

# High-Level Accessibility Evaluation (WCAG 2.1)

BioCyc

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**Prepared for:**

BTAA-Library Accessibility Alliance

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## SUMMARY

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This report reflects the findings of a high-level assessment of the BioCyc platform for its conformance with the W3C Web Content Accessibility Guidelines version 2.1 (WCAG 2.1).

Overall, there are very few issues with the BioCyc platform. There are, however, some essential WCAG 2.1 A and AA level requirements that need to be met for compliance around navigation and nested controls. Additionally, there are a few other issues with color contrast, alt text, and ARIA implementation. Below are the most critical issues to address to improve system compliance.

### Top Findings

1. **Site Navigation:** The navigation menu is inaccessible to keyboard users which blocks them from being able to fully navigate the site. Several of the pages have dual-axis scrolling that cuts off content and makes navigation within the page more difficult. The focus order on the search results page does not follow the logical flow of content and should be remediated to reduce cognitive load.
2. **Nested Controls:** There is a significant issue on the search results page where the right panel has several nested controls. This can lead to serious issues with screen readers and interactivity.
3. **Color Contrast:** There are minor color contrast issues between the orange buttons and their backgrounds. Interactive elements need to meet at least 3:1 contrast with the background and 4.5:1 contrast with their text.
4. **Alt Text:** There is an issue on the genome browser page and the advanced search page with images that have no alt text.

### Best Practices

- ◆ All page content should be contained by landmarks.
- ◆ Landmarks should have a unique role or role/label/title (i.e. accessible name) combination.
- ◆ Ensure elements marked as presentational are consistently ignored.
- ◆ Links should be underlined.
- ◆ Heading levels should only increase by one
- ◆ ARIA role should be appropriate for the element.
- ◆ Page should contain a level one heading.

## ACCESSIBILITY FINDINGS

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This report was conducted against the BioCyc Platform and covers a selection of pages and features that were to be tested as a representative sample of the database's conformance to the WCAG 2.1 AA standards.

The resource was reviewed using a combination of manual and automatic review tools and assistive technologies, including the WAVE Accessibility Assessment tool, Axe Accessibility Assessment tool, WCAG Color Contrast Checker, and NVDA screen reader. PDF content was tested against Section 508 requirements using Adobe Acrobat's accessibility tools and manual analysis. All problems identified by automatic tools were verified manually. This evaluation was performed using Firefox on Windows 11.

Below are the errors revealed during the accessibility evaluation of the BioCyc platform. Each result shows a summary of accessibility issues and the reason it was flagged. Screenshots are included.

# 1. Initial Interface

**Test Case:** Test initial interface/landing page to ensure menus, sub-menus, search box, images, icons, etc. are accessible. <https://biocyc-org.utk.idm.oclc.org/>

**SC 1.4.3:** Buttons must meet minimum contrast ratios.

### Location(s):

1. `<button class="pureFreeTrial pure-button" onclick="window.location.href='/intro.shtml'" style="width: unset">BioCyc Intro</button>`
2. `<button class="pureFreeTrial pure-button" onclick="window.location.href='https://share.hsforms.com/1V2-ild18QzSYZi4Xvkxkkg3ipje'" style="width: unset"><!--old form  
onclick="window.location.href='https://share.hsforms.com/1GBRqdFaaSAKBjXodNpBKbA3ipje'" style="width: unset"-->Request Free Classroom Use</button>`

### Reason flagged:

- Element has insufficient color contrast of 2.1 (foreground color: #f89838, background color: #fafafa). Expected contrast ratio of 3:1

**SC 2.1.1:** All content must be operable through the keyboard.

**Reason flagged:**

- The main navigation menu is not navigable using the keyboard, locking very important navigation functions behind inaccessible menus keeping keyboard users from being able to navigate the site.

## 2. Search Results

**Test Case:** From the initial landing page, conduct a search for “lysine”. Test search results page, including filters/refine search (Gene Ontology Terms).

