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Particular example

BioWes

www.biowes.org

Project supported by the Technology Agency of the
Czech Republic



Technology Agency
of the Czech Republic

... from ideas to applications

Example description



- This particular example demonstrates individual steps of BioWes system usage. Its advantages in comparison with current systems of experimental work and management of experimental data and metadata.
- The guide introduce basic functionality of the system. The detail description of individual functions and procedures is available in the help.

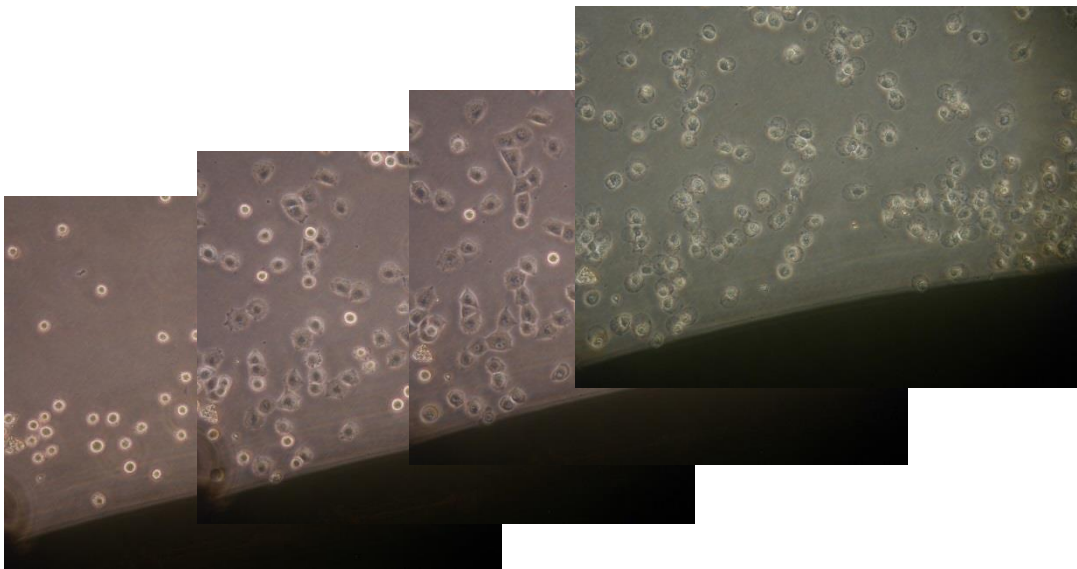
Biocompatibility of materials:

- The aim of the biocompatibility experiment is to determine how the human body will react to the new material (dental implant).
- The first method of biocompatibility evaluation used before clinical tests is the tissue cells growth in the contact with the material.
- The method is based on the evolution of cell colony growth in defined time interval.(1-2 days).
 - The cells are put directly on the material inserted into the leachate of the material
 - Time lapse microscopy is used for the monitoring of cell activity. It produces series of images in given time intervals (2 minutes)
 - The expert analysis of cell behavior during time defines cytotoxicity level.
 - 0 – non toxic - cells are in contact with the material
 - 1 – weakly toxic – any is in the contact with material
 - 2 – middle toxic – there is zone of dead cells near the material - 30 um minimum
 - 3 – toxic – the cells are dead around the material
- Several settings of experiment can influence the results
 - CO2 concentration
 - temperature
 - Cultivation medium
 - etc.

Particular example



- Investigation of bio compatible materials:
 - The sample of the material can be prepared in a different manner. This method of preparation may affect the results of the experiment and therefore must be included in the description of the experiment and method of sample preparation.
 - From the perspective of reproducibility it is necessary to capture all the variables that can influence the behavior of cells in the protocol of the experiment. All of these variables must be described in the protocol of the experiment



- Sample images from the time-collection microscopy

The procedure



The procedure of preparation, measurements (obtained experimental data and metadata) and subsequent manipulation of data can be summarized into the following steps:

1. Creating a user account to access the system
2. Create experimental protocol
3. Execution of a particular measurement
4. Evaluation of measurement
5. Sharing data and metadata for further analysis of the results

The classic approach



The classical approach of performing experiments and data manipulation includes the following specific implementation of the main steps:

1. Create experimental protocol

1. Build a paper version of the experiment (typically Word document)

- The use of standards is limited to knowledge of terminology
- Unable to create Help for people conducting experiments in the form of preferences (the type of microscope)
- Reusability of protocol is limited mostly to the person who created the protocol (protocols are not shared)

2. Execution of a particular measurement

1. The experimenter performed according to the protocol experiment, experiment and experiment setup fills in the protocol

- The person conducting the experiment need not fill in all the information necessary for repeatable experiments
- Information provided by the measuring device must be manually added to the protocol
- Protocols (eg, supporting protocol for sample preparation) can only link the identification numbers - you need to search these logs manually

2. The measured data are not physically linked to the measurement protocols (data are stored on a computer connected to the meter or stored in a shared folder with restricted access without the hierarchy)

3. Analysis of measurement

1. Data must be analyzed where they are stored or transferred (email, data file storage, sharing disk space)

2. Cooperation of more people to the analysis is complicated

4. Sharing data and metadata for further analysis of the results

1. Sharing and data search is complicated due to their heterogeneous storage, the terminology used and the separate storage of data and metadata

Use of BioWes for experimentation and manipulation includes the following specific implementation of the main steps:

1. Creating experimental protocol

1. Electronic model protocol - electronic version of the experiment, stored in the database
 - Graphic design using predefined components
 - Easy to use standardized terminology as a "whisperer"
 - The definition of preferences for each user input (usual input s - type of microscope, magnification)
 - Save the log in the database allows for easy re-use

2. Execution of a particular measurement

1. The experimenter conducting an experiment using protocol template and completed the experiment setup by software
 - Software ensures completion of all relevant information in terms of repeatability
 - The possibility to automatically retrieve data from the measuring devices
 - Linking protocol with other supporting protocols
2. The measured data are physically linked to the protocol. All the experiments are stored in the database together

3. Evaluation of measurement

1. Easy sharing of experimental data or metadata
2. Cooperation of more people is simple

4. Sharing data and metadata for further analysis of the results

1. Sharing and retrieval of data is available through the web interface of the local database and allows easy collaboration and re-usability of metadata

Division of the system



The BioWes system is accessible through two basic access points

- Protocol manager (requires installation on local computer)
 - Provides access to the local database
 - Provides the creation of protocol templates, execution of a specific experiment and interconnection of experiments
 - It provides further analysis of experimental data using data-mining modules
- Web interface - local
 - Platform-independent access to the local database
 - Allows viewing of experimental data and metadata
 - Allows sharing of experimental data and metadata, and setting access permissions
 - Allows to search in metadata of the experiments

Protocol Manager



The screenshot shows the 'Protocol Templates' window in BioWES. The interface includes a navigation pane on the left with 'Protocols', 'Protocol templates', and 'Protocol Groups'. The main area displays a table of protocols. Red callouts provide the following information:

- Menu for work with protocols:** Points to the 'Protocol Templates' menu item in the top navigation bar.
- Menu for managing protocols and templates:** Points to the 'Protocol templates' folder icon in the left navigation pane.
- Basic information about protocols:** Points to the 'Name', 'Description', 'Author', and 'Last Change' columns of the table.
- Finalized protocol flag:** Points to a green checkmark icon in the first column of the table.
- The list of protocols available for the user:** Points to the entire list of protocol rows in the table.

