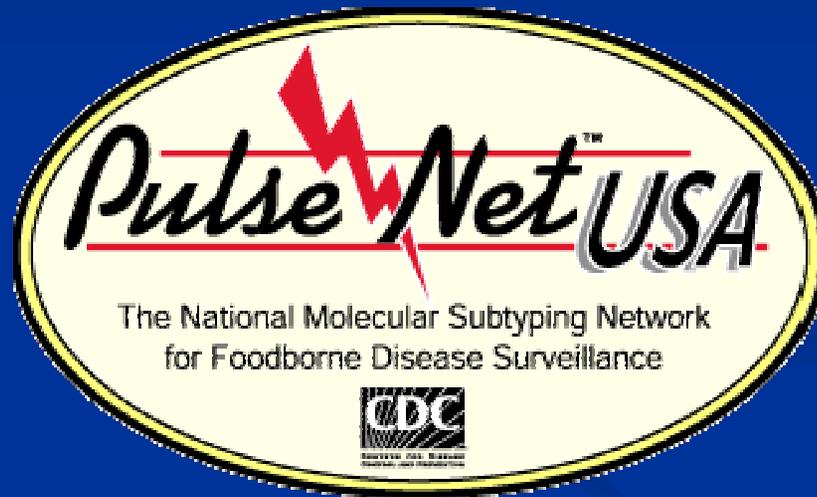


# Advanced Tools



Kelley B. Hise

April 2011



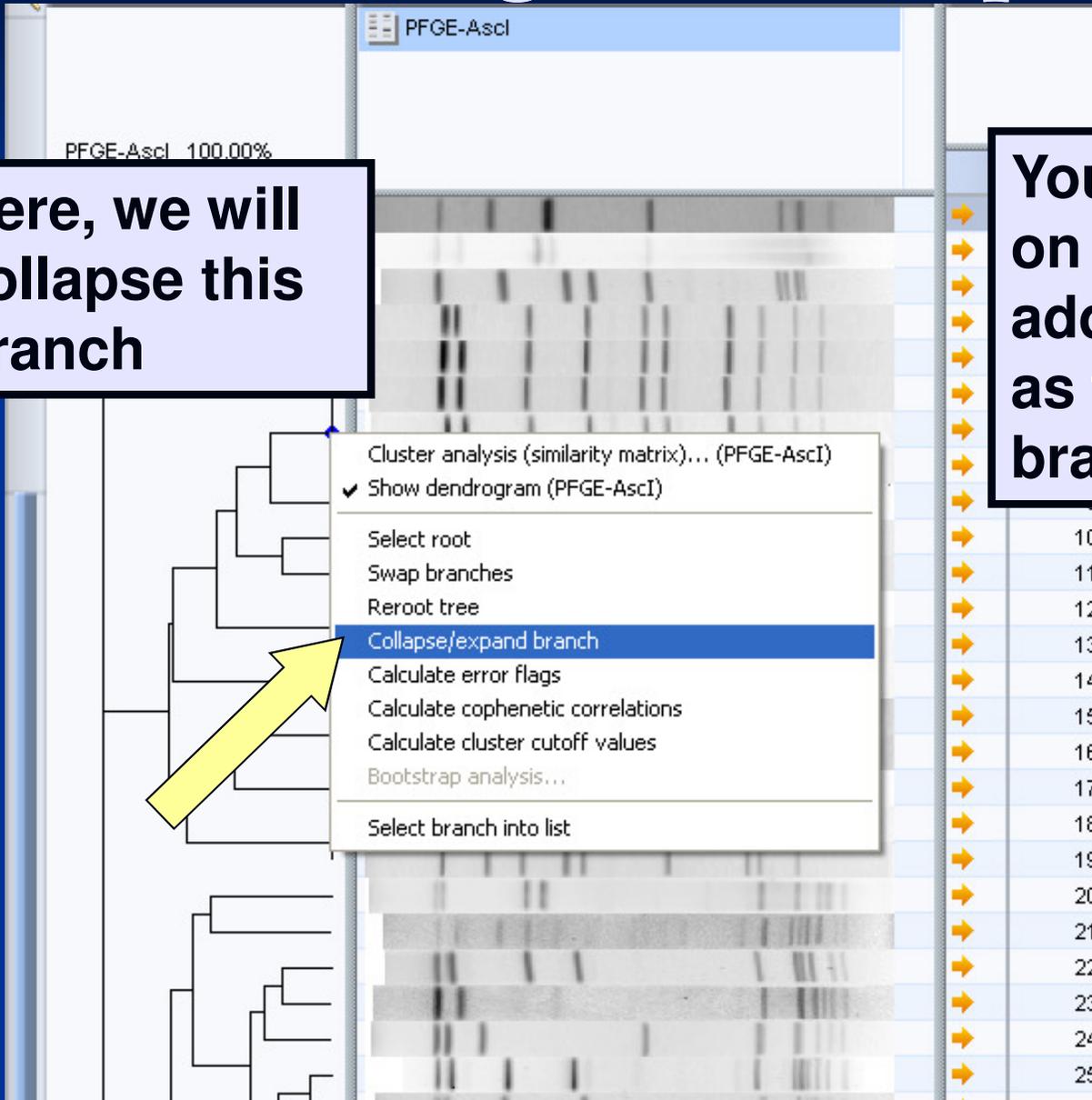
# Overview

- Advanced options with dendrograms
- Advanced options with comparisons
- Advanced options with groups
- Advanced Queries
- Examples of advanced queries
- Plugins

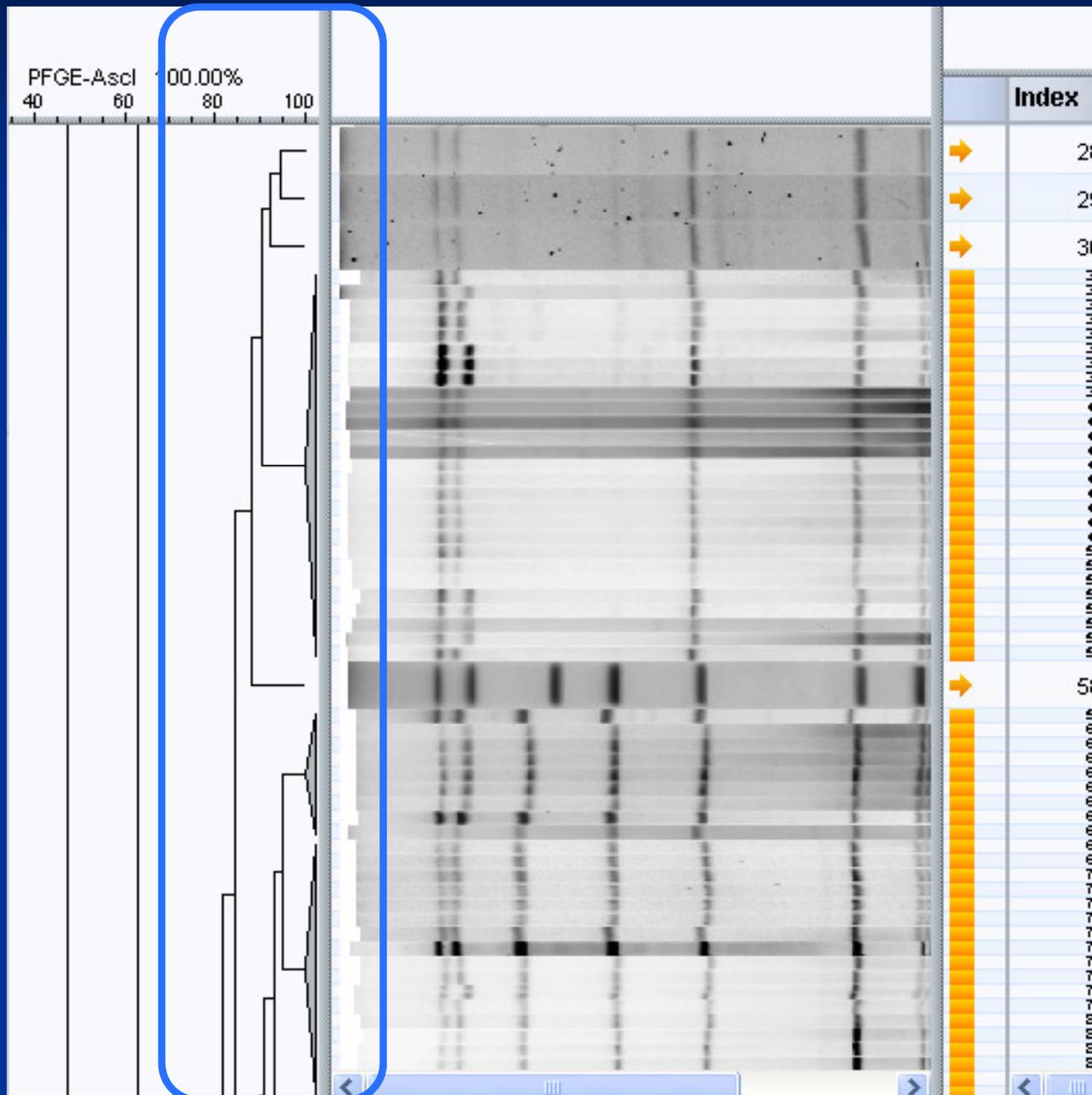
# Dendrograms: collapse branches

Here, we will collapse this branch

You can also right-click on the branches for additional options, such as to collapse or expand a branch