The screenshot shows the EcoCyc search results for "lysine". The page header includes navigation links (Tools, Sites, Pathway Tools, Help) and a "Create Free Account" button. The current database is "Escherichia coli K-12 substr. MG1655". A search bar contains the text "Enter a gene, protein, metabolite or pathway...".

**Search Results for lysine**  
using database *Escherichia coli K-12 substr. MG1655* [what is this?](#)

Pathways (8) | Proteins (55) | RNAs (1) | Compounds (106) | Gene Ontology Terms (46) | Reactions (6) | EC Numbers (22) | Growth Media (1)

**Pathways** Pathway pages contain: Depiction of metabolic pathway, of chromosomal locations of pathway genes, and of regulation of pathway genes.

- cadaverine biosynthesis (*L-lysine*-dependent acid resistance)
- Class: L-pyrrolysine Biosynthesis
- Class: L-lysine Biosynthesis
- Class: L-lysine Degradation
- fructoselysine and piccoselysine degradation
- L-lysine biosynthesis I
- L-lysine degradation I
- superpathway of L-lysine, L-threonine and L-methionine biosynthesis I

[Login to turn into a SmartTable.](#)

**Proteins** Gene/Gene Product pages contain: chromosomal location of gene; depiction of its operon; link to genome browser; detailed summaries and citations; subunit structure (for protein complexes); cofactors, activators, and inhibitors (for enzymes); depiction of regulon (for transcriptional regulators); protein features.

- lysine / arginine / ornithine ABC transporter
- lysine 2,3-aminomutase
- lysine decarboxylase 1 (polypeptide)
- lysine decarboxylase 1 (protein complex)
- lysine decarboxylase 2 (polypeptide)
- lysine decarboxylase 2 (protein complex)
- lysine/arginine/ornithine ABC transporter / histidine ABC transporter, ATP binding subunit
- lysine/arginine/ornithine ABC transporter / histidine ABC transporter, membrane subunit HisM
- lysine/arginine/ornithine ABC transporter / histidine ABC transporter, membrane subunit HisQ
- lysine/arginine/ornithine ABC transporter periplasmic binding protein
- lysine:cadaverine antiporter
- lysine:H<sup>+</sup> symporter
- lysine-tRNA ligase - LysS
- lysine-tRNA ligase - LysU
- lysine-tRNA ligase, constitutive
- aminoalkylphosphonate N-acetyltransferase (*peptidyl-lysine N-acetyltransferase*)
- ArgP-L-lysine

**Alternative searches:**

- Full text search for lysine on all pages in this database using Google
- Full text search for lysine on all pages of this website using Google

**SC 1.4.10:** Content must be presented without loss of information or functionality, and without scrolling in two dimensions.


**Reason flagged:**

- Scrolling on this page currently occurs both vertically and horizontally. Content should reflow so that scrolling only occurs in one direction.

### 3. Individual Results

**Test Case:** Test individual search result landing page & test actual document (lysine 2,3,-aminomutase).  
<https://biocyc.org/gene?orgid=ECOLI&id=G7836-MONOMER#SUMMARY>

Tools ▾ Sites ▾ Pathway Tools ▾ Help ▾ Subscribe to BioCyc LOGIN Create Free Account




Change Current Database | Current Database: *Escherichia coli K-12 substr. MG1655*

**Search in Current Database:**

gene	enzyme	
<b>epmB</b>	<b>lysine 2,3-aminomutase</b>	
<i>Escherichia coli</i> K-12 substr. MG1655		
Synonym	yjeK	
Accession IDs	G7836 (EcoCyc)	Length 1029 bp / 342 aa
	b4146	Map Position [4,374,629 <- 4,375,657] (94.25 centisomes, 339")
	ECK4140	Location cytosol
	P39280 (UniProt)	
Reaction	5.4.3.-: L-lysine ↔ (R)-β-lysine	
Evidence	Assay of protein purified to homogeneity [Behshad06]	

Summary | GO Terms (8) | Essentiality | Reactions (1) | Protein Features | Operons | Modeling

**Summary of Regulatory Influences on epmB**



**Summary**

Co-expression of EpmB enhances the lysylation of EF-P by EpmA *in vivo*. EpmB may catalyze the conversion of α-lysyl-EF-P to β-lysyl-EF-P [Yanagisawa10], but preliminary evidence indicates that it acts before EpmA [Park12].

