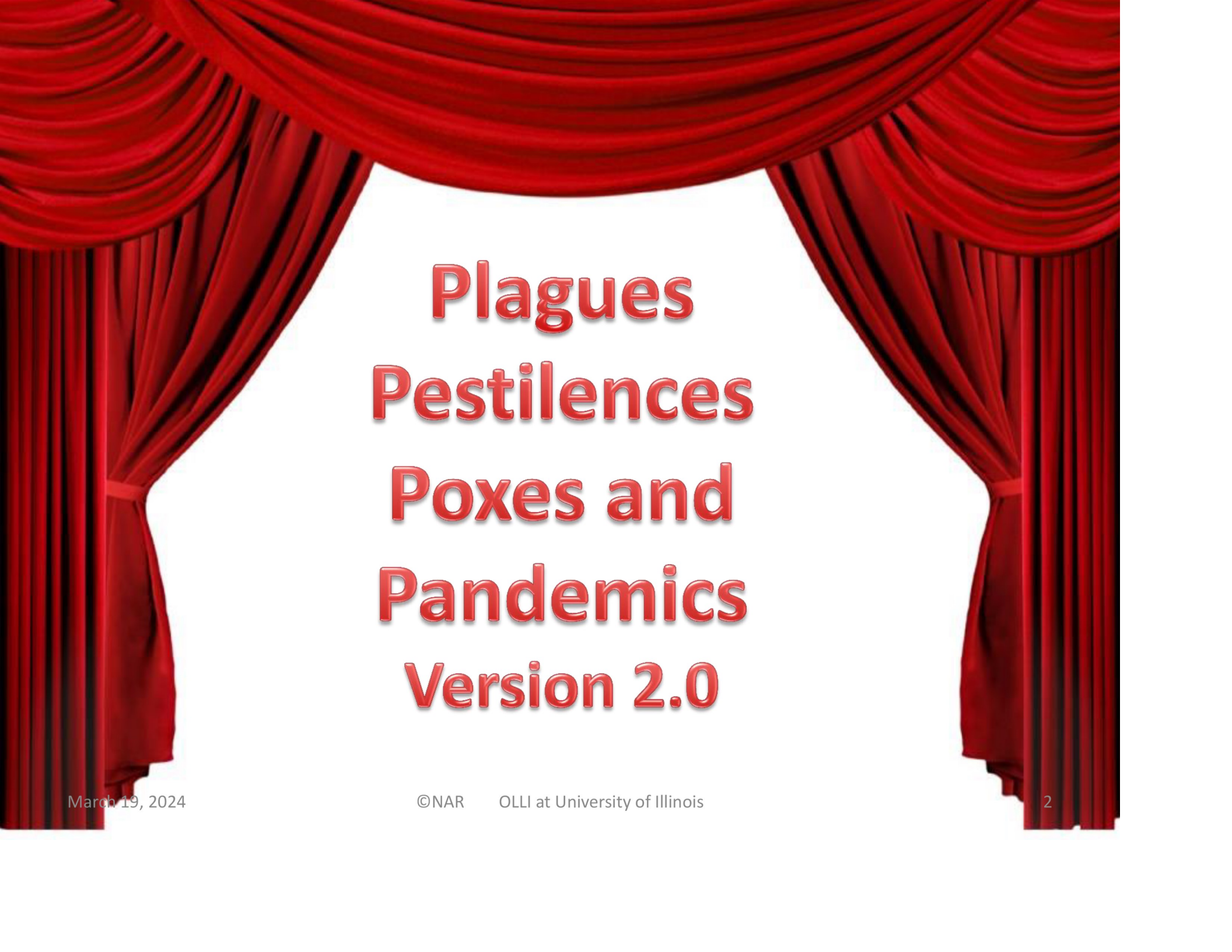


Good Afternoon!





**Plagues
Pestilences
Poxes and
Pandemics
Version 2.0**

March 19, 2024

©NAR OLLI at University of Illinois

2

Plan for the Session

- Session 1 Feb. 27: Definitions, Biblical Plagues.
- Session 2 March 5: The PLAGUE through time, new theories
- Session 3 March 12: Other Infectious Pestilences
- **Session 4 March 19: The Columbian Exchange.**
- Session 5 March 26: 20th Century Pandemics, Past & Current
- Session 6 April 2: HIV/AIDS
- Session 7 April 9: 20th and 21st Century Viruses.
- Session 8 April 16: Crystal Ball into the Future?

Plan for the Session

- Definition of Columbian Exchange.
- Columbus: The man, the dream, the fallacy.
- Portuguese Navigators.
- Goods, foods, animals and diseases.
- Triangular Trade and slavery.
- Native Americans and their fate.
- Smallpox
- Syphilis and other treponematoses.
- Review of Typhus.




Session 4
The Columbian Exchange
Effects of Transoceanic Trade

Just the Facts!!!



What Was It?

- Columbus's voyages resulted in mixing of people, introduction of deadly diseases, exchanges of crops and animals and flow of goods and trade.
- Bidirectional: Europe  America.
- Not a real exchange, more of a transfer.
- Driven by commercial gain and desire for power.

The Columbian Exchange

Gains and losses on both sides:

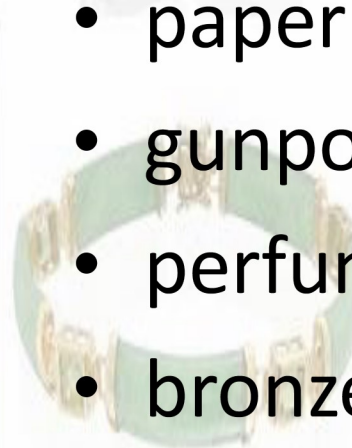
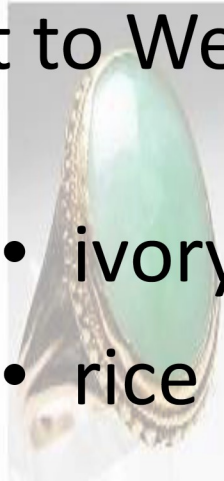
- illnesses and their treatments
- agriculture
- lifestyle
- cooking and eating
- gold, silver and gemstones
- science and culture
- environmental disruption
- slavery

Economic Driving Force

Trade from Asia (East to West) brought:

- spices
- silk
- tea
- dyes
- gems
- china

- ivory
- rice
- paper
- gunpowder
- perfumes
- bronze artifacts



The Land Trade Routes (1)

- Travel on the Silk Road took a long time, and many middlemen made money along the way.
- Many risks like bandits and loss of goods.
- The East to West route had also brought the Plague from Asia to Europe in the mid1300's.
- Portuguese and Spanish wanted alternative routes to the East to maximize their profit.

The Solution

- Sea routes using large ships (Rule of 1-7-23).
- Portuguese took the lead and started sailing Eastward along the coast of Africa.
- The Spanish crown backed Columbus's crazy plan to go Westward across the (unknown) Atlantic.
- People did not think earth was flat, but they feared the unknown dangers and long distances.