# Dendrograms: collapse branches



**When multiple branches have been collapsed, you can see more of the dendrogram on one page**

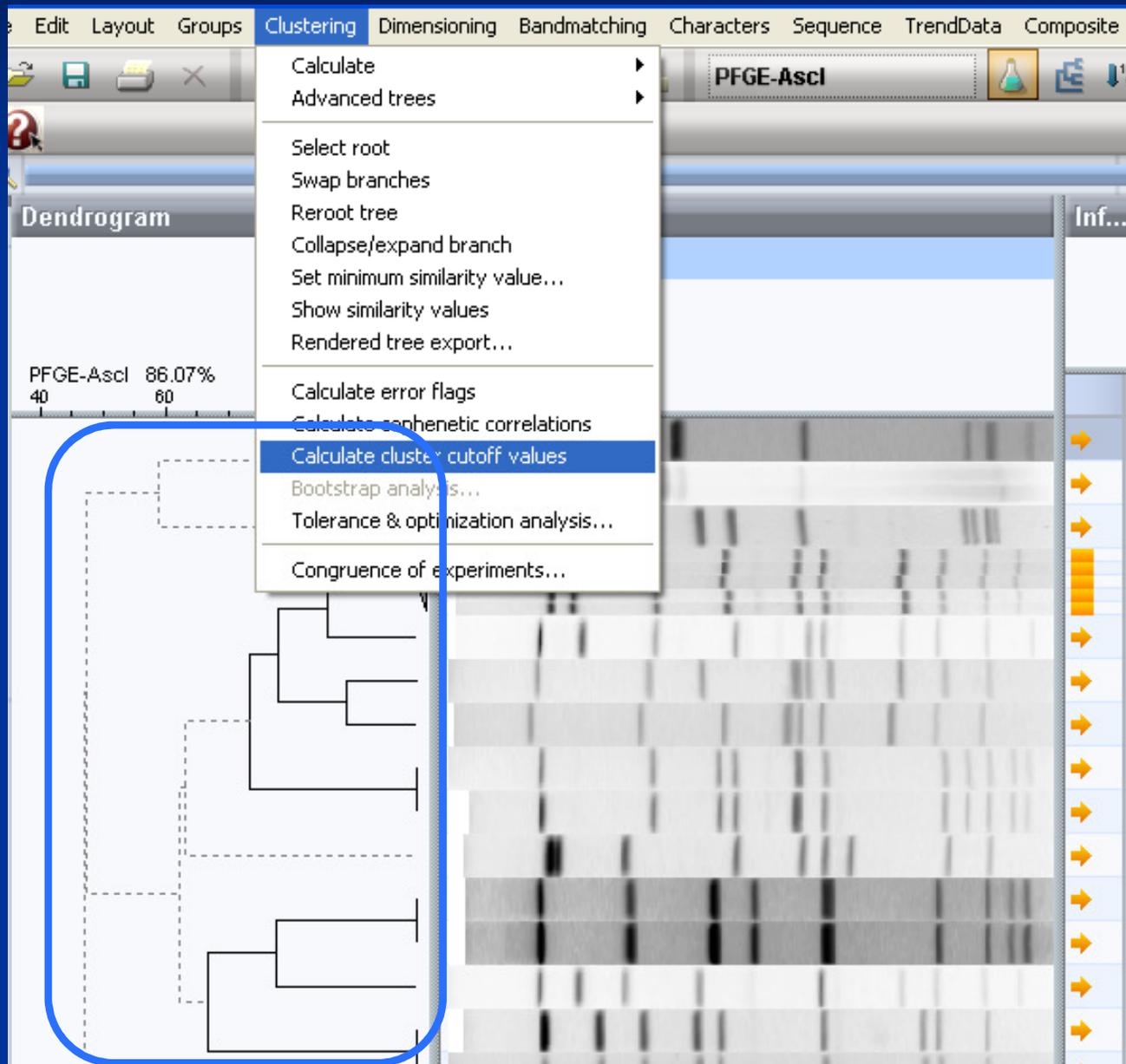
# Dendrograms: swap branches



If you would rather clusters be switched around in the dendrogram, right-click on the node and select “Swap branches”

Now these branches have swapped places

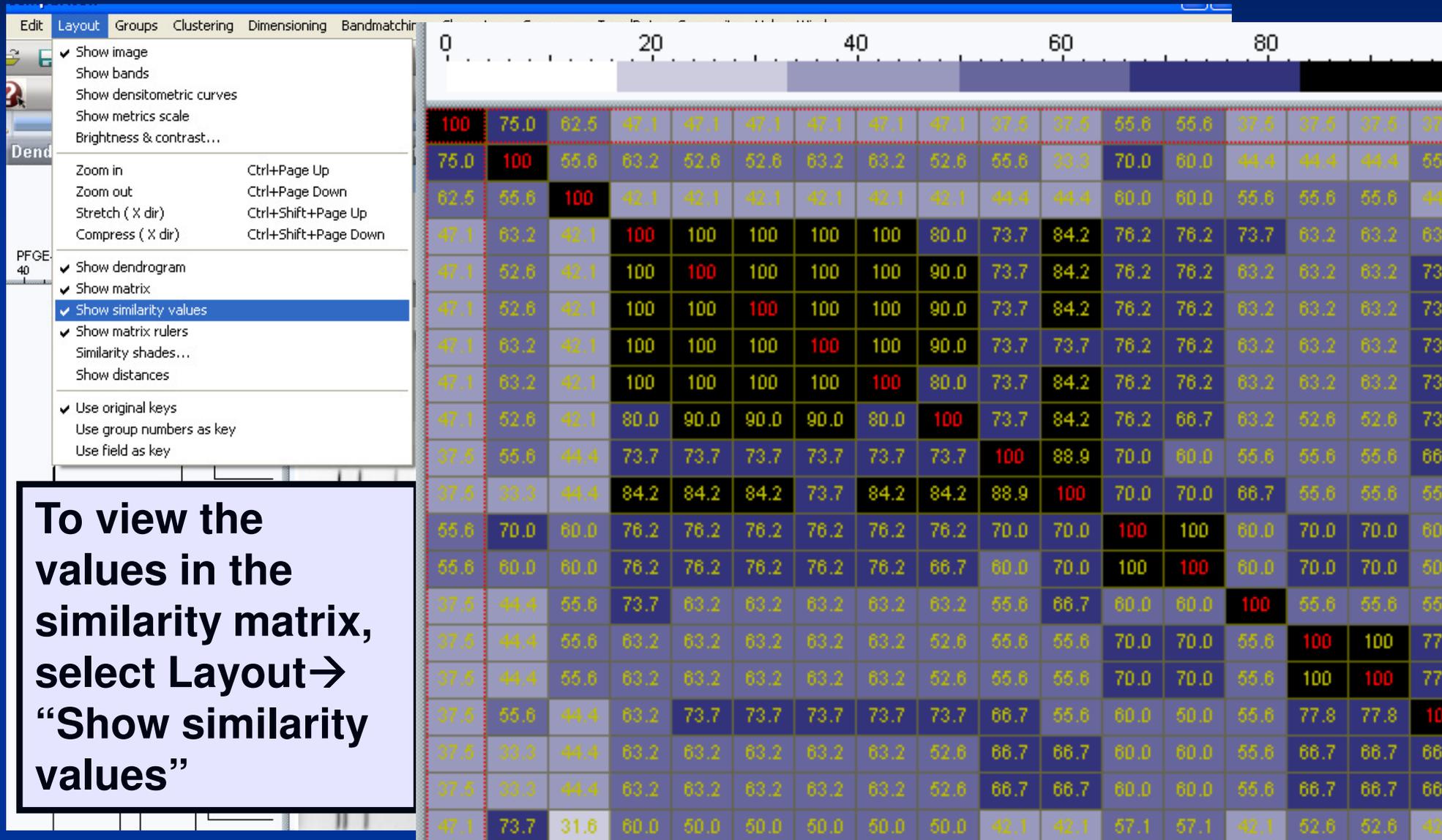
# Dendrograms: cluster cutoffs



To quickly view clusters, select **Clustering** → **“Calculate cluster cutoff values”**

