Meet the Gene Machine – UK-Wide Roll Out

Evaluation Report

Clare Wilkinson, Karen Bultitude,
Laura Strieth and Frank Burnet

Science Communication Unit
University of the West of England
Bristol
UK

October 2009

Contents

1 Executive Summary 5
1.1 Key Recommendations 6

2 Introduction 7

3 Meet the Gene Machine 9
3.1 The Mini-Drama 9
3.2 The Debate 9
3.3 The Continuing Professional Development (CPD) Workshop 9

4 Evaluation Methodology 11

5 Evaluation Results 13
5.1 Participant Demographics 14
5.2 Meet the Gene Machine Mini-Drama 16
5.3 The Meet the Gene Machine Discussion 24
5.4 Continuing Professional Development (CPD) Workshop 32

6 Conclusion 37
6.1 Raising awareness amongst students 37
6.2 Generating engagement with the issues 38
6.3 Effectiveness as a science communication event 38
6.4 Implementation and success of the CPD workshops 39
6.5 Key Recommendations 40

7 Appendix 1: Evaluation Materials 41

List of Tables

Table 1. Participant Numbers by Science Centre.....14

Table 2. Audience Questionnaire Completion by Science Centre.....15

Table 3. CPD Questionnaire Completion by Science Centre.....15

Table 4. Student Enjoyment by Year Group.....18

Table 5. Student Enjoyment by Science Centre.....20

Table 6. Student Enjoyment by Enjoyment of Science Classes.....22

Table 7. Student Enjoyment of Discussion by Science Centre.....26

Table 8. Student Enjoyment of Discussion by Enjoyment of Science Classes.....27

Table 9. Student Enjoyment of Discussion by Year Group.....29

List of Figures

Figure 1. Student Audience Questionnaire – Did you enjoy the drama?.....16

Figure 2 – Techniquest Gene Machine.....19

Figure 3 – Glasgow Science Centre.....19

Figure 4. Teacher Audience Questionnaire –
The drama was clear/comprehensive.....23

Figure 5. Teacher Audience Questionnaire –
The drama was engaging.....23

Figure 6. Audience Questionnaire –
The discussion was engaging.....25

Figure 7. Teacher Audience Questionnaire –
The discussion was engaging.....31

1 Executive Summary

Meet the Gene Machine (MGM) was a nationwide project funded by The Wellcome Trust, which ran between September 2006 and April 2007. Led by the Science Communication Unit (SCU) based at The University of the West of England, Bristol, UK, the project ran in partnership with 8 UK science centres throughout the UK. The event format comprised 3 distinct elements; a mini-drama, facilitated debate and continuing professional development (CPD) workshop for young people aged 13-18 and their teachers.

This evaluation report summarises the findings from a range of evaluation methods including observations, questionnaires, individual and group interviews, in addition to diaries and reports from the science centres involved. The report evidences a series of key recommendations for organisations and individuals seeking to establish similar projects in the future.

1.1 Key Recommendations

1. Drama is an effective way to engage young people with a number of the challenging ethical and social implications of science.
2. Creating a supportive environment for science centre presenters to develop and incorporate acting techniques in such activities has broad benefits.
3. The scripting of such dramas can include a good level of scientific information but must be wary of the constraints and confidence levels of presenters to communicate these aspects clearly.
4. Facilitated discussion activities are inspiring and informative, in addition to being popular with young people and teachers alike.
5. Targeting mixed ability groups within a discussion presents its challenges but encourages students with differing levels of experience and confidence to contribute their views.
6. CPD activities are beneficial for teachers, but must be planned and recognise the difficulties of marketing to this sector. They provide a key opportunity for science centres to form strong partnership with teachers within their Local Education Authority.
7. Providing a central training and resource opportunity for individual science centres to utilise and develop is a key technique for shared learning, innovation and sustainable approaches to science communication across the sector.

2 Introduction

Meet the Gene Machine (MGM) was a nationwide project funded by The Wellcome Trust, which ran between September 2006 and April 2007. Led by the Science Communication Unit (SCU) based at The University of the West of England, Bristol, UK, the project ran in partnership with 8 UK science centres throughout the UK:

- At-Bristol, Bristol.
- Centre for Life, Newcastle.
- Glasgow Science Centre, Glasgow.
- Museum of Science and Industry (MOSI), Manchester.
- Science Oxford, Oxford.
- Techniquest, Cardiff.
- Thinktank, Birmingham.
- W5, Belfast.

This project was supported by the Wellcome Trust through an Engaging Science *Society Award*. The event format was previously piloted with support from a Wellcome Trust People Award, in partnership with Techniquest and the Wales Gene Park, and grew from an original activity format developed in partnership with the British Council in the Czech Republic. At each stage of development the event format has been further refined and the content adapted to best suit the venues and partners involved.

For the UK-wide roll out the Science Communication Unit coordinated and managed the project, revised the event format, provided training for science centre staff, performed core evaluation and disseminated key learning outcomes to partners. Ben Johnson and Becky Williams from Graphic Science provided valuable assistance in this aspect of the project. A Project Coordinator, Laura Strieth was based in the Science Communication Unit and played a central role in a number of aspects, including the training for science centres and communication across the project.

Each science centre hosted in-house training, constructed a 'Gene Machine', adapted the event format to best suit their venue and audiences, recruited local schools and disseminated the *Meet the Gene Machine* event.

An external evaluator, Sarah Jenkins of Jenesys Associates (http://www.jenesysassociates.co.uk/) was commissioned to provide an independent perspective of the successes and challenges of the project. This report summarises the key findings of the evaluation in order to share learning for future similar projects.

3 Meet the Gene Machine

The *Meet the Gene Machine* event format has three distinct elements, each of which were designed to be delivered by science centre presenters within school settings.

3.1 The Mini-Drama

Meet the Gene Machine opens with a short mini-drama which is intended to be entertaining and provocative. It has been specifically designed and tested to appeal to young people aged 13-18, with a chat show format. It sets up potential scenarios involving a 'Scientist' and a 'TV presenter', who are 'played' by two science centre presenters who have been trained in advance. The drama acts as a stimulus for a debate: students are taken through the process of genetic testing in the future and what it might mean for the characters involved.

3.2 The Facilitated Debate/Discussion

Through a facilitated debate the students then discuss their own opinions and consider those of their peers with regards to the topics raised within the mini-drama., The facilitation is performed by the science centre presenters using a series of prompts, ranking games and fictional scenarios. The debate encourages students to consider some of the implications advances in genetic testing may have for them, their friends and their families in the future.

3.3 The Continuing Professional Development (CPD) Workshop

Designed to run as a twilight activity (after classes have finished but before 5pm) within schools, the CPD workshop provides an opportunity for teachers from a range of academic disciplines to consider and explore how debating and discussion skills can be utilised within the classroom. The intention of the CPD component was to build up teachers own abilities and confidence in creating and running events that remind their students that science is affecting real people.

The Science Communication Unit worked with the presenters and other staff at each of the host venues to adapt each of the above aspects to best suit the host venue and local target audiences. Hence although each version of *Meet the Gene Machine* was based on a consistent set of content and ideas, there were slight differences in how the various events were delivered.

Further information about *Meet the Gene Machine*, including the script, teacher's resources, details of the advisory group and information on the CPD is available from http://www.scu.uwe.ac.uk/index.php?q=node/101

4 Evaluation Methodology

The evaluation procedure was designed by the Science Communication Unit, in conjunction with Sarah Jenkins of Jenesys Associates. The evaluation employed a multi-method approach, using quantitative and qualitative techniques to fulfil the following criteria:

- Measure how the event raises awareness amongst students.
- Assess the capacity of the event to generate engagement on science-society issues.
- Determine the project's effectiveness as a science communication event.
- Monitor the implementation and success of the CPD workshops.

In addition, the evaluation sought to consider any legacy the *Meet The Gene Machine* project would have, within the limitations set by the point at time in which this report has been produced. Copies of the observation guide, questionnaires, focus group/interview questions and presenter diaries can be found in Appendix 1.

For each of the eight venues involved the methods employed within the evaluation included:

Observations of MGM events and CPD workshops were carried out at two points during each venue's delivery phase. Events at each science centre were observed at the onset of the project and in the middle of their delivery period. The observations considered a range of different features of the MGM project and the immediate impact it had on the audience. They also provided a source of formative and process data on different methods used by different partner organizations, including identifying particular successes for dissemination across project partners.