The *epmB* gene product is similar to the lysine 2,3-aminomutase of *Clostridium subterminale*, although phylogenetic clustering has shown that EpmB belongs to a different subfamily than the lysine 2,3-aminomutases [Bailey10]. The purified protein has low lysine 2,3-aminomutase activity and produces (R)-β-lysine, the enantiomer of the product of the *Clostridium* enzyme. The low activity of the *E. coli* enzyme compared to the clostridial

**Unification Links**

AlphaFold	P39280
ASAP	ABE-0013580
EchoBASE	EB2366
EcoWiki	b4146
ModBase	P39280
OU-Microarray	b4146
Pride	P39280
RefSeq	NP_418570
RegulonDB	b4146

**OPERATIONS**

**Sequences**

- ▶ Get Protein Sequence
- ▶ Get Nucleotide Sequence
- ▶ BLAST the Nucleotide Sequence
- ▶ BLAST the Protein Sequence
- ▶ Save Nucleotide Sequence to File
- ▶ Save Protein Sequence to File

**Overviews**

- ▶ Show on Cellular Overview

**Functional Linkage**

- ▶ Genome Context Analysis

**Comparison Operations**

- ▶ Show This Gene in Another Database
- ▶ Search for This Gene in Multiple Databases
- ▶ Show Orthologs (with Operon Diagrams) in Multiple Databases
- ▶ Align in Multi-Genome Browser
- ▶ Align Gene Nucleotide Sequence with Orthologs
- ▶ Align Gene Product Amino Acid Sequence with Orthologs

**SC 1.3.1:** Certain ARIA roles must contain particular children.

**Location(s):**

1. `<ul id="geneMenu" class="tightMargin" role="menu">`
2. `<ul role="menu" aria-labelledby="geneSeqMenu_div" id="geneSeqMenu_ul">`
3. `<ul role="menu" aria-labelledby="geneOvMenu_div" id="geneOvMenu_ul"><li class="navBoxLink"><a title="Show on Cellular Overview" href="/overviewsWeb/celOv.shtml?orgid=ECOLI&amp;gnids=G7836" role="menuitem">Show on Cellular Overview</a></li></ul>`
4. `<ul role="menu" aria-labelledby="gcontext_div" id="gcontext_ul"><li class="navBoxLink"><a title="Genome Context Analysis" href="/ECOLI/genome-context?object=G7836" role="menuitem">Genome Context Analysis</a></li></ul>`
5. `<ul role="menu" aria-labelledby="compareOps_div" id="compareOps_ul">`

**Reason flagged:**

- Element has children which are not allowed: li[tabindex]

