PROJECT FINAL REPORT

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Project acronym: EXGENOMES

Project title: Exgenome Molecular Enzymes

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[1] Usually the contact person of the coordinator as specified in Art. 8.1. of the Grant Agreement.

[2] The home page of the website should contain the generic European flag and the FP7 logo which are available in electronic format at the Europa website (logo of the European flag: http://europa.eu/abc/symbols/emblem/index_en.htm logo of the 7th FP: http://ec.europa.eu/research/fp7/index_en.cfm?pg=logos). The area of activity of the project should also be mentioned.

4.1 Final publishable summary report

This section must be of suitable quality to enable direct publication by the Commission and should preferably not exceed 40 pages. This report should address a wide audience, including the general public.

The publishable summary has to include **5 distinct parts** described below:

• An executive summary (not exceeding 1 page).

• A summary description of project context and objectives (not exceeding 4 pages).

• A description of the main S&T results/foregrounds (not exceeding 25 pages),

• The potential impact (including the socio-economic impact and the wider societal implications of the project so far) and the main dissemination activities and exploitation of results (not exceeding 10 pages).

• The address of the project public website, if applicable as well as relevant contact details.

Executive summary

The SME companies participating in the Exgenomes project are small but active players on the large market for laboratory supplies, reagents and services. This market is highly fragmented with few large international companies but hundreds of small and medium size companies that are mostly based on local markets. Since the primarily operate through the interent they also sell world-wide on the web and via network of distributors. The companies in this area often grow slowly for many years based on few products, best described as "diagnostic kits", which then are gradually improved and modified according to customer needs. Initially most of their product items have small sales volumes, with steady but often slow and incremental increase in sales. By steady input and improvement of new products the number of sales items grows and so does their revenue. At the same time, often through few focused, R&D projects, the companies aim at developing one or more of these products into higher novel and innovative stage, hoping eventually to create a "blockbuster" product. To do that they also have to pay much attention to securing IP rights during the development.

The Exgenomes project has served the companies well as seen by overview of the main results: Genome sequences of 18 thermophilic phages plus 15 *Thermus* spp genomes were analysed for novel genes in three new (lysogenic) prophages, plasmids and phage-like genes. In addition about 1000 L of hot spring water was filtered and fractionated by cytometry giving two viral DNA metagenomes of >31 & >4 million bases in contigs that could be analysed for new genes.

About ~19,000 and ~42,000 putative ORFs from proprietary thermophilic phages and from 531 publicly available phage genomes were predicted, respectively. A database was created, that stores results of bioinformatics analyses, including domain prediction, 3D fold recognition, and function prediction. The identified genes included; 863 helicases, 125 ligases, 476 lysozymes, 1987 nucleases, 669 DNA polymerases, 188 RNA polymerases, 236 protelomerases, 335 RecA and 273 SSB.

In total 39 new enzymes were selected for cloning and expression the following 23 enzymes produced on small scale and purified for activity evaluation and characterization: Helicase (1), RNAseH (1), Lysozyme (3), RecA (2) DNA polymerase (8), Primase (1), SSB (4) Prototelomerase (3).

After activity evaluation 14 enzymes were obtained in pure and active form and taken for characterization, protocol design and prototype construction and finally 6 enzymes were developed into commercial products with product sheets and QC. Thes enzymes have now been opended for sale on the websites of A&A Biotechnology and Prokazyme. LysT lysozyme from *Thermus* phage Pro2631, Lys2119 lysozyme from *Thermus* phage Ph2119, RecA recombinase from *Thermus* phage T72, RadA recombinase from *Pyrococcus woesei*, Pol72 (or Pol Tis) DNA polymerase from *Thermus islandicus*, SSB M2 single stranded binding protein from metagenome. Promotional materials and public actions as introduction on Biotechnica 2013. Scientific papers have been published or submitted for 3 new enzymes and two patent applications were filed.

DNA vaccine vectors "doggybones" with the firefly luciferase gene were constructed and tested *in vitro* in cell cultures and *in vivo* in mouse and shown to be active. Two new protelomerases, TelA and TelK were cloned, expressed and purified and used for experiments in making new DNA vaccine constructs. These constructs will be tested *in vivo* and compared to DNA vectors prepared using protelomerase TelN. A scientific paper about this work has been submitted to Gene Therapy.

