# DNA World Record Attempt

**13th March 2008**

**University of Huddersfield**

**Written by Dr Jeremy D Hopwood**

**Photography by David Casson**

**Video footage and editing by Steven Bentley**

**Submitted 23 July 2008**

University of
HUDDERSFIELD

**School of Applied Sciences**

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# 1. The Record Attempt

## 1.1.Registration details

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## 1.2. Existing record

**The largest model of DNA** contained 300 base pairs and over 1,800 atoms and was roughly 12m (40ft)tall. Constructed of molymod, the base pairs were assembled by more than 3,000 British school children as well as celebrities from science, politics and the arts. The model was first assembled at the Potteries Shopping Centre in Stoke-on-Trent (UK) on 9 March 2002. It was then further constructed, to its current full length, on 10 July 2002 in Earl's Court London.

## 1.3. The new world record attempt

On 13th March 2008 the University of Huddersfield constructed a DNA model that was 1118 base pairs long. The model was constructed from 51 Molymod Advanced Mini DNA kits. The construction took place in the Quayside conference facility with 51 University of Huddersfield students and 7 lecturers together with 61 sixth form students and 5 teachers from Greenhead College, Heckmondwike Grammar School, Huddersfield New College, Huddersfield Technical College, Rastrick High School and Shelley College. In total 124 people were involved. The model is approximately 25m in length, is an exact replica of the coding section of the human insulin gene and was built in 51 minutes. The record was attempted during the U.K. National Science and Engineering Week and both The Physiological Society and SetPoint gave financial support. The model now hangs in the School of Applied Sciences.

## 1.4 The structure of DNA

We chose a particular model kit to break the world record. To understand why we made this choice it is necessary to be familiar with the basic structure of DNA.

DNA is an abbreviation for Deoxyribonucleic acid. It comprises a long code made out of a sequence of four nucleic acid molecules. The four nucleic acids are thymine, adenine, guanine and cytosine, usually written as T, A, G and C. The molecules T and A are bound together in DNA and are known as base-pairs and the same is true of G and C. It is possible to imagine a length of DNA as being a ladder with the base pairs forming the horizontal steps. For example, the insulin gene has 1118 steps.

In DNA, the sequence of base pairs (the ladder) are held together by an outer backbone that comprise two helices. The helices are identical in form, made of a chain of alternating

sugar and phosphate molecules. The only difference between the two helices is their orientation as the axes of the helices run in opposite directions (anti-parallel).

The structure of DNA can be represented using different models. The closest physical representation is the space filled model. Here the atoms are represented as spheres with adjoining spheres indicating that two atoms are held together (figure 1). In the picture, the purple atoms represent atoms within the helices and the red, green, blue and yellow represent atoms within the base-pairs. Although, it is a good physical model it does not really help the viewer see the sequence of base pairs.

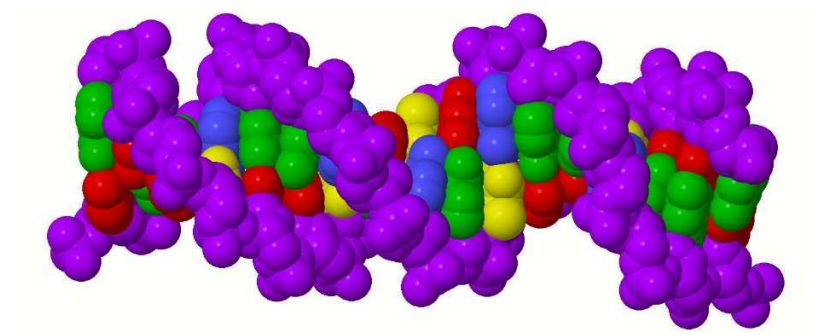

Figure 1. Space filled model of DNA[1]

A second model is the ball and stick representation (figure 2). This is like the space filled model except the atoms are artificially held apart so that the structure is made more clear. The sticks represent the bonds between atoms.

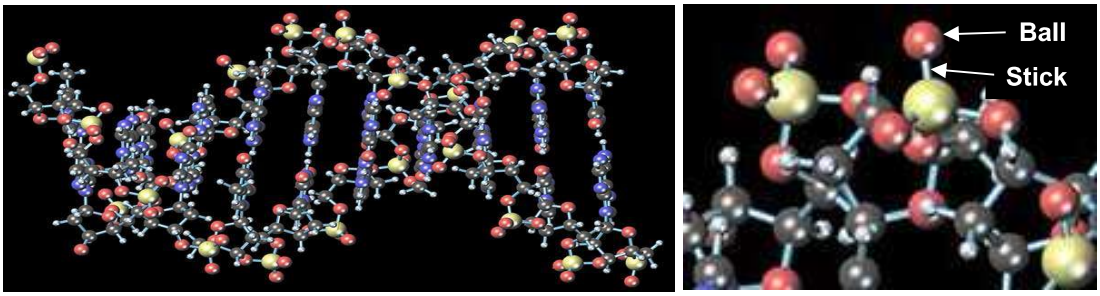


Figure 2. Ball and stick model of DNA[2]

A third model is one that is made up of adjoining molecules rather than atoms and is commonly used to represent complex biological entities such as DNA, proteins and enzymes. The Molymod Advanced Mini DNA model was of this type.