	Name	Description	Author	Last Change
✖	crayfish-data recoding		cisar@frov.jcu.c...	2014-10-07 09:53
✔	Biocompatibility		cisar@frov.jcu.cz	2014-10-08 14:06
✔	Biocompatibility - cell segmentation		cisar@frov.jcu.cz	2014-10-08 13:59
✔	Cytotoxicita		cisar@frov.jcu.cz	2014-10-07 13:33
✖	LTK-biostation		cisar@frov.jcu.cz	2014-10-07 09:58
✔	LTK-cell preparation		cisar@frov.jcu.cz	2014-10-08 13:48
✔	Biocompatibility - report		cisar@frov.jcu.cz	2014-10-08 13:48
✔	Biocompatibility - contract		cisar@frov.jcu.cz	2014-10-08 13:50
✔	Biocompatibility_fixed		cisar@frov.jcu.cz	2014-10-08 14:13
✔	Biocompatibility_fixed1	Added information about measurement	cisar@frov.jcu.cz	2014-10-08 14:22
✔	Biocompatibility_fixed2	Corrected image sample	cisar@frov.jcu.cz	2014-10-08 14:25
✔	test-Oct-8-2014	test	dsoloviov@fro...	2014-10-08 15:00
✔	Test - Fish color analysis		abarta@frov.jc...	2014-10-08 16:15

Record 1 of 13

Creating a protocol template



The process of creating a protocol requires expert knowledge of the experiment. The experiment is divided into logical parts (material description, a description of the sample, a description of the microscope, a description of data acquisition). The variables that need to be monitored during the experiment are identified for each part of the experiment and their values are recorded.

1. The user creates a new protocol template (modifies the existing model of the protocol) using the software Protocol manager
2. User will design a protocol template using a graphics application Protocol designer
3. The user saves a protocol template to the database
4. User shares protocol template to colleagues for final inspection and finalization (lock of template)

Creating a Bio – compatibility protocol template



- In Bio-compatibility experiment it is needed to record data about the material, microscopic specimen, the microscope settings and properties of the scanning
- For this reason, the protocol template is divided into four logical parts
- Terminology in the field of bio-compatibility is included in the ontology of Eagle-I Research Resource Ontology, available via the portal - Bioportal - the standard was connected and used to design of the protocol template using the software
- Some of the information of scanning images of cells can be retrieved by using a specialized plug-ins directly from the image itself and it is in this format protocol template plug-in used

Creating a Bio – compatibility protocol template



The screenshot shows the 'Template Designer' application window. The title bar reads 'Template Designer' and 'Bio compatibility - BioWES'. The ribbon includes 'Home' and 'Template Designer' tabs. The 'Home' ribbon contains icons for 'Load', 'Save to file', 'Save to database', 'Finalize', and 'Clone'. The 'Template Designer' ribbon contains icons for 'Terminology Standardization', 'View protocol', and 'Setting'. Below the ribbon, there are tabs for 'Protocol Templates' and 'Bio compatibility'. The main workspace is divided into several sections:

- Protocol controls:** A list of components including Groupbox, Buttons, Number, Date/Time, Checkbox, Image, DropDown, Label, Protocol link, QRCode, Table, Text, Rich text, and Hyper link.
- Properties:** A table with columns 'Name' and 'Value'. The 'Name' column lists 'Name', 'Items', and a list of items (1) through (5). The 'Value' column lists 'micros', 'microsatellite analysis', 'microscale thermophoresis', 'microscope', 'microscope digital camera', 'microscopy', 'Microsoft Word doc', and 'microsurgical instrument'.
- Design Canvas:** A grid-based workspace with tabs for 'Mandatory information', 'Specimen', 'Microscopy', and 'Measurement'. The 'Microscopy' tab is active, showing a form with fields for 'Type', 'Magnification', and 'Contrast'. The 'Contrast' section has three radio buttons: 'Bright field', 'Dark field', and 'Phase contrast'.

Five red callout boxes with white text and red borders point to specific features:

- Components for design of the experiment:** Points to the 'Protocol controls' list.
- Logical parts of the experiment:** Points to the 'Microscopy' tab in the design canvas.
- Terminology is used from the standard:** Points to the 'microscope' item in the 'Items' list of the Properties table.
- Graphical design of Protocol template:** Points to the form layout in the 'Microscopy' tab.
- Properties of component of protocol template:** Points to the 'Properties' table.

Creating a protocol template - Bio-compatibility



- The protocol template was stored in the database under the name Biocompatibility

Realization of measurement



The process of a particular measurement is based on the usage of the Protocol template and the fulfillment of specific values. The user uses the information contained in the Protocol and fills information (using information provided by the measuring device) using the protocol generator.

1. The user creates a new protocol using software Protocol manager
2. User interconnect protocol with other protocols
3. The user makes the completion of all relevant information for a given experiment.
4. The user connects the experimental data to the protocol and stores them in a local database

Realization of the measurement



To measure cell cyto-toxicity, the protocol template Biocompatibility stored in the database was used. The protocol is linked to the sample preparation protocol (nano fibers), which was conducted prior to the experiment. The protocols related to the same experiment are linked in this way.

The screenshot shows a software interface with a 'Protocol Tools' menu and a table of protocol templates. A 'Define New Protocol' dialog box is open, showing the configuration for a new protocol named 'Biocompatibility - microscopy'. The dialog includes fields for Name, Protocol template, and Source protocols. A list of source protocols is shown, with 'Biocompatibility - TiGr2 - Contract' selected. Red callouts provide context: 'Defining the protocol template' points to the 'Protocol template' dropdown, 'The processing of a specific experiment' points to the 'Define New Protocol' dialog, and 'Interconnection with other experiment' points to the 'Source protocols' list.

Name	Description	Author	Last Change
Cytotoxicity-7.10.2014		cisar@frov.jcu.cz	2014-10-07 2...
Cytotoxicity-1.10.2014		cisar@frov.jcu.cz	2014-10-07 1...
Biocompatib...			0-08 1...
Biocompatib...			0-09 1...
Biocompatib...			0-08 1...
Biocompatib...			0-08 1...
Biocompatib...			0-08 1...
Biocompatib...			0-08 1...
Biocompatib...			0-08 1...
Test - Fish co...			0-09 1...
			0-08 1...

