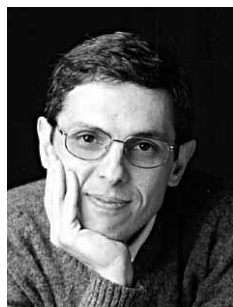## Award for the Best First-Timer Oral Presentation

# Development of a Digital Repository Prototype applied to the Faculty of Pharmacy, University of Lisbon

**Sílvia Lopes[1], Pedro Faria Lopes[2], Fernanda Campos[3]**

1. Faculty of Pharmacy Library, Lisbon, Portugal
2. ISCTE – IUL, Lisbon, Portugal
3. National Library of Portugal, Lisbon, Portugal

**Abstract**

*University libraries have played a key role in scientific research as well as in the support of education-related activities. Their main goal is to provide their users with immediate access to relevant information through updated information sources. Science evolves rapidly and so the daily information needs on health matters are large and require rapid access to the sources. One of the problems that currently exist in university libraries is the access and processing of information in digital format. Digital objects are technologically diverse and there is not enough technical information regarding its proper handling. In this paper we present the tools and methodologies that should be used to provide, in an organized and validated way, the wide range of existing information in a digital format. This work was done in the context of a Master of Science thesis in Information Studies and Digital Libraries. The aim was to find practical solutions for the processing and offering of information in digital format in the context of pharmaceutical sciences. Finally, the paper presents reliable benchmarking of best practices to implement and evaluate a prototype applied to the Pharmaceutical Sciences, in order to satisfy the user's needs.*

*Key words:* digital repositories; organisation of information; prototype; DSpace; evaluation criteria.

## Introduction

One of the problems that currently exist at university libraries is the access and processing of information in digital format because it is information that is technologically diverse and there is still much to resolve regarding the technical knowledge of its proper handling. We intend to find out how libraries should act and what kind of tools and methodologies should be used in order to provide, in an organized and validated way, the wide range of information available in digital format. As science evolves rapidly, the daily information needs in healthcare increase, and require rapid access to information. The credibility of institutions devoted to research is demonstrated by its publications and availability of its scientific production. As services to support research, libraries should create and develop mechanisms that answer positively to these issues. These services should consider users as customers seeking a service - in this case, information. Also, it is important to create services that are increasingly user

*Address for correspondence*: Sílvia Lopes, School of Pharmacy Library, University of Lisbon, Av. Prof. Gama Pinto, 1649-003 Lisboa, Portugal. Tel. +351 217946484; Email: slopes@ff.ul.pt

friendly. To do that, it is necessary to adjust their services to new needs and new kinds of users, more and more dependent on the use of information technology but not always prepared for the overwhelming information that is discovered on the Web.

Thus, the development of a digital repository prototype, especially applied to the Pharmaceutical Sciences but which can be implemented in any library or university, is essential.

**Digital technologies in a university context**
University libraries have played a key role in scientific development and research, as well as supporting activities related to education. They have, as their main objectives, to provide users quick access to relevant information through updated information resources. With the advent of new technologies it is very important to assess how the *digital* environment actually changes the libraries. WY Arms believes that digital libraries will allow a better provision of information and bring several benefits such as the approach of the user's library, the ease of information search, the sharing and updating information, the 24 daily hours of available services and the appearance of other formats besides printed formats (1).

*Scientific production and digital repositories*
In the late twentieth century, the publishing model of scientific production went into crisis (2-5). That crisis brought great problems to the accessibility and dissemination of science. The time between submission, acceptance and actual publication is very large and libraries are no longer keeping up with the high costs of journals, compromising either access or scientific development. Thus, at the beginning of the 21th century, there was a revolution in the communication model of scientific production, with the reorganization of the processes and initiatives of the researchers themselves, via the Web, allowing free access to its production, promoting communication between researchers and the integration of geographically dispersed scientific communities and knowledge sharing (2, 3, 6, 7). The digital repositories emerged, based on the Open Archive Initiative (OAI) philosophy, to ensure a model of scientific publication to allow access, credibility, dissemination and scientific development. Universities as generators of scientific information, that is likely to be used either internally or externally, give greater credibility to both researchers and universities themselves, and lead to the emergence of repositories in higher education institutions (8). Crow and Rodrigues consider institutional repositories as *digital collections that preserve and provide access to the intellectual*

*output of an institutional community* (9, 10). However Lynch defines a university institutional repository as a set of services that the university provides to its community, and to managing and disseminating digital documents created by the institution and the members of that community (11) and Crow adds that institutional repositories, in addition to allowing free access to information and reduce the monopoly of scientific journals, can also serve as indicators of the quality of the university and *demonstrate the scientific, societal, and economic relevance of its research activities, thus increasing the institution's visibility, status, and public value* (12-14). With regard to the content, repositories can store various types of documents that can be archived in different formats of text, image, audio, video, and can co-exist in more than one kind of document type (8, 15, 16). To ensure the long-term reliability of the contents, it is necessary to adopt management policies and selection of content with scientific value. Thus, the creation of a digital repository, that centralizes the materials produced in the institution, which organizes and allows their search and information retrieval and that enables the authors themselves to feed the database of the digital repository, is an asset in the academic and scientific context because it promotes, preserves and disseminates the scientific production of an university.

*Institutional repositories: benefits and problems*
One of the most important issues in the process of building an institutional repository, as well as all the technical issues related to software implementation and support of various informatics applications, is the stakeholders' issue. Thus, it becomes essential to create a multidisciplinary team with librarians, computer programmers, researchers, institution director and people involved with the institution management policy. Simultaneously, the support and participation of the entire community is essential so that the repository is widely recognized as an asset for the institution and, in particular, for its members (8, 11). The development of internal policies regarding self-archiving, copyright, access to information, preserving and use of the digital repository by the entire community (researchers, directors and institutional repository users, be they individuals or centers and departments) is very important to the building, implementation and development of the repository (2, 3, 7). The authors-researchers themselves identify several advantages in the existence of institutional repositories such as a wider audience, accessibility and impact of scientific production (17). The repositories also positively affect

the institutions, since they may be the way the institution is shown in the academic and scientific world and have more credibility, to deploy its scientific output in open access (18).

