

# Annotation of the *Helicobacter pylori* 83 Genome from DNA Coordinates 44270 to 45736

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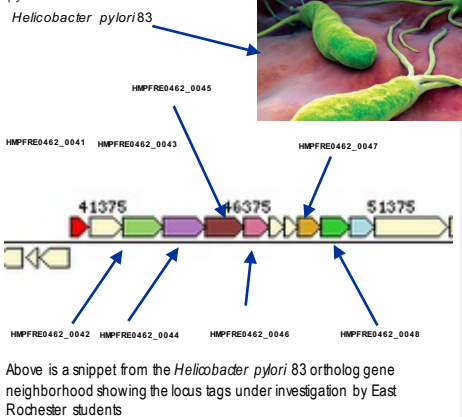
## Abstract

Our group annotated 4 conserved genes from *Helicobacter pylori* 83 using the modules given by GENI-ACT. Following the instructions given in our GENI-ACT manual, we went to many different sites that aided us in annotating our genes. These included BLAST, CDD, T-coffee, WebLogo, Gram Stain, TMHMM, SignalP, Psort, Phobius, IMG EDU, TIGRfam, Pfam, PDB, KEGG, MetaCyc and Rfam. We recorded these findings on the online GENI-ACT lab notebook. Our results were established using all 4 students' annotations. Finally, as you can see, we are presenting our results on this tri-fold poster. We added pictures and diagrams to help show what our genes do. In the end, most of the proposed annotations for the sequenced genomes were the same. The purpose of our research was to annotate specific genes then compare the results to those already given by GENI-ACT and see if the data proposed annotations were either correct or incorrect. All of our genes were as proposed except for *HMPREF0462\_0043*.

## Introduction

The gram negative *Helicobacter pylori* 83 bacterium can alter the human regulatory mechanisms for gastric acid production. During initial, *Helicobacter pylori* 83 can decrease acid secretion levels in the stomach. This can result in ulcers in the stomach, and even in the duodenum. For many years, people believed that smoking, stress, spicy food, and other lifestyle caused stomach ulcers. It was later found that *Helicobacter pylori* 83 was ingested through undercooked food. The pylorus is the sphincter muscles between the duodenum and the stomach. This research is very important because it will help us learn new ways to fight diseases and bacteria, such as *Helicobacter pylori* 83.

Our bioinformatics group has been working to analyze and annotate eight different genomes, that make up *Helicobacter pylori* 83. We split into two groups of four, who each annotated parts of the genome. We used websites such as Pfam, TIGRfam, Kegg, T-Coffee, to discover what our genes do, and what purpose they serve in *Helicobacter pylori* 83.



## Methods and Materials

Modules of the GENI-ACT (<http://www.geni-act.org/>) were used to complete *Helicobacter pylori* 83 genome annotation. The modules are described below:

Modules	Activities	Questions Investigated
Module 1- Basic Information Module	DNA Coordinates and Sequence, Protein Sequence	What is the sequence of my gene and protein? Where is it located in the genome?
Module 2- Sequence-Based Similarity Data	Blast, CDD, T-Coffee, WebLogo	Is my sequence similar to other sequences in Genbank?
Module 3- Cellular Localization Data	Gram Stain, TMHMM, SignalP, PSORT, Phobius	Is my protein in the cytoplasm, secreted or embedded in the membrane?
Module 4- Alternative Open Reading Frame	IMG Sequence Viewer For Alternate ORF Search	Has the amino acid sequence of my protein been called correctly by the computer?
Module 5- Structure-Based Evidence	TIGRfam, Pfam, PDB	Are there functional domains in my protein?
Module 6- Enzymatic Function	KEGG, MetaCyc, E.C. Number	In what process does my protein take part?
Module 7- Gene Duplication/ Gene Degradation	Paralog, Pseudogene	Are there other forms of my gene in the bacterium? Is my gene functional?
Module 8- Evidence for Horizontal Gene Transfer	Phylogenetic Tree	Has my gene co-evolved with other genes in the genome?
Module 9- RNA	RFAM	Does my gene encode a functional RNA?