**SC 1.3.1:** Certain ARIA roles must be contained by particular parents.**Location(s):**

1. `<a title="Navigate to a page that shows the protein amino acid sequence." href="/ECOLI/sequence-aa?type=GENE&object=G7836" role="menuitem">Get Protein Sequence</a>`
2. `<a title="Navigate to a page that shows the gene nucleotide sequence. Also pops up a panel to adjust the region for which the sequence is shown." href="javascript:self.name='main';var w = window.open('/ECOLI/seq-selector?chromosome=COLI-K12&object=G7836','remote','width=670,height=300,menubar=0,toolbar=0,location=0,directories=0,status=0,resizable=1');if (true) location='/ECOLI/sequence-rc?type=GENE&object=G7836';setTimeout(function(){w.focus();},1000);" role="menuitem">`
3. `<a title="BLAST the Nucleotide sequence." href="/ECOLI/blast.html?object=G7836&objtype=G" role="menuitem">BLAST the Nucleotide Sequence </a>`
4. `<a title="BLAST Protein the sequence." href="/ECOLI/blast1.html?object=G7836-MONOMER&objtype=P" role="menuitem">BLAST the Protein Sequence</a>`
5. `<a title="Saves nucleotide sequence to file." href="/ECOLI/nuc-seq-to-file?object=G7836" role="menuitem">Save Nucleotide Sequence to File</a>`
6. `<a title="Save Protein Sequence to File" href="/ECOLI/prot-seq-to-file?object=G7836" role="menuitem">Save Protein Sequence to File</a>`
7. `<a title="Show on Cellular Overview" href="/overviewsWeb/celOv.shtml?orgid=ECOLI&gnids=G7836" role="menuitem">Show on Cellular Overview</a>`
8. `<a title="Genome Context Analysis" href="/ECOLI/genome-context?object=G7836" role="menuitem">Genome Context Analysis</a>`
9. `<a title="Select a different organism database, and open a new tab showing the page for this gene (if it exists) in that database" href="javascript:showChooser(function(selectedOrgID){window.open(queryShowString(selected OrgID,'gene','ECOLI','G7836','Gene'))}" role="menuitem">`
10. `<a title="Select a set of organisms to search, and generate a table of links to this gene in all of those organisms in which it was found. Searching is by both ortholog and gene name." href="javascript:showInSelectedDBs()" role="menuitem">Search for This Gene in Multiple Databases</a>`
11. `<a title="Generate a table listing this gene and its orthologs in the selected organism databases, showing gene products and operon organization." href="javascript:selectOrgsAndGo('/ECOLI/compare-frame-in-orgs?type=ORTHOLOG&object=G7836&initial-orgs=ECOLI', navBoxMultiorgChooser)" role="menuitem">`
12. `<a title="Show this gene, along with its orthologs in the selected organism databases, in the Multi-Genome Browser" href="javascript:selectOrgsAndGo('/ECOLI/invoke-browse-orthologs?type=LOCUS-POSITION&object=G7836', navBoxMultiorgChooser)" role="menuitem">Align in Multi-Genome Browser</a>`

**Reason flagged:**

- Required ARIA parents role not present: menu, menubar, group



**SC 1.3.1:** <li> elements must be contained in a <ul> or <ol>.

**Location(s):**

1. <li id="geneSeqMenu">
2. <li class="navBoxLink"><a title="Navigate to a page that shows the protein amino acid sequence." href="/ECOLI/sequence-aa?type=GENE&amp;object=G7836" role="menuitem">Get Protein Sequence</a></li>
3. <li class="navBoxLink">
4. <li class="navBoxLink"><a title="BLAST the Nucleotide sequence." href="/ECOLI/blast.html?object=G7836&amp;objtype=G" role="menuitem">BLAST the Nucleotide Sequence </a></li>
5. <li class="navBoxLink"><a title="BLAST Protein the sequence." href="/ECOLI/blast1.html?object=G7836-MONOMER&amp;objtype=P" role="menuitem">BLAST the Protein Sequence</a></li>
6. <li class="navBoxLink"><a title="Saves nucleotide sequence to file." href="/ECOLI/nuc-seq-to-file?object=G7836" role="menuitem">Save Nucleotide Sequence to File</a></li>
7. <li class="navBoxLink"><a title="Save Protein Sequence to File" href="/ECOLI/prot-seq-to-file?object=G7836" role="menuitem">Save Protein Sequence to File</a></li>
8. <li id="geneOvMenu">
9. <li class="navBoxLink"><a title="Show on Cellular Overview" href="/overviewsWeb/celOv.shtml?orgid=ECOLI&amp;gnids=G7836" role="menuitem">Show on Cellular Overview</a></li>
10. <li id="gcontext">
11. <li class="navBoxLink"><a title="Genome Context Analysis" href="/ECOLI/genome-context?object=G7836" role="menuitem">Genome Context Analysis</a></li>
12. <li id="compareOps">
13. <li class="navBoxLink">
14. <li class="navBoxLink">
15. <li class="navBoxLink">
16. <li class="navBoxLink">

**Reason flagged:**

- List item parent element has a role that is not role="list"