'**Audience' Questionnaires** were distributed to students and teachers attending the MGM event. The student questionnaire was two-part, combining simple open and

closed questions to be completed both prior to and after their participation. The opinions of teachers who attended the MGM show were separately explored, with questions on aspects including curriculum suitability and the effectiveness of the chosen facilitation techniques.

CPD Questionnaires were distributed to teachers attending the CPD workshops. The questionnaires intended to capture both closed and open responses on teachers' motivations for attending the workshop, the subject areas the resources were applicable to and any suggested improvements or perceived best practice within the workshop itself and resources that were distributed.

Follow up group and single interviews were carried out with teachers and students two to three weeks after they had participated in an MGM show in order to evaluate any further impact the project was having.

Reports from each of the eight partner science centres, alongside **presenter diaries** (from science centre presenters delivering the show and teacher workshops) sought to capture data from the science centre level of the project. This had two purposes: to help presenters capture their ideas and best practice techniques and to gain evaluative insight on the project format and delivery from their perspectives. Reports from the 8 science centres are included in Appendix 2. This is not included in the publically available version of this report.

5 Evaluation Results

The evaluation data comprises:

- Observations of sixteen *Meet The Gene Machine* events, two from each science centre at outset and mid-stages of delivery.
- 1,530 completed student audience questionnaires (representing over 14% of the student audience reached).
- 281 teachers' CPD questionnaires (representing over 56% of the teachers reached by CPD).
- 167 completed teacher audience questionnaires.
- Group interviews with students were held at 6 different schools. Teachers were interviewed in person at 5 schools and via telephone at 5 further schools.
- Reports were returned from each of the 8 UK science centres and a total of 21 presenter diaries were returned.

Science centres were requested to distribute questionnaires at a range of event performances. They were asked to spread the questionnaire distribution across the duration of the project, to map for any developments or changes as their delivery progressed, and where possible to stratify the questionnaire distribution in order to be as representative as possible, for example to include schools across differing local areas.

Within this section of the report we cover:

- The metrics associated with the programme (number of pupils and teachers involved etc.)
- Participant demographics
- Evaluation of the mini-drama, including both teacher and pupil feedback

A total of 10,455 secondary school pupils attended *Meet the Gene Machine* events and 632 teachers came into contact with the *Meet the Gene Machine* project. This was distributed across the eight partner science centres as indicated in Table 1.

Science Centre	Students Reached	Teachers (CPD) Reached
At-Bristol	1425	40
Centre for Life	1425	45
Glasgow Science Centre	1336	79
Museum of Science and Industry	1005	-
Science Oxford	2040	134
Techniquest	1328	127
Thinktank	580	56
W5	1316	17
TOTAL	**10455**	**498**

Table 1. Participant Numbers by Science Centre

5.1 Participant Demographics

Of those completing the student questionnaires 57% (n=877) were female, and 41% (n=629) were male. The majority of student participants (88%; n=1328) described their ethnicity as 'White', followed by 'Asian/Asian British' (n=97), and 'Black/Black British' (n=27). In terms of key stages, 33% (n=496) were at key stage 3 (aged 11-14 or school years 7-9), 47% (n=724) were at key stage 4 (aged 14-16 or school years 10-11) and 19% (n=286) were in post-16 education (aged 17-18 or in school years 12-13). The majority of science centres were able to evaluate the responses of at least 10% of their student audiences, as is indicated in Table 2.

In terms of the teachers completing questionnaires from the audience perspective, 43% (n=72) were male and 55% (n=93) were female. Most had been teaching for under ten years: 29% (n=49) had been teaching for 1-4 years and 27% (n=45) for 5-10 years. 41% (n=69) had taught for over 11 years. The majority of teachers (62%; n=104) taught science subjects, including biology, physics and chemistry. 20% (n=34) of teachers said they taught more than one subject (e.g. biology and PE).

Science Centre	Frequency	Percentage	Percentage of Total Audience Evaluated per Science Centre
At-Bristol	331	21%	23%
Centre for Life	204	13%	14%
Glasgow Science Centre	183	12%	13%
Museum of Science and Industry	146	10%	14%
Science Oxford	244	16%	11%
Techniquest	201	13%	15%
Thinktank	134	9%	23%
W5	87	6%	6%
TOTAL	**1530**	**100%**	**-**

Table 2. Audience Questionnaire Completion by Science Centre

Science Centre	Frequency	Percentage	Percentage of Total CPD Participants Evaluated per Science Centre
At-Bristol	14	5%	35%
Centre for Life	26	9%	57%
Glasgow Science Centre	37	13%	46%
Museum of Science and Industry	-	-	-
Science Oxford	87	31%	64%
Techniquest	98	35%	77%
Thinktank	19	7%	33%
W5	-	-	-
TOTAL	**281**	**100%**	**-**

Table 3. CPD Questionnaire Completion by Science Centre

The majority of teachers who participated in the CPD activities were also female (64%; n=179). Again, almost half had been teaching for 1-4 years (46%; n=129), whilst 20% (n=57) for 5-10 years. 32% had been teaching for over 11 years. The teachers involved in the CPD also tended to teach science-based subjects. 76% (n=214) taught science including Biology, Physics and Chemistry. 10% (n=29) taught multiple subjects, and this was most closely followed by English, taught by 2% (n=7) of those completing the CPD questionnaire. As noted in Table 1, the scale of CPD activities run by individual science

centres varied, and in turn the percentage of CPD evaluated by science centres also varied between them, as is indicated in Table 3.

5.2 Meet the Gene Machine Mini-Drama

In this section we report on key evaluation findings relating to the mini-drama aspect of the project, including:

- Levels of audience enjoyment and engagement
- Teacher's impressions of the mini-drama
- Relationships between appreciation of science and audience enjoyment

The majority of young people who participated reported that they enjoyed the mini-drama element of the event. As is illustrated in Figure 1, 64% (n=936) of the young people involved reported that they enjoyed the mini-drama, whilst only 10% (n=151) said that they did not.

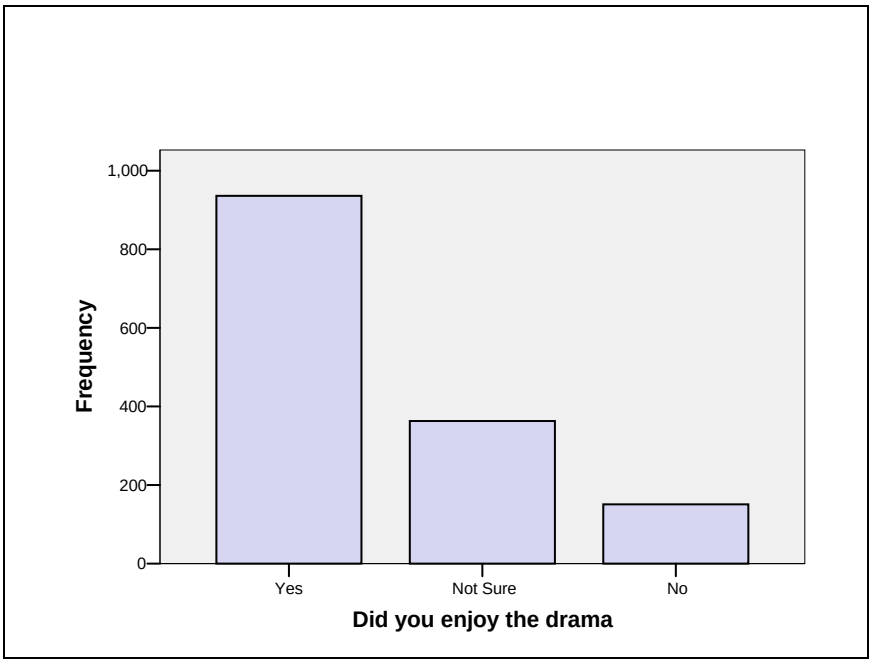

Figure 1. Student Audience Questionnaire – Did you enjoy the drama?

