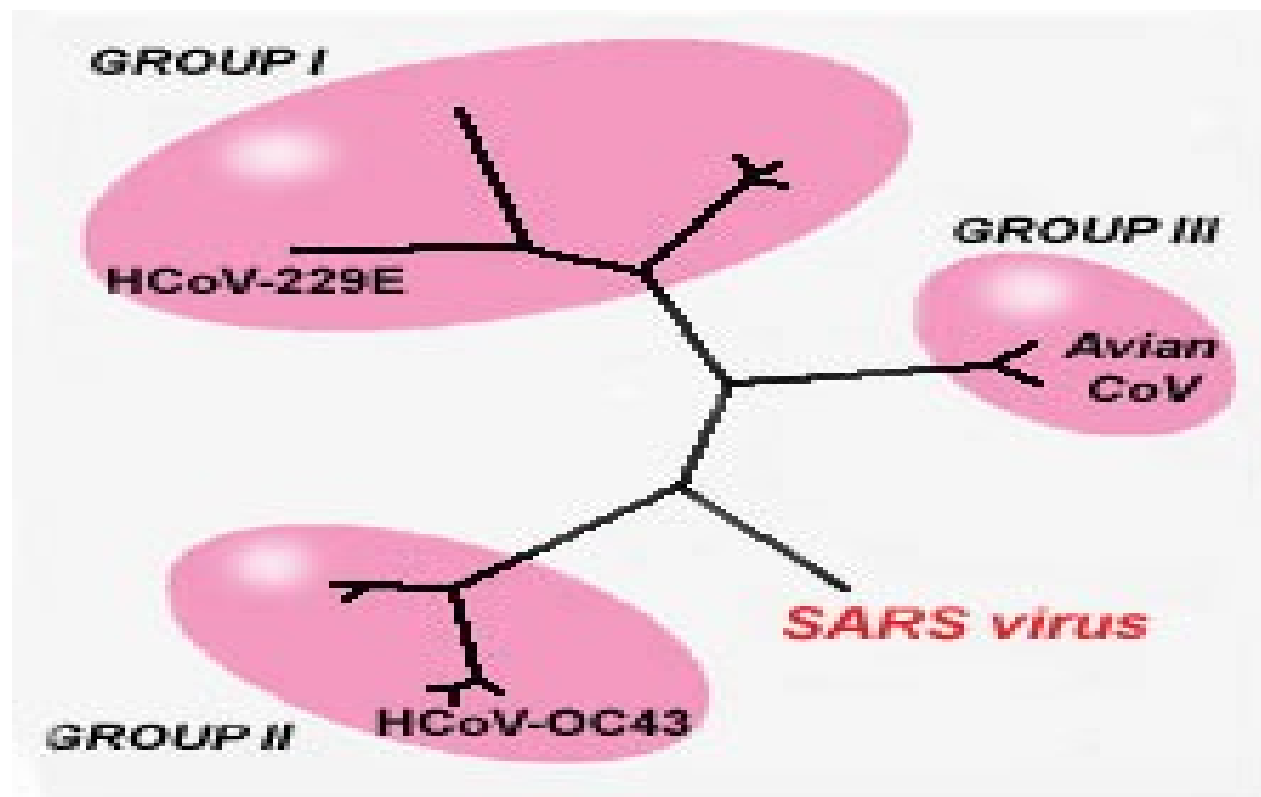
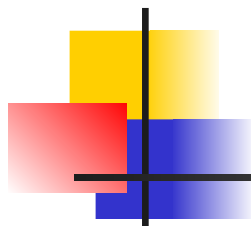
Pathogenesis –cot'd

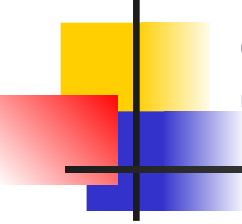
- Highly species specific-no experimental animal-do not grow well in cell culture
- Humans coronaviruses usually confined to URT
- Patchy destruction of cilia and ciliated epithelial cells → development of disease



Epidemiology

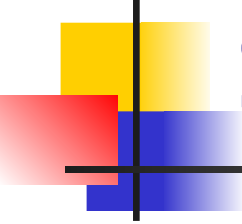
- Humans-very common and occurs worldwide
- strongly **seasonal**, with the greatest incidence in children in winter
- Adult infections are less common
- The number and the extent of antigenic variation is unknown
- Re-infections appear to occur throughout life, implying multiple serotypes