**SC 1.4.3:** Buttons must meet minimum contrast ratios.

**Location(s):**

1. <input type="button" value="Provide Feedback" onclick="window.open('/feedback.html?' + encodeURIComponent(location), 'bugreport', 'toolbar=no,dependent=yes,height=640,width=620,menubar=no,location=no,scrollbars=yes')">
2. <input type="button" value="View in Genome Browser" onclick="location.href='/genbro/genbro.shtml?orgid=ECOLI&amp;gene=G7836&amp;replicon=COLI-K12'">

**Reason flagged:**

- Element has insufficient color contrast of 1.6 (foreground color: #f1ba84, background color: #f8f7f0). Expected contrast ratio of 3:1
- Element has insufficient color contrast of 1.7 (foreground color: #f2bb85, background color: #ffffff). Expected contrast ratio of 3:1

**SC 1.4.10:** Content must be presented without loss of information or functionality, and without scrolling in two dimensions.

**Reason flagged:**

- Scrolling on this page currently occurs both vertically and horizontally. Content should reflow so that scrolling only occurs in one direction.

**SC 2.1.1:** All content must be operable through the keyboard.

**Reason flagged:**

- The main navigation menu is not navigable using the keyboard, locking very important navigation functions behind inaccessible menus keeping keyboard users from being able to navigate the site.

**SC 2.4.3:** Focus order must follow logical order.

**Reason flagged:**

- Focus should move from the top left to the bottom right of the screen in a logical flow. Currently focus moves left to right, then to the right panel, then to the main content.

**SC 2.4.4:** Links must have discernible text.

**Location(s):**

1. `<a href="javascript:popupUrlContent(encodeURIComponent('/help.html?object=reg-summary-diagram'), 600, 656, 'Help')" data-tippy-content="Learn more about this diagram" aria-expanded="false"><i class="fa fa-question-circle green"></i></a>`
2. `<a href="javascript:popupUrlContent(encodeURIComponent('/help.html?object=gene-rxn-schematic'), 600, 400, 'Help')" data-tippy-content="Learn more about this diagram" aria-expanded="false"><i class="fa fa-question-circle green"></i></a>`
3. `<a href="javascript:popupUrlContent(encodeURIComponent('/help.html?object=fully-curated'), 600, 400, 'Help')" data-tippy-content="This entry was last comprehensively curated, meaning the curation drew from all literature known to the curator, on the date shown." aria-expanded="false">`

**Reason flagged:**

- Element does not have text that is visible to screen readers
- aria-label attribute does not exist or is empty
- aria-labelledby attribute does not exist, references elements that do not exist or references elements that are empty
- Element has no title attribute

**SC 4.1.2:** Elements must only use supported ARIA attributes.

**Location(s):**

1. `<span data-tippy-content="Unification links are links to an object in another database that represents the same biological object" aria-expanded="false">Unification Links</span>`

2. `<span data-tippy-content="Relationship links are links to an object in another database that represents a related object. The relationship is listed after the database name." aria-expanded="false">Relationship Links</span>`

