

LKPD

For 10th Grade Students



BACTERIA

Group

MEMBERS OF THE GROUP:

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A. Introduction

Answer the questions below!

Question	Answer
What do you know about bacteria?	
Did you know that bacteria can produce compounds that can inhibit fungal growth (antifungal)?	
Have you ever heard of the bacterium <i>Bacillus subtilis</i> ? What do you think its benefits are?	
In your opinion, how can biology be combined with computer technology (bioinformatics)?	
Did you know that the shape and function of an organism's proteins can be predicted digitally using special sites such as Phyre2?	

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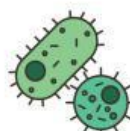
Question	Answer
What do you know about the MEGA app? Do you think it can help you identify the relationships between proteins?	
Why is <i>Bacillus subtilis</i> considered an environmentally friendly biocontrol agent compared to chemical pesticides?	

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Now, let's watch a video below!

a). Mechanism of action of anti-fungal

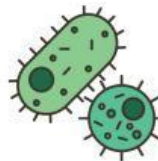
b). Benefits of *Bacillus subtilis* bacteria for plants



B. Investigations

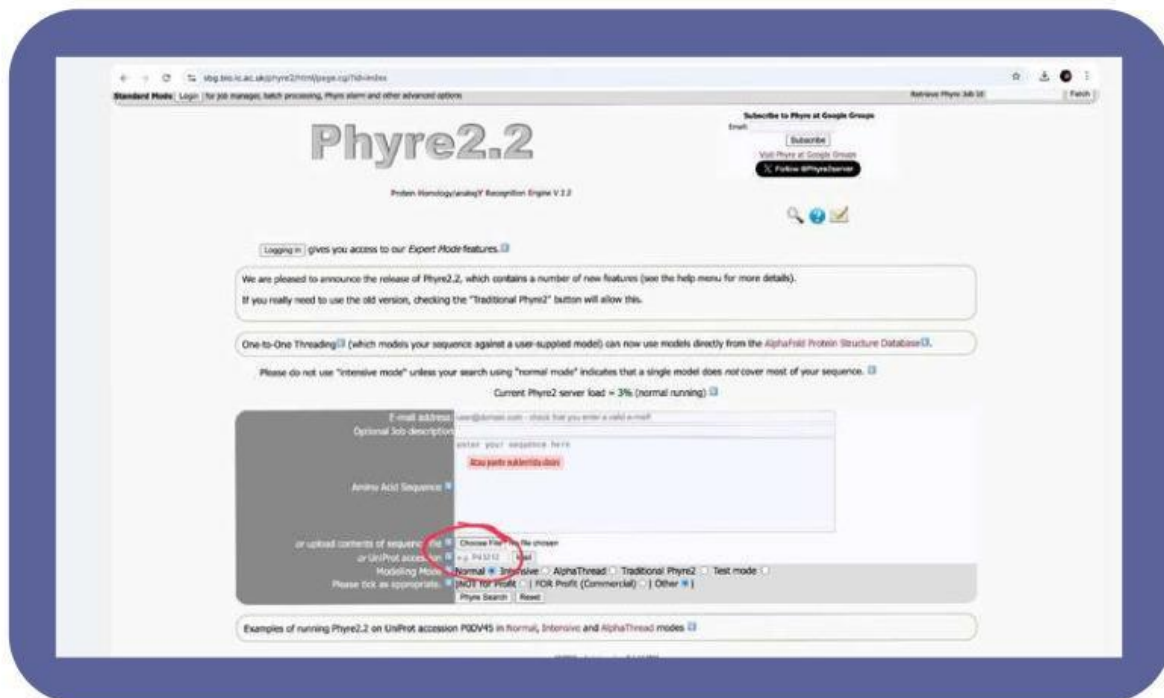
On October 10, 2023, an outbreak of the fungus *Fusarium solani* occurred in agricultural fields in the Cianjur area of Indonesia. This infection resulted in the death of young and mature plants, resulting in significant economic losses for local farmers. *Fusarium solani* is a major pathogen that limits plant productivity by attacking root and stem tissue. To address this issue, an investigation was conducted into the potential of *Bacillus subtilis*, known to produce the protein chitosanase (csn), as a biological control agent against the fungus.

The investigation focused on analyzing the structure and function of the chitosanase protein to determine its mechanism of action in protecting plants from *Fusarium solani* infection. This was followed by assessing its effectiveness as an antifungal agent and identifying other bacteria possessing chitosanase through phylogenetic analysis to explore potential alternative biological control agents. The results of this investigation are expected to provide effective and environmentally friendly solutions for addressing fungal infections in plants.

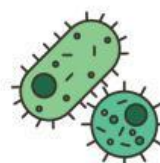
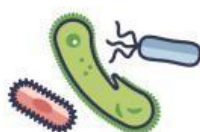


Finding out the form and function of *Bacillus subtilis* proteins

- Visit the NCBI website, in the “all database” section, select protein and search “*Bacillus subtilis* csn”, click fasta, then “send to” select the file to download or click https://docs.google.com/document/d/1RwgFtMcDPqofTYJADk6qFfn_6sG0y2BiLjEfA-37oSQ/edit?usp=sharing
- Visit the phyre 2.0 website : <https://www.sbg.bio.ic.ac.uk/phyre2/html/page.cgi?id=index>
- Then log in first.
- Select choose file or paste directly into the column provided.



- Then click phyre search and wait until the 3D protein appears.



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After conducting an analysis of the structure and function of proteins (chitosanase) from *Bacillus subtilis* through the NCBI website and modeling its structure using Phyre2, now it's time for us to dig deeper into the important role of this protein and its potential applications.

Question	Answer
What do you know about the csn (chitosanase) protein in <i>Bacillus subtilis</i> ? Why is this protein important?	
Why is it important to compare the csn protein from <i>Bacillus subtilis</i> with csn from other species? What can we learn from this comparison?	
How can information about the structure and function of CSN be used in the development of antifungal agents?	

WHAT THE NEXT?



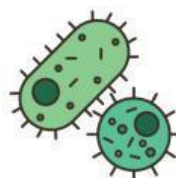
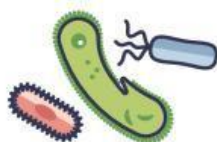
After completing the above investigation, search for bacteria containing the protein chitosanase (csn), which can be used as an alternative antifungal agent, supported by the literature!

Write down your search results in Word, then upload the document and investigation results to the Google Form below!

<https://forms.gle/vsRPbCWfdadBzSri9>

Answer the questions below again!

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