Another advantage identified is that the repository could become an important tool in the evaluation of research units and researchers to provide access to statistical data, generate activity reports, statistics of access to their documents (number of hits, queries and downloads) (19). Despite the many benefits of creating an institutional repository, some concerns are pointed out, such as how the diversity of users types can be a barrier to information retrieval (9). Other recent studies show concern for the peer review in the repositories (17). However Viana, et al. argue that repositories can create conditions for discussion among peers and exchange ideas (6). Lynch points out the possibility of the repository failing due to adopted policies, management fault and/or technical problems. In this case problems can be experienced in accessing information or, worse, there might be total and permanent loss of documents stored in the repository (11). Besides the technical issues related to creation of digital content, as the integrity and authenticity of digital objects, metadata, digital preservation, interoperability standards, copyright and intellectual preservation, there are also issues related to quality and usability of electronic resources, including digital libraries and digital repositories.

*Evaluation of university digital libraries and repositories*
The main goals of this study are to understand how the libraries and digital repositories are built, which platforms are used, what features are available and, finally, how we should develop a digital library or repository that responds to the increasing demands of its users. In order to understand this reality an analysis of the national and international panorama was completed, performing a comparative study on the university digital libraries, especially in the area of pharmaceutical sciences and/or health sciences. This study was conducted in several phases. Initially, it was necessary to define our sample. At the national level, research was done at the website of the Ministry of Science, Technology and Higher Education, at http://www.mctes.pt, where we searched for all Higher Education Institutions, regardless of the study area. We analyzed all the Web pages of the institutions in order to see which provided digital library or repository services. Please note that in Portugal, only the University of Minho had already implemented this service and operated it in a more advanced way. Other institutions, such as the University of Porto and ISCTE, were

implementing similar services. At the international level, the analysis was made from the webpage *Virtual Library: Pharmacy Page: Schools, Colleges, Faculties, and Departments* (21) which gives access to all schools of pharmacy in the world. Earlier, this evaluation study considered 362 universities and tried to search directly on schools or colleges of pharmacy and their libraries. However, in general, in the pages of the schools and colleges of pharmacy that exist throughout the world, there is no access to libraries and therefore to their digital libraries. Given this difficulty, the research was conducted at the university level.

At the end of the first phase of the analyses research, the Webpages that had no access to digital libraries were not considered for study. The digital libraries not allowing access to general users were also not considered since it was not possible to analyze their organization and content. After this filtering, 300 libraries remained to be studied. Given the large number of digital libraries to analyze, it became necessary to filter and examine their qualities and characteristics. A new criterion was created: *true digital library* or *false digital library*. In this context, *true digital library* means using a structured and organized technology platform enabling basic and advanced searching functionalities in opposition to *false digital library* meaning a simple list of resources or digital collections. Please note that throughout this exhaustive analysis of Web pages of universities, colleges, libraries and digital libraries our concern was also to search for digital repositories. At the final stage of selection, the sample for study considered 45 platforms of digital libraries and repositories.

The evaluation grid was developed based on the literature on evaluating websites, portals and digital libraries. We used the grid adopted for Portals studies (16) and made the adjustments that were considered relevant for the evaluation of digital libraries and repositories. It was considered important to examine both the institution and the library homepages, especially with regard to the information provided and the access points to the digital library and/or digital repository. For the digital library or repository, the analysis fell into two distinct parts which complemented each other: the homepage and the structure of the platform. It was considered relevant to study the following components: general and specific information, authority, updating and accessibility on the homepage and, regarding to the structure of the platforms, analyzing their characteristics concerning the tasks and available functionalities, including types and

search fields, information about the metadata schemas, the collections and its organization, available document types and display.

*Evaluation results*
The 45 digital libraries and repositories analyzed are distributed in five continents, from the following countries: USA, UK, Spain, Netherlands, South Africa, Australia, Portugal, Austria, Canada, South Korea, Norway, Peru, Sweden, Switzerland and Turkey (*Figure 1*).
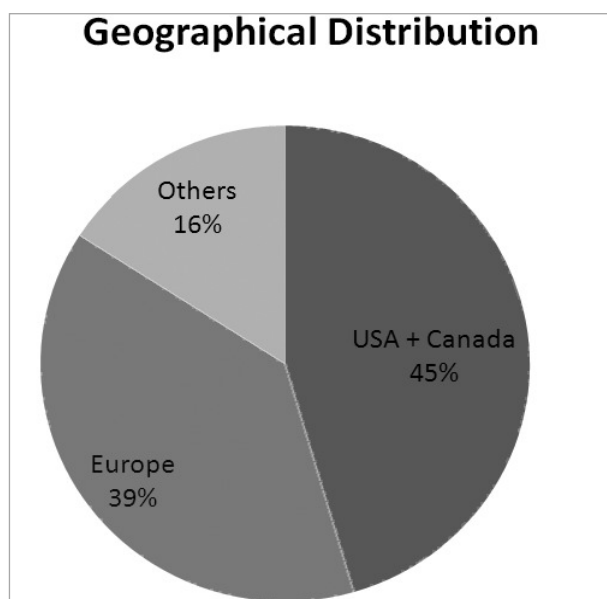


**Fig. 1.** *Geographical distribution of the analyzed digital libraries.*

This study allowed us to understand the reality of university digital libraries and repositories around the world and to plan a more structured way to develop the prototype. It was possible, first, to draw some inferences about the best practices adopted. The parameters were analyzed in four different phases:

- available information at the institution homepage;
- available information at the library homepage;
- available information at the digital library or Repository homepage;
- characteristics about the digital library or repository.