**Reason flagged:**

- ARIA attribute is not allowed: `aria-expanded="false"`

**SC 4.1.2:** Interactive controls must not be nested.**Location(s):**

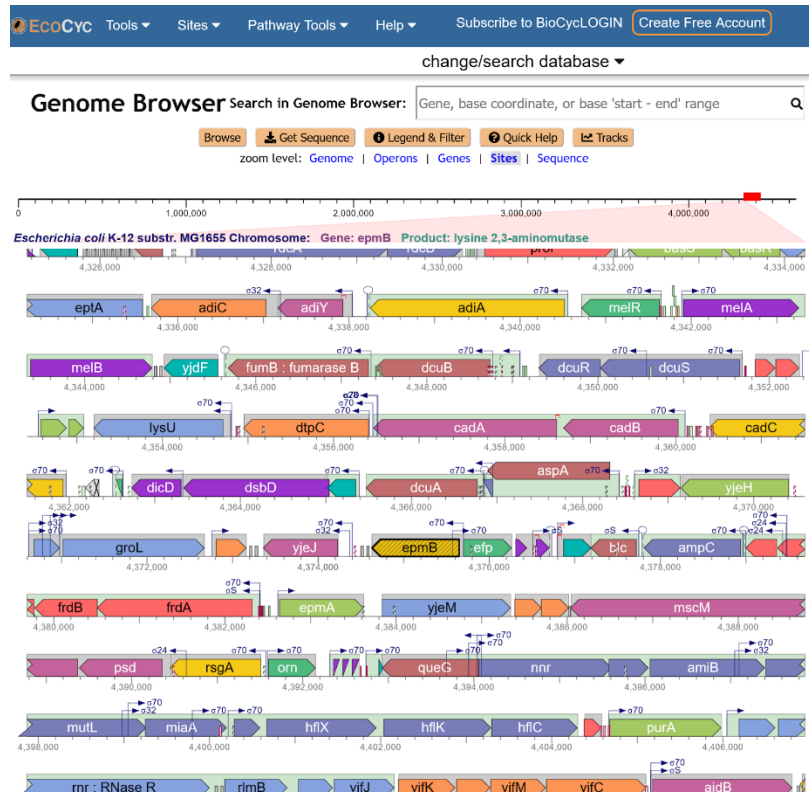
1. `<li class="ui-state-default ui-corner-top ui-tabs-active ui-state-active" role="tab" tabindex="0" aria-controls="SUMMARY" aria-labelledby="ui-id-1" aria-selected="true" aria-expanded="true"><a href="#SUMMARY" class="ui-tabs-anchor" role="presentation" tabindex="-1" id="ui-id-1">Summary</a></li>`
2. `<li class="ui-state-default ui-corner-top" role="tab" tabindex="-1" aria-controls="GO" aria-labelledby="ui-id-2" aria-selected="false" aria-expanded="false"><a href="#GO" class="ui-tabs-anchor" role="presentation" tabindex="-1" id="ui-id-2">GO Terms (8)</a></li>`
3. `<li class="ui-state-default ui-corner-top" role="tab" tabindex="-1" aria-controls="ESS" aria-labelledby="ui-id-3" aria-selected="false" aria-expanded="false"><a href="#ESS" class="ui-tabs-anchor" role="presentation" tabindex="-1" id="ui-id-3">Essentiality</a></li>`
4. `<li class="ui-state-default ui-corner-top" role="tab" tabindex="-1" aria-controls="RXNS" aria-labelledby="ui-id-4" aria-selected="false" aria-expanded="false"><a href="#RXNS" class="ui-tabs-anchor" role="presentation" tabindex="-1" id="ui-id-4">Reactions (1)</a></li>`
5. `<li class="ui-state-default ui-corner-top" role="tab" tabindex="-1" aria-controls="FTRS" aria-labelledby="ui-id-5" aria-selected="false" aria-expanded="false"><a href="#FTRS" class="ui-tabs-anchor" role="presentation" tabindex="-1" id="ui-id-5">Protein Features</a></li>`
6. `<li class="ui-state-default ui-corner-top" role="tab" tabindex="-1" aria-controls="TU" aria-labelledby="ui-id-6" aria-selected="false" aria-expanded="false"><a href="#TU" class="ui-tabs-anchor" role="presentation" tabindex="-1" id="ui-id-6">Operons</a></li>`
7. `<li class="ui-state-default ui-corner-top" role="tab" tabindex="-1" aria-controls="MODL" aria-labelledby="ui-id-7" aria-selected="false" aria-expanded="false"><a href="#MODL" class="ui-tabs-anchor" role="presentation" tabindex="-1" id="ui-id-7">Modeling</a></li>`
8. `<li class="ui-state-default ui-corner-top" role="tab" tabindex="-1" aria-controls="REFS" aria-labelledby="ui-id-8" aria-selected="false" aria-expanded="false"><a href="#REFS" class="ui-tabs-anchor" role="presentation" tabindex="-1" id="ui-id-8">References</a></li>`
9. `<li class="ui-state-default ui-corner-top" role="tab" tabindex="-1" aria-controls="showAll" aria-labelledby="ui-id-9" aria-selected="false" aria-expanded="false"><a href="#showAll" class="ui-tabs-anchor" role="presentation" tabindex="-1" id="ui-id-9">Show All</a></li>`

