

A Diagnosis of ABC Transporters, ATP-binding proteins in *Elizabethkingia anophelis* R26

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ABSTRACT

Elizabethkingia anophelis originates from mosquitos and is commonly found in soil, river waters, and reservoirs. *Elizabethkingia*, itself, is a bacterium that has recently (March 2016) sprung an outbreak in Wisconsin, Michigan, and Illinois with a total of 65 cases (including 20 deaths). This has become the largest outbreak, and this bacteria is involved in the bloodstream of the host. We as a group or class are identifying selected genes within the genome, and we are trying to find and clarify different functions in hopes of adding to the research of Dr. Patricia Canaan.

INTRODUCTION

Our class, supervised by Dr. Canaan, is studying *Elizabethkingia anophelis*. Which is a bacteria that causes human disease.[3] This bacteria was first traced back to the gut of mosquitoes.[4] The bacteria is resistant to multiple antibiotics.[3] Our study more focuses around the fact that the bacteria has multiple genes that code for ABC Transporter- ATP Binding Proteins.[1] It is believed that discovering why the bacteria codes multiple times for the same function can lead to a discovery of a way to combat the bacteria or at least understand the bacteria's reasoning for it. We lack the information as to understanding why, but by examining expression numbers we can determine how these genes potentially relate to the cells ability to cause disease in humans.[3] .

MATERIALS AND METHODS

We navigated to the Rast database and logged into the database using the credentials that our teacher provided. We located our genes by searching for "ABC transporter ATP-binding proteins" in the function column of the database. That narrowed our search from 3,800 genes to 11 genes and from there we narrowed our search even more by choosing the five genes we thought to be the most interesting. Once we found our genes, we continued to use the Rast DB to compare and contrast the gene sequencing, the visual region information, and the transcription patterns.

RESULTS

During this research assignment, we are unable to do any experimental activities to carry out any theories due to lack of information. We are only able to create theories, and evaluate possibilities of the genes in *Elizabethkingia anophelis* from the databases. We have discovered and chose 5 out of 11 genes within *E. Anophelis* that share the same functions..[1]

These include:

- [fig|1246994.5.peg.70](#)
- [fig|1246994.5.peg.296](#)
- [fig|1246994.5.peg.347](#)
- [fig|1246994.5.peg.2982](#)
- [fig|1246994.5.peg.3603](#)

	Transcripts under Control Conditions	Transcripts grown with Cefotax	Transcripts grown with Impipenem	Total Transcripts overall 3 conditions	Fold Change in transcription in Cefotax compared to Control	Fold Change in transcription in Impipenem compared to Control
Gene 70	1	2	1	4	2.0	-1.0
Gene 296	17	9	36	62	-1.9	2.1
Gene 347	92	78	75	245	-1.2	-1.2
Gene 2982	3	6	3	12	2.0	-1.0
Gene 3603	9	13	13	35	1.4	1.4

Each of the transcribed gene sequences tells us something specific and different for each of the chosen genes.

Gene 70 was surrounded by hypothetical proteins, transcriptional regulators, and a closely related a putative membrane protein. For this significance, it is more than likely regulated by the transcriptional genes.

Gene 296 was surrounded by hypothetical proteins, Hydroxymethylglutaryl-CoA reductase, and COG2363.

