Hands-on DNA: Exploring Evolution

Final Project Report

25 May 2012

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Foreword

It gives me great pleasure to introduce this report summarising the National Hands-on DNA project.

The vision for this strategic project was to give students in all parts of the UK the opportunity to experience for themselves the amazing techniques of molecular biology, using real cutting-edge lab equipment and techniques. This fast-paced project has now trained, equipped and supported 15 new centres to begin running one of two excellent molecular biology workshops with 14-18 year olds.

Overall over 1700 students and 176 teachers have taken part in the workshops in the first months following the training academies, and we hope this is just the beginning of the story. The design of the whole project and a fundamental part of the vision was to enable centres to embed the workshops into their on-going schools programme so they might continue to deliver and evolve them into the future.

Furthermore, through the buddy support system, the collaborative nature of the training academies, and the National Meeting in April 2012, the project aimed to begin the creation of a national network of public engagement professionals with specialist expertise in molecular biology. It is our hope that they will continue to support one another and innovate together in this area of inspirational science education for many years to come.

I am hugely delighted with the outcomes of this project and the exceptional enthusiasm, dedication and collaborative approach shown by all of the 15 new centres, each of whom had to overcome wide-ranging challenges to set up and embed these workshops in their centres. I pay tribute to the professionalism of all 37 staff who are now delivering these workshops. In addition I would like to both thank, and celebrate the outstanding work of Dr Michaela Livingstone, the project manager, and the five other exceptional members of the project team whose passion and dedication has made this project come alive within the short time frame of 14 months.

Science is at its heart a hands-on, ever-changing investigative pursuit, and this project really brings this alive. If we want our nation's young people to be inspired and motivated by science and consider it as a career for their future, we need to give them opportunities like these so they can see how astounding and enlivening the techniques and questions of real science are.

Dr Penny Fidler, the Project director and CEO of UK Association for Science and Discovery Centres

Dr Penny Fidler,

CEO

Executive Summary

'Hands-on DNA' is a national strategic project which aims to make highly engaging, practical molecular biology experiences accessible to students in all parts of the UK. The project was led by The UK Association for Science and Discovery Centres (ASDC) and was delivered in partnership with three organisations with considerable experience running innovative DNA programmes, namely At-Bristol, Centre for Life and Nowgen.

Over the 14 months of the main project the team selected, trained, equipped and supported 15 geographically spread UK centres to deliver excellent molecular biology workshops. The project also provided the necessary resources and project structure to assist centres to embed these high-quality molecular biology workshops as part of their on-going schools programme so they could continue their delivery after the funded phase of the project had been completed.

Overall, the new centres delivered cutting-edge molecular biology workshops to 1,707 students and 176 accompanying teachers in 15 UK locations in the four months following training. All 15 centres have expressed their intent to continue running these workshops for students into the future.

The centres selected to take part included science and discovery centres, museums, and universities all of whom had proven expertise in schools engagement and very different levels of equipment and experience in molecular biology. The needs of every centre were assessed and ASDC centrally purchased over 1500 individual items of equipment costing over £80,000 and delivered these in a bespoke manner to each centre. The Hands-on DNA team ran training academies to train participants in how to use this equipment as well as how to set-up and deliver one of two high-end practical molecular biology workshops. In addition the project ran a 'buddy support system' to help new centres to set up labs and run these workshops in their centres. Training handbooks and training videos were also created along with a full and flexible marketing pack to support the centres.

Centres were trained in one of two practical workshops dependant on the existing skills of the centre. The first, 'A Question of Taste' is a pre-existing full-day curriculum linked workshop for Post-16 students where students isolate and test an aspect of their own DNA. The second workshop known as 'Bacterial evolution' was created specifically for this project and is two-hours long and targeted at 14-16 year olds.