The most frequently stated reasons given by pupils for enjoying the drama were that it was entertaining (n=344), informative (n=154) and interesting (n=144). During the

interviews students elaborated that '*the drama was a really interesting way of explaining something that could be quite boring*' (Abronhill High School, Glasgow Science Centre) and that it '*helped introduce the science*' (St. Benet Biscop School, Centre for Life). It was agreed that even if the acting by presenters wasn't professional, '*they still got the message*' (Langley School, Thinktank), and that the '*information was the most important part of the play*' (Abronhill High School, Glasgow Science Centre). Some older pupils said it reminded them of '*things we did in GCSE Science*' (St. Benet Biscop School, Centre for Life), and felt that the drama did not go into enough science detail or that '*it may have helped with revision to have more science in it*' (Chesham High School, Science Oxford). In part this may relate to the broad range of key stages to which science centres offered the event.

Students had mixed opinions on the acting standards of some of the presenters. However, those who were critical of the acting still found the drama enjoyable, perhaps due to this additional aspect of the entertainment (Katharine Lady Berkley's School, At-Bristol). Others said that '*the drama was the most fun*' (St. Benet Biscop School, Centre for Life), '*the actors were really good and funny*' and '*because it was funny it was easy to remember*' (Abronhill High School, Glasgow Science Centre). Students from Chesham High School who watched a mini-drama by Science Oxford agreed that '*the drama was entertaining*' and that '*it didn't matter whether the jokes were good or bad, just having some humour made the whole thing more memorable*'.

There were a range of reactions to the humour used in the mini-drama, some students said that the drama could be more entertaining if '*the jokes were written for our age group*' or if they had been written by someone younger (Kathrine Lady Berkeley's School, At-Bristol). Conversely, some age groups said that '*you could tell they [the jokes] have been written by someone much older*' (Langley School, Thinktank), highlighting the difficulty in satisfying students across the entire age range. Others said that '*the actors were better when they were ad-libbing*' and that the '*teachers found the jokes funnier than we did*' (St. Benet Biscop School, Centre For Life). A presenter from At-Bristol said that '*the children generally understood the content of the play but I am not convinced that they understood the humour*'. Over time presenters increased in

confidence to alter or create new jokes befitting to the audiences they were working with.

As described in Section 4.1, the *Meet the Gene Machine* event was offered to a range of different year groups across science centres. Statistical tests (cross tabulations and Cramer's V test) were applied to investigate how this impacted on general enjoyment. As demonstrated in Table 4, the results indicate that there was a low association between the participant's year group and their enjoyment of MGM drama.

Year Group	Yes	Not Sure	No	TOTAL
9	289	125	51	465
% within this year group	62%	27%	11%	100%
10	422	184	71	677
% within this year group	62%	27%	11%	100%
11	7	0	0	7
% within this year group	100%	0%	0%	100%
12	158	37	19	214
% within this year group	74%	17%	9%	100%
13	49	12	6	67
% within this year group	73%	18%	9%	100%
TOTAL	**925**	**358**	**147**	**1430**

Table 4. Student Enjoyment by Year Group

An additional element of the *Meet the Gene Machine* Mini-Drama was the use of a fictional 'Gene Machine' prop. Each science centre designed and produced their own gene machine, a selection of which are illustrated on the following page.

For some students this become an integral part of the impact of the performance, the 'lotto-ball' style gene machine created by Thinktank and a 'walk-in' gene machine designed by Glasgow Science Centre were both mentioned by students in the

evaluation. In some cases students were even disappointed to find the gene machine was not real.

Figure 2 – Techniquest Gene Machine

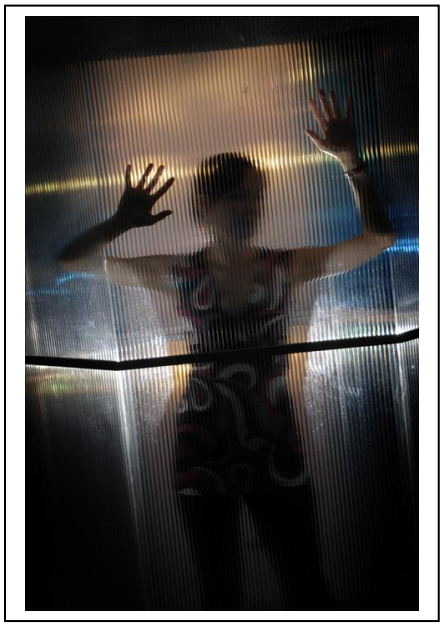

Figure 3 – Glasgow Science Centre

The gene machine named GRETA and created by the Museum of Science and Industry in Manchester was one such case, where the realism and impressive nature of the prop added to the flavour of the mini-drama. However, in some cases, for example for some students involved in the At-Bristol events, a more realistic machine was suggested by students to add to the impact of the mini-drama. During some observation sessions performed by the external evaluator students were reported to cheer spontaneously when the machine was unveiled, with several students standing up to get a better look at the machine when it printed its output.

In summary, there were some variations in audience reception of the mini-drama on the basis of which science centre it was involved in the delivery. When the relationship between the science centre and audience enjoyment from the audience questionnaire results was specifically examined there were some small variations across the audiences. Table 6 demonstrates that the mini-drama was received well at all eight venues, with the positive response to the question 'Did you enjoy the mini-drama?'. In

Table 5 a crosstabulation indicates that there were however differences between levels of student enjoyment at Glasgow Science Centre for example, and science centres such as Thinktank and statistical testing indicated that there was a statistically significant association between the audience's enjoyment of the MGM drama and the science centre delivering the show.

Science Centre	Yes	Not Sure	No	TOTAL
At-Bristol	182	88	35	305
% within science centre	60%	29%	11%	100%
Centre for Life	141	41	14	196
% within science centre	72%	21%	7%	100%
Glasgow Science Centre	136	29	10	175
% within science centre	78%	16%	6%	100%
Museum of Science and Industry	105	36	5	146
% within science centre	72%	25%	3%	100%
Science Oxford	141	68	35	244
% within science centre	58%	28%	14%	100%
Techniquest	101	45	22	168
% within science centre	60%	27%	13%	100%
Thinktank	64	44	22	130
% within science centre	49%	34%	17%	100%
W5	66	12	8	86
% within science centre	77%	14%	9%	100%
TOTAL	**936**	**363**	**151**	**1450**

Table 5. Student Enjoyment by Science Centre

The reasons for this association were investigated through the observations performed by the external evaluator. The most significant cause appeared to be presenter confidence in both delivering the drama and facilitating the discussion. Enthusiastic acting that brought the characters to life and made them more realistic made a greater impression. Knowing the script well and being particularly comical and even exaggerated increased the entertainment value for students. Performers who were

confident, expressive, projected their voices well and had a good rapport with the audience appeared to achieve better engagement levels.

It should be noted that those science centres with slightly poorer audience enjoyment figures were still well received according to the audience observations, however had occasional practical issues related to the event delivery. Also, some had received their training earlier in the project, when less learning and feedback was available for presenters on how to diversify or deliver performances.

In addition, there were some specific factors which appeared to impact on levels of student engagement across a number of the science centres. These included:

- *Introduction to the Mini-Drama*

  A recurring theme in the observation data was the introduction to the event. Performers who introduced the format clearly and explained the role of the audience received a more involved reaction throughout the drama. In observations at both Techniquest and the Museum of Science and Industry, presenters asked the students to imagine they were a TV studio audience for the drama; this engaged the students from the outset, which relaxed the presenters and led to a better performance.

- *Seating Arrangements*

  Those sitting at the front were most engaged during observations at At-Bristol, Centre for Life and Science Oxford. Subsequently, within the project training and monthly newsletters science centres were encouraged to rearrange rooms and circulate more frequently to increase levels of engagement for those sitting further away.

- *Humorous Acting and Ad-libbed Jokes*

  The observation data from the Museum of Science and Industry and Glasgow Science Centre indicated that unscripted jokes and exaggerated performances of both characters – especially the stereotypical scientist – met with high levels of loud

spontaneous laughter. At W5 the presenters even strayed into the territory of the audience during the mini-drama, '*the host* [a character in the drama] *made a few asides to the audience which was the funniest part of the performance*'. However, this clearly takes a certain level of confidence and experience on the part of the presenters.