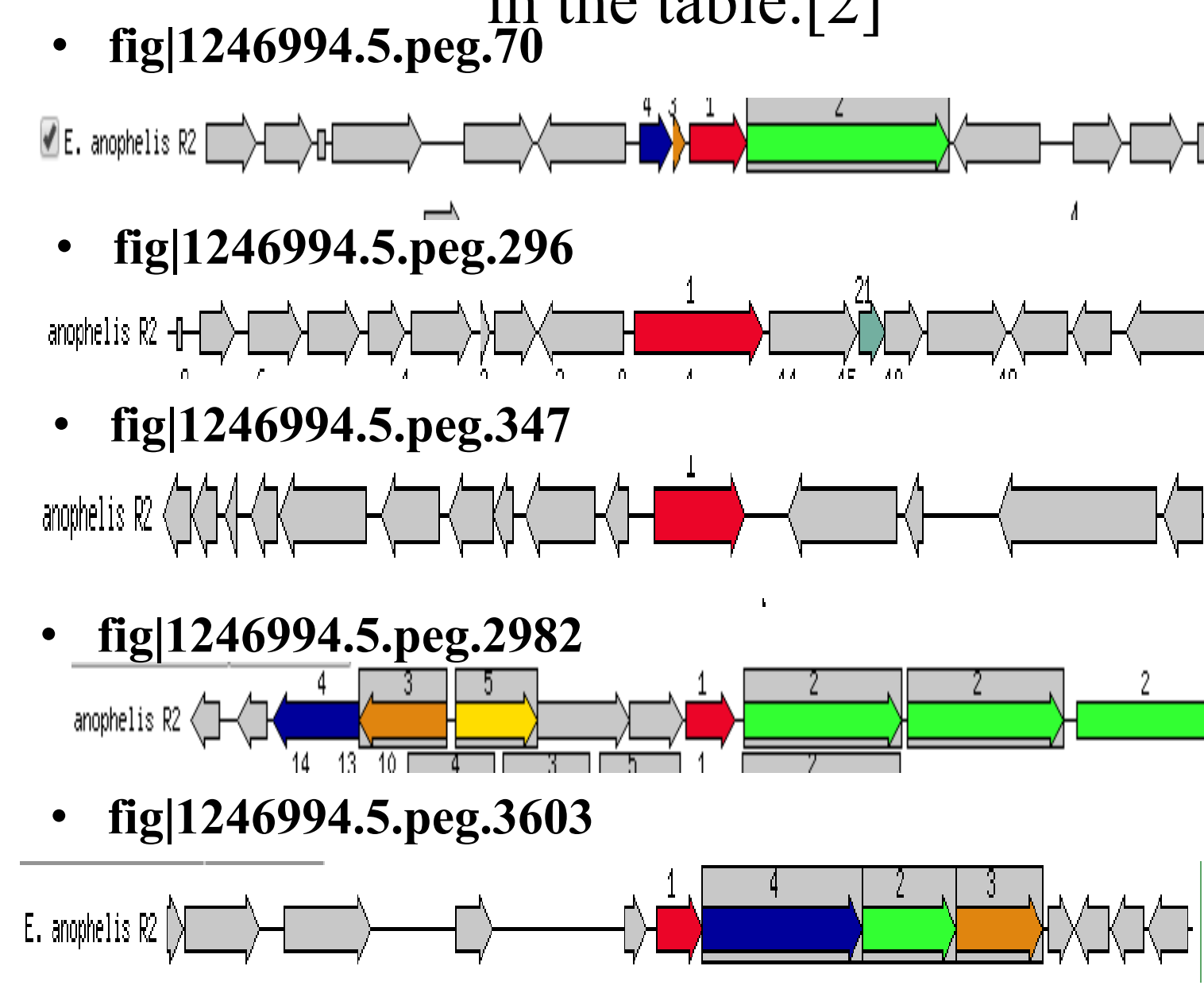
Gene 347 was surrounded by hypothetical proteins and Staphylococcal pathogenicity islands which were considered non active for the bacteria.

Gene 2982 was surrounded by a Sensor histidine kinase, a response regulator, Probable RND efflux membrane fusion protein, hypothetical proteins, and ABC Transporter, permease protein.

Gene 3603 was surrounded by a TonB-dependent siderophore receptor and hypothetical proteins.[1]

Each of these five genes share a common function of being ABC Transporter ATP-binding proteins. ABC Transporter ATP-binding proteins are involved in the import and export of a wide variety of substrates ranging from all ions to macromolecules. The major function of ABC import systems is to provide essential nutrients to bacteria by transporting substrates through the cell membrane[1][3]

Each individual gene transcript was compared. We as a group pointed out any significant changes or lack of changes. These genes are not alike in many ways when referring to their level (or number) of transcripts. Each specific gene's identity and function for *Elizabethkingia anophelis* R26 is shown in the expression of the transcripts, if identified by the RASTDB and BLASTDB. The results of the comparisons are shown to the left in the table.[2]



DISCUSSION

When examining the data from the Copy of E.anoR26_RNAseqData_FoldChanges excel sheet, there is no significant change in expression between the five ABC Transporter ATP-binding protein genes within *Elizabethkingia anophelis*. This means if the genes are expressed at all then they are expressed very little. Multiple factors may be responsible for this type of this response. For example, due to the redundancy in function between the genes, *Elizabethkingia anophelis* may express all the genes however they may not be "fully" expressed. This would mean that *Elizabethkingia anophelis* is producing a specific ABC transporter for ATP-binding proteins, however; because they all have similar functions, each ABC transporter can be used for a wide range of functions. In addition to this, there is posable explanation for this reaction in expression. Which is that all five ABC transporters, although unlikely due to the redundancy of the function, may be housekeeping genes. This would mean that all five ABC transporters would be expressed at all times, no matter the circumstances. This could be due to the functioning nature of ABC transporters. ABC transporters are used in active transport of a compound or a class of compounds over the membrane of the bacteria, which would be fundamental to *Elizabethkingia anophelis* due to the environment that it lives in. *Elizabethkingia anophelis* is found in the gut of mosquitos, and, as the result, *Elizabethkingia anophelis* would need a specific set of ABC transporters to allow it to move compounds in and out of its membrane. In addition to this one distinct finding between the five genes is that gene [fig|1246994.5.peg.296](#) is commonly found in many other bacteria related species as well.

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etc.
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