A summary description of project context and objectives

The main objective of the EXGENOMES project is to develop new and improved enzymes for use, as lab reagents, in large-scale DNA synthesis and/or that can act on unnatural components such as in LNA (Locked Nucleic Acids). The target source for the new enzymes is a range of self-replicating mobile genetic elements (phages, plasmids and transposons) from thermophilic bacteria. Thermophilic enzymes have played a key role in the development of biotechnolgy, and good examples are i.e. polymerases (DNA and RNA), ligases, nucleases, reverse transcriptases, polynucleotide kinases, restriction enzymes and more. Such enzymes are of great importance in the research industry today.

A key basis for success in the project is the access to vast existing public and proprietary databases containing genome banks for thermophilic bacteria & phages. A set of not-yet- sequenced phages and phage metagenomes from hot springs, will also be DNA sequenced and sourced in this project. With the help of the RTD partners the databases are analysed, candidate genes selected, cloned and expressed. Produced enzymes are then purified and characterized, followed by prototype generation and market testing. The project will target at up to six types of enzymes, all aimed at having specific properties that will make them useful as new and/or improved tools in the application sectors that the four SME partners are targeting for their business.

Objectives to advancing knowledge, technology & business

The focus of the project is to explore in a systematic way the commercial possibilities associated with the enzyme systems used naturally by exotic mobile genetic elements. This requires deep insight and frontline science, together with access to state-of-the-art technology. This is provided by the world-class scientists working for the RTD partners. The end results, however, should lead to useful new products, that will be commercialized by the SME partners, or further their business in various ways. Therefore part of the results from the project will be new scientific knowledge that will end up being published in the open scientific literature. There will also be new and improved methods and processes used in-house by the SME partners and the RTD partners. Most importantly, however, the project will lead to new products, new IP and stronger competitive edge for the SME partners.

With the increased knowledge and interest in phages and viruses and the new DNA sequencing technology the number of available viral genomes is growing rapidly and therefore sequence data analysis and gene identification is much more efficient. The new sequencing machines can handle very complex mixtures of DNA and sort them before sequencing. Therefore the main hurdle of isolation and cultivation of purified viruses is no required there and we can sequence complex viral mixtures of uneven composition.

This project will therefore significantly enhance the knowledge in the field of thermostable molecular enzymes and also identify novel approaches to their improvement. At present only few such enzymes have been studied in details and in many cases there are no thermophilic representatives on the market, when compared to their non-thermophilic counterparts. Real practical needs and market niches can therefore be identified. The EXGENOMES consortium of highly qualified SME´s and RTD partners definitely represent a group that is capable of making a major progress in the field, as well as securing the necessary IP protection and commercialisation. Currently the main competition in this field is not in Europe, but mostly in US and Asia.

EXGENOMES therefore has these overall knowledge and business objectives:

1) New tools that can improve and save time and money in research and diagnostics
2) New knowledge on thermophilic mobile genetic elements and their replication mechanisms
3) Better understanding and knowledge on how DNA enzymes work
4) Stronger technology base for SME´s
5) New IP that can protect the SME´s going forward

6) New science and training of young scientists with the RTD partners
7) Growth in business revenue and employment in Europe

EXGENOMES furhtermore has these scientific objectives:

- Completing and analysing the genomes of up to 8 thermophilic phages
- Identifying and describing the sequence-functional aspects of phage-specific enzymes, in particular those being; RNA & DNA ligase, Prototelomerase, Nuclease and Lysozym.
- Analysing up to 10 newly sequenced *Thermus* genomes for SSB proteins and for transposon-linked
- DNA polymerases and associated primases, having strand displacement activity
- Cloning and expression with characterised activity up to 18 novel enzymes
- Characterising in details up to 12 novel enzymes with activity and other functional properties
- Publishing a scientific paper describing at least one new thermophilic phage
- Publishing a scientific paper describing at least 3 new thermostable enzymes
- Describing the use of novel enzymes for the synthesis of short DNA vaccines
- Demonstrating the immunogenicity of new DNA vaccine constructs
- EXGENOMES furhtermore has these dissemination and commercial objectives:
- Producing prototypes, QC and user-protocolls for up to 6 novel enzymes
- Introducing up to 6 new enzymes as a commercial product and having them evaluated by
- customers
- Filing two new patents on new enzymes and/or on methods of their use.
- Introducing the EXGENOMES project on own homepages and at scientific conferences

The objectives listed above are further reflected in the deliverables, milestones and results descriptions.

