PHProteomicDB: A Module for Two-dimensional Gel Electrophoresis Database Creation on Personal Web Sites

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PHProteomicDB is a PHP-written module to help researchers in proteomics to share two-dimensional gel electrophoresis data using personal web sites. No technical or PHP knowledge is necessary except a few basics about web site management. PHProteomicDB has a user-friendly administration interface to enter and update data. It creates web pages on the fly displaying gel characteristics, gel pictures, and numbered gel spots with their related identifications pointing to their reference pages in protein databanks. The module is freely available at http://www.huvec.com/index.php3?rub=Download.

Key words: proteome, two-dimensional gel electrophoresis, database, web tool

Introduction

There is an awareness for researchers of the need to share experimental data using the Internet. Proteomics, which is the study of the entire protein complement expressed by a genome in a cell, holds a key position in the present biology (1). For the separation of such complex protein mixtures, 2-dimensional electrophoresis (2-DE) is currently the only technique that can reveal hundreds of proteins at a time. The proteins are detected by chromophoric staining and appear as colored spots on the 2-D gels that can be scanned for computerized spot detection. Afterwards, to determine protein content, spots are analyzed with mass spectrometry either directly or after in-gel enzymatic cleavage for peptide mass fingerprinting. Mass spectrometry results are compared with theoretical data from protein databanks allowing content identification of protein spots. Thus, researchers desirous of sharing their experimental 2-DE data need to display: 2-DE experimental conditions, gel pictures with stained and numbered spots and, for a given spot, the protein(s) content with appropriate links to the identification pages in databanks. When considering the high and always increasing amount of results obtained from a single 2-DE gel (commonly up to 1,000 spots), the more convenient way for storing, organizing, and displaying them lies undoubtedly in Internet databases.

PHP, a recursive acronym that stands for PHP: Hypertext Preprocessor, is a widely used general-purpose HTML-embedded scripting language that especially suits for web development. The code is executed on the server side and allows to dynamically generate pages, in particular, using information accessed from databases. Now, most of the web hosting companies offer the opportunity to use MySQL databases and dynamic languages such as PHP. Thus, PHP could facilitate 2-DE presentations on web sites because information can be stored in a database and assembled using PHP commands into web pages on the fly when requested. It also allows to create user-friendly interfaces to store easily content into the database tables.

Functions and Features

We have developed a PHP-written module, namely PHProteomicDB, that can be used in the purpose to share 2-DE data without knowledge for PHP or database manipulations. It can display smartly online 2-DE gel data, including gel characteristics, gel pictures, and numbered spots with their related identifications pointing to their reference pages in protein databanks (SWISS-PROT or NCBI). This module is freely available from our web site at http://www.huvec.com/index.php3?rub=Download.

Using PHProteomicDB implies that your web site hosting company must have PHP-MySQL enabled server, which is usually the case. No technical or PHP knowledge is required except a few basics about web site management. Indeed, installation

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and configuration of PHProteomicDB are quite simple. Briefly, the steps are introduced as follows:

1. Download the last compressed version of the module from http://www.huvec.com/index.php3?rub =Download and unzip the downloaded file on your local drive to obtain: (1) a folder (PHProteomicDB), (2) a file for data table creation (proteomicdb.sql), and (3) a readme.pdf file for ultimate detailed instructions.

2. Upload the PHProteomicDB folder to your web site root directory using any FTP software, after having updated the MySQL database configuration file with your own parameters (login, password, ...).

3. Link one of your web site pages with the module index page.

4. Execute the proteomicdb.sql file using the PhPMyAdmin interface of your MySQL database to create the data tables to store your 2-DE gel data.

5. Fill these tables with data of your gels, spots, and proteins in the user-friendly administration area using forms and drop-down menus.

6. Upload your pictures and documents (gel pictures in jpg format, pdf documents, ...) in the appropriate folders of the module.

When achieved, click the link installed on your web site at Step 3 to display the module index page with pictures and characteristics of the 2-DE gels. When clicking one of these pictures, the list of the spots and the link with the attached pdf document related to this gel are displayed. Finally, clicking a spot number allows to access a new page that displays the identified proteins in this spot (Figure 1) with hypertext links to their reference pages in the protein databanks (SWISS-PROT or NCBI).