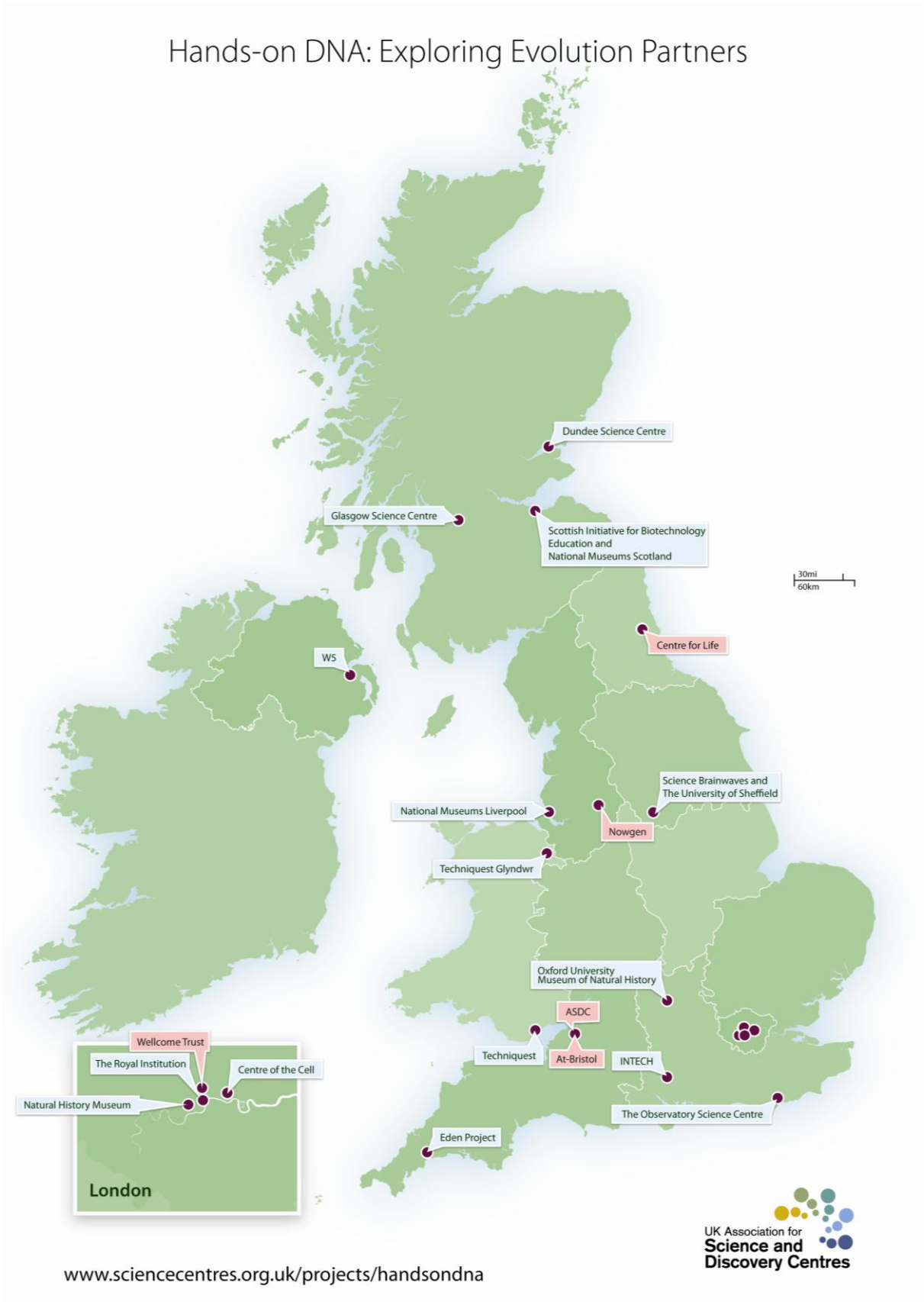
Overall the project team trained and supported 37 staff members to successfully deliver these workshops in 15 centres in England, Northern Ireland, Scotland and Wales. 1514 students and 147 teachers across the UK took part in the project's overarching evaluation study and the results have been impressive.

Evaluation results from Students aged 14-16 after a workshop

- 95% felt it increased their confidence in them being able to understand this area of science
- 89% felt it increased their interest in science
- 90% of students had never used this type of equipment before in school
- 74% felt it made them think that working in science might be interesting

And their teachers said…

- 100% felt that more workshops like this would increase students' motivation to study science
- 85% felt that the workshop will have made them more likely to consider a career in science
- 100% of the teachers said that they would recommend the workshops to their colleagues
- 100% felt that the workshop inspired their students



Centres shown in red are the three delivery partners plus the Wellcome Trust who supported the project. The 15 centres in blue are the new organisations selected to participate in the project.

Introduction

Hands-on DNA: Exploring Evolution was a 14 month national project managed by ASDC and supported by the Wellcome Trust. Its goal was to make high quality engaging molecular biology experiences accessible to school students in all parts of the UK, following on from the successes of an earlier Wellcome supported pilot project, delivered as part of the Darwin 200 Celebrations.

The project aimed to achieve this by providing high-quality training, along with the necessary equipment and supporting resources, to fifteen UK Science and Discovery Centres and related organisations to enable them to successfully deliver one of two workshops related to exploring evolution. Further, the project aimed to provide sufficient support to enable centres to embed these activities in their on-going schools programme so they could continue inspiring students with these workshops long into the future.

The project was designed and delivered by The UK Association for Science and Discovery Centres (ASDC) in partnership with three UK centres with considerable expertise in running these programmes, namely At-Bristol in Bristol, Centre for Life in Newcastle and Nowgen in Manchester.

Overall, the project was complex, involving 19 centres led by ASDC partner organisations, the delivery of over 1,500 items of equipment to 15 centres, the creation of a new molecular biology workshop for KS4 and the sharing of an existing 5-hour Post-16 PCR workshop as well as full training and support programmes for the 15 new centres. We are delighted to report that the project achieved its objectives within the planned schedule and budget as well as exceeding its goal of 1,500 school students having completed the workshops across the UK by March 2012.