Define New Protocol

Name: Biocompatibility - microscopy

Protocol template: Biocompatibility

Source protocols:

- Biocompatibility - microscopy
- Biocompatibility - segmentation
- Biocompatibility - segmentation
- Cytotoxicity-1.10.2014
- Cytotoxicity-7.10.2014
- Test - Fish color analysis

Selected source protocol: Biocompatibility - TiGr2 - Contract

Buttons: OK, Cancel

Realization of the measurement



The output of measuring cytotoxicity is a series of microscopic images of cells and material.

1. The user has filled in all the information about the cultivation, setting a microscope and a scanning method in the protocol
2. User received information about the camera from EXIF information stored in captured images
3. User stored the protocol with data into the database under the name Biocompatibility - microscopy

Realization of the measurement



The screenshot shows the 'Protocol Generator Tools' window in BioWES. The window title is 'Biocompatibility - microscopy - BioWES'. The ribbon includes 'Home' and 'Protocol Generator'. The 'Protocol Generator' ribbon has buttons for 'Save', 'Finalize', 'Clear', 'Settings', 'Generate PDF', and 'Fill protocol'. The 'Fill protocol' button is highlighted with a red callout box containing the text 'Acquisition external data using plugins'. Below the ribbon, there are tabs for 'Protocol Templates', 'Protocols', and 'Biocompatibility - microscopy'. The 'Biocompatibility - microscopy' tab is active, showing a sub-tabbed interface with 'Mandatory information', 'Specimen', 'Microscopy', 'Measurement', and 'Experimental Data'. The 'Specimen' sub-tab is selected, showing fields for 'Cell line' (MG63), 'Specimen type' (Cultivation flask), and 'Testing method' (Direct contact). A red callout box points to the 'Cell line' field with the text 'Completing all the necessary information about the experiments'. Another red callout box points to the 'Experimental Data' sub-tab with the text 'Connecting the experimental data'. At the bottom right, there is a QR code. A 'Note:' field is visible at the bottom left.

Further data processing

As part of further data processing it is necessary to share data or metadata with coworkers. For this purpose, the Web interface of the local database is used.

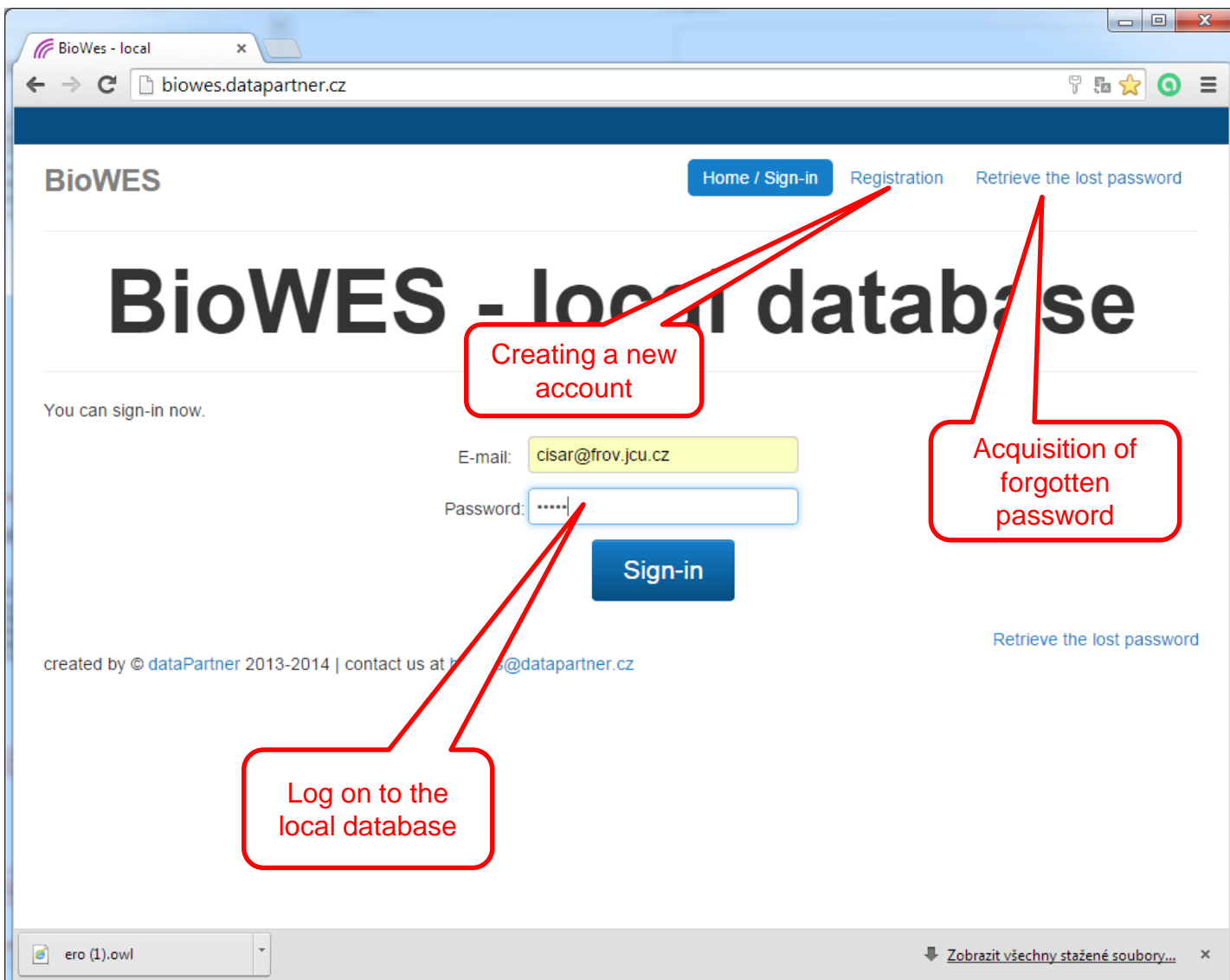
1. Sharing data with coworkers
2. Search of experiments by metadata experiment
3. Data processing and their re-store in the system
4. Visualization chain processing of experimental data

Further data processing

1. Sharing data with coworkers

After obtaining the data from time-lapse microscopy data are shared to the worker that performs the detection of areas of cell colonies and evaluation of cyto-toxicity materials.

Using the web interface, the person who carried out the experiment log in to your account.



The screenshot shows the BioWES web interface in a browser window. The address bar shows `biowes.datapartner.cz`. The page title is "BioWES - local database". The navigation menu includes "Home / Sign-in", "Registration", and "Retrieve the lost password". The main heading is "BioWES - local database". Below the heading, there is a "Sign-in" button and a "Registration" link. The "Sign-in" form includes fields for "E-mail" (containing `cisar@frov.jcu.cz`) and "Password" (masked with dots). A "Sign-in" button is located below the password field. A "Retrieve the lost password" link is located at the bottom right of the page. Three red callouts are present: one pointing to the "Registration" link with the text "Creating a new account", one pointing to the "Retrieve the lost password" link with the text "Acquisition of forgotten password", and one pointing to the "Sign-in" button with the text "Log on to the local database".