**Reason flagged:**

- Using a negative tabindex on an element inside an interactive control does not prevent assistive technologies from focusing the element (even with `aria-hidden="true"`)

## 4. Genome Browser

**Test Case:** Test “View in Genome Browser” page. Test “Legend and Filter” options.



**SC 1.1.1:** Images must have alternate text.

**Location(s):**

1. ``

**Reason flagged:**

- Element does not have an alt attribute
- aria-label attribute does not exist or is empty
- aria-labelledby attribute does not exist, references elements that do not exist or references elements that are empty
- Element has no title attribute
- Element's default semantics were not overridden with role="none" or role="presentation"

**SC 1.3.1:** Certain ARIA roles must contain particular children.

**Location(s):**

1. `<div class="menubar-wide-margin-border" role="menubar" tabindex="0">`

**Reason flagged:**

- Element has children which are not allowed: `img[tabindex]`

**SC 3.1.2:** Frames must have an accessible name.**Location(s):**

1. `<iframe class="genbro-iframe" src="genbro.html" style="width: 100vw; height: 100vh; border-width: 0px;"></iframe>`


**Reason flagged:**

- Element has no title attribute
- aria-label attribute does not exist or is empty
- aria-labelledby attribute does not exist, references elements that do not exist or references elements that are empty
- Element's default semantics were not overridden with role="none" or role="presentation"

## 5. Advances Search Page

**Test Case:** Test advanced search page.

Tools ▾ Sites ▾ Pathway Tools ▾ Help ▾ Subscribe to BioCyc LOGIN Create Free Account


Change Current Database Current Database: *Escherichia coli K-12 substr. MG165*

**Search in Current Database:**

### STRUCTURED ADVANCED QUERY PAGE

[Switch to the Free Form Advanced Query Page](#)  
(Advanced Query Documentation | SAQP Webinars)

**1. Select your database, class of objects, and conditions to search:**

Query database Escherichia coli K-12 substr. MG1655 for Compounds (7601 instances) remov

Where

Name ▾ contains the substring ▾  Switch to variable e

add a condition ▾

Select an operation to add an additional search component or variable: ▾

**2. Select attributes to include in the query output:**

Column 1	Column 2 <span style="font-size: small;">✖</span>
<input checked="" type="radio"/> Sort based on this column	<input type="radio"/> Sort based on this column
Name ▾	Chemical-Formula ▾
<a href="#">add a column</a>	

**3. Select query output format:**

HTML  Tab Delimited Text (columns are separated by tabs)

4. Submit Query

Reset Query

**SC 1.1.1:** Images must have alternate text.

**Location(s):**

1. ``

**Reason flagged:**

- Element does not have an alt attribute
- aria-label attribute does not exist or is empty
- aria-labelledby attribute does not exist, references elements that do not exist or references elements that are empty
- Element has no title attribute
- Element's default semantics were not overridden with role="none" or role="presentation"

**SC 1.4.10:** Content must be presented without loss of information or functionality, and without scrolling in two dimensions.

**Reason flagged:**

- Scrolling on this page currently occurs both vertically and horizontally. Content should reflow so that scrolling only occurs in one direction.

**SC 2.4.2:** Documents must have <title> element to aid in navigation.

**Location(s):**

1. `<html lang="en" class="yui3-js-enabled">`

**Reason flagged:**

- Document does not have a non-empty <title> element

Disclaimer: This high-level evaluation was conducted for the Library Accessibility Alliance and represents a good faith effort conducted within a limited time frame. It should not be assumed to be complete or free from error. No warranties or guarantees are implied. UT is not responsible for direct, indirect, or incidental damages based on this work; its use or interpretation by any individual, group, or organization; or on conditions beyond our control.