Unknown Dangers of the Large Oceans



Portuguese Travels

- Prince Henry the Navigator sponsored Bartolomeu Dias who sailed the west coast of Africa and named its tip the “Cape of Storms” in 1488.
- John II of Portugal renamed it "Cape of Good Hope" because of the great optimism created by opening a sea route to the East.
- In 1498, Vasco da Gama rounded the Cape from Africa to India, arriving in Calicut and starting a sea route from Portugal to India.



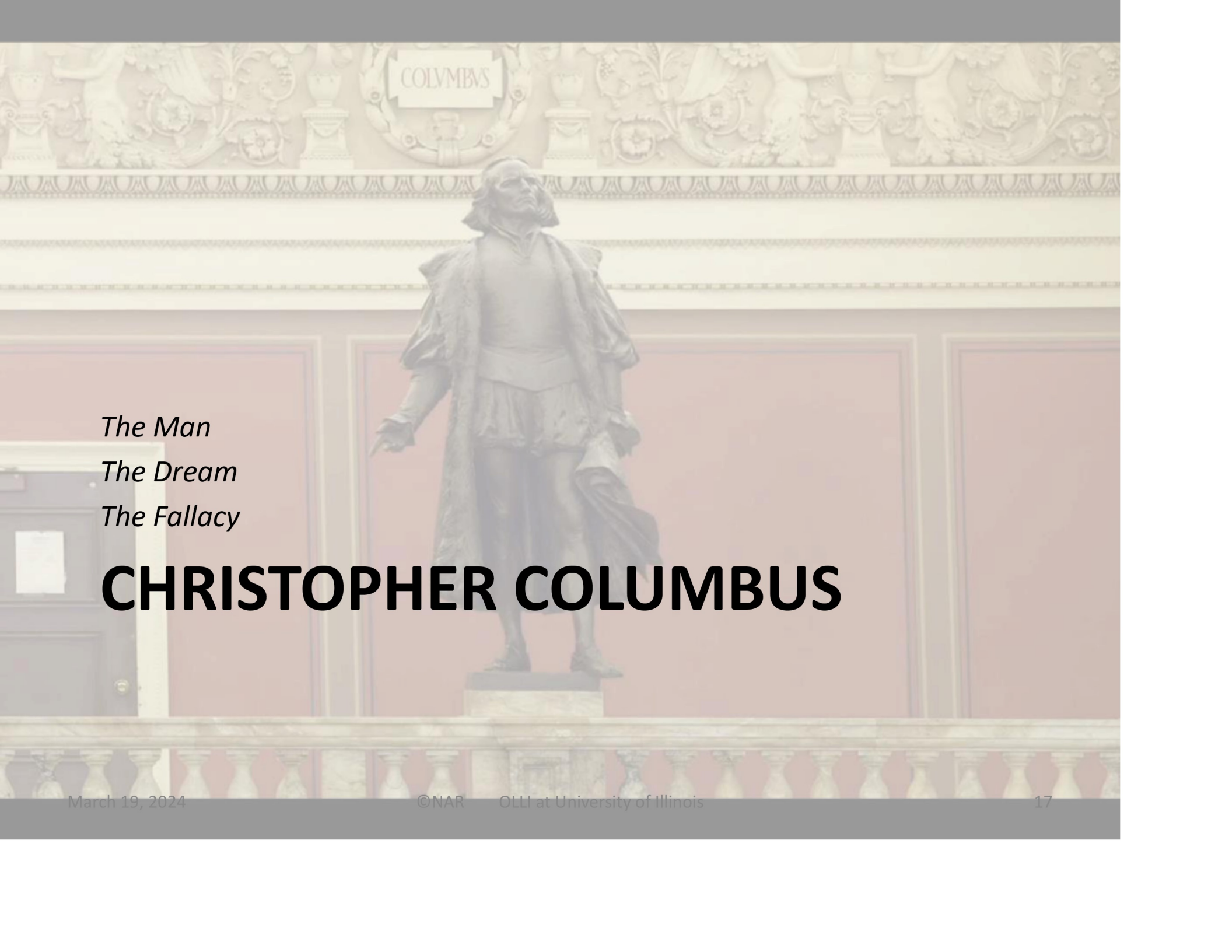
The Spanish Counterplay

- Columbus asked Queen Isabella I of Castille and her husband Fernando II of Aragón to finance his 1492 trip.
- He was initially denied, but the monarchs, to keep their options open, gave him an annual allowance of 12,000 *maravedis*.
- Also a letter ordering all cities and towns to provide him free food and lodging.

Age of Discovery

(1453-1660)

- The closure of the Silk Road opened the Age of Discovery defined by European explorers sailing and charting new water routes to replace over-land trade.
- This impacted many cultures around the world as European ships claimed lands in the name of their god and country.
- They introduced western culture and religion, but the new nations also influenced European culture.

A bronze statue of Christopher Columbus stands on a pedestal in a grand, ornate hall. The statue is positioned in the center, facing slightly to the left. Above the statue, a decorative frieze features the name 'COLUMBUS' in a central medallion. The background consists of large, paneled doors and a classical architectural style with columns and a decorative railing in the foreground.