Home / Sign-in Registration Retrieve the lost password

BioWES - local database

You can sign-in now.

E-mail:

Password:

[Sign-in](#)

[Retrieve the lost password](#)

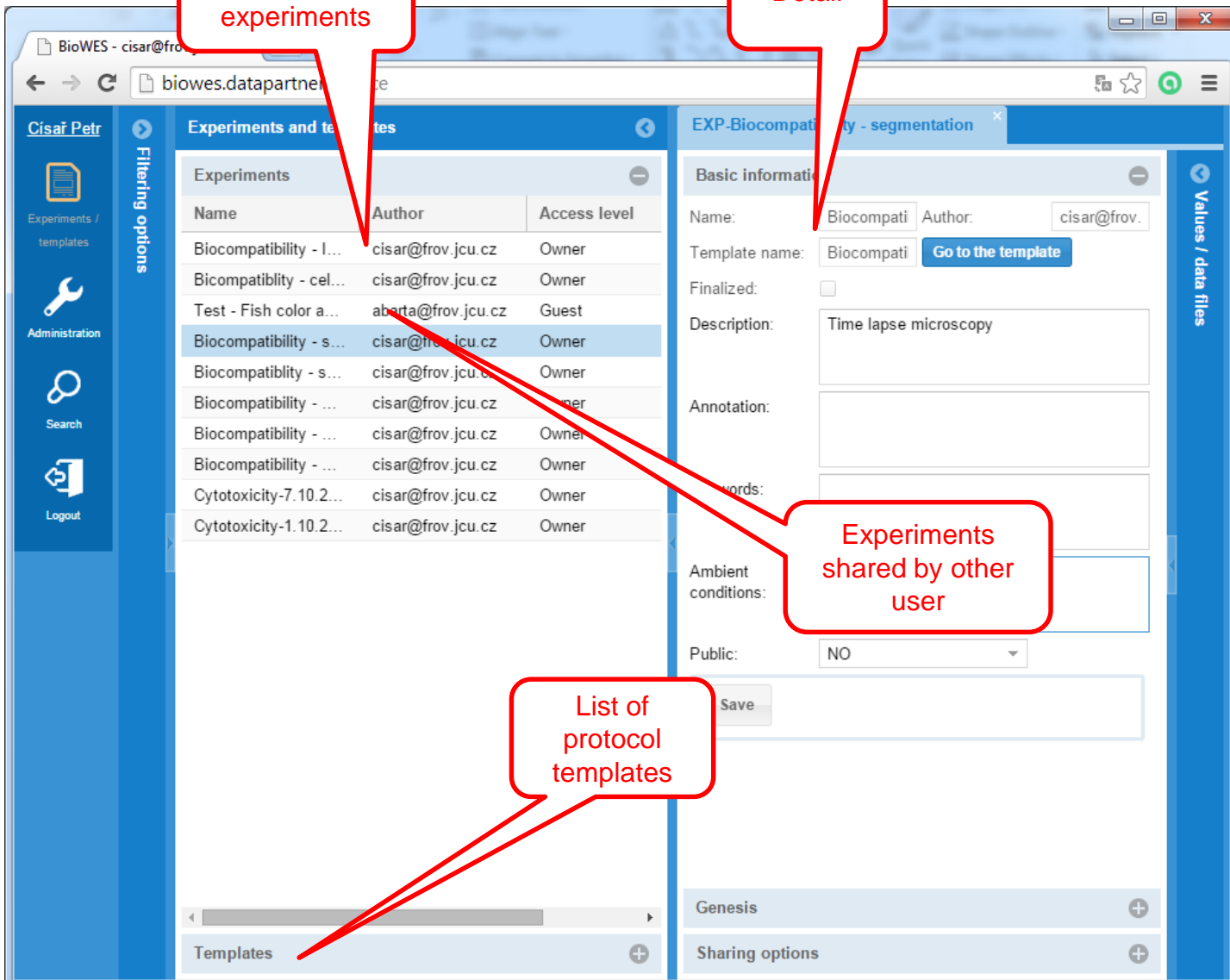
created by © dataPartner 2013-2014 | contact us at info@datapartner.cz

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[Zobrazit všechny stažené soubory...](#)

Further data processing

The web interface allows to obtain information about experiments or protocol templates, sharing, searching and downloading data from the local database.



The screenshot displays the BioWES web interface. On the left, a sidebar contains navigation options: 'Experiments / templates', 'Administration', 'Search', and 'Logout'. The main content area is divided into two panels. The left panel, titled 'Experiments and templates', shows a table of experiments. The right panel, titled 'EXP-Biocompatibility - segmentation', shows the details for a selected experiment.

List of experiments

Name	Author	Access level
Biocompatibility - I...	cisar@frov.jcu.cz	Owner
Biocompatibility - cel...	cisar@frov.jcu.cz	Owner
Test - Fish color a...	abarta@frov.jcu.cz	Guest
Biocompatibility - s...	cisar@frov.jcu.cz	Owner
Biocompatibility - s...	cisar@frov.jcu.cz	Owner
Biocompatibility - ...	cisar@frov.jcu.cz	Owner
Biocompatibility - ...	cisar@frov.jcu.cz	Owner
Biocompatibility - ...	cisar@frov.jcu.cz	Owner
Cytotoxicity-7.10.2...	cisar@frov.jcu.cz	Owner
Cytotoxicity-1.10.2...	cisar@frov.jcu.cz	Owner

