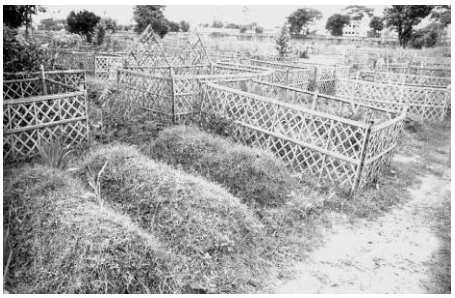
Name(s): _____ School: _____

Disease Detectives - Division B - Holt Invitational

Part 1. Match the following terms on the left with the definitions on the right. Each term will be used only once.

1	___D__	Attack rate	A)	Study that follows a group of subjects who received a specific exposure in order to examine the differences in incidence of a specific disease or other outcome of interest.
2	___H__	Case-control	B)	A histogram showing the course of a disease or outbreak.
3	___A__	Cohort	C)	An inanimate object that is laden with disease-causing agents.
4	___E__	Endemic	D)	The rate that a group experienced an outcome or illness.
5	___K__	Epidemic	E)	Disease or infectious agent that is habitually present in a community, geographic area, or population group.
6	___B__	Epidemic curve	F)	Measure of association between frequency of exposure and frequency of outcome.
7	___X__	Fecundity	G)	Ratio of the risk of disease or death among the exposed to the risk among the unexposed.
8	___Y__	Fertility	H)	Study that compares individuals who have a disease with individuals who do not have the disease in order to examine differences in exposures or risk factors for the disease.
9	___C__	Fomite	I)	An animate, living insect or animal that is involved with transmission of the disease agent.
10	___R__	Incubation period	J)	An epidemic that spans a wide geographic area.
11	___V__	Life expectancy	K)	Occurrence of a disease clearly in excess of normal expectancy.
12	___W__	Life span	L)	More cases of a particular disease than expected in a given area or among a specialized group of people over a particular period of time.
13	___M__	Morbidity	M)	Occurrence of an illness or illnesses in a population.
14	___N__	Mortality	N)	Occurrence of death in a population.
15	___U__	Natural Growth Rate	O)	A disease that can be transmitted to humans from animals.
16	___F__	Odds ratio	P)	Continuous observation of a place, person, group, or ongoing activity in order to gather information.
17	___L__	Outbreak	Q)	A disease that causes death and that spreads quickly to a large number of people.
18	___J__	Pandemic	R)	Time in between when a person comes in contact with a pathogen and when the first symptoms are shown.
19	___S__	Pathogen	S)	Something that causes a disease.
20	___Q__	Plague	T)	Birth rate - death rate + immigration - emigration rate.
21	___T__	Population Growth Rate	U)	Difference between the birth and death rate.
22	___G__	Relative risk	V)	The average age that an individual is expected to live in a particular time and place.
23	___P__	Surveillance	W)	The max number of years a species can survive (120-130 years).
24	___I__	Vector	X)	The physical ability to reproduce.
25	___O__	Zoonosis	Y)	The number of offspring produced per female in a population.

Part 2. Read the following excerpts taken from the article "7 Devastating Infectious Diseases" by Wynne Parry and answer the questions that follow. (Taken from: https://shar.es/14uGpg on 2/9/16)



Smallpox

Credit: CDC/ World Health Organization; Stanley O. Foster/ Pierre Claquin

A photo taken in 1975 shows the village cemetery in the Bangladesh countryside where smallpox victims were buried. The disease was believed to have killed 46 percent of its victims at a hospital in the Dacca, Bangladesh and to have ravaged the country for centuries. A disease marked by lesions on the skin, smallpox is believed to have emerged about 3,000 years ago in India or Egypt before sweeping across continents. The variola virus, which causes smallpox, killed as many as a third of those it infected and left others scarred and blinded, according to the World Health Organization. In 1980, the WHO declared the disease officially eradicated, after a decade-long vaccination campaign. The last known remaining samples of the virus are being held in facilities in the U.S. and Russia.