The Man

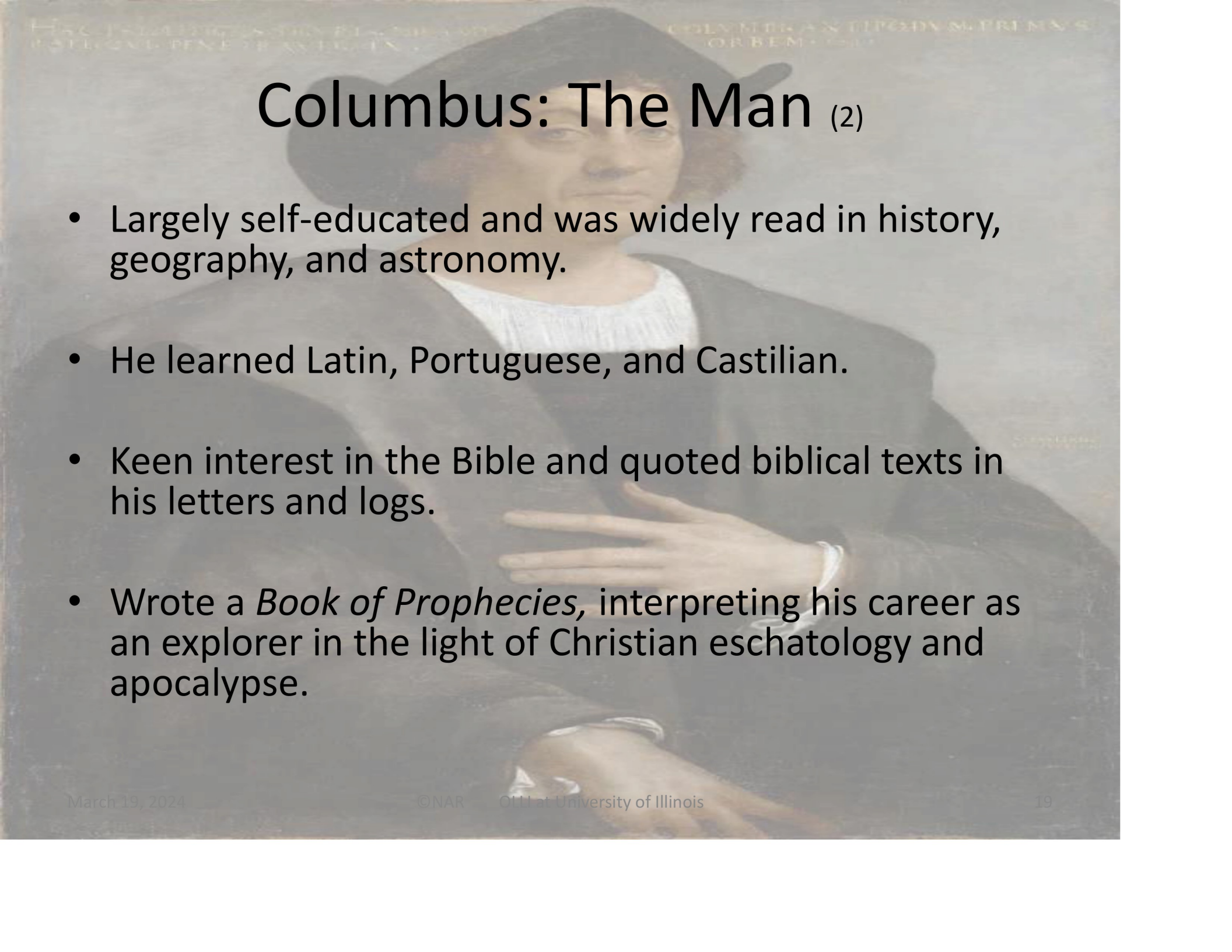
The Dream

The Fallacy

CHRISTOPHER COLUMBUS

Columbus: The Man ⁽¹⁾

- Name in Spanish Cristóbal Colón, in Italian *Cristoforo Colombo*.
- Born in Genoa, northern Italy, around 1451 (?) and died in 1506 in Valladolid, Spain.
- He was a young sailor on ships to Africa, England, and Iceland and was on a ship that was sunk by the French off Portugal.

A portrait of Christopher Columbus in academic regalia, including a black mortarboard cap and a dark gown over a white shirt. He is seated and looking slightly to the right. The background is a light, textured grey. At the top of the image, there is faint Latin text: "HIC PRÆFERTURUS THOMAS DE... COLONIBUS ANTIQVVM PRIMVS ORBEM...".

Columbus: The Man (2)

- Largely self-educated and was widely read in history, geography, and astronomy.
- He learned Latin, Portuguese, and Castilian.
- Keen interest in the Bible and quoted biblical texts in his letters and logs.
- Wrote a *Book of Prophecies*, interpreting his career as an explorer in the light of Christian eschatology and apocalypse.

Columbus' Dream

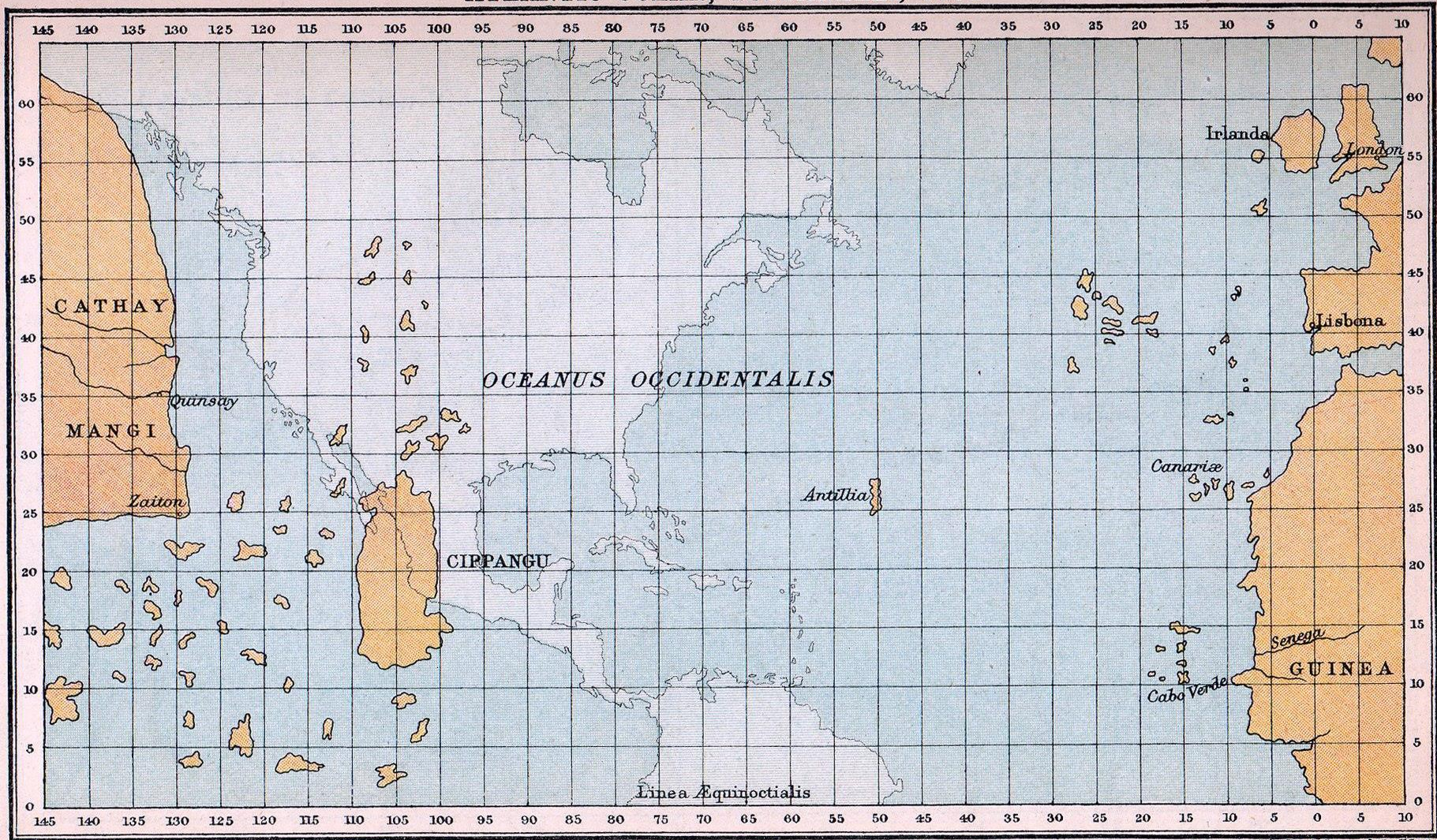
His motivations were **The 3 G's**:

- **Glory:** Be 1st to reach the Indies by going West.
- **Gold:** Bring riches to the monarchs of Spain.
 - allow retake of the Holy Land from Muslims
 - gain more power than Portugal
- **God:** Holy duty to convert infidels.