Students were also asked about their general level of enjoyment of science, to examine any relationships between this and their perception of the mini-drama. This data (shown in Table 6) also provides some indication as to what extent the *Meet the Gene Machine* mini-drama was able to reach traditionally disinterested audiences. Statistical testing performed here indicated an association between audience enjoyment of science classes as school and enjoyment of mini-drama.

	'Did you enjoy the mini-drama?'			
Do you enjoy science classes at school?	**Yes**	**Not Sure**	**No**	**Total**
Strongly Agree	154	39	19	212
% within strongly agree	73%	18%	9%	100%
Agree	407	132	43	582
% within agree	70%	23%	7%	100%
Not Sure	215	97	39	351
% within not sure	61%	28%	11%	100%
Disagree	93	64	22	179
% within Disagree	52%	36%	12%	100%
Strongly Disagree	60	31	28	119
% within strongly disagree	50%	26%	24%	100 %
Total	929	363	151	1443

Table 6. Student Enjoyment by Enjoyment of Science Classes

Although the mini-drama managed to reach disinterested audiences to some extent there is a statistically relevant association between general enjoyment of science at school and enjoyment of the mini-drama. The highest percentage of audience enjoyment was from students who also enjoy science class at school (73%, n=154). However, half of the students who do not enjoy science class at school (50%, n=60) still

agreed that they enjoyed the mini-drama as indicated in Table 6. This is a positive result, particularly for this age group who are often hard to please.

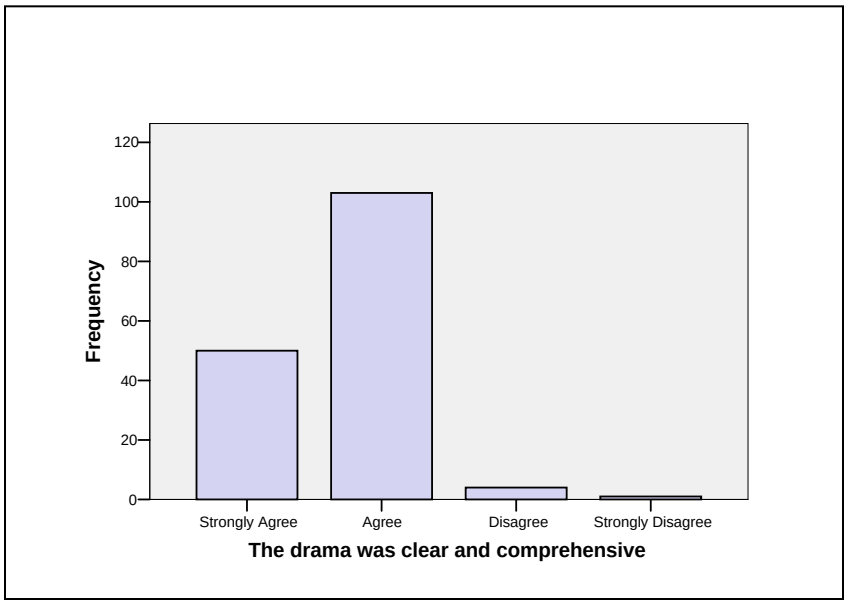

Figure 4. Teacher Audience Questionnaire – The drama was clear/comprehensive

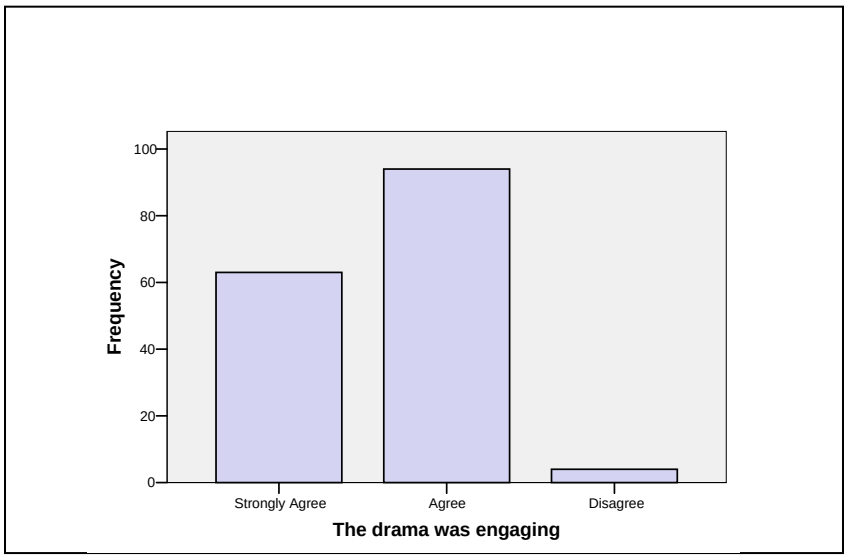

Figure 5. Teacher Audience Questionnaire – The drama was engaging

Separate questionnaire data from teachers suggests that like students they found the mini-drama element engaging. 56% (n=94) of teachers 'agreed' and 38% (n=63) 'strongly agreed' that 'the drama was engaging'. As is indicated in Figures 4 and 5, a

large majority also felt that it was clear and comprehensive, and from their perspective as teachers, engaging for the students. In the interviews with teachers the evaluation established that many felt the mini-drama gave a good prompt and introduction to genetics and the ethical issues surrounding genetic testing. They found it suitable for students who were not studying biology as well as those who were and agreed that it related to the curriculum.

5.3 The Meet the Gene Machine Facilitated Debate/Discussion

In this section we report on key evaluation findings relating to the facilitated discussion aspect of the event format, including:

- Levels of audience enjoyment and engagement
- Teacher's impressions on the discussion
- Relationships between appreciation of science and audience enjoyment

The majority of young people who participated reported that they enjoyed the discussion element of the event. As is illustrated in Figure 6, 60% (n=912) of the audience said they enjoyed the discussion whilst only 9% (n=136) said they had not.

Students stated that they enjoyed the discussion for a range of reasons including that it was *'interesting'* (n=165), *'participatory'* (n=162), *'informative'* (n=152), and *'entertaining'* (n=77). During the interviews students stated that the discussion was especially enjoyable '*because we were involved*' and '*we had to do things*', they also felt '*it was important that every student had done or said something*' (Abronhill High School, Glasgow Science Centre). Some said that the section of the discussion about 'who would you tell' was their favourite part, because '*it was personal*' and '*all of us could relate to it*', they also said that they continued talking about the *Meet the Gene Machine* discussion issues with their friends after the session (St. Benet Biscop School, Centre for Life). Students mentioned that the presenters' facilitation skills meant that no one took over the debate and the presenters were described as '*very good at getting*

people involved' (Droylesden High School, Thinktank). They felt that the fact that the presenters kept reiterating that there was no right or wrong answers to the questions being posed was very encouraging and made it easy to contribute, even for some of the quieter students and those who felt less able in science (Droylesden High School, Thinktank). Presenters were also seen to provide balance in terms of highlighting both the pros and cons of genetic techniques.

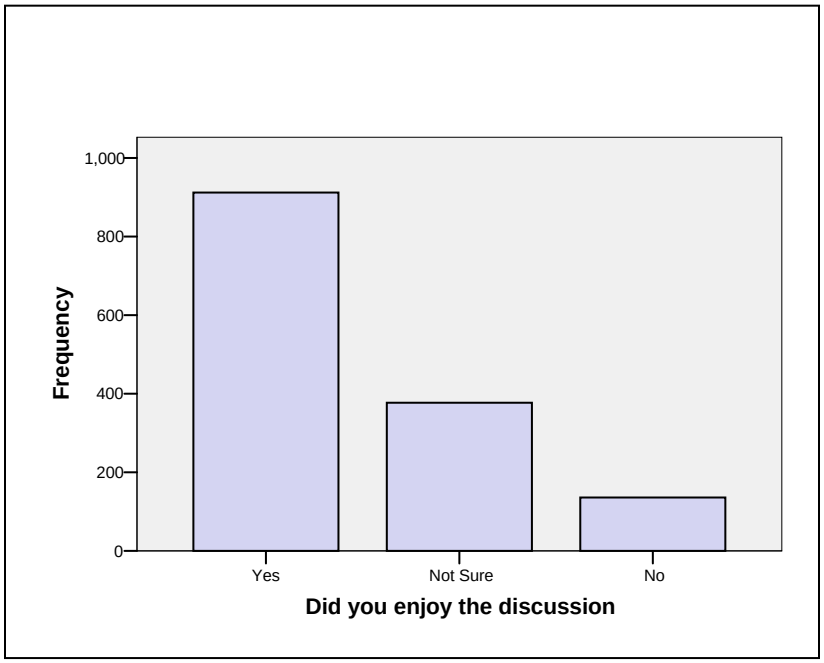

Figure 6. Audience Questionnaire – The discussion was engaging

Variations in the delivery of the discussion elements by the different science centres was also investigated. The presenters had all undertaken facilitation training but had diverse facilitation skills and prior experience. Statistical tests examined the association between the host science centre and the level of audience enjoyment of the discussion. This found an association between science centre delivery and audience enjoyment of the MGM drama. The differing levels of student enjoyment and science centre are indicated in Table 7.