As one would imagine for a project of this scale and complexity, the project was not without its challenges. The most notable of this was the time frame for the project, which was dictated by the budget available for ASDC and project team staff time.

This report summarises the overall project, detailing the key achievements, legacy and lessons for the future. The full set of project materials is also available on the ASDC website.

www.sciencecentres.org.uk

Who took part in the project?

The following 15 organisations were selected via a competitive process to be trained and equipped to run molecular biology workshops as part of the Hands on DNA project. In addition, the three project partners also ran these workshops completing the geographical spread.

The Selection process

The 15 organisations to be trained and equipped as part of the project were selected through an open application process managed by ASDC. To achieve this, the full project information and criteria for selection was sent out by ASDC to its wide network of contacts in the major public engagement organisations across the UK, published on the ASDC website, and advertised on sector-wide mailing lists.

Ensuring at this early stage that all applicants had enough information to fully understand what they and their organisations would be committing to if their application were successful was absolutely key to the success of the overall project. Therefore, in the 'Invitation to Participate' the expectations for each partner were clearly set out, including all key training academy dates and workshop delivery deadlines, as well as the need for centres to fund their staff time and consumables in return for the training and equipment. In addition, to highlight and support that the workshops could be embedded for the future, ASDC required the applicants CEO or senior manager to tell us why their organisation would benefit from running these workshops. We believe this has paid dividends in the energy and enthusiasm that the 15 partners brought to the project.

21 organisations applied and a panel made up of representatives from ASDC and the Wellcome Trust convened to select the 15 organisations to participate. Applications were sought from not-for-profit and charitable organisations across the UK with a remit for education, and engagement with science.

Priority was given to organisations that:

- Have a remit to engage the public and school students with science.*
- Have access to publically accessible venues for the majority of the year.
- Have expertise in engaging students with science.
- Have existing education or learning personnel.
- Can demonstrate the desire and ability to embed one of the workshops into their future learning programmes.
- Are science and discovery centres or museums.
- Are members of ASDC, or could become members of ASDC.

*Please note, science was used here in its broadest form

Geographical considerations were also taken in to account to achieve a national spread and to avoid competition between organisations to ensure the on-going sustainability of the programme.

The following centres were selected to take part in the project:

A Question of Taste

- Techniquest, Cardiff
- Eden Project, Cornwall
- Oxford University Museum of Natural History, Oxford
- Glasgow Science Centre, Glasgow
- L'Oreal Young Scientist Centre at the Royal Institution, London
- The University of Sheffield in collaboration with Science Brainwaves, Sheffield
- The University of Edinburgh in collaboration with National Museums Scotland, Edinburgh
- W5 at Odyssey, Belfast

Bacterial Evolution

- Techniquest Glyndwr, Wrexham
- Intech, Hampshire
- Centre of the Cell, East London
- National Museums Liverpool, Liverpool
- The Observatory Science Centre, East Sussex
- Dundee Science Centre, Dundee
- The Natural History Museum, London

The Two Hands-on DNA workshops

The Hands-on DNA project trained, equipped and supported fifteen centres to run one of two molecular biology workshops to enable students to explore evolution using the latest techniques. These two workshops are outlined below and the full details appear on the ASDC website.

1. The 'A Question of Taste' workshop for post-16 students

For the Post-16 students, the project offered the 'A Question of Taste' (QoT) workshop which had been created as part of the Darwin 200 programme by the three project partners (Centre for Life, At-Bristol, Nowgen), with support from The Wellcome Trust. These three centres had successfully delivered this workshop to nearly 2700 students achieving excellent feedback from both the students and their teachers.

This 5-hour workshop allows students to investigate an intriguing trait in humans whereby some people can taste a bitter compound, and others cannot. Students first take a taste test to see if they can taste the compound, which is similar to that found in sprouts. They then extract their own DNA and use PCR to amplify the version of a bitter taste receptor protein gene they have. They can then compare this to whether or not they can actually taste the compound. By comparing the trait in Chimpanzees, students then have the opportunity to investigate why the ability to not taste the chemical may have evolved.

2. The Bacterial Evolution workshop for 14-16 year old students

Research undertaken by ASDC before the start of this project, made it clear that whilst organisations dedicated to science engagement were extremely keen to learn to run molecular biology workshops, they wanted to begin their journey with something shorter and more manageable than the full 5 hour PCR workshop. Therefore the project team proposed at the outset to create a new 2-hour 'starter' workshop to ensure those centres with no molecular biology experience could gain the necessary experience and skills as part of the project. This approach enabled students right across the UK had access to these hands-on experiments.

The project team therefore created, led by Centre for Life, a bespoke 2-hour workshop aimed at 14-16 year olds (KS4 in England) to allow organisations with little or no molecular biology experience to be trained to deliver high-end molecular biology.