Columbus' Fallacy

- Believed Japan was much larger, farther to the east from China, and closer to the equator.
- Influenced by Toscanelli and Marco Polo.
- Estimated distance from the Canary Islands to Japan to be about 9,800 Km (5,300 nmi).
- In reality, it is 20,000 Km (10,00 nmi).

ATLANTIC OCEAN, TOSCANELLI, 1474



The Correct outline of North America is shown in light blue tint

John Bartholomew & Co., Edinr.

How Did Columbus Get Here?



The Columbian Exchange

- Historian A. Crosby: “the transference of plants, animals, and diseases among the Americas, Eurasia, and Africa unleashed by Columbus’s *geographical miscalculation*.”
- Some scholars use the term *Columbian Exchange* to describe the driving force behind the creation of “new worlds for all.”

Cost of Columbus' 1st Voyage

- Estimated cost in 1492 maravedies 1,765,734
- One 1492 maravedí = about US \$3.00 today
- So the total cost was about US \$5,297,000

What the Monarchs Promised

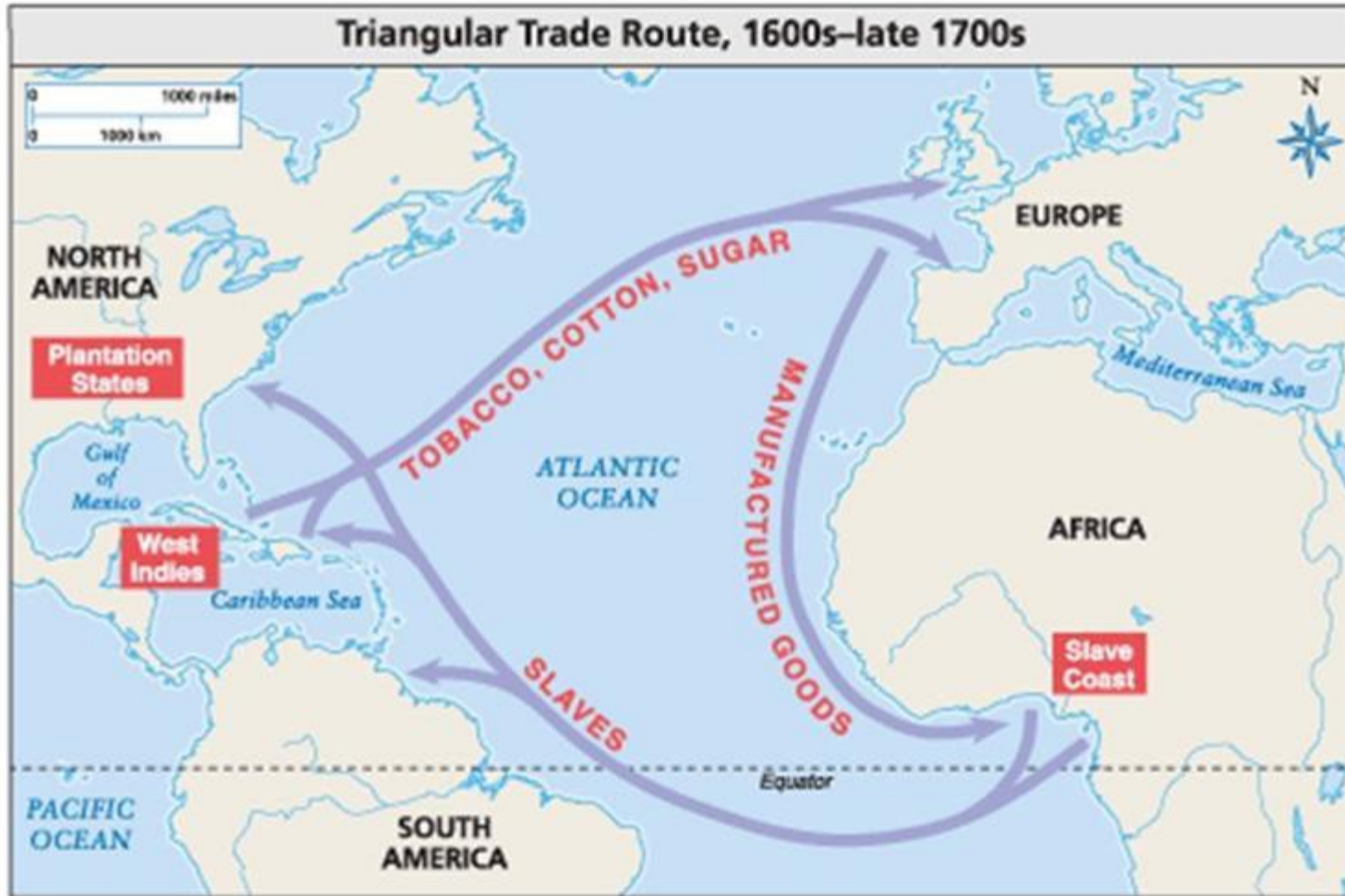
- Title of Admiral of the Ocean Sea.
- Viceroy and Governor of all new lands.
- 10% of all revenues from them in perpetuity.
- Option to buy $\frac{1}{8}$ interest in any commercial venture within the new lands and to receive $\frac{1}{8}$ of their profits.

Columbus' Voyages

Voyages:

- First voyage (1492–1493)
- Second voyage (1493–1496)
- Third voyage (1498–1500)
- Fourth voyage (1502–1504)

Triangular Trade



© Facts On File, Inc.

Triangular Transatlantic Trade ⁽¹⁾

- Slave Trade was part of a vast, intercontinental mercantile system commonly called the Triangular Trade.
- In the 15th century, Europeans discovered that navigating the Atlantic required using perpetual wind cycles and ocean currents:
 - North Atlantic Gyre
 - Gulf Stream
- Portuguese navigators established a triangular route while exploring the western coast of Africa.

Triangular Transatlantic Trade (2)

- They went there with the aid of the Northeast trade winds that dominate the tropics.
- They then returned to Europe by sailing NW to the Azores and catching the SW Westerlies home.
- Columbus became the 1st person to apply this principle to a transatlantic voyage.
- He sailed North after landing in the Caribbean before returning to tell the world his discoveries.

