PRIMARY APPLICANT DETAILS

Title
Name
Surname
Tel (Mobile)
Email (Work)

Address

COLLABORATOR DETAILS

Role	**STEM partner**
Title	
Name	
Surname	
Tel	
Email (Work)	
Address	

Role	**Head teacher or Principal**
Name	
Surname	
Tel (Work)	
Email (Work)	
Address	

Section 1 - Contact Details

PRIMARY APPLICANT DETAILS

Title
Name
Surname
Tel (Mobile)
Email (Work)

Address

COLLABORATOR DETAILS

Role	STEM partner
Title	
Name	
Surname	
Tel	
Email (Work)	
Address	

Role	Head teacher or Principal
Name	
Surname	
Tel (Work)	
Email (Work)	
Address	

School contact details:

Please enter your School Name

Please enter your school address

Please enter your school postcode

Please select your school level from the list below:

Secondary

Please select the type of school from the list below:

State-funded

If you selected other, please provide details in the box below

No Response

STEM partner contact details:

Please enter the STEM partner's organisation name

Please enter the STEM partner's organisation address

Please enter the STEM partner's organisation postcode

Please select the type of organisation from the list below:

Higher Education Institution

Section 2 - Project Overview

Project title

This must be a short and snappy question that will be the focus of your project.

How do we determine what's in a burger?

Please select the main strand that your project falls under from the list below:

Biology

List up to 5 (max) investigations that the students will carry out as part of this project

1. Bioinformatics - pupils will use public access websites (ncbi and ebi) to find insulin gene sequences for Bovine, porcine and ovine (cow, pig and sheep) species (insulin is used as the gene of choice in this practical as it is constantly referred to throughout the GCSE and GCE specifications).
2. Primer design - pupils will design primers, from the sequence information obtained from their bioinformatics study, that will be specific to each species.
3. DNA extraction - from different types of meat available in a supermarket e.g hamburger.
4. Polymerase chain reaction - multiplex PCR will be carried out using the primers to see if the different types of meat contain cow, pig or sheep DNA. The primers will be designed in such a way as to amplify 3 different size products (e.g. cow = 500 bp, pig = 800bp, sheep = 1.1kb) which will be easily identified following gel electrophoresis with known molecular weight markers.
5. Agarose gel electrophoresis will be carried out to visualise the different base pair products and to determine if different meats contain simply cow, pig or sheep DNA or all three.

Please provide a brief description of the equipment that you require for funding.

DNA primers.
DNA extraction kit.
PCR machine.
General PCR consumables - Taq DNA polymerase + buffer, dNTPs, PCR tubes.
Microfuge.
Molecular weight markers.
1 x pipiette and tips.
(gel electrophoresis equipment is already available)
Fast stain DNA kit or other method to visualise DNA in a gel.

Has your school applied for a partnership grant before?

Previous recipients of partnership grants may apply for further funding, as long as the new application is made one year or more after the previous application.

However, you must make sure that your new project is not a simple extension of your previous one.

⦿ No

Section 3 - STEM Partner Details

Please include the full name of your STEM partner here

Please include the job title of your STEM partner here

Relevant qualifications and/or experience

STEM partner's involvement

Please provide details on how the STEM partner will contribute to the project, by writing a short paragraph and adding details in the question below.

[redacted] She has undertaken PCR, electrophoresis, Western blotting and DNA damage and repair assays. Therefore [redacted] will provide background to the practical aspect of the study, extraction of DNA, explain how primers work, and setting up a zero DNA room in addition to the details provided below.

Please enter the details of the STEM partner's activity below. Please list each activity separately, including time per session and frequency.

1. Introduction to bioinformatics and its uses (1 x 2h).
2. Practical introduction to DNA extraction from animal tissues (meat/ muscle). Risk assessment to include use of chaotropic agents; use of RNase; elution of purified DNA from spin columns (1 x 2h).
3. PCR - applications and uses - role in diagnostics (e.g. Epstein Barr virus); role in forensics and fingerprinting; role in amplification of genes or femtogram amounts of DNA for cloning and further investigation such as DNA sequencing; idea of how a PCR machine works (1x2h).
4. Gel casting and electrophoresis; understanding of DNA having a net negative charge and that smaller DNA molecules move faster through agarose; loading and running a gel (1x2h).

Has the STEM partner applied for a partnership grant before?

⊙ No

Section 4 - Participants

How will the students taking part in the project be selected?

Include information for core and additional participants if applicable. How do you plan to include diversity as a consideration?

It is anticipated that all Year 14 (6th Upper) pupils studying A Level Biology will be taking part in the project. This academic cohort currently consists of 24 males and 26 females.

Please select your school region from the list below.

Please select which student year(s) will participate in your project from the list below:

☑ Year 14

What is the total number of students who will be involved in your project?

50

What is the total number of students at your school?

1,500

Will any other schools be involved?

If so, please give details.