This new workshop is called Bacterial Evolution (BE) and it puts students in the role of a clinical bacteriologist. They use gel electrophoresis and restriction mapping to investigate 'bacterial DNA' that has come from a culture grown from a patient with an infection. Is the strain of bacteria that the patient is infected with a mild one, or is it a more serious, antibiotic resistant strain, and what course of treatment should be given?

The project team worked closely with the National Centre for Biotechnology Education (NCBE) to produce a set of consumables to make obtaining what is needed for the workshop as easy as possible for the centres involved. Also, this workshop uses a bespoke mix of plasmid DNA, which NCBE will provide into the future.

The Two Training Academies

The Hands-on DNA training programme involved two two-day intensive residential training academies, one for each workshop.

The programme of both academies included

- A full and thorough run through of the workshop.
- Training on the equipment use.
- Training on preparing the solutions and consumables to run the workshop.
- Other specific training modules, for example introductions to genetics and evolution, running dialogue activities, using the evaluation framework, and marketing the workshop to schools.

The project funded the travel and accommodation costs for two members of staff from each organisation to attend the academy, with ASDC administering the finances for this.

Organisations were asked to commit two members of staff to be part of the full project training programme to make certain that the expertise gained would not be lost through staff turnover.

The first of these was the A Question of Taste academy which took place in At-Bristol from 4-5 October 2011 where 18 members from 8 organisations attended the training.

The Bacterial Evolution academy then took place 2-3 November in Centre for Life in Newcastle where 17 members from 10 organisations attended (this included three centres who were delivering A Question of Taste).

Feedback from the academies was extremely positive, with participants providing comments such as

"Best workshop/short course I've attended in years!" (QoT Academy)

"Very good, great way of doing the course. Excited to do this now!" (QoT Academy)

"As a complete novice I was concerned I would not be able to keep up. Everyone was very supportive and took time to explain/clarify things for me. An excelling training session" (BE Academy)

The Buddy Support System

Additional support was provided to participants after the academies through the 'buddy system'. Each of the three partner organisations was paired with 5 participant organisations. Introductions took place prior to the academies, and during the academies the participating centres worked closely with and got to know their buddies. Buddies visited each of their centres up to two times. In general the first took place in advance of their first workshop being delivered, to support planning and set-up, and the second to help support the staff delivering their first workshop with students.

In planning the project, we had expected that staff would leave the academy full of confidence and would then feel rather nervous when setting up alone in their centres. The buddy system was to support staff through this process to ensure successful delivery. To assess this, and ensure we addressed as many concerns as possible, the project evaluation was designed to both examine their feelings at the end of the academy (very positive), and then three weeks later. As anticipated, the evaluation by Ben Gammon shows they were looking forward to the buddy visits and many felt they were vital to assist them with setting up the workshops in their labs and education rooms and operating the equipment.

Ben Gammon reports "there was universal praise for the buddy system and the role they played in this project".

"It's very reassuring to have the Buddy system in place"

Additional Support

Equipment support

ASDC offered support to all participants on the set up, use and programming of all the project equipment on the phone and by email. The evaluation report shows that this immediate problem-solving aspect of the support offered by the ASDC project manager, Dr Michaela Livingstone (who has a recent PhD in molecular biology), and the additional support from buddy visits was highly valued by participants.

A Series of Training Videos

ASDC also created a series of professionally made training videos which are online and freely available. They cover all practical aspects of the workshops as shown in the list below. Their goal was to enable academy participants to refresh their own skills as well as to enable them to train colleagues into the future. The 11 videos are available through

http://sciencecentres.org.uk/projects/handsondna/videos.html

Title	Duration
Using The picofuge	1:06
Preparing and diluting HaeIII for a Question of Taste	2:10
Preparing 1 X TBE	1:11
Preparing PTC primer stock and mixes	1:51
Preparing Chelex for a Question of Taste	1:45
Looking at your results	2:29
Loading and running gels	4:17
Making an agarose gel	5:32
Setting up the PCR reaction	4:39
Using the microcentrifuge	2:10
Using the micropipettes	5:51

The Hands-on DNA National Meeting

On 17 April 2012 we brought together all of the organisations involved in the project to take part in the Hands-on DNA National Meeting. This meeting aimed to solidify the links *between* the members of the network, so that they could go on to support *each other* beyond the end of the project, ensuring the legacy of the expertise built within the project was not lost, even with staff turnover. The evaluation from the day showed that 80% of respondents had rated the day very good overall, but no one rated it below 3 on a seven-point scale. Participants most valued being able to hear about the workshops in other centres, and discussing issues to work solutions out together. Others appreciated being able to meet equipment and consumable suppliers, whilst many had already made contact with suppliers.

The Project Handbook

Handbooks were produced for each workshop and distributed in hard copy to participants at both Training Academies. These acted as workshop manuals for the practical elements as well as containing sections on marketing, evaluation and the curriculum links. Following the academies, memory sticks were sent to all participants containing the entire handbook contents, along with all the photographs for marketing, the PowerPoint presentations needed for the workshops, and all the presentations given at the academies.