**Solid lines** indicate clusters and **dashed lines** link different clusters

# Dendrograms: similarity matrix



# Comparisons: Print

Click "Show print preview"

Note: recommend changing your layout first to only show those fields you want printed

Index	SourceState	Serotype
1	A AK	Heidelberg
2	A AK	Heidelberg
3	A AK	Heidelberg
4	A AK	Heidelberg
5	A AK	Heidelberg
6	A AK	Heidelberg
7	A AK	Heidelberg
8	A AK	Heidelberg
9	A AK	Heidelberg
10	A AK	Heidelberg
11	A AK	Heidelberg
12	A AK	Heidelberg
13	A AK	Heidelberg
14	A AK	Heidelberg
15	A AK	Heidelberg
16	A AK	Serotype pending
17	A AK	Heidelberg
18	A AK	Serotype pending
19	A	Heidelberg
20	A AK	Heidelberg

# Comparisons: Print

Comparison print preview

File Edit Layout Window

- Enlarge image size
- Reduce image size
- Use colors
- Show similarity matrix
- Show comparison information
- Show field names

Overview

Print preview

Go to Layout → Show field names to turn these on

Use nodes to move columns

. AK	Heidelberg	JFS-01.0122
. AK	Newport	JFS-01.0122
. AK	Heidelberg	JFS-01.0122
. AK	Heidelberg	JFS-01.0317
. AK	Heidelberg	JFS-01.0122
. AK	Heidelberg	JFS-01.0568
. AK	Heidelberg	JFS-01.0122
. AK	Heidelberg	JFS-01.0122
. AK	Heidelberg	JFS-01
. AK	Heidelberg	JFS-01
. AK	Heidelberg	JFS-01.0049
. AK	Serotype pending	JFS-01.0022
. AK	Heidelberg	JFS-01.0258
. AK	Serotype pending	JFS-01.0258
. AK	Heidelberg	JFS-01.0212
. AK	Heidelberg	JFS-01.0326
. AK	Heidelberg	JFS-01.0326
. AK	Heidelberg	JFS-01.0022
. AK	Heidelberg	JFS-01.0080
. AK	Heidelberg	JFS-01.0022

# Comparisons: Print

Use toolbar to change settings/view

Comparison print preview

File Edit Layout Window

Overview

Print preview

Shows pages

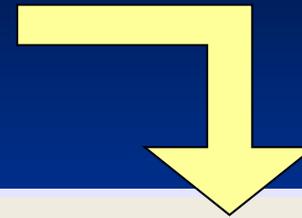
KeBouBerotype	PROE-Xbal-pattern	PROE-Xbal-clatu
. AK Heidelberg	JF6X01.D1Z2	Confirmed
. AK Heidelberg	JF6X01.D1Z2	Confirmed
. AK Heidelberg	JF6X01.D1Z2	Confirmed
. AK Heidelberg	JF6X01.D1Z2	Confirmed
. AK Heidelberg	JF6X01.D1Z2	Confirmed
. AK Newport	JF6X01.D1Z2	Unconfirmed Sex
. AK Heidelberg	JF6X01.D1Z2	Confirmed
. AK Heidelberg	JF6X01.0317	Confirmed
. AK Heidelberg	JF6X01.D1Z2	Confirmed
. AK Heidelberg	JF6X01.0568	Confirmed
. AK Heidelberg	JF6X01.D1Z2	Confirmed
. AK Heidelberg	JF6X01.D1Z2	Confirmed
. AK Heidelberg	JF6X01	Unsatisfactory
. AK Heidelberg	JF6X01	Unsatisfactory
. AK Heidelberg	JF6X01.0049	Confirmed
. AK Serotype pendl.	JF6X01.0022	Unconfirmed Sex
. AK Heidelberg	JF6X01.0258	Confirmed
. AK Serotype pendl.	JF6X01.0258	Confirmed
. Heidelberg	JF6X01.0212	Confirmed
. AK Heidelberg	JF6X01.0326	Confirmed
. AK Heidelberg	JF6X01.0326	Confirmed
. AK Heidelberg	JF6X01.0022	Confirmed

# Groups: Printing

When printing grouped isolates in a comparison, the colors will automatically change to shapes unless you choose to print in color



Use colors



CT__02032150	Typhi	JPPX01.049	
MI__08ST000498	Typhi	JPPX01.053	
VA__08-0631	Typhi	JPPX01.002	
WV__M08001411	Typhi	JPPX01.046	
LAC__Z20894	Typhi	JPPX01.056	
NY__BAC08000024...	Typhi	JPPX01.002	
NY__BAC08000024...	Typhi	JPPX01.002	
CASC_08SCPH06708	Typhi	JPPX01.045	
PA__08E00636	Typhi	JPPX01.034	
GA__08C0365113	Typhi	JPPX01.034	
HI__N08-148	Typhi	JPPX01.002	
NJ__800895	Typhi	JPPX01.022	
NYC__nyc08-100601...	Typhi	JPPX01.074	
NYC__nyc08-100601...	Typhi	JPPX01.004	
NYC__nyc08-100608...	Typhi	JPPX01.014	
NYC__nyc08-100610...	Typhi	JPPX01.002	
VA__08-0691	Typhi	JPPX01.0026	Cont
CA__M08X01512	Typhi	JPPX01.0459	Cont
NY__BAC08000028...	Typhi	JPPX01.0480	Cont
PA__08E00706	Typhi	JPPX01.0026	Cont
MO__MOENT0773-08	Typhi	JPPX01.0704	Cont