With regard to the first stage of analysis, it is worth noting that none of these institutions' homepages provide all indicators considered in the evaluation grid. But some of them provided the majority of the indicators (*Figure 2*) namely the sites of the University of South Carolina, University of California, Idaho State University, University of Kentucky, University of

Southern California (USA) and University of Sydney (Australia), Ankara University (Turkey), Uppsala University (Sweden) and University of Minho (Portugal).
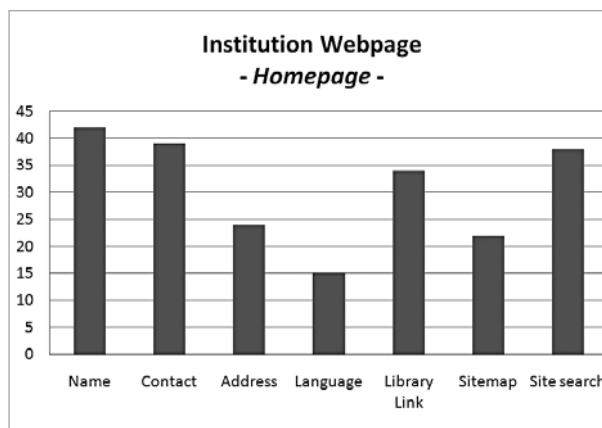


**Fig. 2.** *Available information at the analyzed institutions' homepages.*

Next we searched for the information present at the libraries homepage, such as page name, contact info, address and other parameters (*Figure 3*). In some cases this information was only accessible beyond the homepage, after browsing through not very well structured access points. Libraries providing the majority of the information at the homepage were ETH Zurich - Swiss Federal Institute of Technology Zurich (Switzerland), the University of Florida (USA), Seoul National University (South Korea), Freie Universität - Berlin (Germany), University of Pretoria (South Africa) and the University of Minho (Portugal) (*Figure 3*).
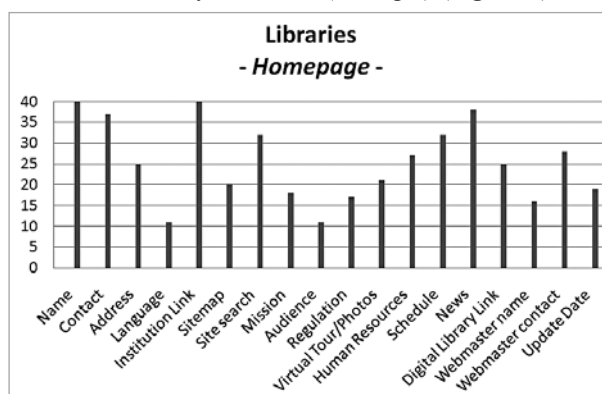


**Fig. 3.** *Available information at the libraries' homepage.*

In the analysis of the digital library homepage, some issues were evidenced as to the difficulty of the libraries to integrate in one place all the digital resources available in the institution. We found the University of Minho (Portugal), ETH Zurich - Swiss Federal Institute

of Technology Zurich (Switzerland), Rhodes University (South Africa), University of South Carolina and University of Wisconsin - Madison (USA) and University of Sydney (Australia), to be the digital libraries that best integrate the analyzed parameters in their homepages (*Figure 4*).
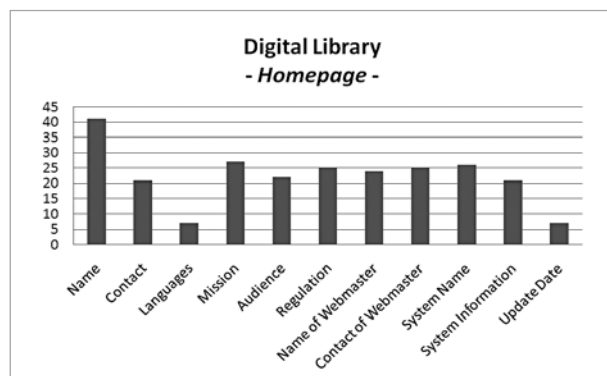


**Fig. 4.** *Available information at the libraries' homepage.*

Furthermore, the digital libraries and repositories tools depend largely on the platform used. Thus, we highlight the platforms Dspace, Eprints, and CONTENTdm, but Dspace has been the most identified and used in the study, by the tools it provides (*Figure 5*). It is noted also that this may be due to the fact that it is an open source platform and allows the use of other free programs allowing the implementation of services that with a licensed platform would have to be paid. Thus, in the analyzed group, the highlights were the libraries and digital repositories at the University of Sydney (Australia), University of Manitoba (Canada), University of Barcelona (Spain), University of Pretoria (South Africa), University of Cansas, Edinburgh University (Scotland) using the Dspace platform.
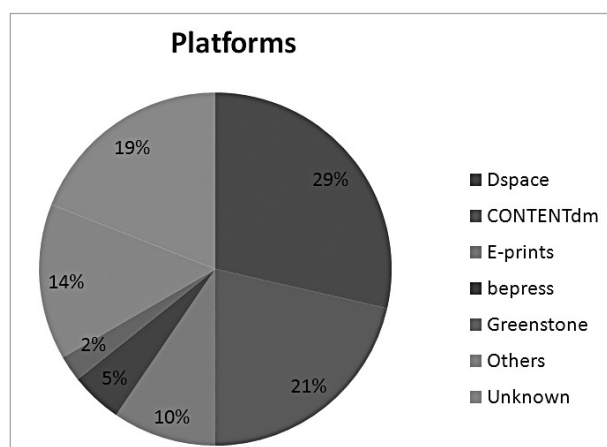