The handbooks for each workshop covered;

- Background scientific information, including the workshops key messages, introductions to genetics, molecular biology and evolution;
- Background practicalities, such as curriculum links (for all four nations) and marketing advice;
- Teaching resources, with demonstrator notes and the presentation slides, as well as information and resources needed to carry out the additional activities;
- Technical information, consisting of technician's notes on how to set up the workshop, the protocol of the workshop, health and safety considerations, supplier information and top tips.

The evaluation at the first academy showed that the participants needed to be led more slowly through the handbook, and this was incorporated into the second academy.

The Marketing Pack

The 15 participating organisations and the three partners are vibrant, independent centres with their own identities and approaches. Having run national collaborative projects for some years, it is clear to us that any marketing resources needs to be more of a flexible tool-kit, a pick-and-mix, rather than a rigid set of artwork and guidelines. With this principle at the fore, ASDC commissioned a series of photographs of students participating in the workshops in At-Bristol and Nowgen at the start of the project, and these formed part of the resources new centres could use to promote the workshop in advance of their delivery. ASDC also supplied set texts that marketing teams could use to promote the workshops and the partnership, as well as specific press releases with notes to

editors to tie in with the publication of the Select Committee Report on the need for school students to undertake more practical work.

We were aware that science and discovery centres generally print their year's schools programme in June / July to send to schools early in the September term. The overall short time frame for the project meant this was not possible as the selection process for centres was not complete until mid July. It was also noted that centres preferred to come to the academy to learn about the workshops first, before feeling confident to promote them.

Within the academies, the project director also gave a talk about marketing and PR, proposing centres use the seasonal brussel sprouts link and giving a selection of calendar days and events to link to.

Press releases based on this were released by some centres, e.g., Ri and Eden Project press teams. The project was covered by print and online press nationally, but also reached websites in America and India.

The photos that were provided were all licensed under creative commons so that the centres could use them as they saw fit.

Additionally, the handbooks, project information and key dates were provided online via the ASDC website, and the marketing photos were uploaded the photo social media website Flickr (with helpful tags to make searching easy).

The following was provided as part of the marketing pack:

- Marketing Images
  - Photographic images to promote the Workshops
    - High Resolution for Print
    - Web-optimised Photos
  - Images of adults doing the workshop for CPD training
  - sample model release form
  - sample copyright reassignment form
- Sample Press Releases and PR Ideas
  - Involvement in Project Press Release
  - General Sample Press Release
  - Workshop summary – sample copy
  - Celebratory Days and PR Ideas
  - Approved Text

Logos

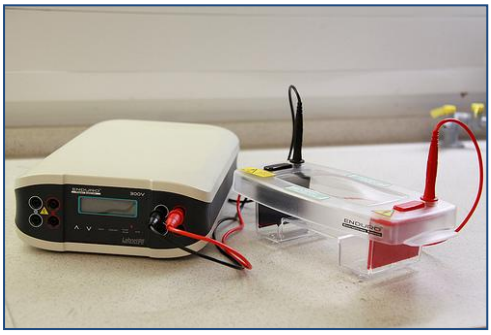
An earlier Wellcome-funded project had created the A Question of Taste workshop and the associated logo is shown below. For Hands-on DNA we were creating a new KS4 workshop called Bacterial Evolution, which needed its own logo that complemented the pre-existing one. Working

with graphic designers, the logo below was developed and is used by centres to promote this workshop.

The marketing pack include electronic versions of the following

- The two workshop logos above.
- The project partner logos in the agreed format.
- Guidance document for logo usage.

Equipment



Across the project over 1,500 individual items of equipment were purchased and distributed to the 15 organisations across the UK.

In research undertaken prior to the project, it was clear that across the UK there was great variability in the level and type of equipment centres had. This ranged from centres with no bespoke lab or equipment, to centres that had previously run PCR and had much of the equipment.

In order to provide all the equipment the participating organisations would need to effectively deliver their chosen workshop, ASDC made equipment assessment visits to most of the centres in the weeks following the centres' selection. To achieve the project delivery within budget, we needed to provide a bespoke set of equipment to each centre to ensure they had the means and capacity to deliver their chosen workshop. Centres had already been asked to list what equipment they had on their application forms, and the project manager visited 11 of the participating centre to assess equipment and facilities with the staff.

From the information collected from the 15 centres, a full list of equipment required was created and used as the basis in negotiation with three lab supply companies.

Through these negotiations the core equipment needed was secured below the budgeted amount. This allowed extra items to be purchased subsequently by ASDC for the centres, such as microwaves, lab coats, and storage trolleys for those requiring them. Additionally, the low prices that were secured were frozen until August 2013, for any centre involved in the project who might later wish to purchase further items.

The core lab equipment was supplied by Progen Scientific Ltd, whilst

other additional equipment came from a range of suppliers.

There are cheaper alternatives for some of these items of equipment, however the project team felt very strongly that students would gain more from being able to use genuine lab-quality equipment rather than simplified alternatives.