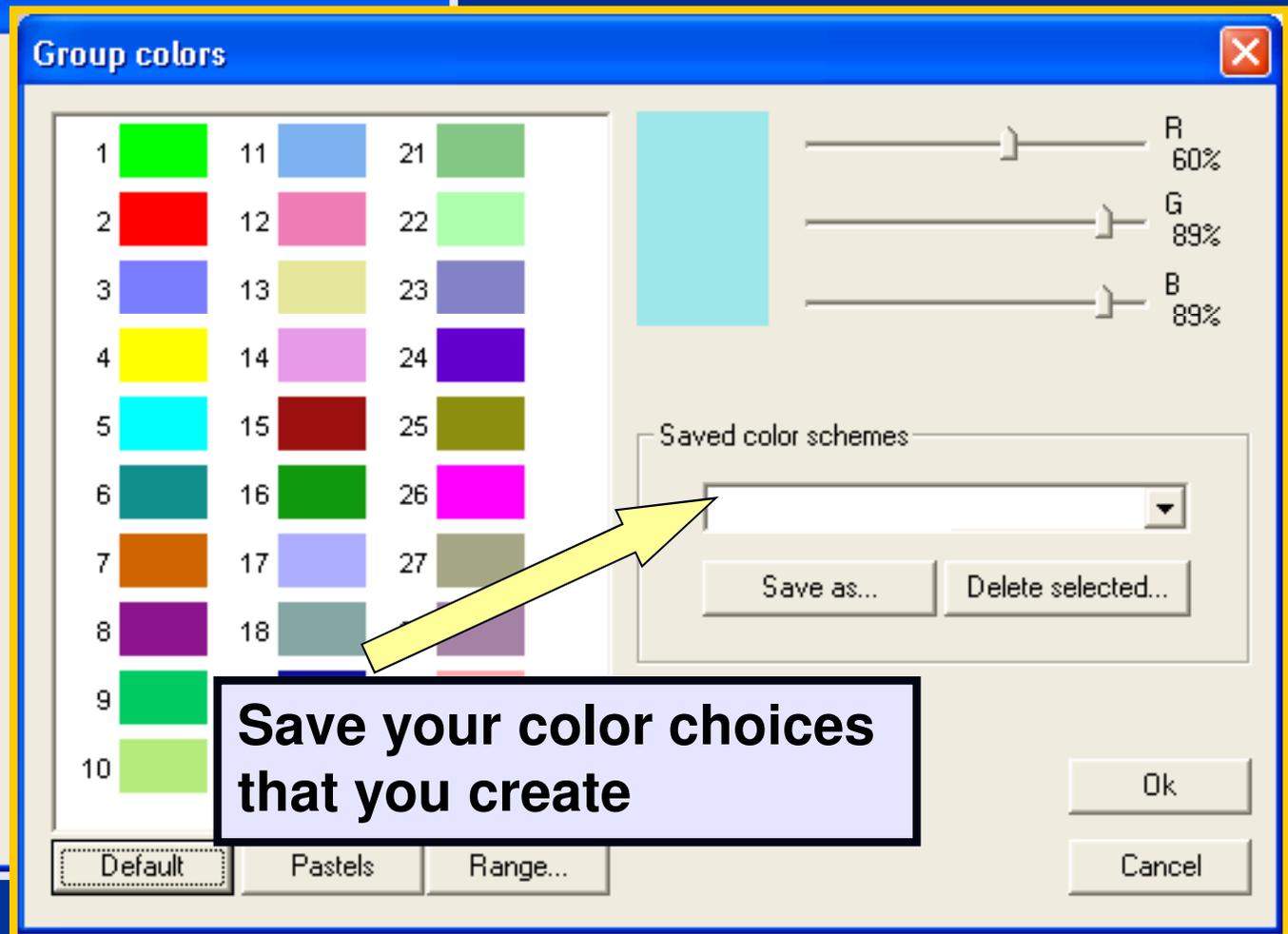
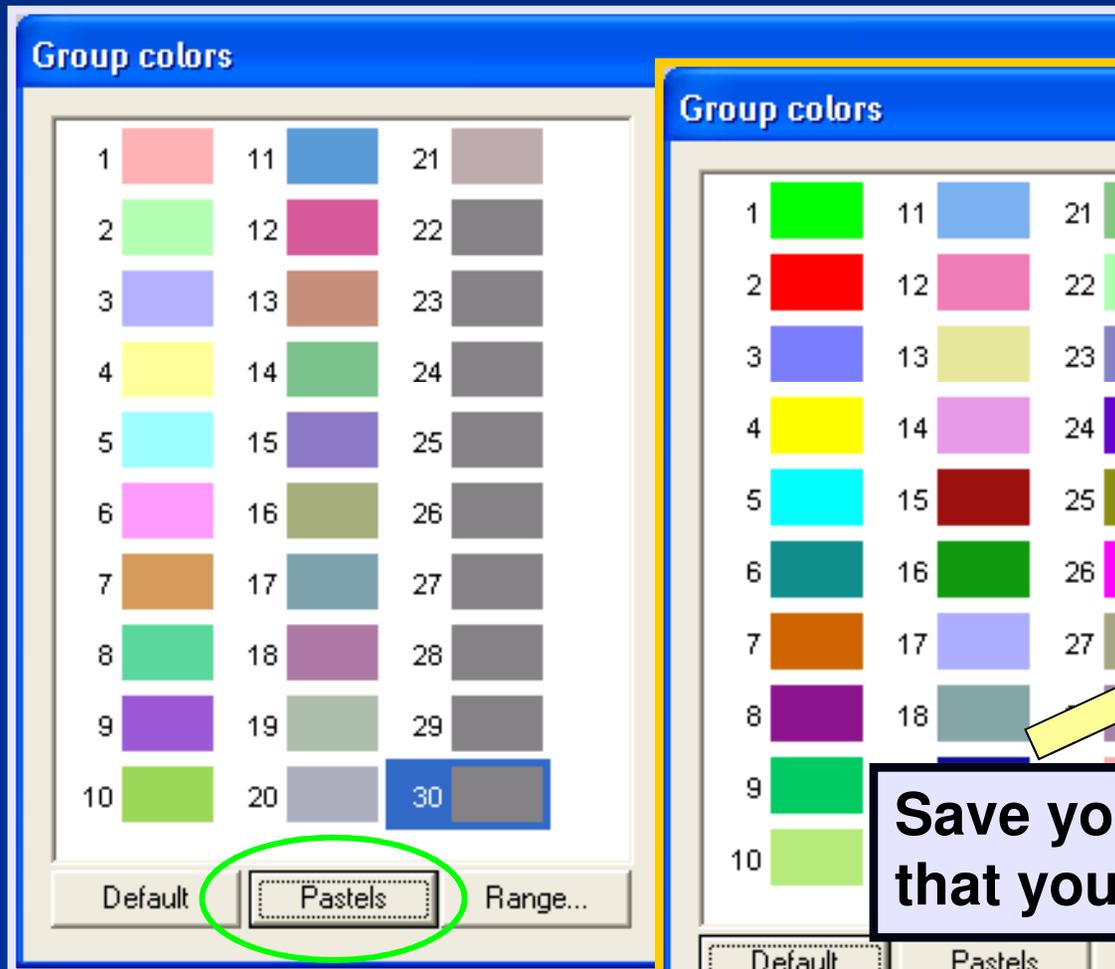
# Groups: Customizing Colors

The screenshot shows the 'Comparison' software interface. The 'Groups' menu is open, and 'Edit group colors...' is selected. The 'Group colors' dialog box is displayed, showing a grid of 30 color swatches (10 rows by 3 columns) and a 'Saved color schemes' section with 'Save as...' and 'Delete selected...' buttons. The 'Default', 'Pastels', and 'Range...' buttons are highlighted with a green box.

Group	Color 1	Color 2	Color 3
1	Red	Blue	Green
2	Yellow	Pink	Light Green
3	Purple	Light Yellow	Dark Purple
4	Cyan	Pink	Dark Purple
5	Teal	Dark Red	Olive
6	Orange	Green	Magenta
7	Purple	Light Purple	Olive
8	Green	Teal	Purple
9	Light Green	Dark Blue	Pink
10	Light Green	Red	Light Blue

**Under edit group colors, you can change the tone of each color from default or change entirely to “pastels.” You can also choose to do a color gradient with “range.”**

# Groups: Customizing Colors



# Comparisons: Compare Two Entries

The screenshot shows the BioNumerics software interface. The 'Comparison' menu is open, and the 'Compare two entries' option is highlighted. A yellow arrow points from the 'Compare two entries' option in the menu to the first two rows of the 'Database entries' table. The table has columns for 'Index', 'Key', and 'LabID'. The first two rows are highlighted in orange, indicating they are selected.

Index	Key	LabID
1	07-65...	
2	07-65...	
3	FL 352	
4	0001...	USA
5	0001...	USA
6	01E0...	USA
7	03X0...	
8	07-03...	USA
9	07-180	USA
10	07-271	USA
11	07-287	USA