Slavery and Religion ⁽¹⁾

- Slavery could only be imposed on non-Christian prisoners of war or on men already sold as slaves.
- Nicholas V issued papal bull *Dum Diversas* (1452) allowing Alfonso V of Portugal to reduce any “Saracens (Muslims), pagans and any other unbelievers” to perpetual slavery.
- This bull justified the subsequent era of slave trade and colonialism.
- First Franciscans who arrived in Mexico in 1524 burned the places dedicated to pagan cults and built churches on the sites (with local slave Indian labor).

Slavery and Religion (2)

- The Spanish Roman Catholic Church, evangelized in Quechua, Nahuatl, Guaraní and other Native American languages, and gave them writing systems.
- To reward their troops, the *Conquistadores* often allotted Indian towns to their troops and officers.
- Black African slaves were introduced to substitute for Native American labor in locations, like the West Indies where the indigenous population was almost extinct.

WHO GAVE WHAT TO WHOM?

Indigenous Peoples Introduced Europeans to:

- corn
- white & sweet potatoes
- manioc (cassava)
- peanuts
- **tomatoes**
- chili peppers
- cod
- quinine
- coca
- beaver
- cacao
- squash
- pumpkins
- pineapples
- papaya
- avocados
- vanilla
- rubber

Tobacco: the 1st crop to make colonization profitable was indigenous to the Americas.



Europeans Introduced Indigenous People to:

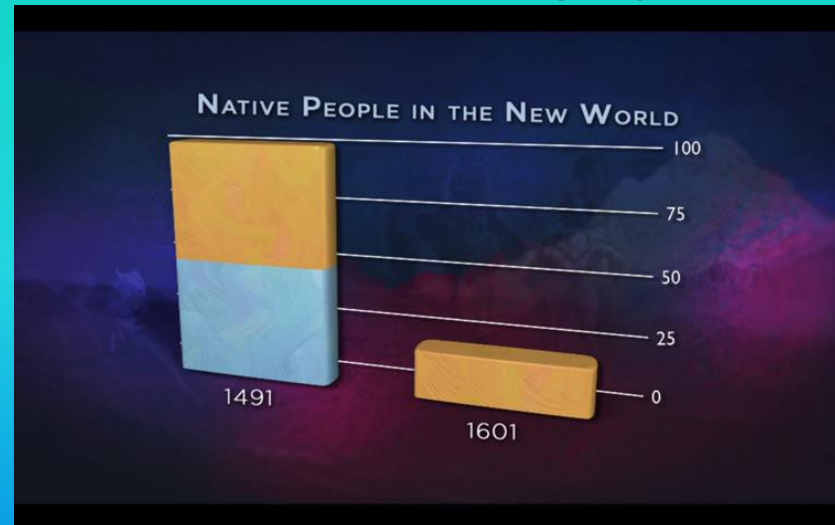
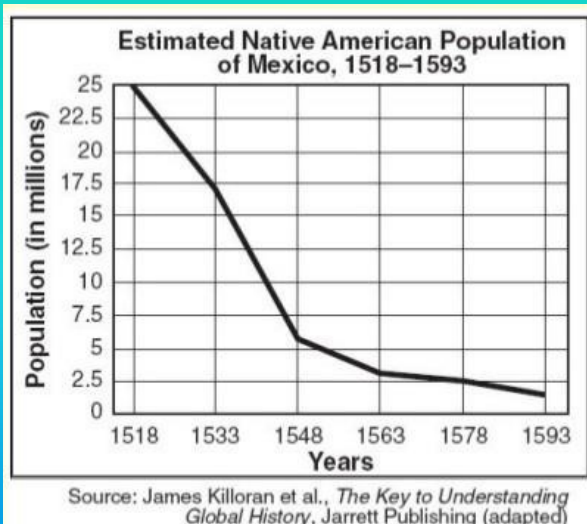
- coffee
- sugar
- soybeans
- bananas
- oranges & citrus fruits
- rice
- wheat & barley
- grapes
- black pepper
- onion and garlic
- horses
- donkeys
- mules
- pigs
- cattle
- sheep
- goats
- chickens
- bees
- rats

DISEASES

EFFECTS OF NEW DISEASES

Depopulation of New World ⁽¹⁾

- It's uncertain how extensively the New World was depopulated:
 - least affected regions lost 80% of their peoples
 - the most affected lost their full populations
 - many other societies lost 90% of their population



“Virgin Soil Epidemics” ⁽¹⁾

- Alfred Crosby: “Epidemics in which the populations at risk have had no previous contact with the diseases that strike them and are therefore immunologically almost defenseless.”
- European explorers and colonists brought diseases to lands they seized in the Americas, Australia and the Pacific Islands.

“Virgin Soil” Epidemics (2)

Smallpox

Yellow Fever

Measles

Chickenpox

Influenza

Common cold

Malaria

Cholera

Typhus

Bubonic plague

Whooping cough

Diphtheria

Typhoid fever

Scarlet fever

Questions? 1



Historic territory of the Wampanoag Indians
 Wampanoag village
 (Salem) Present-day name

miles
 0 10 20
 Present-day shorelines shown

CANADA
 ME.
 VT.
 N.H.
 N.Y.
 MASSACHUSETTS
 CONN.
 N.J.
 GULF OF MAINE
 ATLANTIC OCEAN
 Area of main map

WAMPANOAG



Wampanoag ⁽¹⁾

Wôpanâak

- Loose confederation of tribes in 17th Century.
- Lived in SE Massachusetts and Rhode Island at the time of first contact with English colonists.
- Their territory included the Islands of Martha's Vineyard and Nantucket.
- 3K Wampoang lived In Martha's Vineyard alone.

Wampanoag

- During 1616–1619, many natives died of a disease that presumably spared nearby European fishermen and traders.
- The more severe manifestations were fever, headache, epistaxis (nosebleed), jaundice, and skin lesions.
- Speculations as to the cause have included:

plague
smallpox
chickenpox
typhoid fever
cerebrospinal meningitis

yellow fever
influenza
typhus,
trichinosis,
syndemic HBV/HDV hepatitis

Wampanoag ⁽²⁾

(Wôpanâak)

- From 1615 to 1619, the Wampanoag suffered an epidemic, long suspected to be smallpox.
- Recent research suggests it was leptospirosis, most likely brought to the New World by Europeans.
- Can develop into Weil's syndrome (jaundice, kidney failure and nose bleeds).
- Severe leptospiral pulmonary hemorrhage may be fatal.