## Results

### *Helicobacter pylori* 83 HMPREF0462\_0041:

The initial proposed product of the gene by GENI-ACT was a response regulator receiver domain. This gene function is supported by the top BLAST hit in Swissprot as well as data and results collected in T-Coffee, TIGRFAM, CDD, and PDB results. This specific gene's function for the whole organism is to receive the signal from the sensor partner bacterial two-component systems. It usually found N-terminal to a DNA binding effector domain.

### *Helicobacter pylori* 83 HMPREF0462\_0042:

The initial proposed product of the gene by GENI-ACT was a Histidine Kinase domain protein and the data that supports this is Swissprot BLAST, TIGRFAM, and T-Coffee. The function of this gene for the whole organism is to help send an enzyme that helps play a role in signal transduction across the cellular membrane.

### *Helicobacter pylori* 83 HMPREF0462\_0043:

The original gene proposed was Bifunctional NAD(P)H-hydrate repair enzyme. This evidence was supported by a swissprot BLAST search, CDD results, and T-Coffee results. This search later returned as a sugar kinase, supported by Pfam results, TIGRFAM results, and also, PDB results.

### *Helicobacter pylori* 83 HMPREF0462\_0044:

This gene was proposed as a DNA Replication gene. The top swissprot hits on B.L.A.S.T. and the results returned from T-coffee, IMG/EDU, and Pfam. This gene is controls the parts of *Helicobacter pylori* 83 that regulate its replication. It can be found working to replicate DNA prior to cell division.



Figure 1 - Picture of the ortholog gene neighborhood of *Helicobacter pylori* 83, *HMPREF0462\_0041* showing very similar organisms meaning there is no horizontal gene transfer.

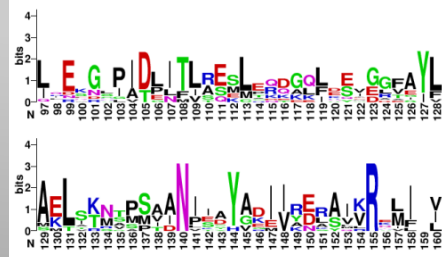


Figure 2: This is a picture of a WebLogo from *HMPREF0462\_0044*. It shows well conserved amino acids in other closely related species.

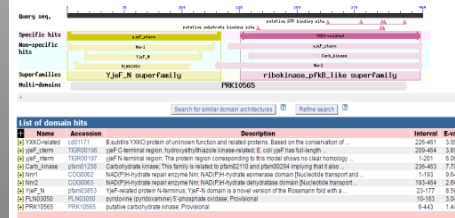


Figure 3 - The above picture is the result from the C.D.D. search through blast. This shows the different domains that are similar to the blast results for *HMPREF0462\_0044*.

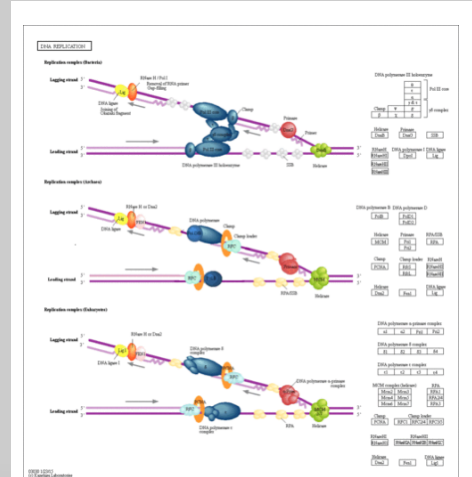


Figure 4: Here is a diagram of a KEGG pathway map for *Helicobacter pylori* 83 replication helicase. It shows how the replication helicase system works in *Helicobacter pylori* 83.

## Conclusion

Locus Tag Numbers	Proposed annotation	Most likely annotation
<i>HMPREF0462_0041:</i>	Response Regulator Receiver Domain.	An N-terminal to a binding effector domain.
<i>HMPREF0462_0042:</i>	Histidine Kinase domain protein.	Histidine kinase domain protein.
<i>HMPREF0462_0043:</i>	Bifunctional NAD(P)H-hydrate repair enzyme.	Sugar kinase.
<i>HMPREF0462_0044:</i>	DNA Replication gene.	DNA Replication gene.

## References

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Geni-act.org

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