**Fig. 5.** *Platforms used in digital libraries and repositories.*

Another important issue in accessibility is the easy access to people with special needs. To this indicator, only ten digital libraries and repositories provide information on accessibility or add the W3C logo identifying concerns about accessibility issues. We also found some weaknesses when analyzing the toolbar and their connections, missing links either to the library webpage either to the institution webpage or on the digital libraries webpage. The type of information provided is another feature included in this evaluation. Therefore, we analyzed the type of bibliographic records available, the identification of document formats, access to full text and/or abstract, and the availability to download the documents. The bibliographic record format most popular is the abbreviated format and, although many of the digital libraries provide the access to full text, the download of the entire document is not always allowed. Here it is noteworthy that many digital libraries provide access to full text in an image format, where each image corresponds to a document page, making it difficult or impossible any search, editing or printing (*Figure 6*).
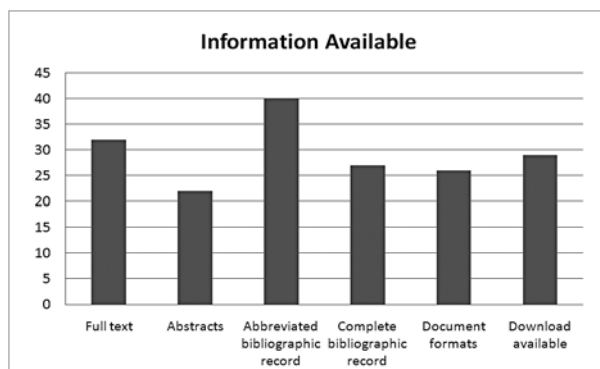


**Fig. 6.** *Information available.*

The interaction with the user is very important. Related to the support services (which allow communication between the library and the user), the *Help* service is the most used and it is included in 30 out of the 45 digital libraries evaluated. The possibility of contacting the libraries, tutorials and FAQ's are other possibilities, but this is available only in 10 digital libraries. Regarding the forms (which allow the user to communicate with digital libraries), these are not much used. Another parameter analyzed is the organization of the collection. It is possible to understand the purpose of the creation of some digital libraries and it is also possible to correlate this with the software adopted. The organization of the collections in digital libraries is given in subject areas, resource type or by communities. In general, when collections were organized in communities, they were

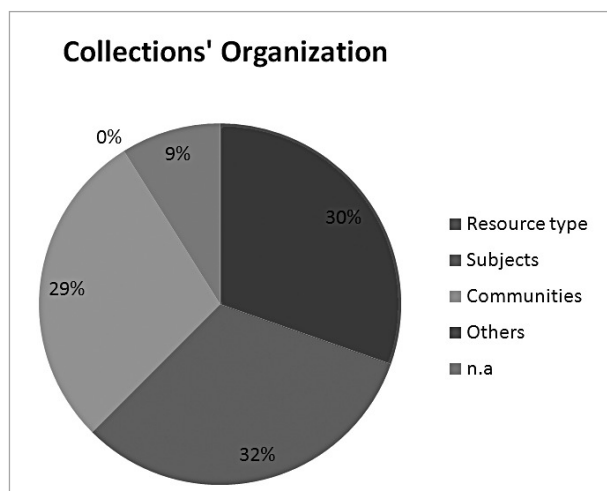also organized, in a secondary level, by the type of resource (*Figure 7*).

**Collections' Organization**



**Fig. 7.** *Collections' organization.*

Regarding the types of documents, 57% of the digital libraries analyzed are composed of electronic documents (such as work reports, masters dissertations, doctoral theses, scientific papers, conference papers, among others) and 30% are special collections (such as photographs, maps, plans, documents, audio – oral history, among others, relating to the history of the institution). It is noted also that only a minority have e-books and electronic journals in the set of resources that integrate the digital library (*Figure 8*). Through the
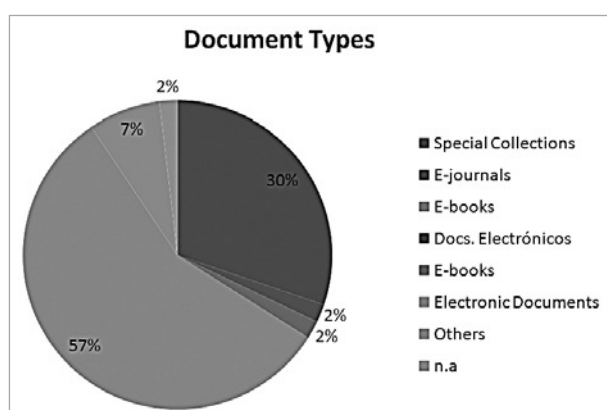
**Document Types**



**Fig. 8.** *Document types.*

analysis of these digital libraries, we also found out which platforms were best suited for the different type of documents that was intended to provide. CONTENTdm is more used for special collections while Dspace and Eprints are best used for electronic documents.

## Prototype of the digital repository for the Faculty of Pharmacy, University of Lisbon

### Characterization of the institution

The Faculty of Pharmacy has a curriculum composed of three scientific disciplines: Life Sciences, Pharmaceutical Sciences and Chemical Sciences and each one of the subject areas is divided into several subgroups (22).

Alongside the educational activity, the Faculty of Pharmacy develops research activities. These activities are distributed by the following research centers:

- Molecular Pathogenesis Center;
- Studies in Pharmaceutical Sciences Center;
- Chemical and Pharmaceutical Biotechnology Center;
- Pharmaceutical Sciences and Technology Unit;
- Molecular Biology Unit: Genetic and Environmental Pharmacogenetics;
- Research Institute for Medicines and Pharmaceutical Sciences.

Each center comprises several groups associated with research projects that produce scientific articles, papers at conferences, contributions from researchers to the scientific literature including chapters in books, some working papers, reports and patents.