Consumables

Through many discussions with the organisations involved towards the end of the project, and the views that were coming out the evaluation, it was clear that it was felt that a barrier to the continuation of these activities in their organisations could be the cost of running them. A large proportion of this was the cost of buying the consumables.

Having taken this feedback on board, the project team provided revised protocols for both workshops which used different consumables to help guide participants on how they might reduce the cost of running their workshop.

For A Question of Taste this involved using a different PCR mix system, and for Bacterial Evolution buying in liquid enzyme, rather than the specially dried enzyme that NCBE offered.

This information was distributed at the National Meeting in April, and time was allocated to covering this through discussion with participants.

Evaluation Programme

Dr Ben Gammon, of Ben Gammon Consulting undertook the evaluation of Hands on DNA. His detailed report has been supplied to accompany this and the most pertinent results are included within this report, particularly in the impact sections.

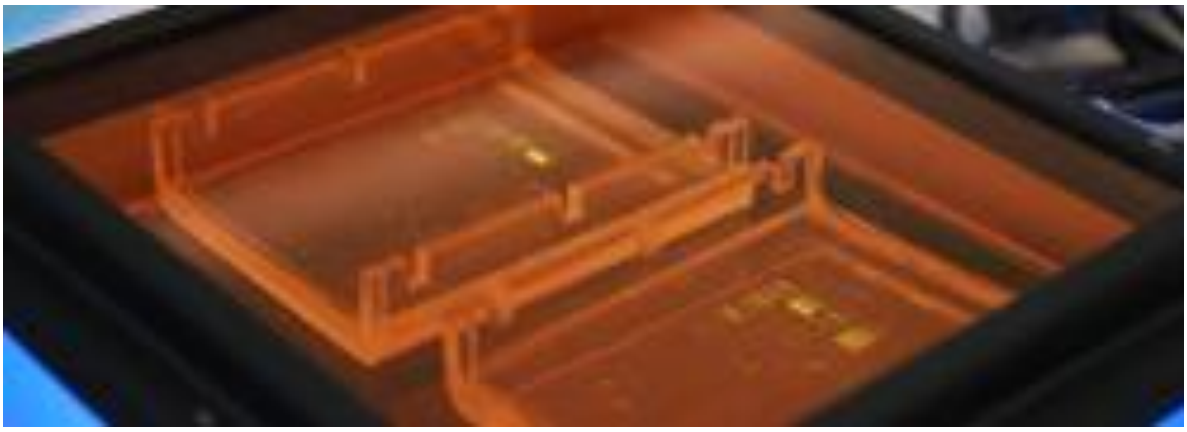
The evaluation had two goals:

1. To assess the students' reaction to the workshops, including their feelings about what they had experienced and learned, and to assess the teachers' feelings about the value of the workshops to their students.
2. To assess the mechanism used to plan and deliver this project and to identify lessons for future UK-wide collaborative projects.

The design of the evaluation programme was co-created between Dr Penny Fidler and Dr Ben Gammon and covered 4 main aspects of the project, as outlined below. All data was analysed by Ben Gammon and compiled into a final report.

Evaluation Overview

	Data Collection by	Mechanism
Assessing the impact on students	The 15 centres gave these to students. Collation by centres and centrally by ASDC	1514 Self-completion Questionnaires
Teacher's assessment of the value of the workshops to their students	The 15 centres gave these to teachers to complete. Collation by centres and centrally by ASDC	147 Self-completion Questionnaires
Evaluating the opinion of staff and managers at the 15 participating centres about the project and its long term impact	Ben Gammon, by phone	15 Semi-structured telephone Interviews
The opinion of the three partner organisations (At-Bristol, Nowgen and Centre for Life) about t0he project and its long-term impact	Ben Gammon, by phone	5 Semi-structured telephone Interviews
Evaluation of Academy 1: A Question of Taste	By ASDC and Ben Gammon	18 Self-completion Questionnaires
Evaluation of Academy 1: Bacterial Evolution	By ASDC and Ben Gammon	20 Questionnaires
Interim Evaluation	By Ben Gammon (by email)	20 Questionnaires
Evaluation of National Meeting (and overall project)	By ASDC	32 Questionnaires
Data Analysis and completion of the evaluation report	By Ben Gammon	-



Impact on the students

1,707 students took part in the project in total, and of this we obtained evaluation results from 1514 students who took part in either workshop. The feedback was exceptional, for example:

Question of Taste workshop (evaluation forms from 787 students)

- 96% felt it increased their confidence in them being able to understand this area of science.
- 93% felt in increased their interest in science.
- 80% of students had never used this type of equipment before in school.
- 80% felt the workshop would help them with their subsequent school work.
- 80% felt it made them think that working in science might be interesting.
- 90% felt it was successful in increasing their understanding of PCR, electrophoresis, restriction enzymes and other elements.