_____ 26. Using the surrounding text, what is the best definition for the word eradicate?

a. to make widely known or apparent
b. to eliminate or destroy
c. to make permanent
d. to decrease in quantity

_____ 27. A smallpox breakout just began and is estimated to continue over a course of 2 years where the population will decline due to deaths from the disease. The future population is predicted to drop to 15,000 from a growth rate at 0.1. Calculate the present population (rounded to the nearest person) given the following formula: $Pop_{Future} = Pop_{Present} \times (1 - i)^n$

Pop_{Future} = Future Population
$Pop_{Present}$ = Present Population
i = Growth Rate (unknown)
n = Number of Years

a. 19,252
b. 16,667
c. 12,150
d. 18,519

_____ 28. A vaccine contains antigens that could cause the host to react to the agent responsible for causing the virus.

a. True
b. False

Plague

Credit: Janice Haney Carr

Unlike smallpox, this ancient killer is still with us. Plague, which is caused by a _____ carried by fleas — like the one shown left — has been blamed for decimating societies including 14th century Europe during the Black Death, when it wiped out roughly a third of the population. The disease comes in three forms, but the best known is bubonic plague, which is marked by buboes, or painfully swollen lymph nodes. Plague is now found in animals throughout the world, particularly in the western U.S. and Africa. In 2009, the World Health Organization reported 958 cases worldwide.

_____ 29. Which word goes in the blank above? In other words, what causes the plague?

a. bacteria
b. virus
c. parasite
d. malaria

_____ 30. What is the percent of incidence rate of the plague in 1914 if there were 552 new cases and 18,400 people who were susceptible to getting it, given the following formula?

$$\text{Incident rate} = \frac{new\ cases\ occurring\ during\ a\ given\ time\ period}{population\ at\ risk\ during\ the\ same\ time\ period}$$

a. 30%
b. 33%
c. 3%
d. 0.03%

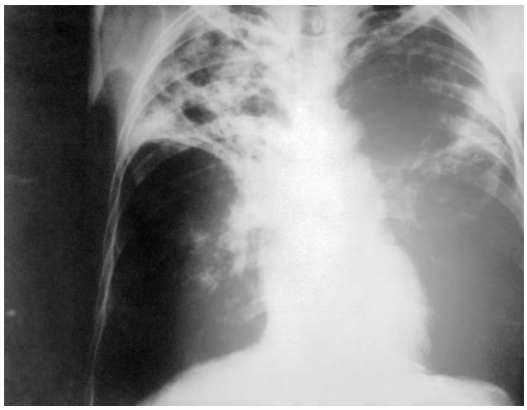
Malaria

Credit: Jim Gathany, CDC.

Although it is preventable and curable, malaria has a devastating effect in Africa, where the disease accounts for 20 percent of all childhood deaths, according to the World Health Organization. It is present on other continents as well. A parasite carried by blood-sucking mosquitoes causes the disease, which is first characterized by fever, chills and flu-like symptoms before progressing on to more serious complications. By 1951, the disease was eliminated from the U.S. with the help of the pesticide DDT. A subsequent WHO campaign to eradicate malaria was successful only in some places, and the goal was downgraded to reducing transmission of disease, according to the U.S. Centers for Disease Control and Prevention.

_____ 31. Which continent would you infer to be the least at risk for death from malaria?

a. South America
b. Asia
c. Africa
d. United States



Tuberculosis

Credit: CDC

Potentially fatal "TB" is caused by the bacterium Mycobacterium tuberculosis, which usually attacks the lungs causing the signature bloody coughs. The x-ray above shows the chest of a patient suffering from far-advanced tuberculosis. The bacterium does not make everyone it infects sick, and up to one third of the world's population currently carries the bacterium. And among people infected with TB, but not HIV, 5 to 10 percent become sick or infectious at some time during their lifetimes. A full-blown TB infection is more common among those also infected with HIV. The TB bacterium has formed a deadly alliance with the immune-system-destroying HIV, with each disease worsening the other, according to the World Health Organization.

_____ 32. Up to what percent of the world population carries the bacterium for Tuberculosis?

a. 5%
b. 33%
c. $\frac{1}{3}$%
d. 10%

_____ 33. Calculate the odds ratio using the following formula and table:

$$OR = \frac{a/c}{b/d}$$

	Diseased	Healthy
Exposed	a	b
Not exposed	c	d

Where a = number of exposed cases = 256
b = number of exposed non-cases = 575
c = number of unexposed cases = 64
d = number of unexposed non-cases = 23

a. 11.1
b. 6.25
c. 0.16
d. 0.42

Part 3: Circle *True* or *False* for each of the following statements.

34. True or *False*. Most fungi are single-celled organisms.

35. True or *False*. Viruses can reproduce on their own, independent of a living cell.

36. *True* or False. Bacteria are unicellular and do not have a true nucleus.

37. True or *False*. Bacteria are mostly harmful and disease-causing.

38. *True* or False. Not all protists are microscopic.