Detail

Experiments shared by other user

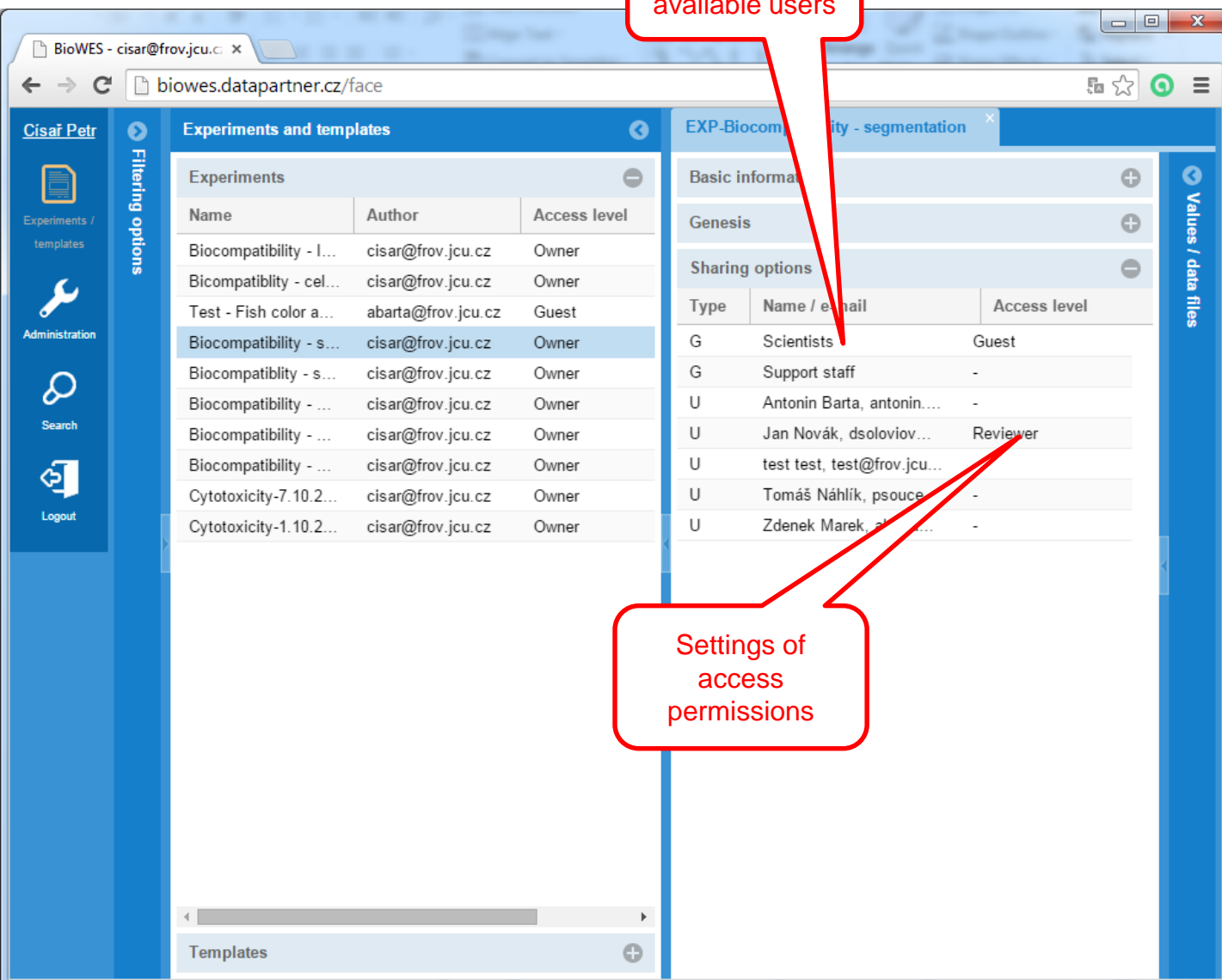
List of protocol templates

The interface also shows a 'Templates' section at the bottom left and a 'Sharing options' section at the bottom right. The 'Ambient conditions' field in the detail view is highlighted with a red box and labeled 'Experiments shared by other user'.

Further data processing

The experimenter shares experimental data to a worker who realize the processing using read-only rights to prevent modification of the measured data.

The list of available users



The screenshot shows the BioWES web interface. The left sidebar contains navigation options: Experiments / templates, Administration, Search, and Logout. The main content area is titled 'Experiments and templates' and displays a table of experiments. The right sidebar shows 'Values / data files' and 'Sharing options' for the selected experiment.

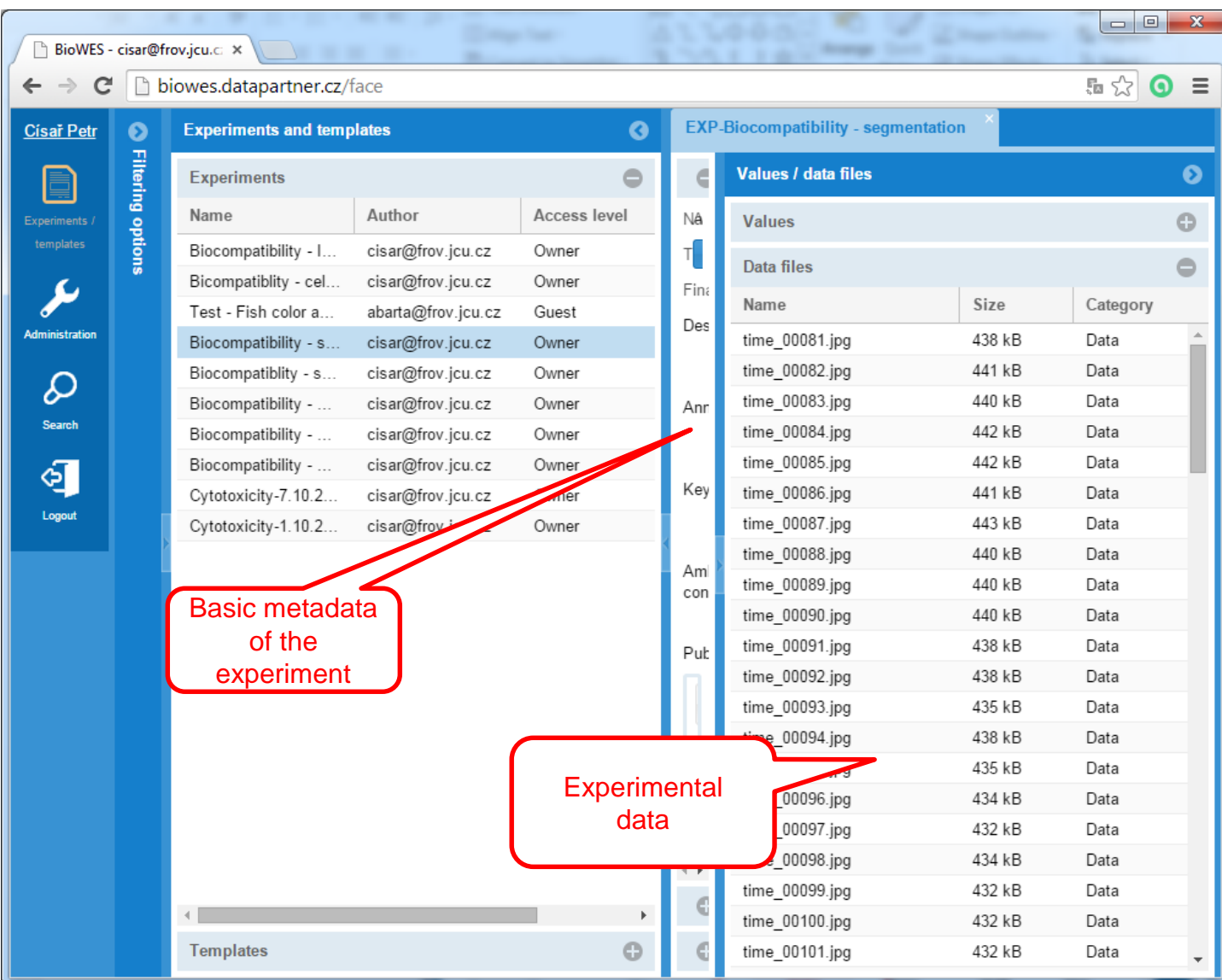
Name	Author	Access level
Biocompatibility - l...	cisar@frov.jcu.cz	Owner
Biocompatibility - cel...	cisar@frov.jcu.cz	Owner
Test - Fish color a...	abarta@frov.jcu.cz	Guest
Biocompatibility - s...	cisar@frov.jcu.cz	Owner
Biocompatibility - s...	cisar@frov.jcu.cz	Owner
Biocompatibility - ...	cisar@frov.jcu.cz	Owner
Biocompatibility - ...	cisar@frov.jcu.cz	Owner
Biocompatibility - ...	cisar@frov.jcu.cz	Owner
Biocompatibility - ...	cisar@frov.jcu.cz	Owner
Cytotoxicity-7.10.2...	cisar@frov.jcu.cz	Owner
Cytotoxicity-1.10.2...	cisar@frov.jcu.cz	Owner

