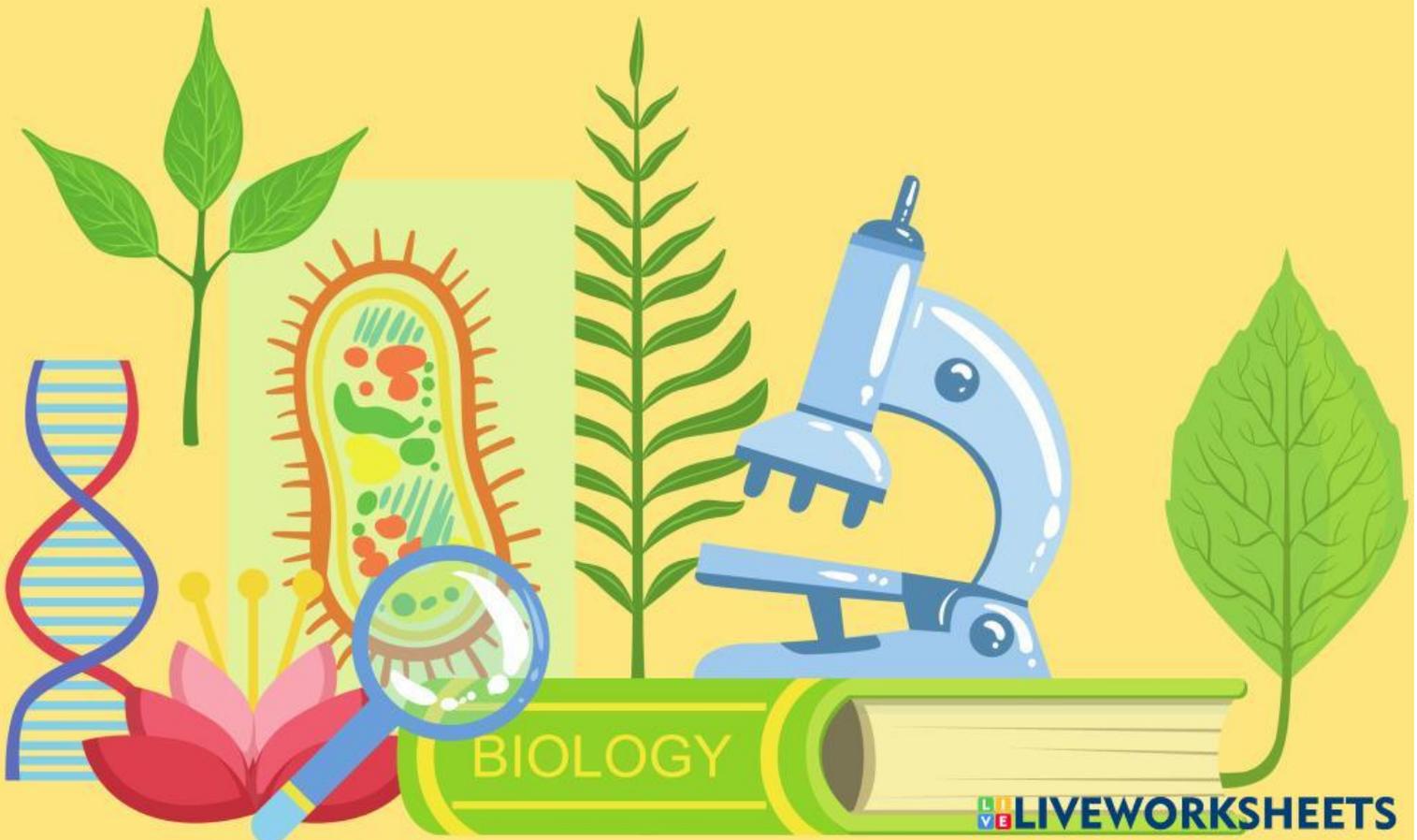


# BIOTECHNOLOGY

Name :

Class :



## Learning Outcomes

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Students are expected to be able to work together in the application of biotechnology to support human survival through food production.

## Learning objectives

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After this lesson, students are expected to be able to:

1. Analyze the basic principles of biotechnology.
2. Analyze the differences between conventional biotechnology and modern biotechnology.
3. Classifying examples of the application of biotechnology in everyday life.