### Methodology

The methodology for the development of the digital repository of Pharmaceutical Sciences encompasses several phases. In the first phase, when the selection of the platform was adopted for the digital repository, it was necessary to know the characteristics of the existing software. Therefore, it was necessary to do a review of the existing literature on platforms and software. It was also important to analyze the case studies of the use of such platforms.

### Platforms for digital repositories

Dspace and Eprints are open source platforms which allow the creation of institutional repositories. By analyzing Dspace and Eprints tools and functionalities we could identify some differences between them. They use different programming languages, Java and Perl, respectively. Regarding configuration, through comparative studies conducted by the University of Glasgow, Eprints needs to be worked in terms of configurations. These configuration changes must be made at the encoding and involve changes in several files *.Xml (23). Dspace does not require major changes to its configuration. However, at an administrator level, you can make changes on the

page of communities and collections, with text or image, such as adding information about copyright. Regarding submission/deposit, both platforms are designed to allow authors and researchers to upload their materials to the repository. However, Eprints is geared more towards self-archiving of peer-reviewed scientific papers produced by universities and Dspace is intended for a variety of institutional uses, which also include the management of digital content, digital preservation and electronic publications (24). According to the University of Glasgow comparative study, the submission process is very similar. But Eprints is based on document type and Dspace focuses on the collection where the document should be added (23).

Both platforms allow the user access to a personal area. To do this, users must register with their access credentials. Once registered, users can submit their work and view the submission stage. In Dspace, users are responsible for some admission or verification tasks of previously submitted content and can be notified by email if any task is pending.

The University of Glasgow study found that Dspace has a very well achieved administration interface in order to administer a range of services such as management of registered users, the admission of items and the creation of communities and collections (23). The model of communities and collections in Dspace allows access to the content of the various collections and it can be very granular. Dspace provides detailed statistical reports regarding registered users' actions, the research carried out on the platform and the number of times a particular item was accessed (19, 23). In Eprints you can apply access controls to a particular item and create different workflow processes and policies for access to specific collections. This is possible by creating groups and access policies for each collection and its contents (23).

Therefore the platform chosen to develop a prototype of digital repository was Dspace due to the fact that it can be used for different types of documents within an institution and not just for peer-reviewed scientific papers such as Eprints. Dspace enables the management of digital content and digital preservation and is more easily configurable without the need of major changes in the coding.

*Building the prototype of the digital repository*
The building of the prototype of a digital repository of Pharmaceutical Sciences applied to the Faculty of Pharmacy, University of Lisbon included the installation

and configuration of software, selection of colors and choice of the logo, the type of persistent identifiers and metadata schema adopted, and the form of information organization that was considered in this particular case. One aspect initially considered was the implementation of a prototype server. However, this did not materialize since the acquisition of the Linux server by the Faculty of Pharmacy, University of Lisbon, did not happen due to budget constraints. In place of the Linux approach, the Windows environment was adopted in which we installed Java SDK 1.5, PostgreSQL 8.2 for Windows, Apache Ant 2.0. and Jakarta Tomcat 5.5, applications needed to run Dspace and available for download at the Dspace homepage (25). After that, we made the Dspace software installation with the most stable version – the 1.4.2 version (as of December 2007). When installation was complete, we started the Tomcat service and opening the browser with the link http://localhost:8080/dspace we can view the Dspace default page. Then, we setup Dspace according to customer needs.

*Colors and logo*
Colors play an important role in the development of websites and must be compatible with all systems that are properly viewed by all users (26). It is therefore advisable to use a palette of 216 colors, usually referred to as web-safe color palette (27). The colors are the way the brain interprets the electromagnetic radiation whose wavelength ranges between 350 (violet) and 750 (red) nanometers. At each wavelength a different color is viewed (28). Simultaneously, the colors should also have a symbolism which conveys a certain meaning to the user. The choice of colors initiated a review of the best colors which would convey credibility and seriousness in the website. Another issue considered was the existence of a color associated with the pharmaceutical sciences (purple), which also corresponds to the color adopted by the Faculty of Pharmacy, University of Lisbon. Thus, the colors selected were white, purple and gray. White symbolizes simplicity and harmony, purple means prosperity, nobility and respect, and gray is a color that conveys stability, success and quality (29).

For the logo, we considered three aspects: the name to assign to the prototype, the subject area and the color adopted. As the prototype is a digital repository of pharmaceutical sciences applied to the Faculty of Pharmacy, University of Lisbon, commonly known as FFUL, the name given was *FFUL digital - Digital Repository of the Faculty of Pharmacy, University of Lisbon*. Moreover, the pharmaceutical sciences are

usually represented by a mortar or bowl of Hygeia (the Goddess of Health in Greek mythology) and the serpent of Epidaurus (ancient Greek city, located near the Aegean Sea and famous for the shrine of Aesculapius, the God of Medicine) (30). The use of the serpent as a physician-pharmacist symbol comes from a legend whereby the hero Gilgamesh dived into the depths of the sea to harvest the plant of eternal youth. However a serpent stole and swallowed it and Gilgamesh is faced with his own ultimate mortality (30). However, in France, the Société Libre de Pharmaciens de Paris, founded in 1796, used a symbol consisting of a serpent coiled around a palm tree and it is believed that Portugal used it also as a form of homage, though never openly admitted, to the French Revolution. The symbol of FFUL, composed by the serpent coiled around the palm tree, is adapted from the original symbol of the Pharmaceutical Society Lusitana, created in 1835. The elements that make up this symbol have a more specific meaning: the palm tree represents the plant kingdom, the serpent represents the animal kingdom and the rocks at the base of the palm tree represent the mineral kingdom (31). Thus, it was considered important to maintain the identity of the Pharmacy School, combining the symbol used by the college with the name of the prototype. (For an image of the logo see *Figure 9*).