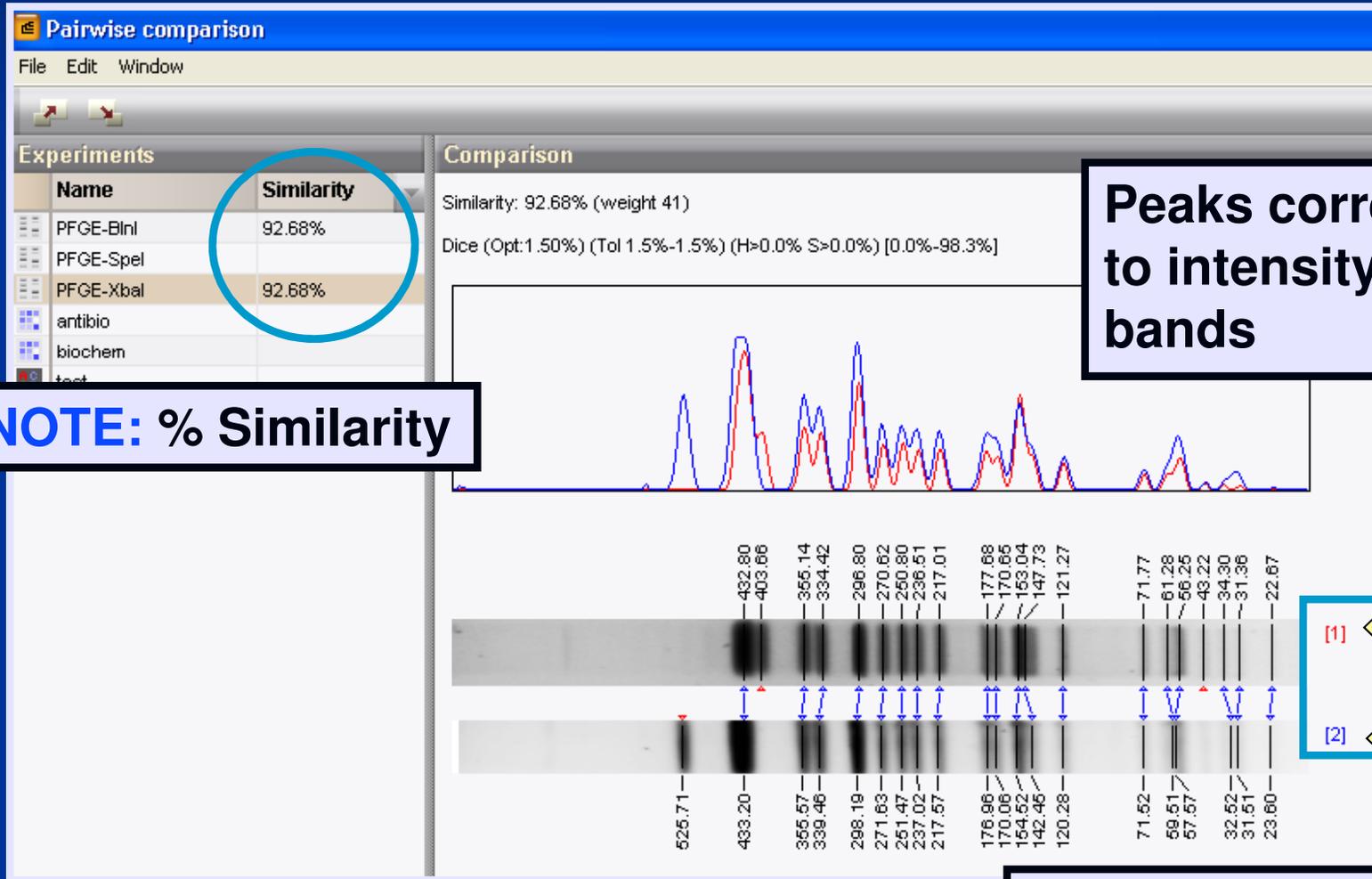
Database: Ecoli-client | 8114 entries | 6 experiments | \vcdc\project\CCID\_NCZVED\_DFBMD\_PulseNet\Data\Ecoli-client

**1. Select two isolates in your database to compare**

**2. Select “Compare two entries” from comparison menu**

# Comparisons: Compare Two Entries

Also called a Pairwise comparison or 2x2 comparison



# Advanced Queries: Components

**BioNumerics**

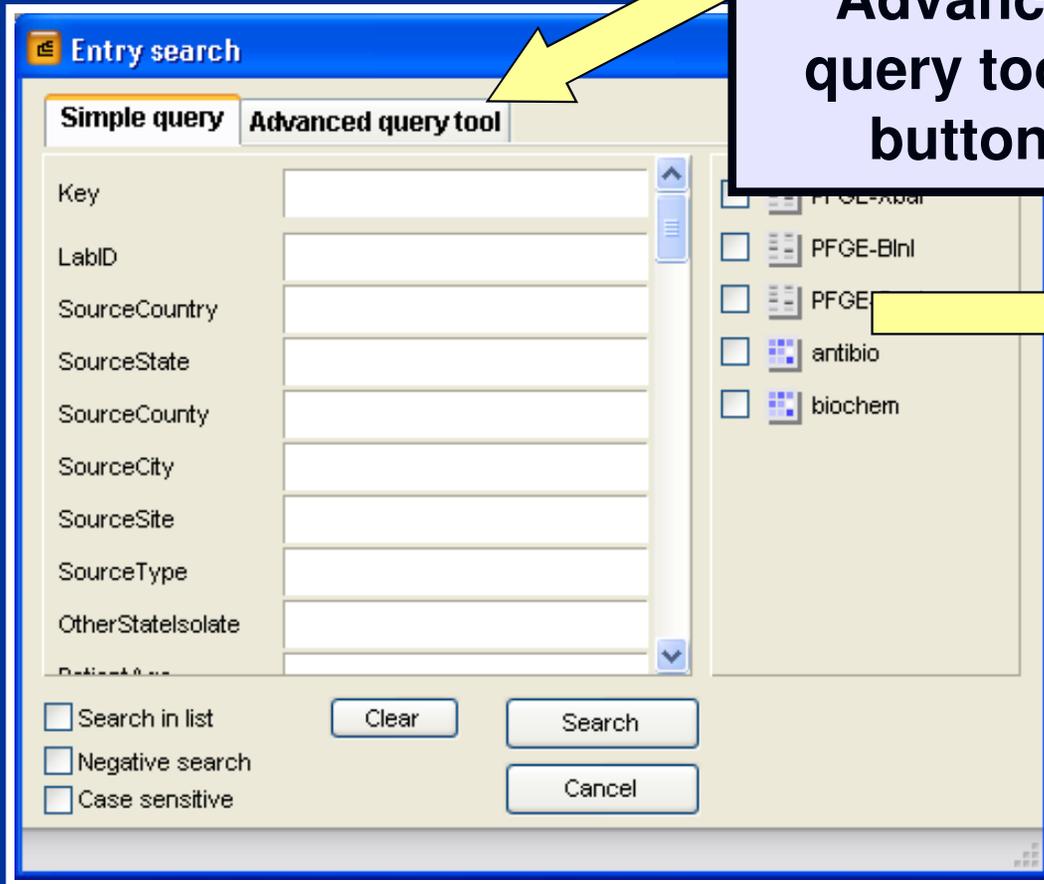
File Edit Database Subsets Experiments Comparison Identification Scripts Window

Search & select database

Key	LabID	SourceCountry	SourceState	1	2	3	4	5
AL__AL-8002391-06	AL__	USA	AL					
AL__AL-8002392-06	AL__	USA	AL					
AL__AL-8002394-06	AL__	USA	AL					
AL__AL-8002395-06	AL__	Canada	AL					
AL__AL-8002397-06	AL__	USA	AL					
AL__AL-8002441-06	AL__	USA	AL					
AL__AL-8002442-06	AL__	USA	AL					
AL__AL-8002443-06	AL__	USA	AL					
AL__AL-8002444-06	AL__	USA	AL					
AL__AL-8002445-06	AL__	USA	AL					
AL__AL-8002446-06	AL__	USA	AL					
AL__AL-8002447-06	AL__	USA	AL					
AL__AL-8002462-06	AL__	USA	AL					

Click the search icon in the BioNumerics main window.