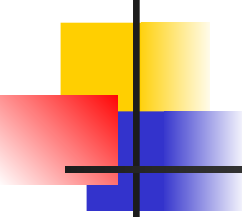
SARS

- Apparently new respiratory disease emerged in China November 2002 ↓
 - Progresses to a global health threat by spring of 2003
 - Cases reported China, Hong Kong, Vietnam, Singapore and Canada
 - March 15, 2003 WHO issued global travel alert
 - Potential pandemic ?
 - Casual agent ?
 - No diagnostic laboratory assays, no defined properties or risk factors for transmission, no infection control practices, no known treatment or preventive measures



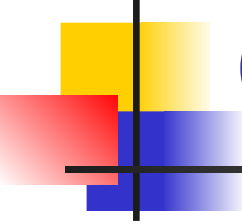
SARS

- 8,098 cases
- 774 deaths
- Billions of dollars



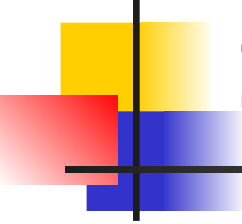
SARS- Clinical manifestations

- fever above 38 degrees (100.4 degrees Fahrenheit)
- accompanied by headache, general malaise and aches.
- Shortness of breath →hypoxia
- In fact, respiratory symptoms are initially usually mild but after a few days (or a week), the patient may develop a dry non-productive cough and breathing may become difficult (dyspnea).
- Respiratory distress leads to death in 3-30% of cases. Laboratory tests show a reduction in lymphocyte numbers and a rise in aminotransferase activity which indicates damage to the liver.



SARS Coronavirus (SARS CoV)

- Coronaviruses
- High degree of mutation
- High frequency of recombination ↓
 - Evolution of new viruses /strains
 - (SARS CoV) may be hybrid of mammalian and avian coronaviruses (J. Virol 2004)



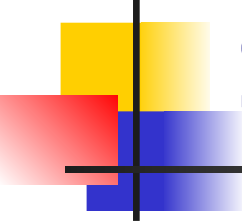
Successfully contained

- Sensitive surveillance
- Isolation and identification of virus
- Diagnostic assays
- Infection control measures
- Community containment-quarantine

SARS

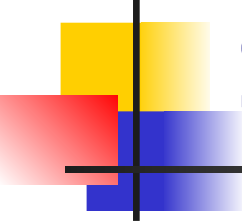
- It is believed that virus was transmitted to humans masked palm civet in food market of Southern China. It is possible that civet picked up the virus from a bird





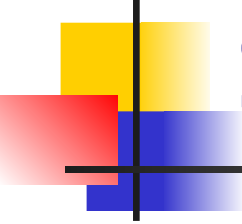
SARS- Diagnosis

- CDC recommendations
- chest radiograph
- pulse oximetry
- blood cultures
- Culture
- urinary antigen testing should also be considered.
- People with suspected SARS should be isolated and quarantined.



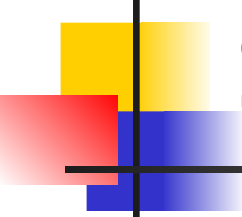
SARS- Diagnosis - specific

- Serology to detect SARS infection
- Nucleic acid assays to detect SARS-CoV
- ELISA to detect SARS-CoV antibodies
- RT-PCR to detect SARS-CoV infection



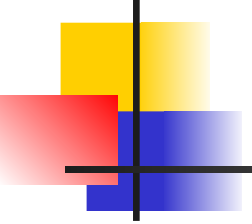
SARS-Diagnosis

- A rapid diagnosis - reverse-transcriptase PCR (RT-PCR) of **respiratory tract samples** and **plasma early** in illness and of **urine** and **stool later on**.
- RT-PCR appears to be more sensitive than tissue culture
- at initial presentation. Serum antibodies can be detected by ELISA or
- immunofluorescence, and nearly all patients develop detectable serum
- antibodies within 28 days after the onset of illness.



SARS- Treatment

- No agreed treatment for SARS
- Management of symptoms.
- Drugs are under development and of particular interest are drugs that may block the protease function since this is crucial to the virus.
- There is no vaccine against the SARS virus or any other human Coronavirus.
- Veterinary vaccination programs of modest success exist for a number of economically important Coronaviruses.
- A major problem with live virus vaccine is antigenic shift and unpredictable outcomes



SARS

- Possibility remains that SARS may reemerge from unidentified animal reservoirs or from persistently infected humans
-