Bacterial Evolution workshop (evaluation forms from 727 students)

- 95% felt it increased their confidence in them being able to understand this area of science.
- 89% felt in increased their interest in science.
- 90% of students had never used this type of equipment before in school.
- 69% felt the workshop would help them with their subsequent school work.
- 74% felt it made them think that working in science might be interesting.
- 84-96% felt it was successful in increasing their understanding of electrophoresis, restriction enzymes and other elements.

Students particularly liked:

"Gel electrophoresis in action because we only learnt about it theory wise."

"It was more adult and advanced than school."

"We don't get to do that many practicals especially in biology."

"I have a chance to learn from experience not just from notes and textbooks."

"The practicals at school are really unreliable and almost never work - it was refreshing to be able to do one properly."

"Using equipment that works, unlike school."

"Being able to find out about your own genes, makes it more interesting."

When asked if anything could be improved, the most often cited suggestion was the want for even more practical work:

"More activities and less talking and writing." *"Less talking more doing."*

40% said that they couldn't think of anything that would improve the workshop (average of both workshops):

"It can't be improved it was amazing." *"I can't think of any. It was simply the best."*

Teachers assessment of the Impact on their students

In total the project reached 176 teachers. Evaluations from 147 teachers who took students to both workshops were collected as part of the evaluation programme to assess their views on the workshops.

Teachers rated the workshops very positively on several aspects, including the content of the workshops, the equipment made available to use, the high practical aspect of the workshops and the organisation of the workshop, with none of them rating any aspect as 'poor' or 'very poor'. Importantly, a large proportion of the teachers felt that it had increased their students' understanding of molecular biology and evolution, and developed their students' practical and investigative skills. Furthermore, all teachers said they would recommend the workshops, and all but one teacher said they would bring students back.

A Question of Taste (Evaluation forms from 78 teachers)

- 95% rated the equipment of the workshop as very good.
- 95% rated the knowledge of the staff running the workshop as very good.
- 98% agreed that the workshop inspired their students.
- 80% felt that the workshop will have made them more likely to consider a career in science.
- 99% felt that more workshops like this would increase students' motivation to study science.
- 94% felt that the workshop was very successful or quite successful in increasing or reinforcing their students' understanding of concepts in evolution.
- 99% felt that the workshop was very successful or quite successful in providing an opportunity for their students to develop their investigative skills.

"Clearly explained, built on AS knowledge, we could never do a practical like this at school students thoroughly enjoyed it."
"Students were able to get hands-on experience of practicals only talked about in class."
"Experiencing work in a "real" lab good preparation for uni."

Bacterial Evolution (evaluation forms from 69 teachers)

- 96% rated the equipment of the workshop as very good.
- 94% rated the knowledge of the staff running the workshop as very good.
- 100% agreed that the workshop inspired their students.
- 85% felt that the workshop will have made them more likely to consider a career in science.
- 100% felt that more workshops like this would increase students' motivation to study science.
- 91% felt that the workshop was very successful or quite successful in increasing or reinforcing their students' understanding of concepts in evolution.
- 99% felt that the workshop was very successful or quite successful in providing an opportunity for their students to develop their investigative skills.

"The feeling of using "proper" equipment and techniques."
"Fantastic for enthusing the pupils to consider biology at A level and beyond."
"Fantastic opportunity for students to see the sort of work done in biomedical labs."

Project Structure and Management

The project was managed and centrally coordinated by ASDC where a dedicated project manager took responsibility to ensure that the project was on schedule and on budget. In addition, the project manager, herself a molecular biologist, carried out the equipment assessments and the equipment procurement. She also wrote, produced and presented the training videos, and managed the development of the marketing resources.

ASDC acted as the main contact point for the project, dealing with project participants, and reporting project progress quarterly to the Wellcome Trust.

The project team were in 4 UK locations. They met in person at a kick-off meeting and once during the development of the content and at the training academies. Regular conference calls were organised by ASDC to discuss specific items, however the project team felt that funds to enable more regular face to face meetings would have been very beneficial. The evaluation report shows that Google groups and Twitter were not seen as a particularly useful mechanism for communications in the project as compared to the phone and email, with face to face meetings being seen as the most productive.

The Project team

ASDC	Dr Penny Fidler (project director) Dr Michaela Livingstone (project manager)
At-Bristol	Neil Cartwright
Centre for Life	Dr Sarah Robinson Dr Nicola Stock
Nowgen	Dr Mat Hickman Kate Dack

The Work Packages (WPs) are listed below. The content of some WPs were led by ASDC, and the consolidation and content development of QoT and BE were lead by At-Bristol and Centre for Life respectively. Through all team meetings, all members were able to discuss and provide advice, inputting on all areas of the project.