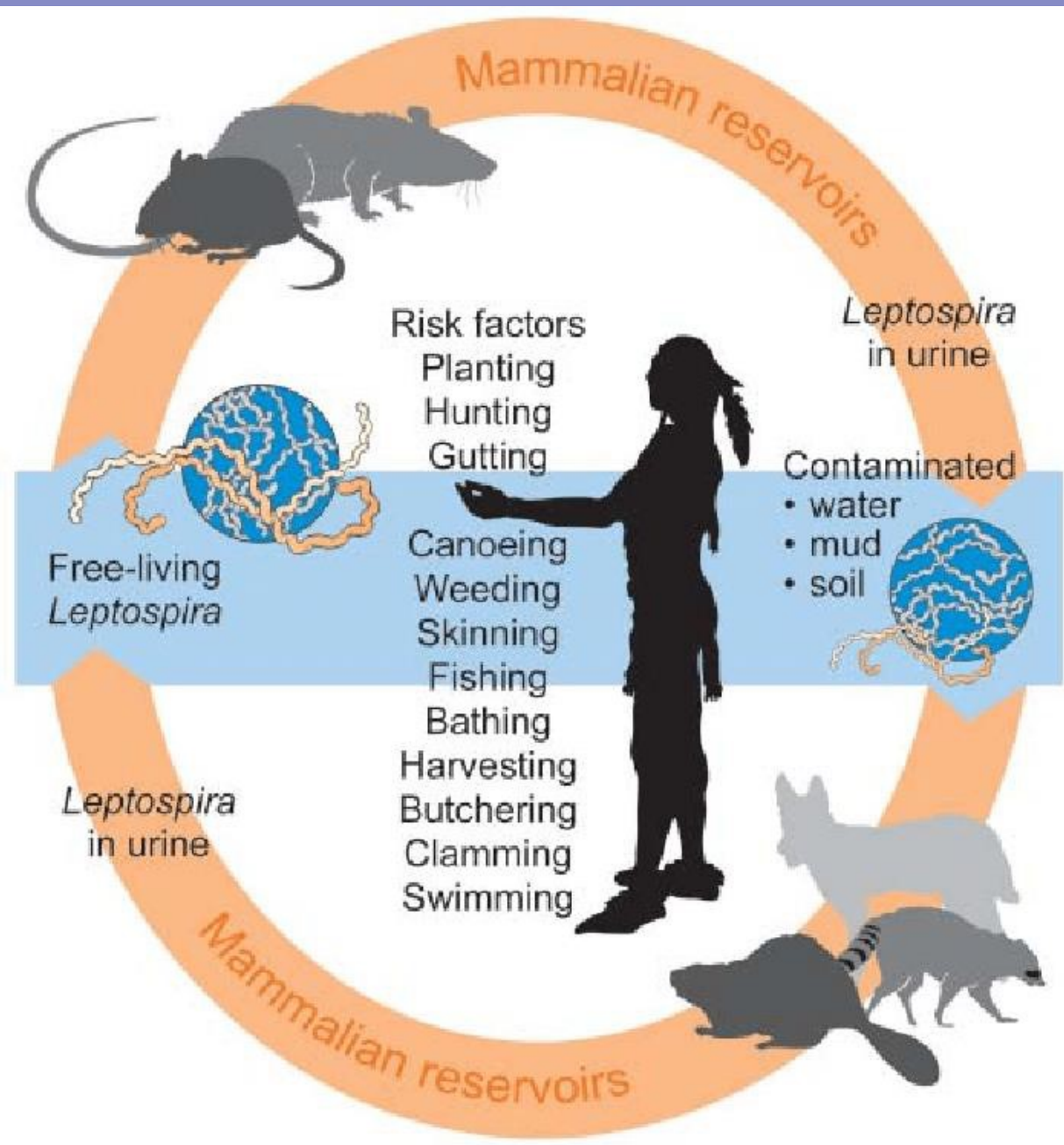
New theory: leptospirosis and Weil syndrome

Consistent with:

- available clinical information
- the habitat (nidality) of *Leptospira* organisms
- the introduction of rodent reservoirs
- the presence of favorable ecologic niches
- practices of the local population
- high-risk exposure to hyperendemic environment

Leptospirosis

- Humans are accidental hosts of *Leptospira*, and become infected through contact with water or moist soil that contains urine & feces from infected animals.
- The bacteria enter through:
 - cuts
 - abrasions
 - ingestion of contaminated food
 - contact with mucous membranes of the body (mouth, nose, and eyes)
- Occupations at risk include farmers (rice), fishermen, garbage collectors and sewage workers.



Leptospira Life Cycle

Leptospirosis

- Currently, it is related to adventure tourism and recreational activities like water sports, as prolonged immersion in water promotes the entry of the bacteria :
 - triathlons
 - water rafting
 - canoeing
 - swimming
- Leptospira are unlikely to penetrate intact skin, and it is not known to spread between humans.
- Bacterial shedding from the kidneys usually persists for up to 60 days.

Treatment

- Most cases resolve spontaneously, but early initiation of antibiotics may prevent progression to severe disease.
- Treatment is with antibiotics like doxycycline, penicillin, or ceftriaxone.
- The overall risk of death is 5–10%, but when the lungs are involved, the risk of death increases to 50–70%.
- 30% of people with leptospirosis complain of long-lasting symptoms: weakness, muscle pain, and headaches.

Wampanoag ⁽³⁾

Wôpanâak

- Men traveled along the Eastern seaboard for seasonal fishing trips.
- Women cultivated varieties of the "three sisters" (maize, climbing beans, and squash).
- Many male Wampanoag were sold into slavery in Bermuda or the West Indies.
- Some women and children were enslaved by colonists in New England.

Squanto

Isquantum

1590 (?) to late November 1622,
last member of the Patuxet tribe.

Known for being a liaison between
the Indian population in
Southern New England and
the *Mayflower* Pilgrims.

The Patuxet tribe had lived on the
western coast of Cape Cod Bay, but
they were wiped out by an
epidemic infection.

Was kidnapped, sold as a slave in
Málaga to local monks who did his
education and evangelization.

Traveled to England, returned to
America in 1619 only to find that
his tribe had been wiped out by an
epidemic.

Spread of deadly diseases in North America following colonists' migrations.

Devastation by Disease

“Smallpox was the captain of the men of death in that war, typhus fever the first lieutenant and measles the second lieutenant. More terrible than the conquistadores on horseback, more deadly than sword and gunpowder...”

Asburn, 1947

Variola major

SMALLPOX

Smallpox ⁽¹⁾

- Known to the Romans as *variola* (spotted), but most Europeans, called it the Pox (“Pocks”).
- In 1495 a new infectious venereal disease, appeared in Europe with a pox-like rash.
- This newly arrived illness was called “the great pox” (later named syphilis), and *variola* was then demoted to “the small pox.”

Smallpox (2)

smallpox is an acute, often lethal infection

virus does not linger in the infected human

victim dies or recovers within 14 to 20 days

virus dies unless transferred to a susceptible human during its period of infectivity

For the virus to survive as an infectious agent, a large, vulnerable population with many newborns constantly replenishing the pool of susceptibles is required.

Smallpox (3)

Variola Major

- The Lakota Indians called the disease *the running face sickness*.
- Smallpox was lethal to many Native Americans, causing sweeping epidemics and affecting the same tribes repeatedly.
- Epidemics killed a large portion of people with disabilities and also created a new large number of people with disabilities.