Possible reasons for the observed association were investigated more deeply with the students. When asked what they had liked most about the event, some students said it was the discussion element and consideration of '*the ethical issues*' because '*it is good*

Science Centre	Yes	Not Sure	No	TOTAL
At-Bristol	184	85	30	299
% within science centre	62%	28%	10%	100%
Centre for Life	122	48	25	195
% within science centre	62%	25%	13%	100%
Glasgow Science Centre	139	28	7	174
% within science centre	80%	16%	4%	100%
Museum of Science and Industry	97	33	12	142
% within science centre	68%	23%	9%	100%
Science Oxford	127	82	30	239
% within science centre	53%	34%	13%	100%
Techniquest	94	50	20	164
% within science centre	57%	31%	12%	100%
Thinktank	86	33	8	127
% within science centre	68%	26%	6%	100%
W5	63	18	4	85
% within science centre	74%	21%	5%	100%
TOTAL	**912**	**377**	**136**	**1425**

Table 7. Student Enjoyment of Discussion by Science Centre

to be asked for our views' and '*it was more about ethics than science, which was good as it put science in real life*' (Chesham School, Science Oxford). Others said that the discussion did not necessarily make them more interested in science but it '*made science more relevant to everyday life*' and '*had linked science with decisions we will all have to make*' (St. Benet Biscop School, Centre for Life). Several students commented that most of what they learnt in science was just facts and this does not lend itself to discussion, some said that the ability to discuss the relationship between science and daily life was helpful. From the observation data it was also apparent that the contribution of personal anecdotes to the discussion was often as valuable for student engagement as contributing scientific knowledge.

As previously discussed, we were interested in the extent to which *Meet the Gene Machine* was able to reach traditionally disinterested audiences. The comments above

allude that it was able to make the subject relevant to a wide range of students. Via the questionnaires we further explored the general level of enjoyment of science and enjoyment of the discussion element. When the association between audience enjoyment of science classes at school and their subsequent enjoyment of the discussion element was examined an association was found between audience enjoyment of science classes at school and enjoyment of the MGM discussion, indicating that students that enjoy science lessons in school were more likely to enjoy the *Meet the Gene Machine* discussion.

	'Did you enjoy the mini-drama?'			
Do you enjoy science classes at school?	**Yes**	**Not Sure**	**No**	**Total**
Strongly Agree	162	37	10	209
% within strongly agree	77%	18%	5%	100%
Agree	419	120	35	574
% within agree	73%	21%	6%	100%
Not Sure	198	112	37	347
% within not sure	57%	32%	11%	100%
Disagree	43	45	26	114
% within Disagree	38%	39%	23%	100%
Strongly Disagree	84	62	28	174
% within strongly disagree	48%	36%	16%	100 %
Total	906	376	136	1418

Table 8. Student Enjoyment of Discussion by Enjoyment of Science Classes

There were though various factors which impacted on the audiences' enjoyment of the discussion, most notably practical factors including audience size. For some students who participated within larger audiences, they suggested it would be better to reduce group size '*if the idea was to get everyone to speak in front of the whole group*' then the smaller group work during the 'who would you tell' activity gave '*everyone a chance to have a go*' (Langley School, Thinktank). Group size was noted as a challenge within some of the presenter diaries. A presenter from Science Oxford said in one event there '*was far too many students for the discussion to be successful. They were much too shy to speak out in front of so many others...there were only meant to*

be 60 but the teacher invited a third class without telling us in advance. I would have liked more interaction and participation from the students.' A presenter from Glasgow Science Centre said similarly that '*keeping such a large audience engaged and on task was difficult given also that there were many outspoken individuals in the crowd*.'
Often it was these types of practical factors that impaired the quality of the discussion; aspects such as room layout, venue type and the role of teachers, who occasionally sought to facilitate the students themselves, all impacted on the discussion. Whilst on occasion teachers' interventions were unnecessary or unwelcome, presenters occasionally lacked confidence in controlling the noise or behaviour of some audience members. A presenter from At-Bristol said that students' occasional disruptive behaviour made it hard to involve everyone in the debate. With more difficult groups of students, presenters appeared to develop an instinct that a greater level of teacher involvement could be required. As a presenter from the Centre for Life described, on one occasion the students:

> '*…were less interested from the start, but a stronger teacher presence could have avoided much of the trouble. I felt I had to constantly remind students towards the end to stop speaking over one another and over the presenter*'.

A Techniquest presenter felt that '*crowd control methods could have been better. Better co-ordination between the groups as to roles and more team work needs to be planned*.' However, discussion amongst pupils was sometimes an indication of engagement; in observations they were frequently found to be discussing the topic amongst themselves.

Presenters tried used various techniques to engage groups in such situations. Particularly successful experiences were disseminated across all of the partner science centres as encouraged and facilitated by the Project Coordinator. One useful approach was to provide a clear introduction to the discussion element, making students aware of their role and encouraging them to participate. Presenters also split the audience into smaller groups and moved the students around. The presenters'

energy and enthusiasm was also identified as being crucial as a motivating factor for students during the discussion.

As previously highlighted in Section 5.1, a range of different age groups were involved in the programme. Science centre presenters noted that some discussion prompts were more relevant than others to the different age groups involved. Analysing student enjoyment on the basis of year group suggests that older participants found the discussion element more enjoyable. As shown in Table 9, enjoyment of the discussion element steadily increased across the school year groups. 86% (n=57) of students in year 13 enjoyed the discussion element compared to 54% (n=248) in year 9. It is likely that older students were able to create more refined arguments and were more confident to participate in this element of the event.

Year Group	Yes	Not Sure	No	TOTAL
9	248	153	54	455
% within this year group	54%	34%	12%	100%
10	427	178	60	665
% within this year group	64%	27%	9%	100%
11	5	1	1	7
% within this year group	72%	14%	14%	100%
12	162	36	15	213
% within this year group	76%	17%	7%	100%
13	57	6	3	66
% within this year group	86%	9%	5%	100%
TOTAL	**899**	**374**	**133**	**1406**

Table 9. Student Enjoyment of Discussion by Year Group

In terms of science centre presenter feedback however, they often enjoyed working with the variety of age groups as explained by an At-Bristol presenter: '*different age groups actually worked really well, year 9 and 10 got really into it and had some*

excellent discussions (as did the older year groups)'. Similarly a presenter from Science Oxford found this a rewarding aspect:

> '*The groups were of mixed ability which meant they were plenty of responsive students who provided opinions and it was obvious that those of lesser ability were also engaged and offering comments by the end which was pleasing.*'

However, working with mixed ages and abilities clearly had its challenges; a presenter from Techniquest said that in one setting:

> '*The audience [key stage 3] was a little too young to discuss this topic in depth. All the pupils were just expressing the same opinions as each other for fear of appearing different from the crowd and because they were very unfamiliar with the topic*.'

Older audiences also had their challenges. A presenter from Centre for Life worked with an older group of students and said:

> '*They had a higher level of background knowledge, so less time was needed to explain scientific background. However in the case of some students this did not work to our advantage as they felt that it was being pitched at a level beneath them, so did not participate as fully as they could have done. As older students they seemed to think a little more deeply about the potential impact of genetic profiles on society*'.