39. True or *False*. Cholera is a disease caused by a virus.

40. *True* or False. Bacteria were not officially discovered until microscopes were invented.

41. *True* or False. Not all protists contain chlorophyll.

42. True or *False*. Fungi are autotrophs, meaning they make their own food.

43. True or *False*. The antibiotic penicillin was derived from bacteria.

Part 4: Using your knowledge and the information listed on the next page, answer the following questions:

Ebola is a rare and deadly disease caused by infection with a strain of Ebola virus. The 2014 Ebola epidemic is the largest in history, affecting multiple countries in West Africa.

44. As one of the deadliest viruses on earth, Ebola has a mortality rate of up to _____.
- a. 22%
- b. 67%
- c. 99%
- **d. 90%**

45. How many cases of the Ebola virus were identified in 2014 alone?
- a. 729
- **b. 1323**
- c. 460
- d. 100

46. Which country in West Africa recorded the most deaths due to the Ebola virus?
- a. Senegal
- b. Sierra Leone
- **c. Guinea**
- d. D.R. Congo

47. Which of the following animals is not a host for the Ebola virus:
- a. antelopes
- b. gorillas
- **c. lions**
- d. bats

48. The first known case of the Ebola virus appeared in what year?
- **a. 1976**
- b. 1994
- c. 2000
- d. 2014

49. Which of the following is not an initial symptom of the Ebola virus:
- a. muscle pain
- **b. vomiting**
- c. headache
- d. severe abdominal pain

50. The number of deaths from the Ebola virus is nearly _____ times as many deaths from SARS.
- a. 10
- **b. 3**
- c. 2
- d. 5

Number of cases and deaths since first outbreak

1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014

431 602 — Ebola first appeared in 1976 in two simultaneous outbreaks in Nzara, Sudan, and in Yambuku, Democratic Republic of Congo

1 — 1977

22 34 — 1979

1 — Laboratory accident in Porton Down (United Kingdom), 1988

31 53 — 1994

254 315 — 1995

67 92 — 1996

224 425 — 2000

97 128 — 2001

157 178 — 2003

7 17 — 2004

10 12 — 2005

224 413 — 2007

14 32 — 2008

1 — 2011

53 77 — 2012

729 1,323 — 2014

Key: Deaths / Cases

Fruit bats of the Pteropodidae family are considered to be the natural host of the Ebola virus

World Health Organization data combines 2001 and 2002

More than 100 health workers have died in the latest outbreak

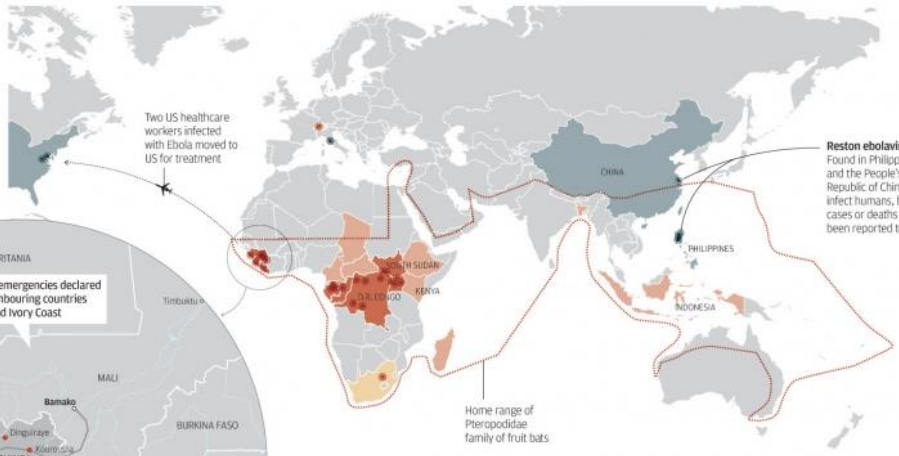
Other Secondary host

Gorillas, Chimpanzees, Antelopes, Pigs

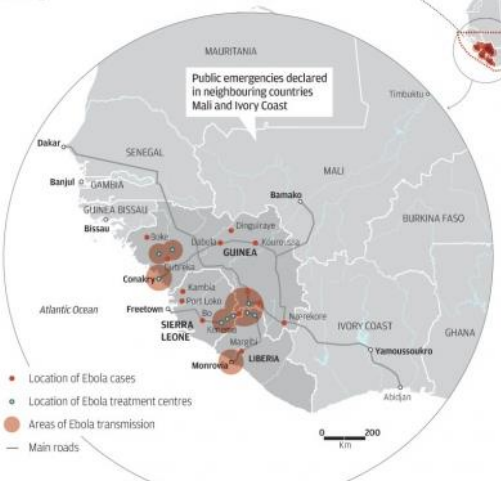
Ebola outbreaks

Ebola is one of the deadliest viruses on earth, with a mortality rate of up to 90 per cent, higher than influenza viruses. Currently, the virus is spreading in West Africa, leading the WHO to say that it is spreading faster than efforts to control it.