Not in this instance. However, the legacy of the project would hope to include pupils from nearby schools visiting to gain practical experience (not normally available) which will greatly enhance their A Level studies.

Section 5 - Planning

Please select the anticipated start date of your project which must be no earlier than the next autumn term.

01 February 2019

Please select the anticipated end date of your project.

01 May 2019

Describe the rationale for your project, using the headers below:

a) Describe below the key learning objectives of this project.

b) How will your students benefit from participating?

c) What skills and experiences will they learn that they wouldn't ordinarily learn as part of their usual lessons?

d) Explain clearly how scientific methodology will be employed throughout this project.

a)Key learning objectives of this project.
As part of their formal A Level studies, pupils have to understand the principles behind the use of phylogenetic analysis, PCR and gel electrophoresis.
In this project pupils will carry out some data mining using the ncbi/ebi websites to find insulin DNA sequences specific to cow, sheep and pig. They will use the program LALIGN to carry out sequence alignments (and see how this information can be used to produce phylogenetic trees) and be introduced to other useful software programs for analysing DNA including BLAST and ClustalW.

Pupils will learn how to design PCR primers using the information obtained from the ncbi/ebi websites.
Pupils will learn how to extract DNA from animal tissue.
Pupils will carry out PCR and gel electrophoresis and understand the importance of this technique and its applications in research, diagnostics and commercial science.

b) How will your students benefit from participating?
This project aims to provide pupils with hands on practical experience of PCR. Being able to carry out the procedure greatly enhances the learning and understanding of this technique and will hugely support their A Level studies as historically, this topic has only been taught using text and YouTube clips.

Pupils have learned the structure of DNA and the semi-conservative theory at AS Level. Designing primers will augment their understanding of the double-stranded nature of DNA and the base-pair rule.

It is hoped the pupils will enjoy the opportunity of working together when searching the ncbi and ebi datatbases to find sequences from which to design primers and understand the primer ordering process (e.g. length of primers and how that affects annealing temperature, cost per base and primer production using a nucleotide synthesiser).
Pupils will also be encouraged to browse the job opportunities available at the EMBL organisation and give them an insight into the qualifications needed to become a working bioinformatician.

It is hoped that pupils will develop an interest in this topic and discuss their findings with their peers as well as see the inter disciplinary nature of this area of molecular biology and how it can be applied to the food industry along with medical and diagnostic applications.

c) What skills and experiences will they learn that they wouldn't learn ordinarily learn as part of their usual lessons?
Pupils will learn how to use a range of bioinformatics tools.
Pupils will learn to design, order and cost primers.
Pupils will learn how to carry out PCR and run agarose gel electrophoresis. This involves using specialist equipment such as DNA extraction from animal tissue and microcentrifugation; programming a PCR machine; handling 0.2ml tubes; making a PCR reaction mixture using Taq DNA polymerase, buffers, primers and dNTPs; use of micropipettes; casting, loading and staining DNA in agarose gels.
Pupils will gain an understanding of this process and the major role it plays in diagnostic and forensic science.

d) Explain clearly how scientific methodology will be used?
The project aims to determine if a hamburger contains cow, sheep and or pig tissue.
The methodology describes how this can be done in the laboratory from a very small amount of animal tissue in a short period of time using PCR.
The project explains that nucleic acid sequence information is freely available on public access websites (ncbi and ebi). That small nucleotide sequences can be purchased very cheaply from small commercial laboratories. That cow, sheep and pig specific PCR fragments can be amplified from very small amounts of DNA in animal tissue. That these fragments can be visualised to show their existence using agarose gel electrophoresis.
That PCR diagnostics has many commercial applications.

Timeline for project

Please indicate key dates and milestones, such as when you expect students to have completed training, hypothesis testing, analyses and any dates where the project will be shared.

Date	Activity	Who involved?
08 February 2019	bioinformatics	
15 February 2019	primer design and ordering	
15 March 2019	DNA extraction and PCR analysis	
12 April 2019	Agarose gel electrophoresis	

Clearly explain why you need the equipment you have requested funding for.

1. A fully programmable PCR machine with a heated lid and a minimum of a 24 well plate for 0.2ml tubes is essential to carry out the project.
2. A microcentrifuge is needed to complete the DNA extraction process (along with the DNA extraction kit).
3. Taq DNA polymerase and dNTPs (purchased as a "master mix") along with HPLC pure/ desalted primers are essential to carry out the PCR analysis.
4. A micropipette along with tips are essential for loading agarose gels.
5. Disposable nitrile gloves are essential to avoid cross contamination.
6. Molecular weight markers and Fast Stain DNA are needed to size and visualise DNA samples respectively.
7. Hamburgers are needed as a source of DNA.

Please give a brief description of the legacy this project will have. For example: how will it be sustained? Can it be repeated with other students? Can it be repeated with the involvement of another school?