Occasionally students found the discussion repetitive and suggested there should have been more variety in the topics covered within the discussion, particularly '*the bit where we decided whether things were genetic or not – they were quite obvious*' (Chesham School, Science Oxford), and a request for '*more varied, different discussion activities*' (St. Benet Biscop School, Centre for Life). Here the level of science background was likely to impact on how engaged students remained in the discussion points. Some students said that it was obvious that '*not everyone knew enough about the science to*

make their point' (Langley School, Thinktank), whereas other students felt presenters could have '*gone into more detail*' or '*knew enough to cover more difficult things to do with genetics*' (St. Benet Biscop School, Centre for Life). Occasionally it was also noted in the observation data that presenters used terminology without explanation, for example terms such as 'Cystic Fibrosis' and 'DVLA'.

In terms of teachers' perceptions of the discussion element, opinions were generally highly favourable, with 94% (n=157) of teachers who watched the *Meet the Gene Machine* discussion 'agreed' or 'strongly agreed' that the MGM discussion was engaging for students.

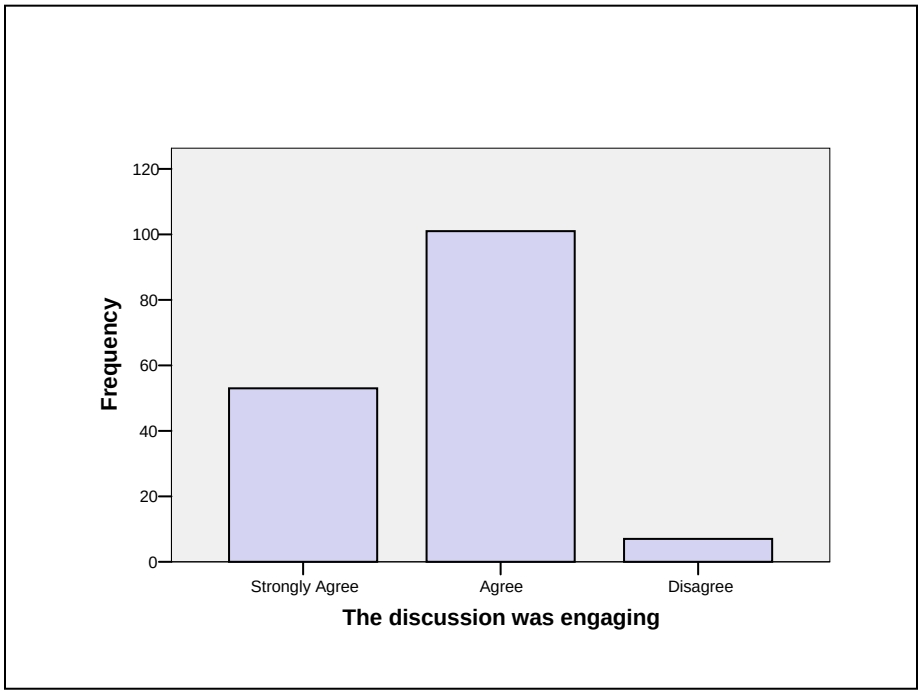

Figure 7. Teacher Audience Questionnaire – The discussion was engaging

In general, despite a few teachers intervening in the discussion element, the majority who observed felt it was well-facilitated. 79% (n=132) of teachers who watched the discussion 'disagreed' or 'strongly disagreed' with the statement that 'the discussion was NOT well managed'. During one interview a teacher explained: '*I was worried that those who are not studying biology would be left out, but they actually added a different dimension to the discussion. I think they were less worried about getting the*

technicalities right' (Langley School, Thinktank). A further teacher said the combination of mini-drama and discussion meant '*it was truly* [a] *multidimensional session, which raised issues which will affect all our students regardless of their culture or the subject they study…I don't think I've seen such a good group before. The presenters had their attention from the start and the students were keen to take part and to listen to one another*' (George Dixon International School, Thinktank).

In terms of content, 91% (n=153) of the teachers who participated in the evaluation 'agreed' or 'strongly agreed' that 'the scientific content was conveyed well'. 92% (n=154) of teachers similarly 'agreed' or 'strongly agreed' that 'the ethical issues were conveyed well'. However within the interview data they also expressed some concern regarding the mixed abilities of some audience members, suggesting more background information could be provided within schools in advance (Langley School, Thinktank) or that a greater level of communication should occur between the school and the science centre in advance of the visit regarding the abilities of the pupils involved. One teacher commented that the level of the debate became '*superficial*' for the more able students in the audience (Katherine Lady Berkley School, At-Bristol). To a degree this issue is unsurprising given the broad range of year groups that the event was offered to, but it also suggests that a stronger reciprocal relationship could occur between schools and science centres when bookings for such activities are taken. Other teachers were less concerned about this dimension, suggesting more able pupils understood more of the scientific aspects and entered more fully into the debates while others took away an understanding of the concepts involved, even if they were unable to see all sides of the ethical debate (Holy Cross College, W5). One teacher said '*the scientific level was very appropriate, the pupils enjoyed the session and most remained engaged throughout*' (Mangotsfield School, At-Bristol).

5.4 Continuing Professional Development (CPD) Workshop

The teachers involved in the CPD tended to teach science-based subjects as indicated in Section 5.1. The remaining teachers taught a range of subjects including history,

languages, drama, physical education, music, religion, and citizenship. The CPD workshop was intended to provide an opportunity for teachers from a range of academic disciplines to consider and explore how debating and discussion skills can be utilised within the classroom, with or without a science focus.

In terms of teachers' motivations to attend, content was a strong motivator: 84% (n=240) attended to advance their knowledge of discussion based activities, and 58% (n=163) hoped to advance their knowledge of bioethics. The opportunity to interact with colleagues was also reported as a strong incentive for 74% (n=209) of participants. 90% (n=254) 'agreed' or 'strongly agreed' that they had personal motivations to attend, such as to increase their own learning. Similarly, 77% (n=216) 'agreed' or 'strongly agreed' there were professional motivations to participate in these types of CPD opportunities.

In terms of the CPD workshop content, 99% (n=277) of the teachers found the exercises (which formed the main basis of the workshop) 'useful' and 90% (n=254) suggested they were likely to go on and use an online resource pack which was linked to the session. The activities branched scientific and ethical examples and stimuli; only 8% (n=23) felt the scientific content had been inappropriate for their needs, whilst 31% (n=88) felt the ethical material had been inappropriate for their requirements. This may be due to a lack of clarity during recruitment or a marketing issue: due to the association of the CPD activity to a science centre teachers may have perceived a stronger emphasis on scientific versus ethical content.

Despite this issue a considerable number of teachers (83%; n=234) 'agreed' or 'strongly agreed' that they would participate in a similar activity in the future. Additional aspects they suggested could be covered included more detail on how to run successful discussions, dealing with controversial questions, challenging students and monitoring the talking and listening during discussion. Others suggested the materials should be adapted to other teaching content, such as physics and chemistry or even religious education. As such a number of teachers felt the CPD workshop could be delivered

over a more extended period of time, which would also allow more of the activities suggested in the resource pack to be demonstrated.

In open questions and via the interviews, the key aspects of the CPD workshop described as useful by teachers were:

- The provision of online resource packs to support the workshop

For some schools this presented an opportunity for the CPD workshop to be cascaded to other members of staff and many teachers commented that they would actively use the resources offered, in particular when designing the following year's curriculum. A presenter from At-Bristol noted that teachers '*were really happy with the packs and could use the materials*', in particular since during the following year '*the curriculum is changing and will include more debating and controversial issues, so will probably be more appropriate then*.'

- Added value to the MGM performances

Teachers who had additionally attended a performance of the accompanying *Meet the Gene Machine* mini-drama and discussion event in their school found it particularly inspiring and innovative. A presenter from Glasgow Science Centre noted that '*teachers were very enthusiastic about the CPD and the drama. They would like us to come to their school again and deliver the whole thing [mini-drama/discussion] just for teachers!*'

- Specific facilitation techniques

The Ballot Box activity was met with a very positive response; teachers liked it because it got students to make the decision, provided anonymity and reduced peer pressure. It gave pupils the confidence to get involved and protected students who may have had a personal connection with the issues being discussed. The Fisherman's Circle was also appreciated by teachers because they felt that it would

make pupils think about both sides of an argument. The Listening Triads on the other hand was perceived to be more applicable to older or more able pupils. Teachers felt that activities that involve role-play are difficult for less confident/less able students and require more detailed briefing and good facilitation.