Type	Name / email	Access level
G	Scientists	Guest
G	Support staff	-
U	Antonin Barta, antonin...	-
U	Jan Novák, dsoloviov...	Reviewer
U	test test, test@frov.jcu...	-
U	Tomáš Náhlik, psouce...	-
U	Zdenek Marek, at...	-

Settings of access permissions

Further data processing

A worker who is responsible for further data processing logs into his account. Select a shared protocol and stores the experimental data from the database on his local computer through dialogue of experiment details.



The screenshot displays the BioWES web interface. The left sidebar contains navigation options: Experiments / templates, Administration, Search, and Logout. The main content area is divided into two panels. The left panel, titled 'Experiments and templates', shows a table of experiments with columns for Name, Author, and Access level. The right panel, titled 'Values / data files', shows a table of data files with columns for Name, Size, and Category. Two red callout boxes highlight specific parts of the interface: one pointing to the experiment table and another pointing to the data files table.

Name	Author	Access level
Biocompatibility - I...	cisar@frov.jcu.cz	Owner
Biocompatibility - cel...	cisar@frov.jcu.cz	Owner
Test - Fish color a...	abarta@frov.jcu.cz	Guest
Biocompatibility - s...	cisar@frov.jcu.cz	Owner
Biocompatibility - s...	cisar@frov.jcu.cz	Owner
Biocompatibility - ...	cisar@frov.jcu.cz	Owner
Biocompatibility - ...	cisar@frov.jcu.cz	Owner
Biocompatibility - ...	cisar@frov.jcu.cz	Owner
Cytotoxicity-7.10.2...	cisar@frov.jcu.cz	Owner
Cytotoxicity-1.10.2...	cisar@frov.jcu.cz	Owner

Name	Size	Category
time_00081.jpg	438 kB	Data
time_00082.jpg	441 kB	Data
time_00083.jpg	440 kB	Data
time_00084.jpg	442 kB	Data
time_00085.jpg	442 kB	Data
time_00086.jpg	441 kB	Data
time_00087.jpg	443 kB	Data
time_00088.jpg	440 kB	Data
time_00089.jpg	440 kB	Data
time_00090.jpg	440 kB	Data
time_00091.jpg	438 kB	Data
time_00092.jpg	438 kB	Data
time_00093.jpg	435 kB	Data
time_00094.jpg	438 kB	Data
time_00095.jpg	435 kB	Data
time_00096.jpg	434 kB	Data
time_00097.jpg	432 kB	Data
time_00098.jpg	434 kB	Data
time_00099.jpg	432 kB	Data
time_00100.jpg	432 kB	Data
time_00101.jpg	432 kB	Data

Basic metadata of the experiment

Experimental data

Further data processing



The screenshot shows the BioWES web interface. The browser address bar displays 'biowes.datapartner.cz/face'. The user is logged in as 'Cisár Petr'. The main content area is divided into two panels: 'Experiments and templates' and 'EXP-Biocompatibility - segmentation'.

Experiments and templates

Name	Author	Access level
Biocompatibility - I...	cisar@frov.jcu.cz	Owner
Biocompatibility - cel...	cisar@frov.jcu.cz	Owner
Test - Fish color a...	abarta@frov.jcu.cz	Guest
Biocompatibility - s...	cisar@frov.jcu.cz	Owner
Biocompatibility - s...	cisar@frov.jcu.cz	Owner
Biocompatibility - ...	cisar@frov.jcu.cz	Owner
Biocompatibility - ...	cisar@frov.jcu.cz	Owner
Biocompatibility - ...	cisar@frov.jcu.cz	Owner
Cytotoxicity-7.10.2...	cisar@frov.jcu.cz	Owner
Cytotoxicity-1.10.2...	cisar@frov.jcu.cz	Owner