A description of the main S&T results/foregrounds

The project has moved rapidly according to plan, and has reached practically all of its scientific and technical goals and in fact more so in many tasks. Already 6 new enzymes have entered the Demonstration and Marketing phase and market entry has been started with creation of trademarks and public product sheets. Public sales offers have been opened on the webpages of Prokazyme and A&A Biotechnology, and promotional material made as well as public actions taken, such as press release and introduction on Biotechnica 2013. Scientific papers have been published or submitted for 3 new enzymes and two patent applications were filed.

The new enzyme products will increase and strengthen the product portfolio of the SME companies and strengthen their position with increasing sales in their market on Molecular Research and Diagnostics. In addition to the 6 enzymes already selected for marketing and use, there are still few other additional enzymes that will be further evaluated and could add more products to Prokazyme and A&A Biotechnology, as well as be useful in further technology development in-house at Exiqon and Touchlight Genetics.

The final results are therefore expected to contribute significantly to expanding the market share and growth of the participating SME companies.

Following below is a concise summary of the main results and progress made in the project. For clarity it is arranged according to the main tasks or work packages with the main significant results specifically emphasized.

WP1	**Sources of genomes**
Summary of progress	Genome sequences from 10 partly or fully sequenced thermophilic phages and 1 phsycrophilic phage plus 15 *Thermus* spp genomes were retrieved and made available for analysis. In addition 8 of the old phages (for gap-closing) plus 8 new phages were revived and lysates/DNA prepared and metagenome sequenced with 454 pyrosequencing. Paper on novel phage is ready for publication. Up to 1000 L from two hot springs was filtered and fractionated by cytometry to isolate the viral part and the metagenome DNA isolated and sequenced. After assemply >31 & >4 million bases were obtained in contigs that could be analysed for new genes. By further analysis three new prophages (lysogenic), plasmids and phage-like genes were found in the sequenced *Thermus* genomes.
Significant results	The conditions of the old phage collection was better than expected. In total 8 new thermophilic bacteriophages, that had not been previously sequenced were successfully revived and their DNA isolated and pooled for 454-pyrosequencing using a “metagenomic-type” approach. A technologically challenging target of obtaining useable viral metagenome directly from hot springs was achieved. Further bioinformatics analysis of the sequenced *Thermus* genomes showed the existence of three new prophages (lysogenic), plasmids and phage-like genes in these genomes.

WP2	CDS gene selection & bioinformatics
Summary of progress	About ~19,000 and ~42,000 putative ORFs from proprietary thermophilic phages and from 531 publicly available phage genomes were predicted, respectively. The identified genes included (from the 10 thermophilic phages in parenthesis); 863 helicases (10), 125 ligases (2), 476 lysozymes (8), 1987 nucleases (13), 669 DNA polymerases (4), 188 RNA polymerases, 236 protelomerases, 335 RecA (1) and 273 SSB (2). A special search for perfect palindromes and associated protelomerases gave 9 candidates, thereof 3 representing novel enzymes. A database was created, that stores results of bioinformatics analyses, including domain prediction, 3D fold recognition, and function prediction (where available) for sequences of all candidate CDS of the target gene families found in the genomes provided and analyzed. The database contains all selected genes with detailed bioinformatics analyses performed using the GeneSilico fold recognition server.
Significant results	First round resulted in 27 new thermophilic enzymes and 2 psychrophilic nucleases, selected for cloning, but no thermophilic protelomerase was found. An intensive search for large palindromic sequences in public phage genomes resulted in many hits with at least 3 new enzymes, and 1 was selected for cloning and testing in this project. The database and the sequence & structure analyses that it made possible had a significant impact on the success of the project. The power of this approach was well demonstrated in the search for new protelomerases, which clearly are rare entities in thermophiles. An intensive search for large palindromic sequences in public phage genomes resulted in 2 new enzymes that were selected for cloning and testing in this project.

