A Collaborative Infrastructure Supporting International Adrenal Cancer Research

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Introduction

A wealth of information about adrenal cancer exists in many individual specialist centres around the world. The cancers themselves are very rare, often fatal and no common consensus on optimal treatment strategies exists, and certainly no treatments targeted to the individual genetic make-up of the tumours and individuals. In order to conduct effective and progressive research into these tumours and the surrounding conditions and treatments of individuals, it is essential to pool the expertise from specialist centres that exist in each country. The ENSAT-CANCER project is a 5-year European Union FP7-funded project tasked with this, through the development of an online environment that holds core data from a body of patients aligned with identified needs from leading specialists in the field. These data sets are also augmented with a host of tools and features that enable and support the research in this domain. This presentation will describe some of the novel features that have been developed in the project including biobank labelling and "match-making" services between centres. The presentation will also cover the hurdles involved in putting together such an enterprise – such as ethical approval for international data sharing and the establishment of canonical identification systems, and how these have been successfully overcome. The ENSAT-CANCER platform has now been used to support a portfolio of major international genetically targeted clinical trials and outcome studies. The presentation will describe the different processes involved in connecting and effectively sharing data and making best use of the ENSAT-CANCER platform. To date, the registry holds over 2900 patient cases and continues to grow every day.

Clinical Background

The European Network for the Study of Adrenal Tumours (www.ensat.org) was founded in 2002 through the merging of three existing but largely independent adrenal tumour research networks in France, Germany and Italy, with research teams from the UK. The central aim of the ENSAT consortium has been to improve the prediction and management of malignant adrenal tumours. In particular the community have focused on four main tumour types: adrenocortical carcinoma (ACC), pheochromocytoma and paragangliomas (Pheo/PGL), non-aldosterone producing adrenocortical adenoma (NAPACA) and aldosterone-producing adenoma (APA); all of which are rare and with typically poor survival rates for patients. It is hoped that the study of the genetics and treatment of adrenal tumour patients will reveal new molecular mechanisms of the growth of these tumour types and provide insight into associated optimized treatment regimes. The comparative rarity of these tumours requires many international resources be drawn upon in order to make significant progress in the field. Given this, a long-term goal of ENSAT is to bring together a critical mass of expertise and resources to achieve significant clinical and biological conclusions and to eventually combat adrenal tumours.

VRE Infrastructure and Features

At the heart of ENSAT-CANCER is a registry-based web application that includes identification and diagnostic information about each patient, along with a collection of sub-forms detailing clinical, biochemical, imaging, treatment, genetics and follow-up data. The registry has been developed using JSP server-side scripting hosted in a Tomcat container, running on a virtualized host (supported by the NeCTAR cloud program at the University of Melbourne). This system provides secure access to a MySQL database holding the primary datasets for the four distinct components of the ENSAT registry. The current features supported include the standard create, read, update and delete functions of repositories. Also provided are search, data export to XLS/CSV file format, PDF formatted label outputs (available for individual printing or in an A4 sheet – using the iTextPDF framework), and summary statistics of clinically relevant items (e.g. a status report that shows in five lines the most important information for ACC cancer follow-up: the condition of the patient, their survival time, time without disease or time to recurrence).

Other technological features offered include the ability to print labels that can be affixed to tissue sample tubes before they are shipped between centres and offering supporting biobank data exchange mechanisms. The information provided includes a high-level description of the contents, the relevant identification numbers, the aliquot number (where one sample is divided into many aliquots for logistical purposes), and a barcode to allow ease of scanning by high-throughput machines (using the Interleaved 2 of 5 standard, implemented using the zxing Google code project).

To maintain the identification number across all studies within the environment, a central "ID clock" database (also MySQL-based) is maintained that is interrogated whenever a new patient record is generated. This database is also available to the clinical trials that are supported , directly through a secure connection integrated with the patient records in each study, e.g., through a RESTful web service exposing selected elements of the trial database electronic Case Report Forms (eCRFs). Integration of the registry to the surrounding trials will be described in detail, along with the challenges of mapping relevant data points across the registry and associated studies (and vice versa).

Figure 1: Example registry biomaterial form (with sample requirements

Figure 2: Screenshot of the signs and symptoms form in the PMT study

About the Authors

Anthony Stell is a clinical software developer at the Melbourne eResearch Group. He holds an MSc in Information Technology from the University of Glasgow, an MPhys (Hons) in Astrophysics from the University of Edinburgh, and is a Chartered IT Professional (CITP) at the British Computing Society. He has previously been the Glasgow representative of the UK Grid Engineering Task Force (ETF), one of the lead developers on the EU FP7 Avert-IT project: an initiative to create a hypotensive event prediction system through the collection of real physiological data from specialist neurosurgery centres around Europe - and is now the lead developer for the ENSAT-CANCER project, a distributed digital repository and biobanking project, specialising in the linkage of information and samples concerning rare adrenal tumors in Europe.

Professor Richard O. Sinnott was appointed as the Director, eResearch for the University of Melbourne in July 2010. Professor Sinnott works in the Research portfolio and also hold an adjunct professorial appointment in the Department of Computing and Information Systems, Faculty of Engineering. Prior to coming to Melbourne, Richard was the Technical Director of the UK National e-Science Centre; Director of e-Science at the University of Glasgow and Deputy Director (Technical) for the Bioinformatics Research Centre also at the University of Glasgow. In these roles Richard was responsible for organising and administrating UK-wide and local Glasgow University activities associated with e-Science and eResearch more generally. He has been integrally involved in the development and successful delivery of a broad portfolio of e-Research projects and associated research-oriented e-Infrastructures. These have covered (amongst other things), the post-genomic clinical sciences from genetic causes of hypertension to clinical platforms for study of rare diseases; the social sciences and supporting public health research platforms; the arts and humanities and development of tailored platforms for language and literature researchers, through to development of research infrastructures for next-generation nanoCMOS electronics systems.

Doctor Chris Duran is a clinical software developer with the Melbourne eResearch Group. He holds a PhD in Bioinformatics and a Bachelor of Science in Computer Science and Evolutionary Biology from the University of Queensland, Australia. His PhD thesis was in the development and application of bioinformatics tools for computational marker discovery and the integration and visualisation of plant genetic and genomic data. He has previously worked as a Bioinformatics and Product Developer for Biomatters: a dynamic Biotechnology startup based in Auckland, New Zealand; focusing on software solutions for next generation sequencing data. He was also a Bioinformatics Developer for the EU FP6 EUMODIC consortium, working on solutions to accelerate research in mouse functional genomics and phenotyping. He is currently working on the ENSAT-CANCER project, a distributed digital repository and biobanking project, specialising in the linkage of information and samples concerning rare adrenal tumors in Europe.