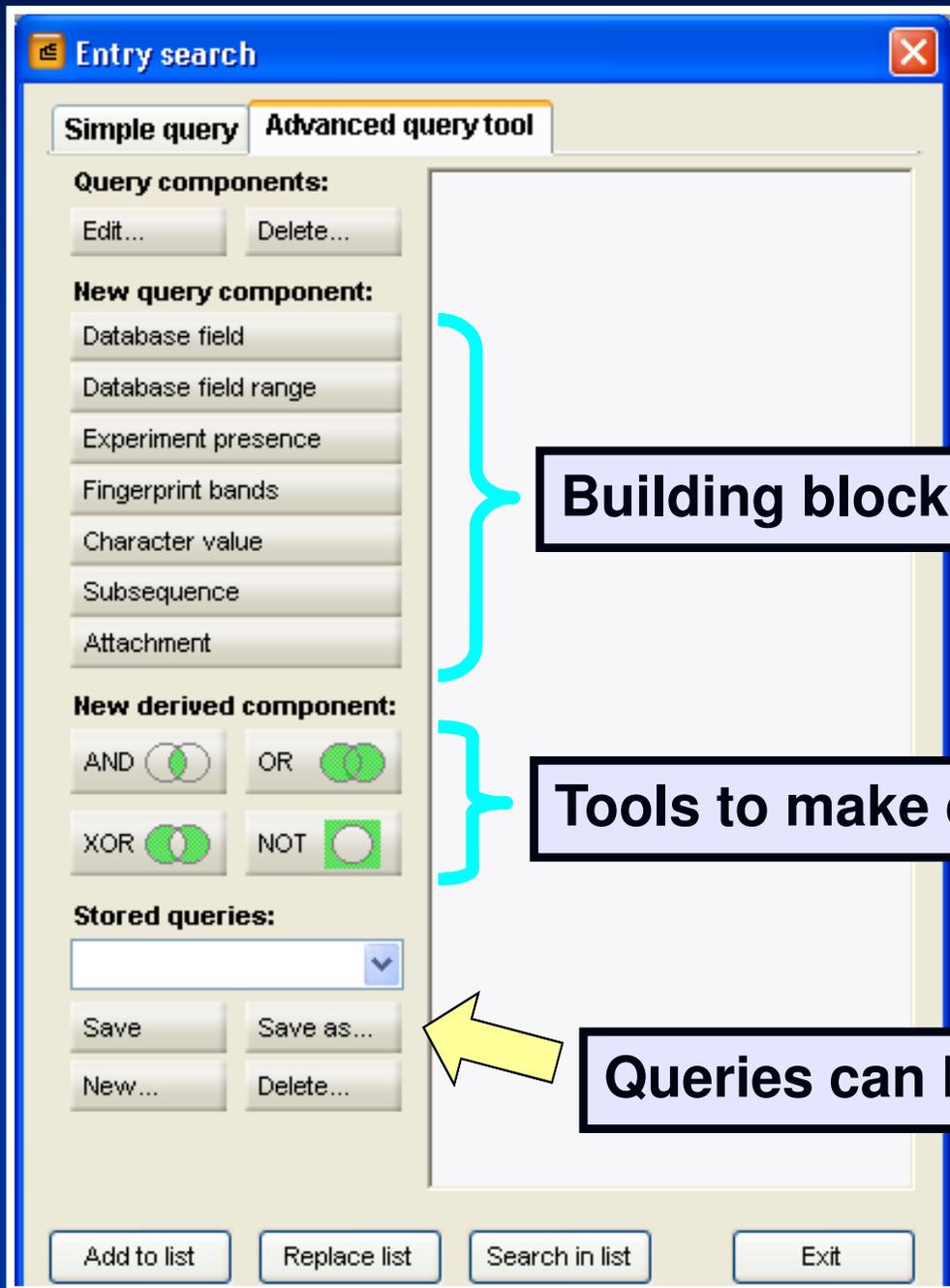
# Advanced Queries: Components



Select the  
"Advanced  
query tool"  
button



# Advanced Queries: Components



Building blocks of the query

Tools to make composite queries

Queries can be stored/saved/deleted

# Advanced Queries: Components

**Entry search**

Simple query | **Advanced query tool**

**Query components:**

Edit... Delete...

**New query component:**

- 1 Database field
- 2 Database field range
- 3 Experiment presence
- 4 Fingerprint bands
- 5 Character value
- 6 Subsequence
- 7 Attachment

**Database field search**

Search for:

In field:

Case sensitive

Regular expression

Cancel

1) Search in a specific field or in any field

**Database field range**

Select entries where field

is between

and

Case sensitive

Numerical values

OK

Cancel

2) Search a range  
Ex: date range

3) Search for the presence of an Experiment type

**Experiment presence**

Select entries for which the experiment

is present

OK

Cancel

# Advanced Queries: Components

**Entry search**

Simple query | **Advanced query**

**Query components:**

Edit... Delete...

**New query component:**

- 1 Database field
- 2 Database field range
- 3 Experiment presence
- 4 Fingerprint bands
- 5 Character value
- 6 Subsequence
- 7 Attachment

**Fingerprint band presence**

Fingerprint experiment: [Dropdown]

Target range: 0.00 - 100.00  
Normalised run length (%) [Dropdown]

Intensity filter: Band height [Dropdown]

between [Input] and [Input]

Number of bands present: Min. 1 Max. [Input]

Cancel OK

4) Search for presence of bands w/range of molecular weights

**Character value**

Experiment: [Dropdown]

Character: < All > [Dropdown]

Min. value: 0.00 [Input] OK [Button]

Max. value: 0.00 [Input] Cancel [Button]

5) Search in your character types (i.e. antibio, biochem)

# Advanced Queries: Components

**Entry search**

Simple query | **Advanced query tool**

**Query components:**

Edit... Delete...

**New query component:**

- 1 Database field
- 2 Database field range
- 3 Experiment presence
- 4 Fingerprint bands
- 5 Character value
- 6 Subsequence
- 7 Attachment

**Subsequence**

Experiment: [dropdown]

Search string: [text input]

Maximum number of mismatches allowed: 0 [spinners]

Allow gaps in sequence

Allow gaps in search string

Accept IUPAC codes

OK Cancel

6) Search for a specific subsequence in a sequence type experiment (if you have these)

7) Search within attachments that are linked to database entries

**Attachment search**

Attachment type: <All> [dropdown]

Search text: [text input]

In description

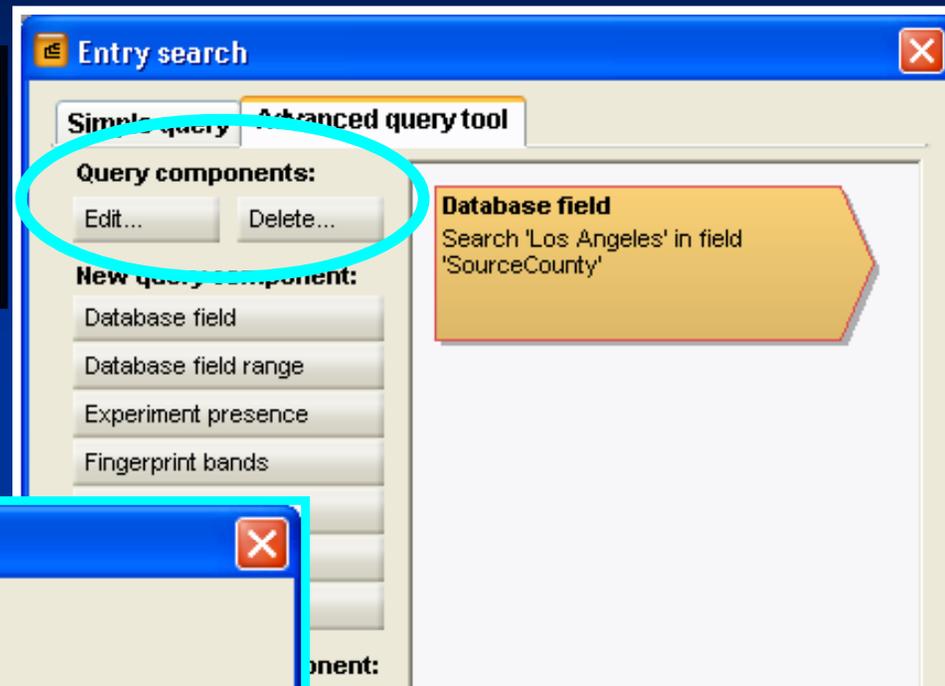
In text

Case sensitive

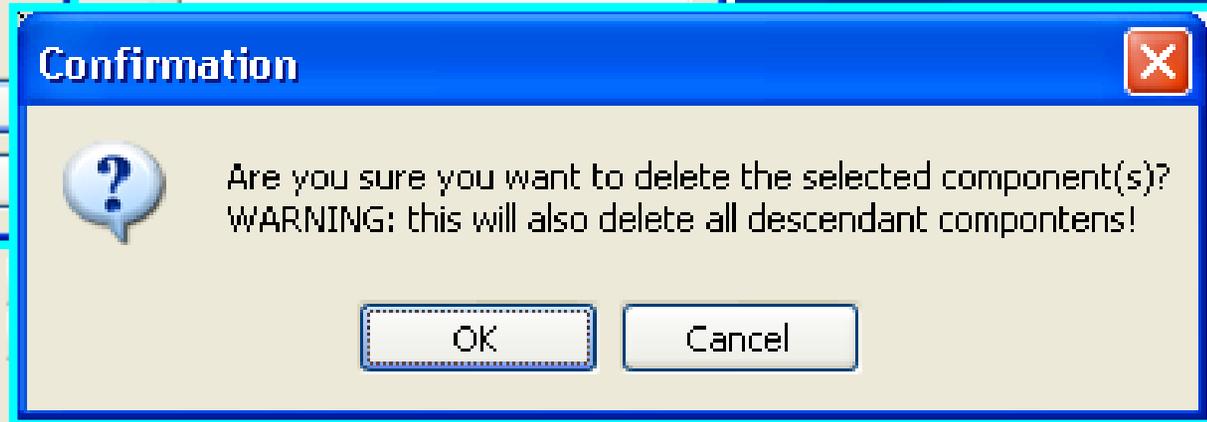
OK Cancel

# Advanced Queries: Editing Components

You can edit or delete any of the components on the right-hand side



“Edit” opens the Component



“Delete” opens a confirmation window

# Advanced Queries: Logical Operators

**Entry search**

Simple query | **Advanced query tool**

**Query components:**  
Edit... Delete...

**New query component:**  
Database field  
Database field range  
Experiment presence  
Fingerprint bands  
Character value  
Subsequence  
Attachment

**New derived component:**  
AND OR  
XOR NOT

**Database field**  
Search 'Los Angeles' in field 'SourceCounty'

**Stored queries:**  
Save Save as...  
New... Delete...

Add to list Replace list Search in list Exit

**Logical Operators link Components together**

AND OR  
XOR NOT

AND

All conditions must be met

OR

At least 1 component should be fulfilled

XOR

Exactly 1 condition from components should be fulfilled

NOT

Condition will be inverted for component

# Advanced Queries: Saving

**Entry search**

Simple query | **Advanced query tool**

**Query components:**  
Edit... Delete...

**New query component:**  
Database field  
Database field range  
Experiment presence  
Fingerprint bands  
Character value  
Subsequence  
Attachment

**New derived component:**  
AND OR   
XOR NOT

**Stored queries:**  
[Dropdown menu]  
Save Save as...  
New... Delete...

Add to list Replace list Search in list Exit

“Save” or “Save as...” allows you to save your query

**Save query**

Enter a name for this query:

OK

Cancel

“New” or “Delete” will reset the current query

**Confirmation**



Are you sure you want to reset the contents of the current query?