*Identifiers*

Dspace uses the CNRI Handle System for creating persistent identifiers that allow references to digital resources to remain available long term. However, we can use another type of identifier, such as PURL. Until the entry into production of the repository, Dspace provides a test server that generates the fictitious type handles http://hdl.handle.net/123456789/n where *n* ranges from [1, + ∞] and corresponds to the order number of a particular object created in Dspace. These handles are generated for testing (they are equal in each existent Dspace test facilities and the Handle System does not recognize them). To use the handle system it is necessary to install the handle server that Dspace provides. Because, during the development of this work we could not have a specific server to implement this project, in the test phase a test server provided by Dspace was used. In the future, as soon as the handle server installation process and CNRI registration is carried out, we shall receive a unique prefix and our identifier becomes the type http://hdl.handle.net/xxxx/n, identifying the digital objects uniquely.

*Metadata schema*

Dspace incorporates the Dublin Core as the default metadata schema. However, it allows the setting of other metadata schemas if necessary. In the particular case of the digital repository of the Pharmaceutical Sciences, according to the characteristics and types of the digital objects, the metadata schema adopted was the Dublin Core. It was also considered very important to develop templates for the different types of documents used in the repository.
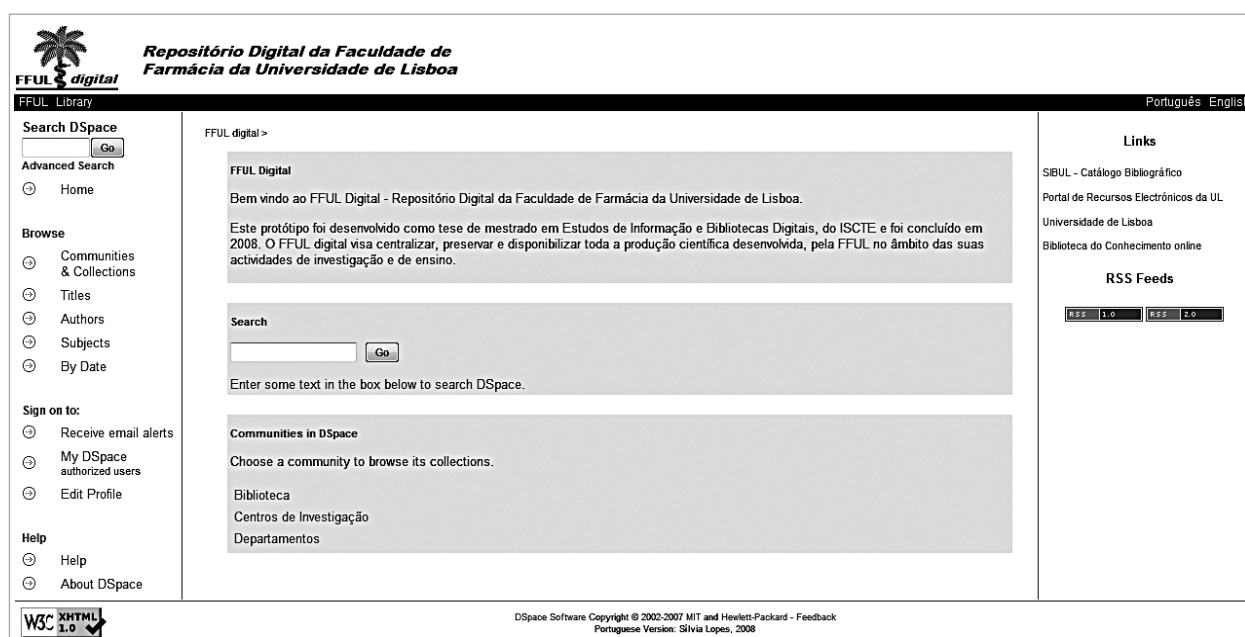


**Fig. 9.** *FFUL digital repository homepage.*

The existence of templates has as its main advantages, the identification of key fields to be completed in a situation of self-archiving by users. Moreover, the existence of templates for each document type lets you keep both the quality and completeness of bibliographic records, or facilitate the retrieval of information in the repository and/or bibliographic catalog. So, for the main types of resources, we set up templates with the respective entry fields. An important aspect is the integration of resources with the bibliographic catalog or, at least, the existence of a connection between the objects of the digital repository and bibliographic record of the library catalog. This connection is possible by placing the persistent identifier (assigned to each document in the repository), in the bibliographic records from the Library catalog. Thus, any user who carries out search in the bibliographic catalog of the Library of the Faculty of Pharmacy will be able to access the document in digital format. The integration of the digital repository with the bibliographic catalog can also be considered in the initial feeding of the digital repository. Another possibility is the bibliographic catalog to be fed from the digital repository. Thus, it would avoid duplication of tasks.

*Information organization*
In the process of organizing information in digital libraries and repositories, it is possible to structure the information in three ways: by communities, by type of resource and by subject area. After analyzing Dspace capabilities and tools, according to the database structure and information retrieval, the thematic organization was excluded. This decision was based on several factors: first, the Dspace lets you search and browse the entire database by subject, on the other hand, it would be more difficult for the user to ingest documents according to subject area, since documents can address several issues, which could confuse the user. It is noted that, with regard to indexing and assignment of descriptors or keywords, the role of information professionals is considered extremely important. Thus, there remains under consideration the communities and type of resource organization. Analyzing the two situations, and considering previous observations in other libraries and digital repositories, it was decided at first level, to organize the information into communities and sub-communities, and at second level, to organize it by the type of resource. Communities correspond to the various sectors or departments existing in the institution and the types of resources will correspond to the collections, which include journal articles, books, periodicals, doctoral dissertations and master's degrees, among others.

Two initial communities were created: Library and Research Centers. It is possible to create sub-communities within each community, and so, some sub-communities were created in the community, Research Centers. After building the prototype it was important to analyze and interact with the system through the introduction of documents according to their templates, create records for new users, make an analysis of the metadata schema and identifiers and the system responses to the several steps of the workflow. We then analyzed the functionality of the system and made the appropriate adjustments to optimize the prototype.