Smallpox ⁽⁴⁾

- Smallpox epidemics led to blindness and scars.
- Native American tribes were proud of their appearance, and the facial disfigurement deeply affected them psychologically.
- Unable to cope, tribe members were said to have committed suicide.

Smallpox ⁽⁵⁾

Symptoms

- fever
- nausea
- vomiting
- muscle pain
- malaise
- headache
- fatigue
- oral spots (enanthem)
- skin rash (exanthem)
- fluid-filled bumps with dent in the center
- slow fluid leak
- crusts and scabs over
- depigmented scars

Smallpox (6)

Skin lesions:

Macules
(colored spots)

Papules
(raised).

Vesicles
full of
opalescent
fluid

Pustules
full of opaque
and turbid
fluid

Crusts, Scabs, Scars

Ramírez 2019

©NAR OLLI at University of Illinois

Questions? 2





SYPHILIS and ENDEMIC TREPONEMATOSIS

Treponematoses

Infection by bacteria of the *Treponema* family

- **Syphilis:** *Treponema pallidum pallidum* [sexual transmission]
- **Yaws:** *Treponema pallidum pertenue* (skin-to-skin)
- **Bejel:** *Treponema pallidum endemicum* (endemic syphilis)
- **Pinta:** *Treponema carateum* (skin-to-skin)

- Traditional laboratory tests cannot differentiate the treponematoses, as all yield positive serologies.

- DNA sequence differences among the *T. pallidum* subspecies have been identified.

Syphilis ⁽¹⁾

- First called *grande verole* or the "great pox" by the French.
- Other historical names have included "button scurvy", sibbens, frenga and dichuchwa.
- "Syphilis" was coined by the Italian physician and poet Girolamo Fracastoro in his poem titled *Syphilis sive morbus gallicus* (Syphilis or The French Disease) in 1530.

What's in a Name?

Italy, Germany and UK named it 'the French disease'

French named it 'the Neapolitan disease'

Russians named it the 'Polish disease'

Polish called it 'German disease'

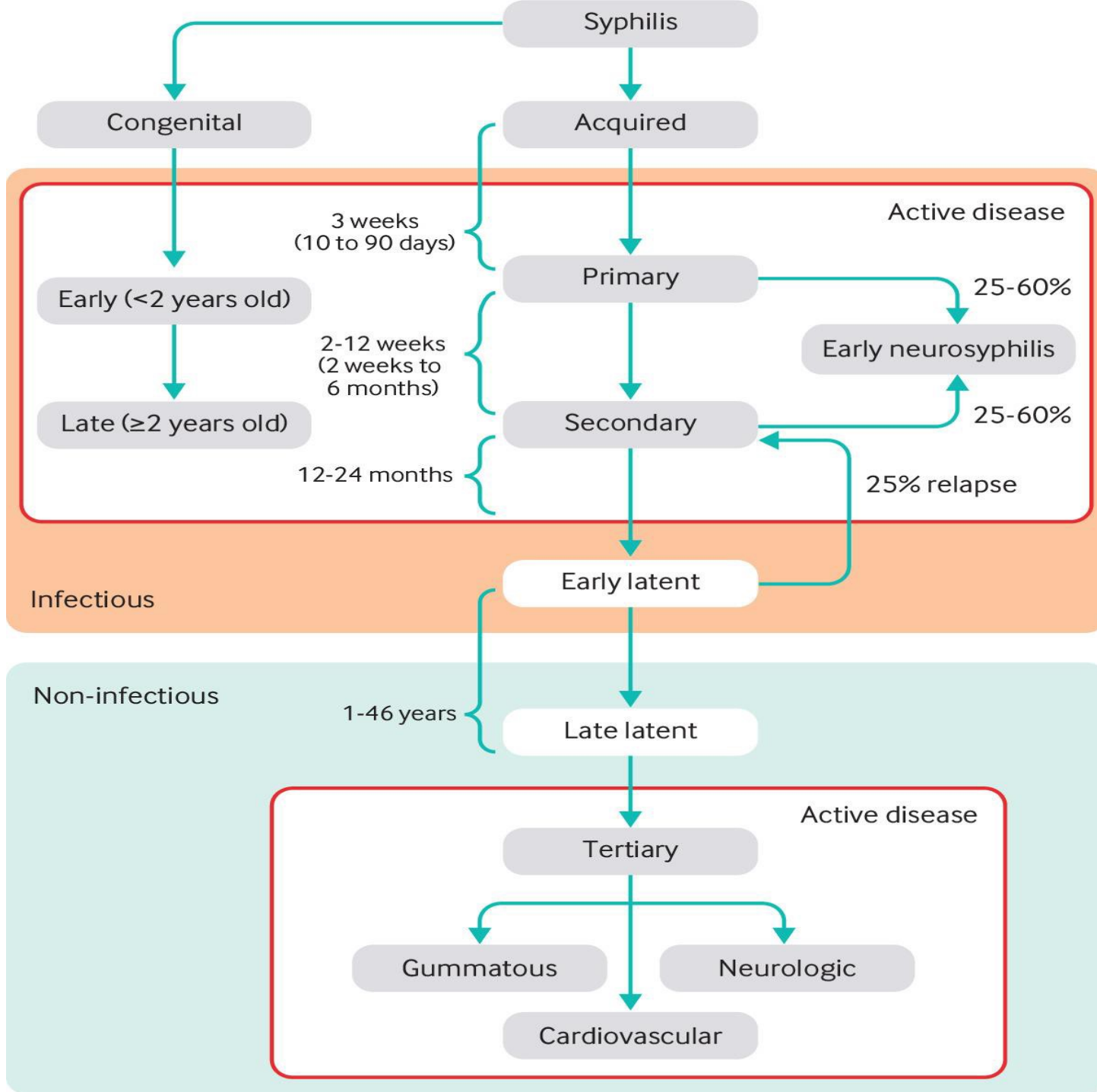
Danish, Portuguese and Northern Africans named it 'the Spanish/Castilian disease'

Turks called it the 'Christian disease'

Northern India Muslims blamed the Hindu for it

However, the Hindu blamed the Muslims

In the end everyone blamed the Europeans!



Natural History of Syphilis

Syphilis (2)

- The syphilis outbreak in Europe didn't begin until 1495.
- Thought to have arrived following Columbus' 1493 return from America.
- Ravaged the continent over two centuries and killed nearly five million people.

Breaking NEWS!!!

NEWSWEEK September 16, 2020:

- An archeological dig may have found evidence proving syphilis was already present in Europe long before Columbus ever set sail.
- Researchers found traces of Treponemal DNA in human remains from Finland, Estonia and the Netherlands.
- Scientists now believe syphilis may have been a home-grown ailment in Europe that evolved between the 12th and 16th centuries.