EXP-Biocompatibility - segmentation

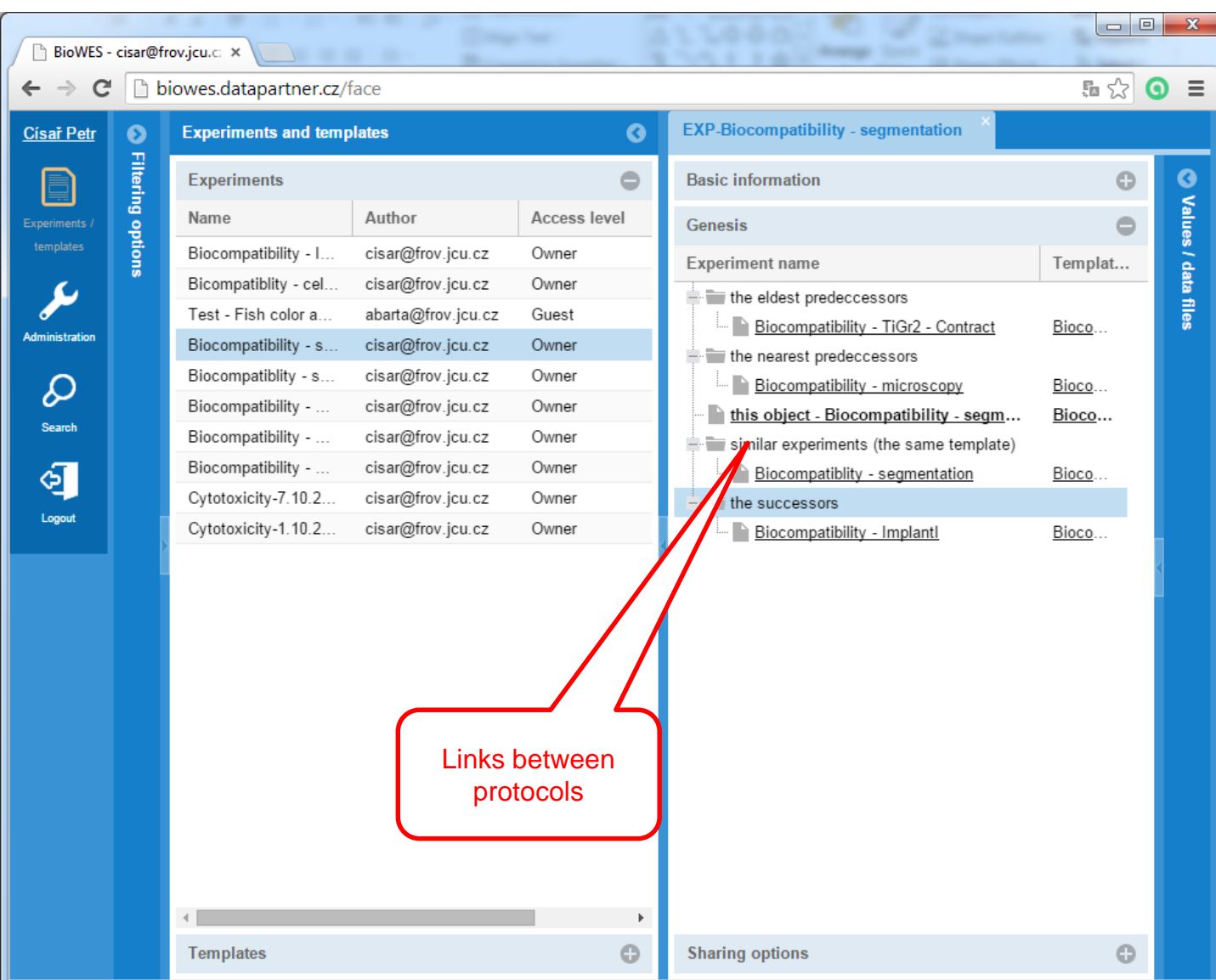
Values / data files

Name	Description
Selection button	044c6c1b-8999-42f3-9466...
Name of person:	38ed01b1-89d1-4020-9a1d...
Version	5f571213-fc76-49d4-b208-...
Object size threshold	90fb46b9-8ef8-4ad1-b86f-...
Cell concatenation threshold	9bf15468-7127-419e-8821...
Background subtraction th...	c2014592-16f7-4300-b51e...
Software name	f-953c05-8017-4670-af75-...

A red callout box with the text 'Experiment metadata' points to the 'Object size threshold' entry in the 'Values / data files' table.

Further data processing

The data processing chain can be visualized in protocol genesis to see the relations between protocols.



The screenshot shows the BioWES web interface. On the left, a sidebar contains navigation icons for Experiments / templates, Administration, Search, and Logout. The main content area is split into two panels. The left panel, titled 'Experiments and templates', displays a table of experiments. The right panel, titled 'EXP-Biocompatibility - segmentation', shows the 'Genesis' of the selected experiment, which is a hierarchical tree of related protocols. A red callout box with the text 'Links between protocols' points to the 'this object - Biocompatibility - segm...' entry in the genesis tree, which is highlighted in blue. This entry is connected by dashed lines to its parent 'the nearest predecessors' and its child 'the successors'.

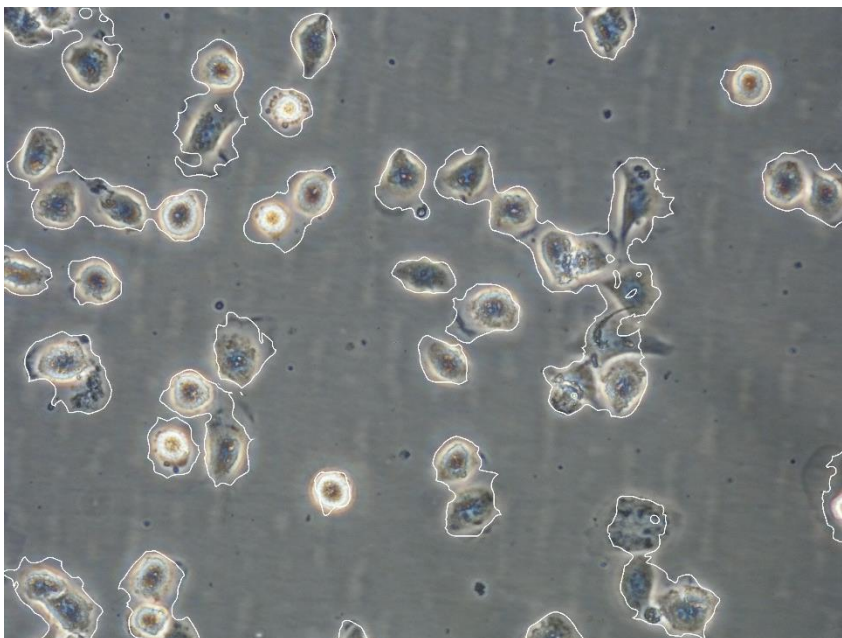
Name	Author	Access level
Biocompatibility - I...	cisar@frov.jcu.cz	Owner
Biocompatibility - cel...	cisar@frov.jcu.cz	Owner
Test - Fish color a...	abarta@frov.jcu.cz	Guest
Biocompatibility - s...	cisar@frov.jcu.cz	Owner
Biocompatibility - s...	cisar@frov.jcu.cz	Owner
Biocompatibility - ...	cisar@frov.jcu.cz	Owner
Biocompatibility - ...	cisar@frov.jcu.cz	Owner
Biocompatibility - ...	cisar@frov.jcu.cz	Owner
Cytotoxicity-7.10.2...	cisar@frov.jcu.cz	Owner
Cytotoxicity-1.10.2...	cisar@frov.jcu.cz	Owner

Genesis tree structure:

- the eldest predecessors
 - Biocompatibility - TIGr2 - Contract
- the nearest predecessors
 - Biocompatibility - microscopy
 - this object - Biocompatibility - segm...**
- similar experiments (the same template)
 - Biocompatibility - segmentation
- the successors
 - Biocompatibility - Implantl

Data processing and their re-stored in the system.

As a further step, method of determining the cyto-toxicity is to determine the cell area during the measurement by which it is possible to determine the behavior of cells. For these purposes, the software for automatic segmentation of cells is used. For the segmentation, a new protocol (using Protocol manager) that contains information about setting up of segmentation methods (affects the outcome) is created and the segmented data are attached to protocol. This protocol is attached to the protocol describing a measured data. This creates a chain of data processing that can be visualized in the web interface.



Example of segmented cells

Further data processing



The screenshot shows the 'Protocol Generator Tools' application window. The title bar reads 'Biocompatibility - segmentation - BioWES'. The ribbon contains 'Home' and 'Protocol Generator' tabs. The 'Protocol Generator' ribbon has buttons for 'Save', 'Finalize', 'Clear', 'Settings', 'Generate PDF', and 'Fill protocol'. Below the ribbon are tabs for 'Protocol Templates', 'Protocols', and 'Biocompatibility - segmentation'. The 'Experimental Data' tab is active, showing a 'List of experimental data files:' with a list of files from 'time_00081.jpg' to 'time_00096.iaa'. To the right of the list are buttons for 'Add folder', 'Add files', 'Remove', 'Copy file', and 'Copy all'. A 'Note:' field is at the bottom left. Three red callout boxes provide annotations: one pointing to the 'Protocol Generator' ribbon, one pointing to the 'Experimental Data' tab, and one pointing to the file list.