WP3	Cloning & productions of enzymes
Summary of progress	The first 30 new enzymes selected for cloning and expression were; Helicase (2) RNAseH (1), Nuclease (2), Lysozyme (3), RecA (1) DNA polymerase (10), Primase (1), SSB (9) Prototelomerase (1). Until now 20 of those have given moderate to high expression. Nine additional new genes were cloned, bringing the total to 39 genes, out of which 30 gave good or high expression. From this were the following 23 enzymes produced on small scale and purified for activity evaluation and characterization: Helicase (1), RNAseH (1), Lysozyme (3), RecA (2) DNA polymerase (8), Primase (1), SSB (4) Prototelomerase (3).

Significant results	Out of the first 30 enzymes selected for cloning, already 20 have given moderate to high expression, sufficient for purification and further testing and characterization. Very high success rate in terms of the number of enzymes of different types that gave high expression and were purified in soluble and active form. High number of interesting enzymes were available to go to next step of characterization.

WP4	**Enzyme characterization & Prototype construction**
Summary of progress	In the first phase a total of 8 enzymes (RNAseH, Lysozyme, RecA, 4 DNA polymerases and Protelomerase) were expressed as soluble active enzymes and 4 enzymes have been purified and moved on to characterization and prototype testing. After activity evaluation the following 14 enzymes from both periods 1 & 2 were obtained in pure and active form and taken for characterization, protocol design and prototype construction: HelT helicase from *Thermus* phage T72, LysT lysozyme from *Thermus* phage Pro2631, Lys2119 lysozyme from *Thermus* phage Ph2119, RecA recombinase from *Thermus* phage T72, RadA recombinase from *Pyrococcus woesei*, Pol540 DNA polymerase A from hot spring biomass, Pol11, ThermoPhi, strand displacing DNA polymerase from *Thermus antranikianii*, Pol72 (or Pol Tis) DNA polymerase from *Thermus islandicus*, SSB PW single stranded binding protein from *Pyrococcus woesei*, SSB C1 single stranded binding protein from *Clostridium* phage phiCP130, SSB M2 single stranded binding protein from metagenome, SSB M3 single stranded binding protein from metagenome, TelA protelomerase from *Agrobacterium tumefaciens*, TelK protelomerase from *Klebsiella oxytoca* phage pKO2. Product sheets were made for the underlined 6 enzymes above for demonstration.
Significant results	The first enzyme as a commercial candidate was a RecA-like protein that was successfully used as an enhancer in PCR and qPCR techniques. Thermophilic lysozyme was tested in the enzymatic DNA extraction techniques from cultures of *Thermus thermophilus* and *Thermoanaerobacterium* sp. and environmental samples such as soil and ground water samples. New batch and reaction conditions was tried for the thermophilic strand displacing polymerase and showed interesting improvements. Novel DNA polymerase A was purified and is highly active and thermostable. From the 14 enzymes that were tested through protocol and QC process and considered for prototypes, 6 were finally selected for making product sheets and customer evaluation. These were LysT, Lys2119, RecA, RadA, SSB M2 and Pol72. Scientific papers were submitted for publication for LysT, Lys2119 and RecA. A manuscript was made on RadA and a patent application written on SSB M2.

WP5	Dissemination & Demonstration of new enzymes
Summary of progress	The SME´s have prepared internal lists of potential customers. A&A Biotec has prepared list for testing the RecA as PCR booster. In the first phase were 4 enzymes started with application testing; 1 DNA polymerase for DNA amplification, 1 strand-displacing polymerase for isothermal amplification, 1 lysozyme for DNA purification and 1 RecA for PCR enhancing.
	Product sheets & QC data was made for the 6 enzymes that were selected above and market entry has been started with creation of trademarks, public sales offers on the webpages of Prokazyme and A&A Biotechnology. Dissemination with promotional materials and public actions, such as the introduction on Biotechnica 2013 was started. Six scientific papers have been published or submitted for 4 new enzymes, one novel thermophilic bacteriophage and on new DNA vaccine constructs. Also two patent applications have been filed.
Significant results	Initially the RecA looked very promising and has been made into prototype product and was entered into the phase of testing by external customers and finally open as a new product. Product sheets and sales material on webpages was prepared and issued publically for the following 6 new enzymes with their internet links: Lysozyme 2119 http://www.shop-aabiot.home.pl/en_GB/p/Lysozyme-Ts2119-2-mgml/244 Lysozyme 2631 http://www.shop-aabiot.home.pl/en_GB/p/Lysozyme-TS2631-2-mgml/243 RadA http://www.shop-aabiot.home.pl/en_GB/p/RadA-0%2C1-mgml/245 RecA Tt72 http://www.shop-aabiot.home.pl/en_GB/p/RecA-Tt72-1-mgml/246 Hyperthermostable SSB http://www.shop-aabiot.home.pl/en_GB/p/Hyperthermostable-SSB-1mgml/247 *ThermoPhage™ Lysozyme* http://prokazyme.com/index.php/products/6-products-general/73-lys64-lysozyme.html *ThermoPhage™ Tis DNA Polymerase* This is the last one coming soon