Project structure

WP1 Project Management
Undertaken by ASDC

WP2 Equipment assessment, procurement and delivery
Undertaken by ASDC

WP3 A Question of Taste training programme
Led by At-Bristol, with input from project team

WP4 New starter workshop training programme
Led by Centre for Life with input from project team

WP5 On-site training and embedding
Buddy visits undertaken by Nowgen, At-Bristol and Life, National meeting by ASDC
Handbooks led by Nowgen, with input from project team
Training videos by ASDC

WP6 Schools marketing pack
Undertaken by ASDC

WP7 Evaluation
Led by ASDC, with Ben Gammon Consulting

Project Schedule

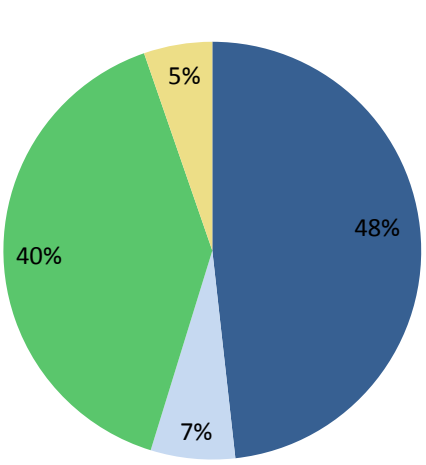
The project began in February 2011 with a kick-off meeting involving all four partners. The contract for the project was signed on May 3 2011, and the project development then began in earnest with the partner organisations receiving subcontracts from ASDC detailing the work they would undertake and the time frames. A large proportion of the development had to be completed in advance of the Invitation to participate being sent out, as much of the project needed to be detailed in this. All development needed to be completed in advance of the first training academy in October 2011. Beyond this time buddy visits took place, as well as additional development of support.

Key Project Dates

Project kick-off meeting	1 March 2011
'Invitation to participate' sent out to UK organisations	1 June 2011
'Invitation to participate' Deadline for applications	July 4 2011
Participants selected and notified	15 July 2011
Question of Taste Training Academy – At-Bristol	4-5 Oct 2011
New workshop Training Academy – Centre for Life, Newcastle	2-3 Nov 2011
Deadline for agreed target number of workshops to have been delivered in new centres	30 March 2012
National Meeting, Wellcome Trust, London	17 April 2012
Project Completed	30 April 2012

Project Budget

Project spend by category



- Staff time for project management, admin, and project partners development, and training
- To science centres e.g. Travel expenses
- Equipment to participating organisations
- Other external spend, e.g. costs for video production, graphic design, events and meetings

Overall project budget: **£199,950** (ex VAT)

Total project expenditure: **£199,950** (ex VAT)

Lessons for future projects

Hands-on DNA has successfully achieved its aims, having reached over 1,500 students in England, Scotland, Wales and Northern Ireland, trained 37 members of staff from 15 science centres, museums and universities, and provided almost £80,000 worth of equipment to these centres.

The project will have a lasting legacy as all of the 15 organisations involved rated the benefits of the project very highly and have stated intentions to carry on their workshops in to the future. Many have already committed dates to delivering the workshop, while yet more have stated plans to develop the activities to tie in with their own collections and programmes.

Additionally, important lessons have been learnt about running UK wide, multi-site collaborative projects. The model of training academies and supporting Buddies coordinated by a central organisation with the UK-wide remit has been shown to be highly effective.

Lessons learned

The following is drawn from the evaluation report:

- The role of ASDC as an unbiased organisation with a strong understanding of the sector to oversee the selection process, centrally coordinating the project, and undertake complicated activities, such as procurement of bespoke sets of equipment was judged to have worked extremely well.
- The support system that was put in place, specifically the buddy system, was perceived to be invaluable in helping provide further information and reassurance to participants.
- The project team organisations were utilised in such a way as to play to their strengths, and also to contribute their expertise to the work that others were carrying out.
- The project has provided the opportunity to show consistent impact data across the nation with a large cohort of students involved in these activities.
- Ensuring that organisations were geographically spread meant that there was no competition between participants.
- The evaluation report showed that it was the feelings of those involved, that the project would have benefitted from a more comfortable schedule. For example, during the evaluation participants often cited the relatively short lead in time, from training in October/November and receipt of equipment, to delivering enough workshops by April as being very challenging.
- Future projects should take in to account the periods when school groups are not able, or willing, to visit.
- The charities involved would have liked financial support to be able to commit staff time and consumables whilst they were preparing for their first workshops instead of competing with other fully funded programmes.
- The management, coordination and administration role undertaken by ASDC required far more days than the original project allowed. This was evident before the contract was signed, and the additional time was funded from the charities reserves.
- A more comfortable pace for the project team to carry out their development work, increasing the time available to collaborate would have been desirable.
- Procurement of equipment should be done as far in advance as possible, to coincide with, or take place shortly after, training has been given.
- More funding available specifically to allow more face-to-face team meetings between the project partners. These were felt to have been the most productive way of allowing discussion over conference calls.
- Training should take account of the wide variation between the different needs of those attending; some need more support with practical aspects of set-up, whilst others need help with presenting the science.

Hands-on DNA

A QUESTION OF TASTE

BACTERIAL EVOLUTION

May 2012

Information correct at time of publishing

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