*Features of the prototype*
The homepage was set up in order to provide a set of essential tools, according to the digital libraries and repositories evaluation, such as the link to the institution and library homepages and the ability to view the page in Portuguese or English at the top of the page. In the navigation bar, on the left, the search area, the user registration area and associated services, and also the user *help* area were available.

On the right hand side, some links were added to the information considered useful, including the ability to subscribe to RSS feeds from the repository. At the center, you can find three distinct areas with the information about the repository (goals, target audience and type of documents available), the ability to make several searches and an alphabetized list with the communities that constitute the repository. At the bottom, users have access to information about Dspace and they can contact those who are responsible for the repository, through the *comments/feedback*.

One essential requirement in a digital repository is the possibility to do several searches. The repository can perform simple or advanced searches. A simple search is performed on the full range of existing documents in the repository while the advanced search allows selection of the search field, the community, sub-community and collection intended. It is possible to browse the entire database by title, author, subject and date.

The access to the administration tools is made through *My Dspace*. Here the administrators introduce their credentials and, in addition to the ability to access its personal area, the system recognizes them as an

administrator. The administrators set up and manage the communities and collections, users and groups, records and metadata schemas, global permissions and access policies, among others, according to community, collections and institution needs.

To keep the consistency and organization of communities, the system was parameterized so that only the system administrator can create communities and collections. The process of creating communities and collections is initiated through the site administrator with the creation of a top community. It is possible to customize the community with specific information such as a community logo, and to set policies and permissions for the community and to make changes, to add or delete communities and collections. User Registration is provided from the homepage of the repository. If the users are already duly registered, they just have to fill in their credentials (e-mail address and password).

In the case of a new user, the *New user? Click here to register* link should be selected. After creating the new record, the user can access his personal area in the repository. However, to be able to make deposits, the system administrator will have to give him permission. Dspace admits authentication through the LDAP system. This system allows all users that are registered in the institution (e-mail address) to sign in without having to register again. So, the credentials are the same as those usually used to access the institution's network. The self-archive process is only possible for authorized users and permission is given by the system administrator or by the community or collection administrator. Templates were defined for specific collections. For each collection, there is a form with specific fields for each type of document, that should be filled in. The self-archive process consists of several steps as in the workflow below:

- describe;
- describe;
- describe;
- upload;
- verify;
- license;
- complete.

The first three phases refer to the description of the registration by completing the fields with the author, title, subject, etc. Then the system asks to load the files. Before concluding the deposit, it is also necessary to

verify the information and that the author grants permission and licenses of copyright. If the author does not grant permission, the process is interrupted.

The statistical information provided by Dspace involves the use of PERL. For PERL to run on Windows Vista, it was necessary to install a compatible compiler. After that, it became possible to run PERL. However, as a separate tool, it was necessary to make some changes to the HTML file, including the full translation of the information provided and the set up of several parameters for the various counters. It is possible to get statistics of use of the repository, including statistics on documents submitted to the repository, items viewed, users who registered, information processing, actions in the repository, surveys and search word, among other possibilities. During the testing phase, this prototype was used by university professors, researchers, students, librarians and general users. Their reactions and feedback were very positive, stating that the prototype was easy to use and very useful.

**Conclusions**

The final goal of this work was the description of the development of a prototype digital repository of pharmaceutical sciences based on the understanding of the contexts involved. The university's digital library must evolve in order that the entire work of the university community becomes an asset for the community itself and the institution. Thus, in the university context, a tool that permits, in addition to access to digital contents, the preservation and archiving of all academic and scientific results produced, is advantageous. In terms of international experience, libraries should develop a very user friendly service and prepare briefings and training sessions about how work with repositories should procede, to ensure that the community sees it as an added value. Similarly, there must be an institutional policy setting out guidelines and directives necessary to ensure the success of projects that universities wish to develop. During the development of the digital repository prototype, we analyzed several open source platforms and chose Dspace because it can be used for different types of documents within an institution, enabling the digital content management and digital preservation and because it is easily configurable without the need for major changes in the coding. It was necessary to explore it in order to enable the configuration and parameterization according to the outlined objectives and the needs identified according to the reality of the institution and the organization of information. One of the main difficulties encountered in building the digital

repository prototype was the need to deepen the knowledge of computer programming. We developed the basic tools for the proper functioning of the digital repository taking into account good practices to be used in the Web environment, creating a page using CSS (Cascading Style Sheet), subtitling of icons and images, the choice of colors and logo. In addition, we considered all aspects with regard to the metadata schema and the identifiers to be used. As Dspace is an open source software, it allows the parameterization and configuration using the underlying technologies or the adoption of others (eg, in the case of identifiers, the use of PURL or Handle System) which are available and deemed most appropriate by facilitating the achievement of predefined goals. Regarding the organization of information, Dspace allows information to be organized according to the needs of the institution

itself. In this case, we tried to organize the information in the digital repository with regard to the reality of the institution. Some aspects should be improved, for instance the statistical information that should be adapted according to university needs. Another important aspect is the user support: the prototype functionalities should be even better and also some tutorials should be prepared to help users in the more complex tasks. The aims of this study and prototype presentation is to demonstrate that the implementation of digital repositories in the university context is now of undeniable importance for greater transparency of scholarly communication, for the institutional value, for the treatment of information in digital format, by the university libraries and documentation services, and for improving access and retrieval of scientific information.