OK

Cancel

# Advanced Queries

## Example 1: County and Date Range

Search for isolates from “Los Angeles” county that were uploaded in May - June 2009

The screenshot shows the 'Entry search' application window. The 'Advanced query tool' tab is active. Under 'New query component', 'Database field' is selected, indicated by a yellow arrow. The 'Database field search' dialog is open, showing 'Search for: Los Angeles' and 'In field: SourceCounty'. The dialog also has checkboxes for 'Case sensitive' and 'Regular expression', and 'OK' and 'Cancel' buttons.

1. Click “Database field”

2. Enter search string [cannot use a wildcard (\*)] and select “SourceCounty”

# Advanced Queries

## Example 1: County and Date Range

Entry search

Simple query **Advanced query tool**

Query components:  
Edit... Delete...

New query component:  
Database field  
Database field range  
Experiment presence  
Fingerprint bands  
Character value  
Subsequence  
Attachment

New derived comp  
AND OR  
XOR NOT

Stored queries:  
Save Save  
New... Delete...

Add to list Replace list Search in list Exit

**Database field**  
Search 'Los Angeles' in field 'SourceCounty'

Select entries where field  is between  and   
 Case sensitive  
 Numerical values  
OK  
Cancel

1. Select "Database field range"

2. Select "UploadDate" and fill in date range  
NOTE: date format

# Advanced Queries

## Example 1: County and Date Range

Entry search

Simple query **Advanced query tool**

**Query components:**  
Edit... Delete...

**New query component:**  
Database field  
Database field range  
Experiment presence  
Fingerprint bands  
Character value  
Subsequence  
Attachment

**New derived component:**  
AND  OR   
XOR

**Database field**  
Search 'Los Angeles' in field 'SourceCounty'

**Database field range**  
'UploadDate' is between '2009-05-01' and '2009-06-30'

**AND**

**Stored queries:**  
[Dropdown menu]  
Save Save as...  
New... Delete...

Add to list Replace list

1. Select both using CTRL + mouse click

2. Press "AND"

3. Press "Replace list" to start the query

# Advanced Queries

## Example 2: Experiment Presence

Need to report all *Xbal*'s that were done from July 1, 2008 – June 30, 2009 for ELCs

**Entry search**

Simple query **Advanced query tool**

**Query components:**  
Edit... Delete...

**New query component:**  
Database field  
Database field range  
Experiment presence  
Fingerprint bands  
Character value  
Subsequence  
Attachment

**New derived component:**  
AND OR  
XOR NOT

**Stored queries:**  
Save Save as...  
New... Delete...

**Database field range**  
'UploadDate' is between  
'2008-07-01' and '2009-06-30'

**Experiment presence**  
Select entries for which the experiment  
PFGE-Xbal  
is present  
OK  
Cancel

Add to list Replace list Search in list Exit

1. Select Date Range

2. Select "Experiment Presence"

3. Choose PFGE-Xbal

# Advanced Queries

## Example 2: Experiment Presence

Entry search

Simple query **Advanced query tool**

**Query components:**  
Edit... Delete...

**New query component:**  
Database field  
Database field range  
Experiment presence  
Fingerprint bands  
Character value  
Subsequence  
Attachment

**New derived component:**  
AND  OR   
XOR  NOT

**Stored queries:**  
[Dropdown]  
Save Save as...  
New... Delete...

**Database field range**  
'UploadDate' is between '2008-07-01' and '2009-06-30'

**Experiment presence**  
Experiment 'PFGE-XbaI' is present

**AND**

Add to list Replace list Search in list Exit

Select both components  
and choose "AND"

# Advanced Queries

## Example 3: Multiple Serotypes and Date

Search for all *Salmonella* Typhimurium/var Copenhagen and I 4,[5],12:i:- isolates uploaded in 2008

The screenshot shows a query builder interface with the following sections:

- Query components:** Edit... Delete...
- New query component:** Database field, Database field range, Experiment presence, Fingerprint bands, Character value, Subsequence, Attachment.
- New derived component:** AND, OR, XOR, NOT.
- Stored queries:** A dropdown menu.
- Buttons:** Save, Save as..., New..., Delete...

A yellow arrow points from the 'Database field' option in the 'New query component' list to a callout box that says 'Select "Database field"'. A blue-bordered dialog box titled 'Database field search' is open, showing 'Typhimurium' in the 'Search for:' field and 'Serotype' in the 'In field:' dropdown. There are checkboxes for 'Case sensitive' and 'Regular expression', and 'OK' and 'Cancel' buttons.

Select "Database field"

### Database field search

Search for: Typhimurium

In field: Serotype

Case sensitive

Regular expression

OK

Cancel

Add 3 Serotype components: Typhimurium, Typhimurium var. O 5 - (Copenhagen), I 4,[5],12:i:-  
NOTE: using the Entry Properties screen will assure that search results are accurate

# Advanced Queries

## Example 3: Multiple Serotypes and Date

The screenshot shows the 'Entry search' application interface. The 'Advanced query tool' tab is active, displaying a list of query components. Two components are visible: 'Database field' (Search 'Typhimurium' in field 'Serotype') and 'Database field' (Search 'Typhimurium var. O 5 - (Copenhagen)' in field 'Serotype'). A yellow arrow points from the 'Database field range' option in the 'New query component' list to the first component. A second yellow arrow points from the 'Database field range' dialog box to the first component. The dialog box is titled 'Database field range' and contains the following fields: 'Select entries where field' (UploadDate), 'is between' (2008-01-01), and 'and' (2008-12-31). There are also checkboxes for 'Case sensitive' and 'Numerical values', and 'OK' and 'Cancel' buttons.

1. Select "Database field range"

2. Select "UploadDate"

3. Fill in the range

# Advanced Queries

## Example 3: Multiple Serotypes and Date

**Entry search**

Simple query **Advanced query tool**

**Query components:**  
Edit... Delete...

**New query component:**  
Database field  
Database field range  
Experiment presence  
Fingerprint bands  
Character value  
Subsequence  
Attachment

**New derived component:**  
AND  OR   
XOR  NOT

**Stored queries:**  
Save Save as...  
New... Delete...

**Database field**  
Search 'Typhimurium' in field 'Serotype'

**Database field**  
Search 'Typhimurium var. O 5 - (Copenhagen)' in field 'Serotype'

**Database field**  
Search '14,[5],12:i:-' in field 'Serotype'

**Database field range**  
'UploadDate' is between '2008-01-01' and '2008-12-31'

1

OR

Add to list Replace list Search in list Exit

**Entry search**

Simple query **Advanced query tool**

**Query components:**  
Edit... Delete...

**New query component:**  
Database field  
Database field range  
Experiment presence  
Fingerprint bands  
Character value  
Subsequence  
Attachment

**New derived component:**  
AND  OR   
XOR  NOT

**Stored queries:**  
Save Save as...  
New... Delete...

**Database field**  
Search 'Typhimurium' in field 'Serotype'

**Database field**  
Search 'Typhimurium var. O 5 - (Copenhagen)' in field 'Serotype'

**Database field**  
Search '14,[5],12:i:-' in field 'Serotype'

**Database field range**  
'UploadDate' is between '2008-01-01' and '2008-12-31'

2

OR

AND

Add to list Replace list Search in list Exit

1. Select all 3 Database field boxes and choose "OR"
2. Select "OR" and Database field range box and choose "AND"

# Advanced Queries

## Example 4: Multiple Values

Search for all non-human *Salmonella* Typhimurium isolates uploaded in 2009 with an *Xba*I experiment file.