If necessary, specific pages in the administration area allow canceling or updating data. For every page generated with the module, the retrieved data are merged with page templates that provide minimal components controlling the style of presentation. Thus, to respect his/her web site graphic chart, the webmaster is free to edit the PHP pages displaying his/her data (index.php3, 2DpatternGel.php3, and
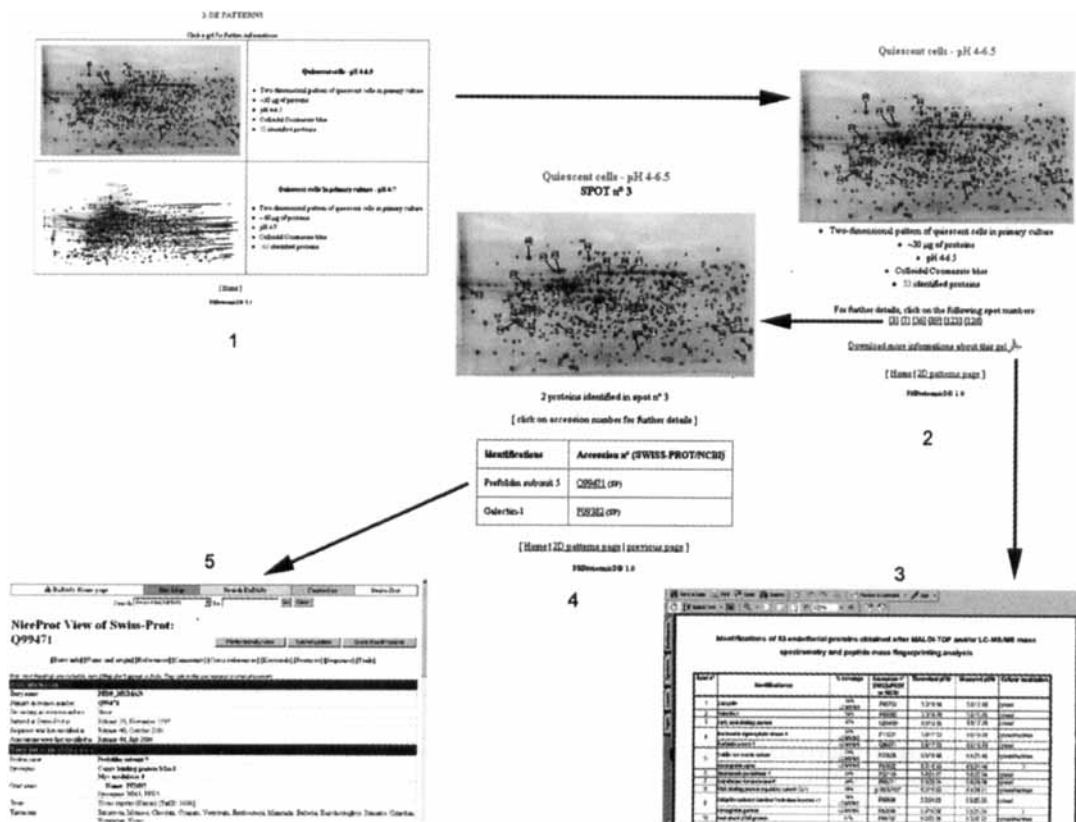

Fig. 1 Illustration of the PHProteomicDB pages, including the index page with the gel pictures (1), the gel page (2) with the numbered spots and the link to the pdf documents (3), and the identification page (4) with the protein identifications in the 2-DE gel spot with hypertext links pointing to their reference pages in the SWISS-PROT databank (5).

identification.php3) to add HTML codes for style or decoration. As an example, the module displays 2-DE gels of human umbilical vein endothelial cells at http://www.huvec.com/index.php3?rub=2Dpattern. What distinguishes our work from others is that it allows researchers that are newcomers in web site management to benefit from the power and the flexibility of the PHP dynamic language and the efficient use of databases. For people who are reluctant to use complex tools such as the Make 2D-DB II package (*2*), which is a federated database for 2-DE users, PHProteomicDB is a smartly way to display updated personal 2-DE data on the web. The development of the module is being pursued with future updates with the latest version available on our web site at http://www.huvec.com/index.php3?rub=Download.

Authors' contributions

PP and AB conceived of the module and drafted the manuscript. BB and MV helped to improve the module and to draft the manuscript. All authors read and approved the final manuscript.

Competing interests

The authors have declared that no competing interests exist.

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Erratum: High-throughput Three-dimensional Gel Electrophoresis for Versatile Utilities: A Stacked Slice-gel System for Separation and Reactions (4SR)

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In this article, the footnote of Table 1 in P.28 was omitted. The footnote should be "*Tested in this work."