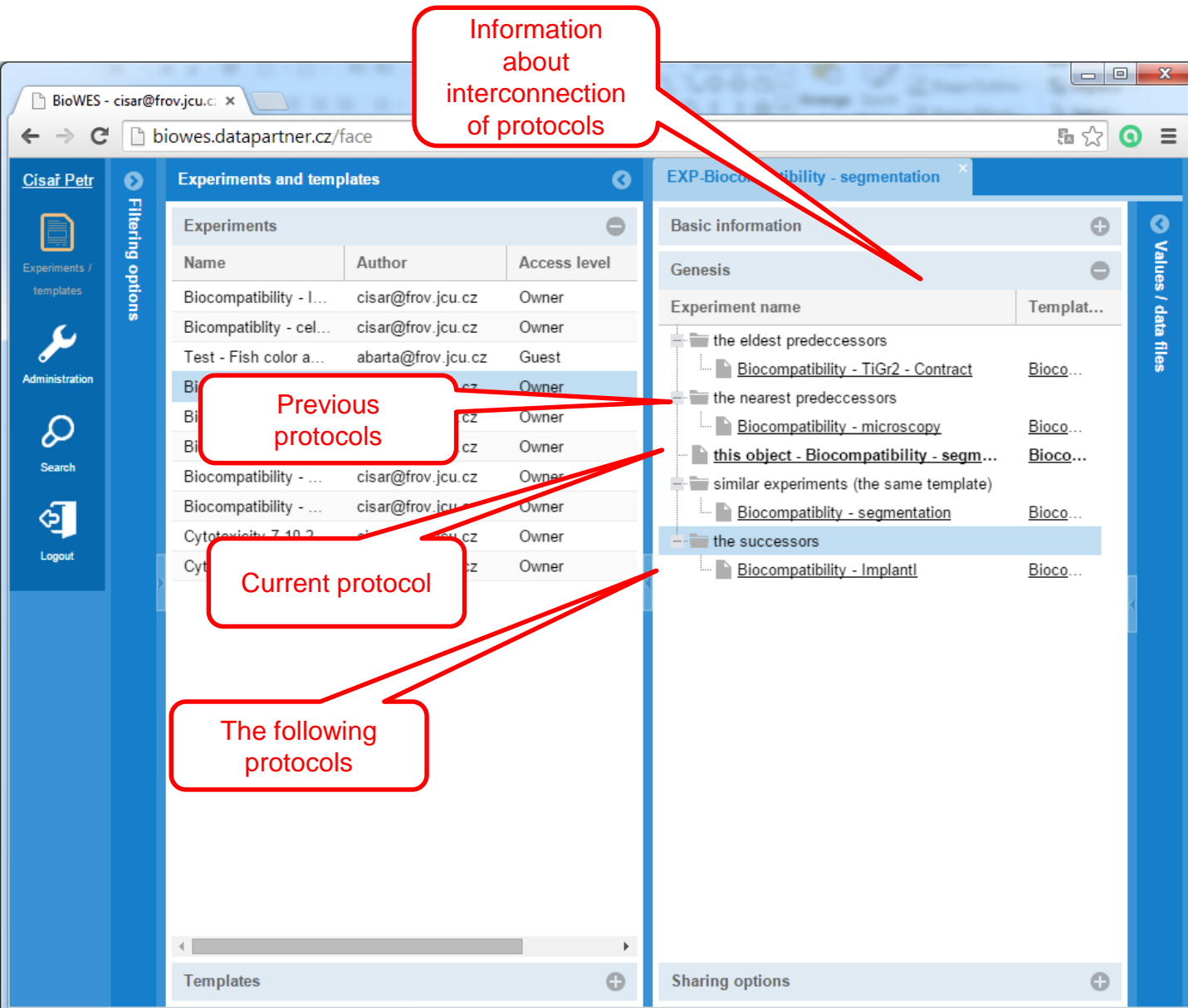
The protocol for data processing

Protocol processing has been linked with the protocol of the experiment (measurement of experimental data)

Attached the processed data

Further data processing

The employee shares the protocol of data processing to the supervisor, who will evaluate cyto-toxicity of the material based on the processed experimental data. The web interface provides information about the entire processing chain.



The screenshot displays the BioWES web interface. On the left, a sidebar contains navigation icons for Experiments / templates, Administration, Search, and Logout. The main area is titled 'Experiments and templates' and features a table of experiments. A red callout box labeled 'Information about interconnection of protocols' points to the 'EXP-Biocompatibility - segmentation' experiment. Another red callout box labeled 'Previous protocols' points to the 'Biocompatibility - TiGr2 - Contract' protocol in the 'the nearest predecessors' section. A third red callout box labeled 'Current protocol' points to the 'this object - Biocompatibility - segm...' protocol in the 'similar experiments (the same template)' section. A fourth red callout box labeled 'The following protocols' points to the 'Biocompatibility - Implant!' protocol in the 'the successors' section.

Name	Author	Access level
Biocompatibility - I...	cisar@frov.jcu.cz	Owner
Biocompatibility - cel...	cisar@frov.jcu.cz	Owner
Test - Fish color a...	abarta@frov.jcu.cz	Guest
Biocompatibility - ...	cisar@frov.jcu.cz	Owner
Biocompatibility - ...	cisar@frov.jcu.cz	Owner
Biocompatibility - ...	cisar@frov.jcu.cz	Owner
Biocompatibility - ...	cisar@frov.jcu.cz	Owner
Cytotoxicity 7-10-2...	cisar@frov.jcu.cz	Owner
Cytotoxicity 7-10-2...	cisar@frov.jcu.cz	Owner

EXP-Biocompatibility - segmentation

Basic information

Genesis

Experiment name

Templat...

- the eldest predecessors
 - Biocompatibility - TiGr2 - Contract
- the nearest predecessors
 - Biocompatibility - microscopy
 - this object - Biocompatibility - segm...
- similar experiments (the same template)
 - Biocompatibility - segmentation
- the successors
 - Biocompatibility - Implant!

Values / data files

Templates

Sharing options

Searching



The web interface enables full-text search in the metadata model protocol and the protocols themselves. In this way it is possible to trace experiments with given conditions and get information about them.

The screenshot shows a web browser window with the URL `biowes.datapartner.cz/face#`. The user is logged in as 'Císař Petr'. The search bar contains the text 'MG63'. The search results table is as follows:

name	entity
Biocompatibility - microscopy	Experiment
Biocompatibility - microscopy	Experiment
Bicompatibility - cell preparation	Experiment

Two red callout boxes are present: one pointing to the search input field with the text 'Searching all experiments with cell line MG63', and another pointing to the search results table with the text 'Found experiments'.

The conclusion



The BioWes system allows several collaborators working over a single comprehensive experiment from the design of the experiment, actual measurement to the further processing of the experimental data.

Metadata (information about the experiment) and data (experimental data, processed data) are stored in a local database and interconnected.

All information is secured by access permissions that are fully managed by individual users.