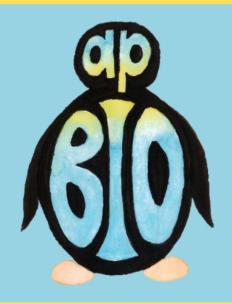# Effect of Density of Populations

SYI-1.H.1

A population can produce a density of individuals that exceeds the system's resource availability.

Effect of Density of Populations

SYI-1.H.2

As limits to growth due to density-dependent and density-independent factors are imposed, a logistic growth model generally ensues.

RELEVANT EQUATION

$$\frac{dN}{dt} = r_{max} N \left(\frac{K-N}{K} \right)$$
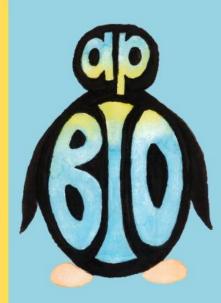
where:

dt = change in time

N = population size

r_{max} = maximum per capita growth rate of population

K = carrying capacity

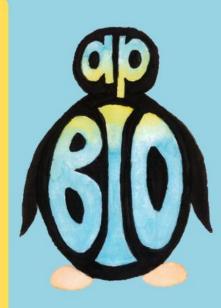# What is the term for the largest population size the environment can support?

What is the term for the largest population size the environment can support?

Carrying Capacity

Which variable represents carrying capacity?

A. dN/dt

B. N

C. K

D. r

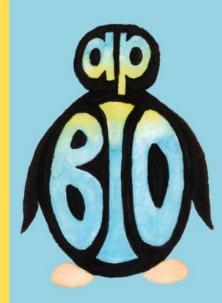**Which variable represents carrying capacity?**

C. K

N = population size

K = carrying capacity

r = per capita rate of increase

dN/dt = change in population size
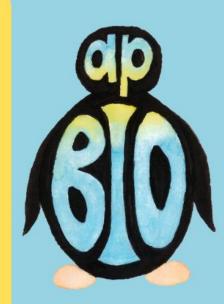
As K approaches N, what happened to the dN/dt?

A. Decreases, then increases

B. Decreases, then remains constant

C. Increases, then decreases

D. Increases, then remains constant

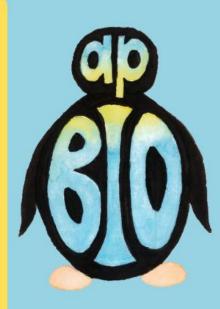## As K approaches N, what happened to the dN/dt?

B. Decreases, then remains constant

$$dN/dt = rN(K-N)/K$$

As N approaches K, the difference between the two gets smaller. This means the numerator will get smaller, so the rate will decrease.
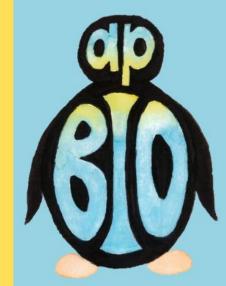
When is dN/dt = 0?

A. N < K

B. N > K

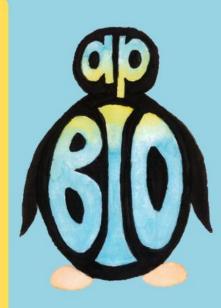C. N = K

When is dN/dt = 0?

C. N = K

$$dN/dt = rN(K-N)/K$$

If N = K, then the numerator is zero. When you multiply anything by a zero, the product is always zero.

Which type of factor is an earthquake?

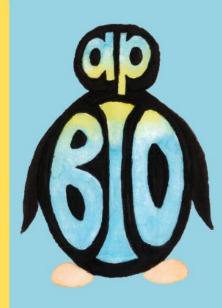A. Density dependent
B. Density independent

Which type of factor is an earthquake?

B. Density independent

An earthquake is not dependent on the density of the population. Recall, the density refers to the number of individuals in a certain area.
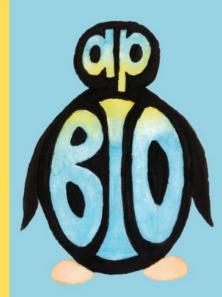
Which type of factor is a disease?

A. Density dependent

B. Density independent

Which type of factor is a disease?

A. Density dependent

Disease spreads more quickly when the population is more densely populated. Recall, density refers to the number of individuals in an area.

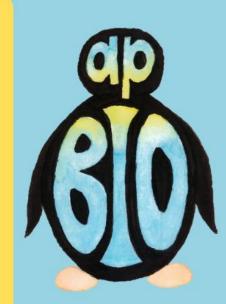If N = **500**, K = **250**, and r = **0.1**, solve for dN/dt?

A. **-500**
B. **-50**
C. **50**
D. **500**

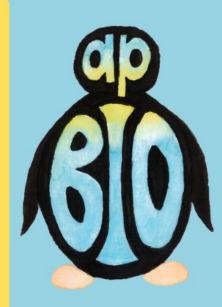If N = 500, K = 250, and r = 0.01, solve for dN/dt?

B. -50

$$dN/dt = rN((K-N)/K)$$
$$dN/dt = 0.1(500)((250-500)/250)$$
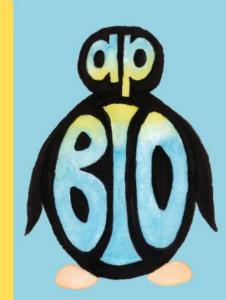
$$dN/dt = 50(-250/250)$$
$$dN/dt = 50(-1)$$
$$dN/dt = -50$$

Which of the following does not represent density?