Calm Down!

- The evidence was of treponemal DNA, without specification of the subspecies.
- Prior phylogenetic studies have shown that the various *Treponemas* are evolutionary gene conversions (SNPs) [Single Nucleotide Polymorphisms].
- The oldest original *Treponema* was the agent of Pinta: *T. carateum* (non-sex transmission).

Treponematoses

- *Pinta* occurred in Afro-Asian zone by 15K BC, with ape reservoir.
- *Yaws* appeared as a consequence of the mutations in *Pinta* around 10K BC and spread all over the world, except for the American continent.
- *Bejel* (“endemic syphilis” with non-sex transmission) emerged from *Yaws* as a consequence of the arid climate around 7K BC.
- Today, only 5 known laboratory strains of *T. pertenue* (*Yaws*), 2 strains of *T. endemicum* (*Bejel*), and no strains or samples of *T. carateum* survive (it is uncertain whether the disease *Pinta* still exists).

Typhus Fever

several similar diseases caused by bacteria in the genus Rickettsia, acquired through the bite of an infected arthropod



Rat flea



Chigger



Tick



Louse

Typhus (2)

- Typhus (typhus fever) includes:
 - Epidemic typhus (*Rickettsia prowasekii*) [body lice]
 - Scrub typhus (*Orientia tsutsugamushi*) [chiggers][Asia]
 - Murine typhus (*Rickettsia typhi*) [fleas]
 - Spotted fevers (Spotted fever group) [ticks][RMSF]
- Different from typhoid fever (*Salmonella enterica*).
- Outbreaks when poor sanitary conditions and crowding are present ("jail fever").

Typhus

- An study of a cluster of Pennsylvania cases concluded that the source of the infection was flying squirrels.
- Sylvatic cycle (from wild animals) epidemic typhus remains uncommon in the US.
- The CDC have documented only 47 US cases from 1976 to 2010.
- An outbreak of murine typhus occurred in downtown Los Angeles in October 2018.

Typhus in Los Angeles

- LA County recently reported its 1st Typhus deaths in more than 30 years, but about 50 typhus cases occur each year, with occasional outbreaks.
- In August 2023, CDC confirmed the first 3 murine typhus-related deaths in LA County since 1993.
- The highest number of cases in the region was 171 in 2022.

Typhus

- WHO reported in 2010 that the death rate from typhus was about one out of every 5M people per year.
- Since the late 20th century, cases have been reported in Burundi, Rwanda, Ethiopia, Algeria, and a few areas in South and Central America.
- Except for 2 cases, ALL instances of epidemic typhus in the United States have occurred east of the Mississippi River.

Typhus

Epidemiology

- Typhus epidemics occurred throughout Europe from the 16th to the 19th centuries including:
 - the English Civil War
 - the 30 Years' War
 - the Napoleonic Wars
- “By the end of the 30 years’ War, typhus may have killed more than 10 % of the total German population (diseases accounted for 90 % of all of Europe's casualties.”) [JP Byrne]
- During Napoleon's retreat from Moscow in 1812, more French soldiers died of typhus than were killed by the Russians.

Typhus

- In the US, a typhus epidemic broke out in Philadelphia in 1837 and killed the son of Franklin Pierce in 1843.
- Several epidemics occurred in Baltimore, Memphis, and Washington, DC, between 1865 and 1873.
- Typhoid was the more prevalent cause of US Civil War "camp fever", but typhus was also a significant killer during the War.
- In Canada, the typhus epidemic of 1847 killed more than 20K people, mainly Irish immigrants who had contracted the disease aboard the crowded coffin ships fleeing the Great Irish Famine.

Typhus

Epidemiology in Ireland

- A major epidemic occurred between 1816 and 1819 with an estimated 100K dead; reappeared in the late 1830s, and again during the Great Irish Famine between 1846 and 1849, and along with typhoid fever caused about 400K deaths.
- The Irish typhus spread to England, where it was sometimes called "Irish fever" and was noted for its virulence.
- In situations of poor hygiene, overcrowding, and limited access to clean water, Typhus and Typhoid fever can thrive, with possible simultaneous outbreaks.

Typhus (1)

Symptoms

- severe headache
- sustained high fever
- cough
- rash
- severe muscle pain
- chills
- falling blood pressure
- stupor
- sensitivity to light
- delirium
- rash in chest on 5th day
- spreads to trunk & extremities

Outcome: DEATH

Typhus rash



Epidemic



Scrub



Murine (endemic)

Typhus (4)

- The lice and flea pests existed in the New world but not the *Rickettsia* bacteriae.
- Columbus' sailors had bad sanitary conditions and were really lousy (literally 😊).
- Natives were unsuspecting, unwilling and unprepared victims of the infection.

Typhus₍₃₎

- A louse feeds on a human who carries the bacteria and gets infected.
- *R. prowazekii* grows in the louse's gut and is excreted in its feces.
- Disease is transmitted to an uninfected human who is bitten by the louse.
- The person scratches the bite and rubs the feces into the wound, infecting self.

Typhus

- Untreated typhus cases have a fatality rate of about 10 to 40%.
- Mortality rates increase with age:
 - infections are rarely fatal in children <10 years old
 - in people over 50 mortality rate can be up to 60%
- In the US:
 - most cases of flea-borne murine typhus occur in Texas, California, and Hawaii
 - there are about 300 cases of flea-borne typhus reported in the US each year

Treatment

- *Doxycycline* (a tetracycline antibiotic) is the preferred treatment against all 3 types of typhus for any age with one single dose.
- *Ciprofloxacin* (Cipro) if allergic to doxycycline.
- *Azithromycin* or *Rifampicin* also possible.

Typhoid Fever

(resembling typhus)

- Caused by bacteria *Salmonella typhi* present in feces-contaminated foods.
- Symptoms, mild to severe, usually begin 6 to 30 days after exposure.
- Gradual onset of a high fever with weakness, abdominal pain, constipation, headaches, and mild vomiting.
- Some people develop a skin rash with rose colored spots.

Typhoid Fever

- In 2015, 12.5M new typhoid cases were reported, with 149K deaths worldwide.
- Children are most commonly affected.
- Every year about 400 cases are reported in the U.S. and an estimated 6K people have typhoid.
- Without treatment, the risk of death may be as high as 20%, but with treatment, it is between 1% and 4%.

Final Questions?



Next Week

- Session 1 Feb. 27: Definitions, Biblical Plagues.
- Session 2 March 5: The PLAGUE through time, new theories
- Session 3 March 12: Other Infectious Pestilences
- Session 4 March 19: The Columbian Exchange.
- **Session 5 March 26: 20th Century Pandemics, Past & Current**
- Session 6 April 2: HIV/AIDS
- Session 7 April 9: 20th and 21st Century Viruses.
- Session 8 April 16: Crystal Ball into the future?

**THANK-
YOU**