**Entry search**

**Simple query** **Advanced query tool**

**Query components:**  
Edit... Delete...

**New query component:**  
Database field  
Database field range  
Experiment presence  
Fingerprint bands  
Character value  
Subsequence  
Attachment

**New derived component:**  
AND OR   
XOR NOT

**Stored queries:**

**Database field**  
Search 'Typhimurium' in field 'Serotype'

**Database field**  
Search 'Human' in field 'SourceType'

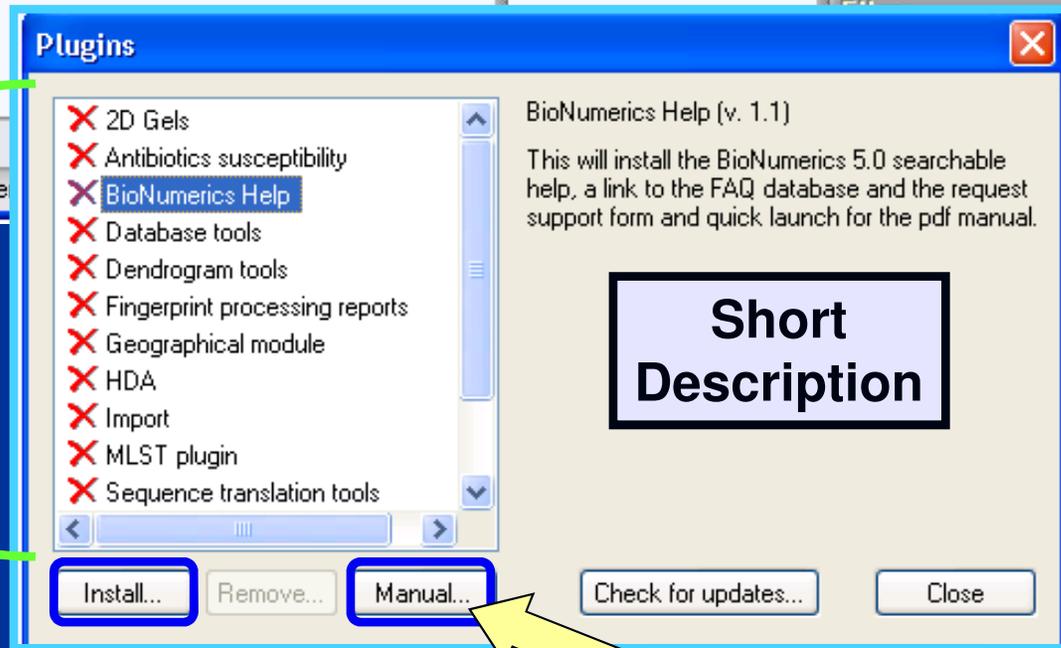
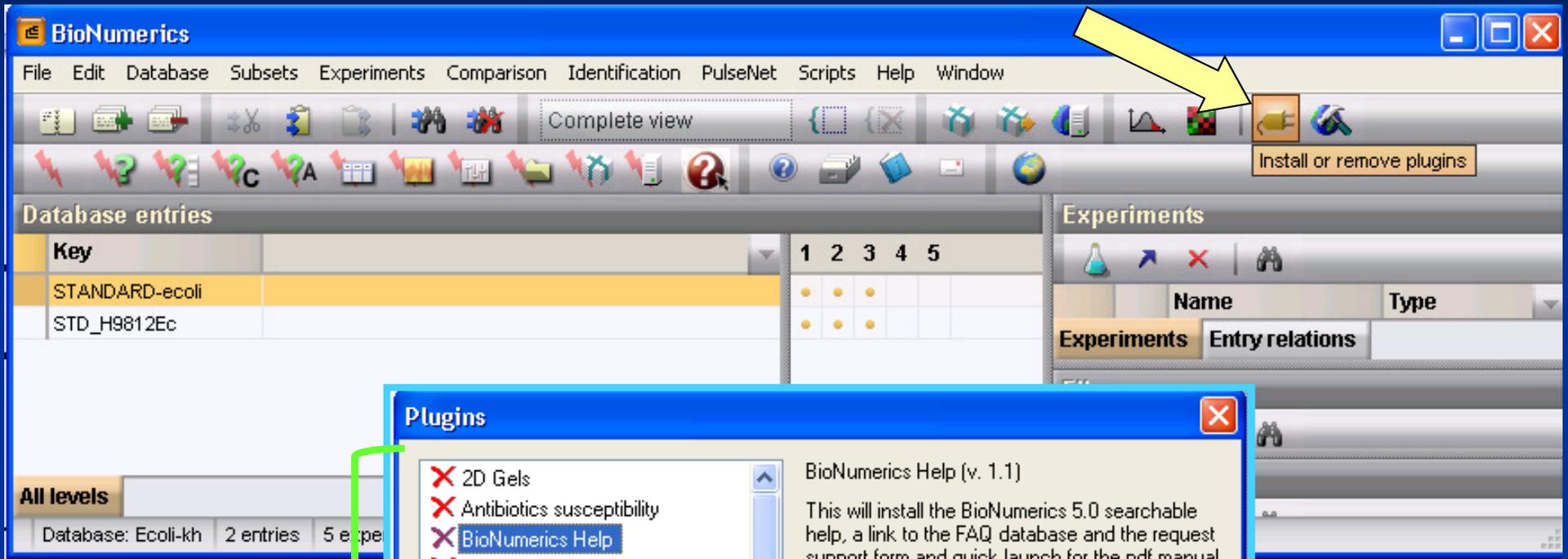
**Database field range**  
'UploadDate' is between '2009-01-01' and '2009-12-31'

**Experiment presence**  
Experiment 'PFGE-XbaI' is present

**NOT**

**AND**

# Plugins



# Plugins

## BioNumerics Plugin Tools

The **Plugin Tools** offer a wide variety of additional useful tools to the BioNumerics software, provided as a service by Applied Maths. The plugin tools are based on the powerful BioNumerics **script** language, which makes it possible for the user to customize them according to personal needs. They can be run directly from the Applied Maths website, or can be downloaded to the local BioNumerics script folder. To download scripts, press the  in the button toolbar of this window.

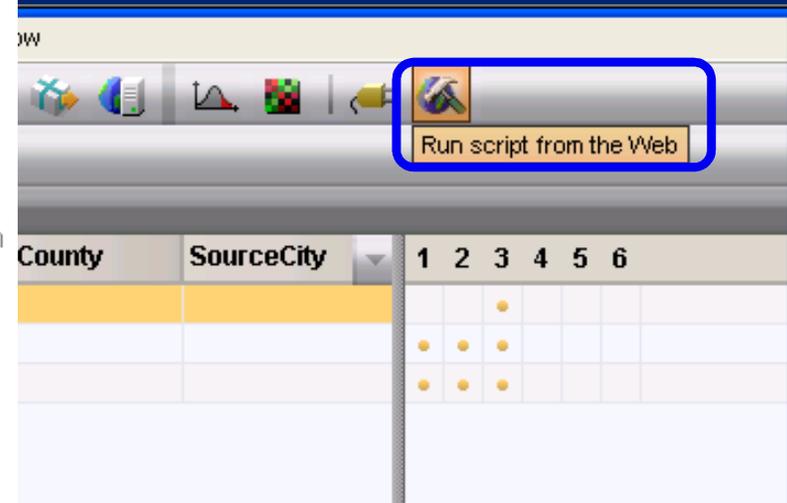
You are free to run and/or download these tools for personal use, and modify the scripts as needed. **Redistribution or reproduction of the plugin tools by any means is prohibited.**

Each plugin tool is provided "as is" and with no further liability or guarantee from Applied Maths. Any consequences that may arise from the use of these tools are at your own responsibility.

*Please select from the following categories:*

- BioNumerics Online Help
- Database related tools
- Fingerprint related tools
- Sequence related tools
- Library and Identification tools
- Comparison tools
- Typing techniques
- Import tools
- Export tools
- Queries
- Miscellaneous

**Available  
Categories**



# Plugins

- Can install plugins when installing a new database—suggest reading about them before installing
- Can provide useful tools
- Recommend trying the plugin out on either a “dummy” or test database or a copy of a database to see how it really works

# Questions?



**Thank you for your attention**  
The findings and conclusions in this presentation are those of the author and do not necessarily represent the views of the Centers for Disease Control and Prevention