A. Number of bacteria in a 10 mL of nutrient media

B. Number of elephants in 1 acre of savanna

C. Number of offspring in each generation

D. Number of fish in a square mile

Which of the following does not represent density?
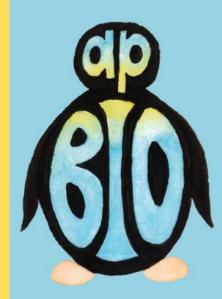
C. Number of offspring in each generation

Density is the number of individuals in an area or volume.

A. Number of bacteria (NUMBER OF INDIVIDUALS) in a 10 mL of nutrient media (VOLUME)

B. Number of elephants (NUMBER OF INDIVIDUALS) in 1 acre of savanna (AREA)

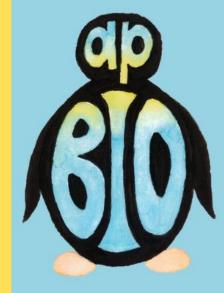D. Number of fish (NUMBER OF INDIVIDUALS) in a square mile (AREA)

What is the carrying capacity?

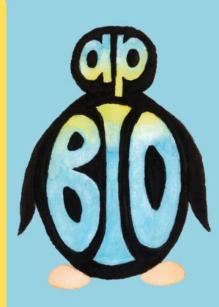## What is the carrying capacity?

The maximum number of individuals that the environment can support

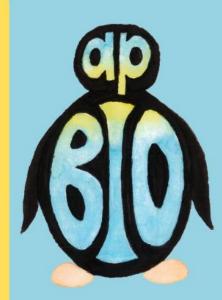What happens to the growth rate as population size approaches carrying capacity?
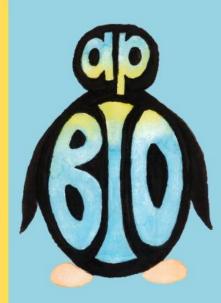
A. Decreases

B. Increases

C. Stay the Same

What happens to the growth rate as population size approaches carrying capacity?

A. Decreases

Recall, rate is slope. If you look at a logistic growth curve, you will see the curve begins to level off. This means that the growth rate DECREASES.

How do density dependent factors affect growth rate?

A. As population size increases, growth rate decreases

B. As population size increases, growth rate increases

C. As population size increases, growth rate stays the same
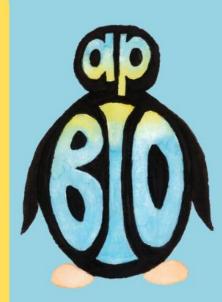
How do density dependent factors affect growth rate?

A. As population size increases, growth rate decreases

Density dependent factors depend on the density. If there is an increase in population, there will be a decrease in growth rate to keep the population size in check.
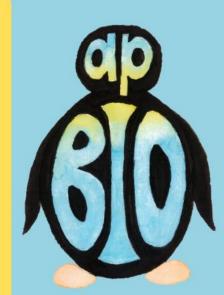
How do density independent factors affect growth rate?

A. As population size increases, growth rate decreases

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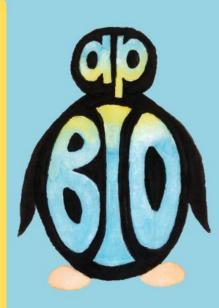C. As population size increases, growth rate stays the same

How do density independent factors affect growth rate?

C. As population size increases, growth rate stays the same

Density independent factors do **NOT** depend on the density of the population. As the population size increases, the growth rate is unaffected because these factors are not dependent on the density.
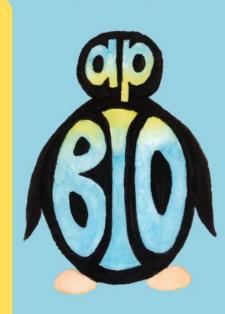
Disease

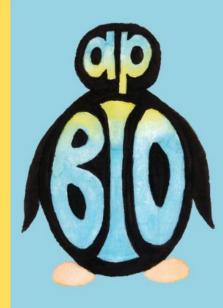A. Density dependent factor
B. Density independent factor

Disease

A. Density dependent factor

Disease spreads more quickly in a more densely populated area than less densely populated area. Disease is density dependent.

Landslide

A. Density dependent factor
B. Density independent factor

Landslide
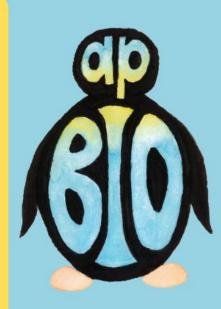
B. Density independent factor

A landslide does **NOT** depend on the population density, so this would be considered a density independent factor.

If you have a population of fish in your pond of **500** and then you add **200** more fish, but the carrying capacity is **600** with a rate of increase of **0.25.** What is the population size after **1** generation?

If you have a population of fish in your pond of 500 and then you add 200 more fish, but the carrying capacity is 600 with a rate of increase of 0.25. What is the population size after 1 generation?

0.25(700)((600-700)/600)

0.25(700)(-0.16)

-29.16

700 - 29.16 = 670.84