WP6	Functional application of novel vector constructs
Summary of progress	New purification protocol and reaction mix has improved the specificity of amplification by strand displacing DNA polymerase. Vectors with the firefly luciferase gene were constructed and tested in

	vitro in cell cultures and in vivo in mouse and shown to be active. New protelomerase was found by bioinformatics analysis and will be use to generate novel DNA constructs. The ResT protelomerase was expressed in different E. coli hosts/vector systems but unable to produce soluble enzyme. Therefore two new protelomerases, TelA and TelK were cloned, expressed and purified and both were active and used for experiments in making new doggybone DNA vaccine constructs. DNA doggybone constructs based on protelomerase TelA and incorporating Firefly luciferase (Lux) or gp140 sequences were prepared for *in vivo* testing by Imperial College. The following constructs were made: TelN DB Lux; TelA DB Lux; TelN DB gp140 and TelA DB gp140. These constructs will be tested at Imperial and compared to DB DNA prepared using protelomerase TelN. A scientific paper about this work has been submitted to Gene Therapy.
Significant results	Functional vectors (doggybone DNA) that express a luciferase gene *in vivo* have been tested and demonstrated to work well. New very interesting protelomerases were produced and characterized and tested for vector synthesis. Several new DNA vector constructs were made and tested *in vivo* for immunogenicity.

4.2 Use and dissemination of foreground

Section A

This section should describe the dissemination measures, including any scientific publications relating to foreground. **Its content will be made available in the public domain** thus demonstrating the added-value and positive impact of the project on the European Union.

A1: LIST OF SCIENTIFIC (PEER REVIEWED) PUBLICATIONS, STARTING WITH THE MOST IMPORTANT ONES

No.	Title	Main author	Journal	Number, date	Publisher	Place of publication	Year of publication	Relevant pages	Permanent identifiers	Is/Will it be open access?
1	Isolation, growth and genome of the *Rhodothermus* RM378 thermophilic bacteriophage	S. Hjorleifsdottir	Extremophiles	December, Online	Springer	Japan	2013		DOI 10.1007/s00792-013-0613-	Yes
2	Isothermal DNA Amplification by a Novel and Non-Ubiquitous *Thermus* Polymerase A	S. Hjorleifsdottir	Current Biotechnology	Vol 3	Bentham Science		2014		http://benthamscience.com/epub.php?JCode=CBIOT	No
3	Novel Highly Thermostable Endolysin from *Thermus scotoductus* MAT2119 Bacteriophage Ph2119 with Amino Acid Sequence Similarity to Eukaryotic Peptidoglycan Recognition Proteins	M. Plotka	Applied and Environmental Microbiology	Vol 80	ASM	USA	2014	886-895	doi:10.1128/AEM.03074-13	Yes
4	Purification and characterization of RecA protein of thermophilic bacterium *Thermus thermophilus* MAT72 phage Tt72 that increases specificity of a PCR-based DNA amplification	A. Stefanska	Biotechnology				2014		Submitted	
5	Comparative analysis of an enzymatically produced novel linear DNA construct with plasmid for use as DNA vaccines	A. A. Walters	Gene Therapy				2014		Submitted	
6	Highly thermostable RadA protein from *Pyrococcus woesei* enhances simplex and multiplex PCR specificity	A. Stefanska					2014		Manuscript	

A2: LIST OF DISSEMINATION ACTIVITIES

No.	Type of activities	Main leader	Title	Date/Period	Place	Type of audinece	Size of audience	Countries addressed	
1	Project website	1	Exgenomes.org	2012-1014	Internet	Science & business	Wide	All	
2	Scientific conference, presentation	7	Gulbankian Training in Bioinformatics	2013	Portugal	Science	Selected	Europe	
3	Scientific conference, presentation	6	Annual Meeting of Polish Biochemical Society	2013	Poland	Science	Local	Poland	
4	Industry Fair & conference, Booth	2	Biotechnica 2013	2013	Germany	Business	1000	Europe	
5	Company brochure & handout	2	Biotechnica 2013	2013	Germany & Poland	Business	Wide	Europe	
6	Press release	1	University of Gdansk cooperates with Prokazyme on marketing of bacteriophage enzyme	7. Jan. 2014	Internet	Internet	Wide	All	