- The interaction with fellow teachers from different backgrounds

Presenters noted on various occasions that having a mix of teachers worked well. A presenter from Science Oxford said there was a '*good mix of teachers – some from Creative Arts department came along, it was helpful in discussion, plus an English teacher*.' Similarly, an At-Bristol presenter said of a mixed session '*it was the most successful CPD that I delivered as it was science and English teachers, who said they were really happy with the packs*.' Some teachers suggested additionally involving drama teachers in running some of the exercises. They also suggested the CPD workshop suited the history curriculum, especially historical perspectives on issues such as eugenics.

The aspects perceived to be less useful included:

- Teachers' self-perceived scientific knowledge

Despite the provision of resources, teachers' confidence in communicating the scientific content to pupils varied, with differing needs exhibited across the subject areas. Many teachers mentioned that the biggest challenge in running a discussion is having answers to the more technical questions. The glossary of terms in the resource pack was judged to be useful in tackling this problem but some teachers felt they needed more content and information to prepare or answer specific questions from students (for example what genetic tests are available at present).

- Length and one-off nature of the CPD sessions

  As mentioned, teachers would have liked the opportunity to run through more of the activities during the CPD training sessions and a general proposal made by teachers during different interviews was to include the CPD workshop into regular training activities, such as inset days, in order to reach a wider group of teachers over a longer time period.

- Varying relevance of content to different teachers' backgrounds

  The teachers' resource pack was deliberately designed to meet the needs of teachers from a wide variety of subject areas. Whilst this was a benefit in terms of engaging teachers across disciplines, it did mean that the immediate relevance of content and nature of activities to any particular teacher was not always assured.

- The lack of teaching experience amongst the science centre presenters

  Whilst overall teachers were complimentary about individual presenters this issue provided a backdrop for some comments. From the presenters' perspective it also proved significant. One presenter from At-Bristol said '*we were brought in as experts in debating controversial issues, though MGM was the first time I had been involved in debates with school students, and most of us have only limited experience. The flip side of this is that I have learnt as much during the course of this project than I feel I have over the first six months in my job [but] certainly I am not in a position to be delivering teacher CPD on this topic*.' A presenter from Techniquest said '*I needed more preparation with the CPD and would now run it slightly differently altering the format more and asking the teachers about their own requirements and experiences*.'

6 Conclusion

The overall aim of the MGM project was to stimulate debate about the personal, social and ethical issues raised by advances in medical genetics. This was to be achieved through a schools-based activity disseminated nationally by a network of trained science centre presenters and creating a CPD workshop for teachers to link with the event and trigger more regular classroom discussions on similar topics.

6.1 Raising awareness amongst students

The MGM project reached 10,455 secondary school pupils and involved 498 teachers in CPD workshops. Each event instigated discussion on the social implications of genetic testing and the CPD workshop provided teachers with an opportunity to explore different techniques for discussing science topics in the classroom. More than 60% of the student audience enjoyed the mini-drama element as it was both informative and entertaining. A number of older students asked for the mini-drama and discussion to contain more scientific information, as the drama element made it more memorable than some other activities and this could be used as a revision prompt. Overall the event format provided excellent levels of entertainment, interest and information for students that participated.

Presenters' prior experience and confidence to deliver the mini-drama element, in addition to appropriate seating arrangements and effective scene setting, positively impacted on the reception of the activity. The mini-drama tended to have slightly higher resonance with those students already enjoying science but also provided an excellent technique to engage those who had less favourable views of science lessons. An extremely high number of teachers (above 90%) found the drama engaging, clear and comprehensive.

6.2 Generating engagement with the issues

The discussion was equally successful; over 60% of the students enjoyed the discussion as it was also interesting, informative, entertaining and participatory. In the students' comments they suggested that they felt a sense of individual involvement, increased by the reiteration that all comments were welcomed. The emphasis that there were no right or wrong answers encouraged those who were less confident of their scientific knowledge to at least express an opinion. The students were also able to make connections between science and daily life, although the discussion was more positively received by older students and those who already enjoyed science. Over 90% of the teachers found the MGM discussion engaging. Practical aspects such as the diversity of the discussion activities, group size, room layout, venue type and the role of teachers could impact on the success of the discussion but individual science centres developed strategies to reduce such factors. Presenting the activity for mixed ability and ages across the delivery periods presented challenges for science centres but was often necessary to reach the target numbers and seen to have both benefits and constraints in the opinions of teachers involved.

6.3 Effectiveness as a science communication event

7 of the partner science centres that took part in the 18-month UK roll-out of the MGM project planned to continue delivering the show either in house or as an outreach activity after the project had ended and there has been interest by non-partner science centres to receive MGM training so that they too can deliver MGM.

From a broader perspective MGM attempted to recruit, coordinate, train and deliver an activity across eight UK science centres in partnership and this presented its own challenges and points of learning. Issues such as high staff turnover, the confidence of individual presenters relating to the different elements (drama, facilitation, CPD), poor scheduling and marketing was identified and remedied as far as possible during the period of delivery. The training could incorporate bespoke elements for each science centre based on their particular requirements or needs, although this would have

cost/time ramifications for similar projects in the future. However, it was clear that all project partners reflected on their learning, challenges and experiences and were actively able to feed these reflections into existing or future projects they were working on.

6.4 Implementation and success of the CPD workshops

Three quarters of those involved in the CPD taught science including Biology, Physics and Chemistry however the incorporation of teachers from other disciplines was seen to have key benefits when this occurred. Nearly all of the teachers (99%) thought the exercises during the CPD workshop were useful and 92% of the teachers said that they were likely to make use of the resource pack.

There was an element of expectation that more science content could be included, but this reflected the background of the teachers involved. Teachers were impressed by the CPD resources and workshop in the long term and the follow up interviews indicated that they would even have liked to have a longer workshop covering more of the material given in the resource packs. Teachers felt that the CPD was a valuable experience and should be included into regular training activities, such as inset days.

From the science centre perspective the CPD element represented one of the most challenging aspects of the project. In particular recruiting teachers was very testing and different science centres took differing approaches (offering it as integral, stand-alone, via wider teacher focused events etc.). Presenters sometimes lacked confidence delivering this element and the training could be increased or adapted in future to recognise and support this more fully. However many had enjoyed this challenge and it provoked recognition amongst some of the centres involved that CPD for teachers is an aspect of science communication which they may be able to develop and address further.

6.5 Key Recommendations

Meet the Gene Machine raises a number of key recommendations for organisations and individuals seeking to establish similar projects in the future.

8. Drama is an effective way to engage young people with a number of the challenging ethical and social implications of science.
9. Creating a supportive environment for science centre presenters to develop and incorporate acting techniques in such activities has broad benefits.
10. The scripting of such dramas can include a good level of scientific information but must be wary of the constraints and confidence levels of presenters to communicate these aspects clearly.
11. Facilitated discussion activities are inspiring and informative, in addition to being popular with young people and teachers alike.
12. Targeting mixed ability groups within a discussion presents its challenges but encourages students with differing levels of experience and confidence to contribute their views.
13. CPD activities are beneficial for teachers, but must be planned and recognise the difficulties of marketing to this sector. They provide a key opportunity for science centres to form strong partnership with teachers within their Local Education Authority.
14. Providing a central training and resource opportunity for individual science centres to utilise and develop is a key technique for shared learning, innovation and sustainable approaches to science communication across the sector.

7 Appendix 1: Evaluation Materials

Meet the Gene Machine: Observation Guide

Please use this guide to record as much as possible about the observation. If unobtrusive circulate around the room whilst performing the observation. Print to minimise page turning.

Getting Started: At some point please draw a diagram of the venue on page 4.	
Date:	**Location:**
Estimated Audience Number:	**Estimated Male/Female Ratio:**
Year Group:	**Adult Audience Roles:**
Audience Familiarity with venue:	
Any general pre-problems? e.g. venue, timetabling, presenter preparation	
Scene setting: e.g. teacher/presenter introduction/questionnaire completion period	
Getting finished:	
Was the discussion curtailed or running out of steam?	
How did the students exit: questionnaire completion, still talking etc.	
Any general problems? E.g. accessibility, rowdiness, scheduling etc.	