Whilst the main expenditure on the project is the PCR machine (which comes with a 4y guarantee) and microfuge, it would be hoped that the other consumables used on the project would be replaced in the future when needed from within the Biology Department's budget at [redacted] School thereby making the project sustainable. The legacy of the project will be that the equipment will be available to carry out PCR and the associated techniques will be taught to future A Level pupils for many years to come.
It would be intended that there will be some interdisciplinary development with other departments within the school itself, such as Nutrition and Food Science.
It is hoped that the Biology Department at [redacted] School will be able to outreach to neighbouring schools who do not have the facilities and skills, to offer those pupils a better understanding of this procedure detailed in the A Level specification so further enhancing their teaching and learning.

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Section 6 - Project costs

Period	Item Type	Item	Field	£
2018 - 2019	Project Item	PCR machine (3PrimeBase/02) Cole Parmer Techne	Cost	£1,529.24
			Latest Cost	£1,529.24
		Microfuge (SS-600 SciQuip)	Cost	£621.40
			Latest Cost	£621.40
		Qiamp DNA Mini Kit (ID:51304), Qiagen.	Cost	£163.00
			Latest Cost	£163.00
		QIAGEN Multiplex PCR kit (100) (ID:206143)	Cost	£167.00
			Latest Cost	£167.00
		Primers (ThermoFisher Scientific A15610 Value DNA Oligo, desalted, dry. 24mer, 50nmol. 6 primers at £6.93 each)	Cost	£41.58
			Latest Cost	£41.58
		0.2ml PCR tubes with Flat caps (Bio-rad TFI0201)	Cost	£50.00
			Latest Cost	£50.00
		Gilson Pipette Pipetman Classic P20 2-20UL (F123600 -list price £199.00 (offer until end of April £115.00))	Cost	£199.00
			Latest Cost	£199.00
		Pipette Tips Towerpack DL10 0.1-20UL pk960 (F167102)	Cost	£30.00
			Latest Cost	£30.00
		Lambda DNA/ HindIII marker 5x 50ug (ThermoFisher Scientific Cat No. SM0101)	Cost	£48.66
			Latest Cost	£48.66
		Fast Blast DNA Stain 1x100ml (Bio-rad, Cat No.1660420)	Cost	£29.00
			Latest Cost	£29.00
		Costs (approximate) to cover delivery charges on ordered items (excluding PCR machine and microfuge).	Cost	£100.00
			Latest Cost	£100.00

		Nitrile gloves (Just Gloves 3 packs at £4.05 each)	Cost	£12.15
			Latest Cost	£12.15
		Hamburger/s (local supermarket)	Cost	£3.00
			Latest Cost	£3.00
2018 - 2019 Total			**Cost**	**£2,994.03**
			Latest Cost	**£2,994.03**

Total	Project Item	PCR machine (3PrimeBase/02) Cole Parmer Techne	Cost	£1,529.24
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		Latest Cost	£3.00
Total		**Cost**	**£2,994.03**
		Latest Cost	**£2,994.03**

Justification for consumables (incl. fieldwork)

Please fully justify your request for consumables, including expenses for fieldwork.

PCR machine - this is a budget PCR machine and the cheapest available which meets the necessary requirements of the project.
Microfuge - this is a budget microfuge which spins at 15000 rpm.
(See quote for both pieces of equipment from Wolf Laboratories Ltd, York).
Qiamp DNA Mini Kit is essential for DNA extraction.
Qiagen multiplex PCR kit contains Taq polymerase and dNTPs needed to perform PCR.
Primers - 3 pairs needed (cow, sheep, pig).
0.2ml thin-walled reaction tubes essential to fit the 24 well plate in the PCR machine.
2-20 microlitre pipette and pipette tips are essential to make up reaction mixtures.
"Fast Blast DNA Stain" to visualise DNA and molecular weight markers are needed to size PCR products in agarose gels.
Nitrile gloves are essential to avoid cross-contamination during the DNA extraction and PCR reaction set up.
Nitrile gloves also afford protection against chemicals used throughout the project.
Hamburger/s are essential as this will be the source of DNA for the amplification process.

Please provide quotes for all individual items over £200

Section 7 - Lead Applicant Declaration

Declaration

I hereby declare that the information provided in this application is true and correct to the best of my knowledge.

Checked

I understand that all reports must be submitted in a timely manner otherwise the Royal Society retains

the right to reclaim grant money.

Checked

Partner details

Name and Surname	
Date	14 March 2018

Section 8 - Collaborating Applicant Declaration (STEM partner)

Declaration

I hereby declare that the information provided in this application is true and correct to the best of my knowledge.

Checked

Partner details

Name and Surname	
Date	15 March 2018

Section 9 - Head Teacher/Principal Support

Full name:

Statement of support

Please provide a statement in support of the application.

I fully support this application and look forward to the mutual benefits gained

Supporting documents

Please upload any documents (PDF), that you feel may support this application.

No Response

I understand that the Royal Society retains the right to reclaim grant money if the Lead Teacher does not submit the required reports in a timely manner.

Checked