## References

1. Arms WY. Digital libraries. Cambridge: MIT; 2000.
2. Weitzel SR. O papel dos repositórios institucionais e temáticos na estrutura da produção científica. Em Questão. 2006;12(1):51-71.
3. Weitzel SR. Reflexões sobre os repositórios institucionais. XVI Encontro Nacional de Informação em Ciências da Comunicação; Brasília 2006. p. 1-11.
4. Correia AMR, Neto MC. LIZA – Repositório de literatura científica cinzenta, produzida em Portugal: relatório final. Universidade Nova de Lisboa, Lisboa: ISEGI-CEGI2001.
5. Correia AMR, Neto MC. Iniciativa LIZA. In: Nacional B, editor. Workshop ECPA: Lisboa;2002.
6. Viana CLM, Márdero Arellano MA, Shintaku M. Repositórios Institucionais em Ciência e Tecnologia: uma experiência de customização do Dspace;2005. Available from: http://eprints.rclis.org/archive/00005563/01/viana358.pdf.
7. Viana CLM, Márdero Arellano MA. Repositórios institucionais baseados em Dspace e Eprints e a sua viabilidade nas instituições acadêmico-científicas. XIV Seminário Nacional de Bibliotecas Universitárias; Salvador - BA (Brasil) 2007.
8. Café L, Melo BA, Barboza EMF, Nunes EMA, Márdero Arellano MA. Repositórios institucionais: nova estratégia para publicação científica na Rede. XXVI Congresso Brasileiro de Ciências da Comunicação; Belo Horizonte, 2 a 6 Set 2003. p. 1-12.
9. Camargo LSA, Vidotti SBG. Elementos de personalização em repositórios institucionais. 1ª Conferência Iberoamericana de Publicações Eletrônicas no Contexto da Comunicação Científica; Universidade de Brasília, 25 a 28 de Abril de 2006. p. 1-7.
10. Rodrigues E. Acesso livre ao conhecimento: a mudança do sistema de comunicação da ciência e os profissionais de informação. Cadernos BAD. 2004(1):24-35.
11. Lynch CA. Institutional repositories: essential infrastructure for scholarship in the digital age. Association of Research Libraries [serial on the Internet]. 2003;(226). Available from: http://www.arl.org/resources/pubs/br/br226/br226ir.shtml.
12. Crow R. The case for institutional repositories: a SPARC position paper. ARL Bimonthly Report. 2002;(223).

13. Leite FCL, Costa SMS. Repositórios institucionais como ferramentas de gestão do conhecimento científico no ambiente acadêmico. Perspectivas em Ciência da Informação [serial on the Internet]. 2006; 11(2). Available from: http://www.scielo.br/pdf/pci/v11n2/v11n2a05.pdf.

14. Leite FCL, Costa SMS. Repositórios institucionais sob a perspectiva da gestão do conhecimento científico. 1ª Conferência IberoAmericana de Publicações Eletrônicas no Contexto da Comunicação Científica; Brasília 2006.

15. Rodrigues E. Acesso livre ao conhecimento nas Ciências e Humanidades: utopias e realidades. Encontro Nacional de Bibliotecas Jurídicas, 1; Lisboa 2004. p. 12.

16. Cândido PAF. Conceptualização de um modelo de biblioteca digital de artes e design integrada no portal da biblioteca da ESAD - Escola Superior de Artes e Design. Lisboa: Instituto Superior de Ciências do Trabalho e da Empresa; 2004.

17. Costa SMS, Leite FCL. Repositórios institucionais: potencial para maximizar o acesso e o impacto da pesquisa em universidades. 1ª Conferência IberoAmericana de Publicações Eletrônicas no Contexto da Comunicação Científica; Brasília, 25 a 28 de Abril de 20062006.

18. L'Hostis D, Aventurier P. Open archives: towards a policy of mandatory deposit: a summary report on current developments, researcher practices and the role of institutions. INRA; 2007.

19. Rodrigues E. Repositórium : criação e desenvolvimento do Repositório Institucional da Universidade do Minho. 8º Congresso Nacional de Bibliotecários, Arquivistas e Documentalistas; Estoril: BAD; 2004.

20. Bourne D. Virtual library: pharmacy page: schools, colleges, faculties, and departments. 2007 [14 de Março 2007]. Available from: http://www.pharmacy.org/schools.html.

21. Lopes S, Lopes PFL, Campos F. Desenvolvimento de um protótipo de repositório digital aplicado à Faculdade de Farmácia da Universidade de Lisboa. Lisboa: ISCTE; 2008.

22. Faculdade de Farmácia da Universidade de Lisboa. Lisboa: FFUL; 2008 [20 de Setembro 2008]. Available from: http://www.ff.ul.pt.

23. Nixon W. Daedalus: Initial experiences with EPrints and DSpace at the University of Glasgow. Ariadne [serial on the Internet]. 2003;(37). Available from: http://www.ariadne.ac.uk/issue37/nixon/intro.html.

24. Harnad S. EPrints, DSpace or ESpace? Jrnlnote mailing list [serial on the Internet]. 2004: Available from: http://www.bio.net/bionet/mm/jrnlnote/2004-March/002230.html.

25. Foundation D. Dspace. [2008-05-13]. Available from: http://www.dspace.org.

26. Barrett E, Levinson D, Lisanti S. The MIT guide to teaching Web site design. Cambridge: The MIT Press; 2001.

27. Lynch P, Horton S. Web style guide: basic design principles for creating web sites. 2nd ed. London: Yale University Press; 2001.

28. Johansson D. Colors on the Web. 2007 [20 de Setembro 2008]. Available from: http://www.colorsontheweb.com.

29. Sibagraphics. Sibagraphics: noosa web design and graphics, sunshine coast. Pomona: Sibagraphics; 2008 [27 de Agosto 2008]. Available from: http://www.sibagraphics.com/.

30. Dias J. A farmácia e a história: uma introdução à história da farmácia, da farmacologia e da terapêutica. 2005.

31. Britain RPSOG. Pharmaceutical symbols. Museum of Royal Pharmaceutical Society of Great Britain: Information sheet. (13).