## Pancasila Student Profile

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1. Independent
2. Critical reasoning
3. Mutual cooperation

## Learning Description

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Learning Activities (120 minutes)

## Instructions

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1. Each student must read the material carefully.
2. Discuss any existing questions or problems through discussion with the group.
3. If there are questions or things you don't understand, ask the teacher for help to explain them.

# Biotechnology

## INTRODUCTION

Biotechnology is a branch of science in the field of biology that studies the application of organisms, systems and biological processes to industrial products and services for the benefit of humans (Purwianingsing, 2009). Alternatively, it can be defined as technology that uses biological systems (biological processes) to obtain goods and services that are beneficial to human welfare. Biotechnology uses cultured bacteria, yeast, fungi, algae, plant or animal cells as components of various industrial processes. Biotechnology is currently experiencing rapid development and plays a very important role in solving various problems related to agriculture and nutrition. With the rapid development of science and technology, biotechnology has become one of the biological scientific fields that students need to master (Riani et al, 2017) .

In general, biotechnology is divided into traditional biotechnology and modern biotechnology. Conventional biotechnology is biotechnology that utilizes microorganisms (organisms) to modify materials and the environment to obtain optimal products. Examples are making tempeh, tape, making bread, and composting waste. Today's modern biotechnology is based on the use of human skills to manipulate living organisms to produce products according to human desires, for example through genetic engineering techniques. Genetic engineering is a technique for producing DNA molecules that contain desired new genes or new combinations of genes, also called manipulation of living organisms (Sutarno, 2014).



**Activity 1. Match the application of biotechnology according to the field.**

**Field  
Agriculture**



**Metal Separation**



**Field  
Farming**



**Hydroponics  
Plant**



**Reproduction  
Human**



**Cloning Artificial  
insemination Embryo transfer**



**Field  
Mining**



**Test-tube baby**



**Industry  
Food**



**Antibiotics, Vaccine  
& Skincare**



**Pharmaceutical industry  
& Medicine**



**Tempeh, Tofu  
& Chees**



# Conventional Biotechnology

Activity 2. Watch the video below and sequence how to make tempeh correctly. !

1

Peeling off the epidermis of tempeh

2

Soybean washing and soaking

3

Boiling soybeans

4

Wrapping soybeans

5

fermenting

# Conventional Biotechnology

Activity 3. Fill in Conventional Biotechnology below. Write the name of the product, basic ingredients and microorganisms used and answer the questions correct !

## 1. Complete the table below

No	Types of products	Product Name and Basic material	Microorganisms used
1		Tempeh is made from soybeans	
2		Cheese is made from milk	
3		Tape is made from cassava	
4		Soy sauce is made from black soybeans	



# Conventional Biotechnology

2. Based on the table you have filled ,discuss questions in below !

1 . Analyze why these changes can occur?

Answer:

2. Based on the questions above, conclude 4 characteristics of convectional biotechnology!

Answer :





# Modern Biotechnology

Activity 4. State whether the questions below are true or false regarding the characteristics of modern biotechnology !

**State**

**True / False**

UTILIZING MICROORGANISM

USING GENETIC ENGINEERING ,  
RECOMBINANT DNA AND CELL  
FUSION

USING FERMENTATION AND  
PRINCIPLES OF MICROBIA  
UTILIZATION  
SIMPLE

PRODUCT EXAMPLES: VACCINES  
AND CHEESE

# REFERENCE

Purwaningsih, S. (2009). Populasi Bakteri Rhizobium di Tanah Pada Beberapa Tanaman Dari Pulau Buton, Kabupaten Muna, Propinsi Sulawesi Tenggara. *Jurnal Tanah Trop.*, 14(1): 65-70.

Riani, S., Hindun, I., & Krisno Budiyo, M. A. (2017). Pengembangan Media Pembelajaran Berbasis Multimedia Interaktif Untuk Meningkatkan Pemahaman Materi Bioteknologi Modern Siswa Kelas Xii Sma. *Jurnal Pendidikan Biologi Indonesia*, 1(1), 9–16.

Sutarno.( 2014). Analisis EfisiensiPemasaran Kedelai Di Kabupaten Wonogiri. e [journal.utp.ac.id](http://journal.utp.ac.id) Agrineca. Diakses pada 23 November 2023 .