Section B

This section should specify the exploitable foreground and provide the plans for exploitation. All these data can be public or confidential; the report must clearly mark non-publishable (confidential) parts that will be treated as such by the Commission. Information under Section B that is not marked as confidential **will be made available in the public domain** thus demonstrating the added-value and positive impact of the project on the European Union.

B1: LIST OF APPLICATIONS FOR PATENTS, TRADEMARKS, REGISTERED DESIGNS, ETC.

Type of IP Rights.	Confidential Click on YES/NO	Foreseen embargo date dd/mm/yyyy	Application reference(s) (e.g. EP123456)	Subject or title of application	Applicant (s) (as on the application)
Patent	No	2013	US Patent Application No. 11/662,879	DNA polymerases having strand displacement activity	Prokazyme
Patent	Yes	2016	US provisional Patent Application No. 61910147	Thermostable Single-Stranded DNA Binding Protein and its methods of Use	A&A Biotechnology

B2: LIST OF EXPLOITABLE FOREGROUND

Type of Exploitable Foreground	Description of exploitable foreground	Confidential Click on YES/NO	Foreseen embargo date	Exploitable product(s) or measure(s)	Sector(s) of application20	Timetable, commercial or any other use	Patents or other IPR exploitation (licences)	Owner & Other Beneficiary(s) involved
Product	RecA Tt72 from bacteriophage MAT72 infecting Thermus thermophilus	No	01/12/2013	Enzyme reagent	1. Molecular R&D 2. Diagnostics	2014	No	A&A Biotechnology
Product	Lysozyme from Thermus ssp. bacteriophage Ts2119	No	01/12/2013	Enzyme reagent	1. Molecular R&D 2. Diagnostics	2014	No	A&A Biotechnology
Product	Hyperthermostable SSB	No	01/12/2013	Enzyme reagent	1. Molecular R&D 2. Diagnostics	2014	Yes	A&A Biotechnology
Product	RadA from Pyrococcus woesei	No	01/12/2013	Enzyme reagent	1. Molecular R&D 2. Diagnostics	2014	No	A&A Biotechnology
Product	*ThermoActive™* Tis DNA Polymerase	No	01/03/2014	Enzyme reagent	1. Molecular R&D 2. Diagnostics	2014	No	Prokazyme
Product	*ThermoActive™ LysT Endolysin*	No	01/02/2014	Enzyme reagent	1. Molecular R&D 2. Diagnostics	2014	No	Prokazyme
Product	*ThermoPhage™ Lysozyme*	No	01/01/2014	Enzyme reagent	1. Molecular R&D 2. Diagnostics	2014	No	Prokazyme
Product	*ThermoActive™ SSB-M2*	No	01/02/2014	Enzyme reagent	1. Molecular R&D	2014	Yes	Prokazyme

					2. Diagnostics			
Product	*ThermoActive™ LysT Endolysin*	No	01/02/2014	Enzyme reagent	1. Molecular R&D 2. Diagnostics	2014	No	Prokazyme
Technology	TelA Protelomerase	Yes	01/08/2014	Enzyme tool	Vaccine production	2015	No	Touchligh Genetics
Technology	TelK Protelomerase	Yes	01/08/2014	Enzyme tool	Vaccine production	2015	No	Touchligh Genetics
Product	Vaccine constructs	Yes	01/12/2014	DNA vaccine	Vaccine production	2015	No	Touchligh Genetics
Patent	Thermophi DNA polymerase	Yes	01/12/2014	Enzyme reagent	1. Molecular R&D 2. Diagnostics	2014	Yes	Prokazyme
Patent	A novel thermostable SSB protein and its use	Yes	01/12/2014	Enzyme reagent	1. Molecular R&D 2. Diagnostics	2014	Yes	A&A Biotechnology, Prokazyme

4.3 Report on societal implications

This part is only filled out online and not repeated here in text.

Project website and contact information

The project website is: www.exgenomes.org

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