Outbreak locations · Outbreaks in animals reported · Countries reporting outbreaks · Countries with evidence of Ebola · Reported Ebola imported cases · Outbreaks in monkeys or pigs

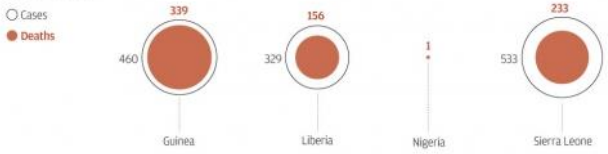


Reston ebolavirus Found in Philippines and the People's Republic of China, can infect humans, but no cases or deaths have been reported to date



Ebola cases and deaths in West Africa

Between 24-27 July



The virus

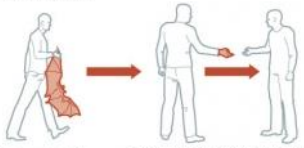
Ebola virus disease, formerly known as Ebola haemorrhagic fever, is a severe, often fatal illness in humans

Genus Ebolavirus comprises five distinct species:

- **Bundibugyo ebolavirus** (BDBV)
- **Zaire ebolavirus** (EBOV)
- **Sudan ebolavirus** (SUDV)
  - Associated with large Ebola outbreaks
- **Taï Forest ebolavirus** (TAFV)
- **Reston ebolavirus** (RESTV)
  - Not associated with Ebola outbreaks

First photo of the virus, taken in 1976

Transmission



1 Close contact with the blood, secretions, organs or other bodily fluids of infected animals

2 Infection resulting from direct contact with the blood, secretions, organs or other bodily fluids of infected people, and indirect contact with environments contaminated with such fluids

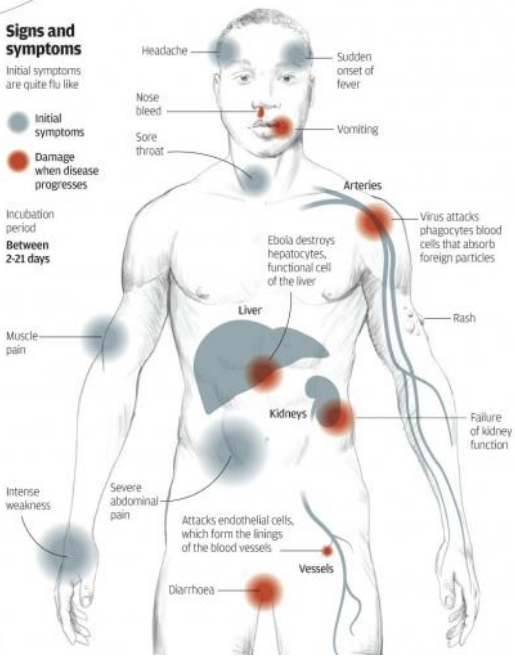
Signs and symptoms

Initial symptoms are quite flu like

Initial symptoms

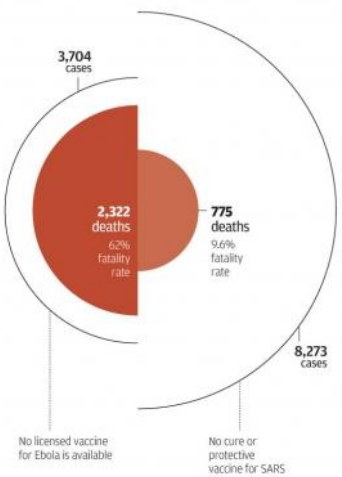
Damage when disease progresses

Incubation period **Between 2-21 days**



Ebola and Sars

Comparison of deaths and cases



Sources: World Health Organization, School of Veterinary Medicine - University of California

SCMP Graphic: Adolfo Arranz

Tiebreakers: First team to get the correct answer to the following questions in order of importance.

1. #27
2. #33
3. #32
4. #30
5. Total number correct from Part 1
6. #31
7. #29
8. Total number correct from Part 3
9. Total number correct from Part 4
10. Longest number correct in a row for Part 1, starting with #1