The Mini-Drama	**Start Time:**	**End Time:**
Stage Environment: e.g. lighting, sound, props etc.		
Presenters: e.g. Age, appearance, confidence, enthusiasm, activity levels etc.		
Script: Adapted or followed? Jokes etc.		
Audience Response: Engagement, laughter, silences, teacher involvement etc.		

The Discussion	**Start Time:**	**End Time:**
Initiation of Discussion: e.g. Props, rules, actor/facilitator transition etc.		
Presenter Activity: e.g. Question-asking, body language, movement etc.		
Transition of Audience: e.g. Engagement, participation, laughter, teacher activity, small group discussions etc.		

Diagram of Venue: Please make sure you insert a diagram of the venue either before/after the observation here

Meet the Gene Machine: Student Questionnaire

Are you?

Male ◯ Female ◯

What year are you in at school?_____

How would you describe your ethnic origin?

White ◯ Black/Black British ◯ Asian/Asian British ◯

Mixed ◯ Chinese ◯

Other ◯ Please state _____

Please indicate how much you agree with the following statements…

	Strongly Agree	Agree	NOT SURE	Disagree	Strongly Disagree
I have heard about genetic testing before	◯	◯	◯	◯	◯
I enjoy science classes at school	◯	◯	◯	◯	◯
I usually feel comfortable in saying what I think	◯	◯	◯	◯	◯

Thank you, now please watch the show and turn over afterwards!

<u>After watching the show</u>, please indicate how much you agree with the statements…

	Strongly Agree	Agree	NOT SURE	Disagree	Strongly Disagree
I understood some of the genetic testing issues that I heard about today	◯	◯	◯	◯	◯
I would like to have a genetic test	◯	◯	◯	◯	◯
I think genetic testing is a positive invention	◯	◯	◯	◯	◯
I think genetic testing is a negative invention	◯	◯	◯	◯	◯
I felt comfortable saying what I thought today	◯	◯	◯	◯	◯

	Yes	Not Sure	No		Yes	Not Sure	No
Did you enjoy the drama?	◯	◯	◯	Would you like to watch a similar drama?	◯	◯	◯

Why?_____

Why?_____

Did you enjoy the discussion?	◯	◯	◯	Would you like to take part in a similar discussion?	◯	◯	◯

Why?_____

Why?_____

Do you have any other comments regarding Meet the Gene Machine?

Please add the first letter of your surname _____ and your date of birth _____

This information will only be used to withdraw you from the study **Thank you!**

Meet the Gene Machine: For Teachers

Are you? Male ☐ Female ☐

Which subject/s do you teach? _____

How long have you been teaching?

- 1-4 years ☐
- 5-10 years ☐
- 11-20 years ☐
- 21 years+ ☐

Please indicate how much you agree with the following statements…

	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
The drama was engaging	☐	☐	☐	☐
The drama was not very entertaining	☐	☐	☐	☐
The drama was clear and comprehensible	☐	☐	☐	☐
The discussion was engaging	☐	☐	☐	☐
The discussion was not well managed	☐	☐	☐	☐
The activities within the discussion were useful	☐	☐	☐	☐
The ethical issues were conveyed well	☐	☐	☐	☐
The scientific content was conveyed well	☐	☐	☐	☐
It was a good use of student's time	☐	☐	☐	☐
It was a poor use of student's time	☐	☐	☐	☐
I would include students in a similar event again	☐	☐	☐	☐
I am confident to use discussion based sessions in my own teaching	☐	☐	☐	☐

Thank you. Please add any further comments to the back of this sheet.

Please tick if you are participating in the Meet the Gene Machine CPD activities. ☐

Meet the Gene Machine: Teachers CPD

Are you? Male ☐ Female ☐

Which subject/s do you teach? _____

How long have you been teaching?

- 1-4 years ☐
- 5-10 years ☐
- 11-20 years ☐
- 21 years+ ☐

Today's CPD

Please indicate why you came along to today's CPD session?

	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
Advance knowledge of bioethics	☐	☐	☐	☐
Advance knowledge of discussion activities	☐	☐	☐	☐
Interact with other staff members	☐	☐	☐	☐
Personal motivation e.g. enjoyment, learning…	☐	☐	☐	☐
Professional motivation e.g. school policy, CV…	☐	☐	☐	☐

Other, please state

_____

Please indicate your thoughts on the CPD session.

	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
The exercises we ran through were useful	☐	☐	☐	☐
The scientific content was appropriate for me	☐	☐	☐	☐
The ethics content was inappropriate for me	☐	☐	☐	☐
I am likely to use the online resource pack	☐	☐	☐	☐
It was beneficial to work with other teachers	☐	☐	☐	☐

What would you describe as most useful for you from today's CPD session?

What would you describe as least useful for you from today's CPD session?

Would you have liked anything else to be covered in the session?

Yes ☐ No ☐

If **yes**, please state what below:

Would you like to participate in a similar session in future?

Yes ☐ No ☐

Thank you for your time. If you would like anymore information on the project please contact the project coordinate Laura2.Strieth@uwe.ac.uk or visit the project website.

Teacher's Interview Questions

ICE BREAKER Ask each teacher to introduce self, the subject/s they teach and how long they have been teaching.

- How many drama/discussions did you watch on the day the science centre visited?

The Drama

- What did you think of the drama element of the show?
- How convincing were the presenters in conveying the story and their characters?
- How entertaining was the drama for the students?
- How appropriate was the drama for the students?

The Discussion

- What were the strengths of the facilitated debate?
- What were the weaknesses of the facilitated debate?
- How did you think the quieter students reacted to the debate?
- How did you think the more disruptive students reacted to the debate?
- What about students that are not normally interested in science?
- Were students more attentive or less engaged than normal?
- Could the presenters have done anything differently?

General Issues

- What was most beneficial for the students? (Prompts: science content, ethical content, debate techniques…)
- Was the event practical for your school to run? (Prompts: Room Layout, timetable, curriculum links…)
- Could your school run similar sessions themselves? (Prompts: with drama students, 6th Formers…)
- Are there any other scientific/subject/ethical problems you would like to see a similar event applied to?
- Did it fulfil your expectations on the day?

Student's Interview Questions

ICE BREAKER Ask each student to introduce self, the subject/s they take and how old they are.

The Drama

- What could be improved in the drama element of the show?
- How convincing were the presenters when performing the drama?
- How could we make it more entertaining?
- Should the drama be longer or shorter?
- How much do you think it linked to the subjects your studying?

The Discussion

- What would you change about the facilitated debate?
- How confident did you feel to say what you thought?
- Did anyone to take over the debate?
- How could the debate make you more interested in science?
- Did you think the debate needed to be shorter?
- Could the presenters have done anything differently?

General Issues

- What did you like most about the show? (Prompts: science content, ethical content, debate techniques…)
- What time of day would be best to hold such an event?
- What props would have improved the event?
- Are there any other topics you would like to see a similar event applied to?
- Would you like to see a similar show come into your school?
- Do you think you would make a visit to the science centre the presenters came from?

Meet the Gene Machine

Presenter's Diary

Welcome to the Meet the Gene Machine Presenter's diary.

The diary is intended to have two purposes:

- To record **all** performances of MtGM that your science centre is involved in throughout the duration of the Wellcome Trust project.
- To provide an avenue for informal feedback and shared learning amongst science centres when **you** feel a performance warrants it.

Please email in a copy of your diary to the Project Coordinator Laura2.Strieth@uwe.ac.uk, at least once a month, throughout the duration of your performances.

It is not necessary to make any diary entries before you begin performing the show. It is hoped that having somewhere for presenters to share their experiences will be useful both at a personal and network level.

Blank electronic copies of the diary are available via the Meet the Gene Machine website at: (insert address)

A few details about you… (This section needs completing only for your first diary)

How long have you been working as presenter?

What would you say are your main strengths as a presenter?

What would you say are your main weaknesses as a presenter?

Below are lists of **diary entries.** Please complete these only when you feel it is useful, they do not need to be completed for every performance. Maybe you had a performance that went incredibly well, a discussion that went wrong, or a 'light bulb' moment that you would like to share…

DIARY ENTRY

Date of performance:

School Involved:

Estimated Audience Size:

Challenges:

Opportunities:

Please cross here if you would like this experience to be made anonymous ☐