### 1.5 The Molymod Advanced Mini DNA kit.[3]

A total of 51 kits were purchased from Spiring Enterprises Ltd, England, www.molymod.com. Participants taking part in our world record attempt worked in pairs.

[1] www.umass.edu/molvis/tutorials/dna/dnacode.htm
[2] www.meteo.mcgill.ca/andrew/vm3/DNA.jpg
[3] European Registered Design

Fifty of the pairs worked on sequences that comprised 22 base pairs and one pair worked on a sequence that comprised 18 base pairs.

Students were instructed to build the “ladder” of base pairs and then to add the two helices (figure 3)


Figure 3. The **Molymod model** at various stages of construction. The components are Blue – Adenine, Orange – Thymine, Green – Guanine, Yellow – Cytosine, Red – Sugar group, Mauve – Phosphate. The participants are shown attaching the model to a metal rod and stand. The DNA sequence, from bottom to top, for the ladder shown at the top is ATCAGTCCTCT (right bases only).

### 1.6. Why the Molymod Advanced Mini DNA kit was chosen.

1. The Molymod Advanced Mini 22 base DNA kit model shows the molecules within the DNA, rather than the individual atoms. The advantage is that the builder is able to see the important structural elements imparted by the helices and base pairs in a way that is not possible with the space filling models. With the space filling model it is difficult to “see the wood from the trees”.

2. Using the Molymod Advanced Mini 22 base DNA kit enabled us to teach all the students / participants about the structure of DNA. We did not want the students / participants to act only as builders.

3. Each 22 base pair kit currently costs £35, which is equivalent to £1.60 per base pair. The cost of 51 kits required to build the insulin gene is £1785.

4. The cost of the space filled model from Molymod, used in the previous world record, is £183 for a 10 base pair model. This is equivalent to £18.30 per base pair. The equivalent cost of building the insulin gene with 1118 base pairs would have been £20,500, a further cost coming from engineering required to support the model.

5. The cost of breaking the record with a space filled model would make it prohibitive for most organisations.

6. The 51 models of DNA were threaded together on a long length of steel wire. The wire was, safe, strong and easy to handle. In addition, the models were of a light weight design.

7. It is easy to count the number of base pairs on the Molymod Advanced Mini 22 base pair kits and therefore it is easy to verify a record attempt.

8. It is easy to verify the exact sequence of base pairs, even though building an exact sequence isn’t necessary for the current record attempt.

Figure 4. Lifting the DNA onto metal hangers

## 1.7. The coding section of the human insulin gene

The 51 sequences of code used to build the human insulin gene are shown below. Only the sense strand is shown.

| | | |
|---|---|---|
| 1 | 2 | 3 |
| ATGGCCCTGTGGATGCGCCTCC | TGCCCCTGCTGGCGCTGCTGGC | CCTCTGGGGACCTGACCCAGCC |
| 4 | 5 | 6 |
| GCAGCCTTTGTGAACCAACACCT | GTGCGGCTCACACCTGGTGGAA | GCTCTCTACCTAGTGTGCGGGG |
| 7 | 8 | 9 |
| AACGAGGCTTCTTCTACACACC | CAAGACCCGCCGGGAGGCAGAG | GACCTGCAGGGTGAGCCAACCG |
| 10 | 11 | 12 |
| CCCATTGCTGCCCCTGGCCGCC | CCCAGCCACCCCCTGCTCCTGG | CGCTCCCACCCAGCATGGGCAG |
| 13 | 14 | 15 |
| AAGGGGGCAGGAGGCTGCCACC | CAGCAGGGGGTCAGGTGCACTT | TTTTAAAAAGAAGTTCTCTTGG |
| 16 | 17 | 18 |
| TCACGTCCTAAAAGTGACCAGC | TCCCTGTGGCCCAGTCAGAATC | TCAGCCTGAGGACGGTGTTGGC |
| 19 | 20 | 21 |
| TTCGGCAGCCCCGAGATACATC | AGAGGGTGGGCACGCTCCTCCC | TCCACTCGCCCCTCAAACAAAT |
| 22 | 23 | 24 |
| GCCCCGCAGCCCATTTCTCCAC | CCTCATTTGATGACCGCAGATT | CAAGTGTTTTGTTAAGTAAAGT |
| 25 | 26 | 27 |
| CCTGGGTGACCTGGGGTCACAG | GGTGCCCCACGCTGCCTGCCTC | TGGGCGAACACCCCATCACGCC |
| 28 | 29 | 30 |
| CGGAGGAGGGCGTGGCTGCCTG | CCTGAGTGGGCCAGACCCCTGT | CGCCAGCCTCACGGCAGCTCCA |
| 31 | 32 | 33 |
| TAGTCAGGAGATGGGGAAGATG | CTGGGGACAGGCCCTGGGGAGA | AGTACTGGGATCACCTGTTCAG |
| 34 | 35 | 36 |
| GCTCCCACTGTGACGCTGCCCC | GGGGCGGGGGAAGGAGGTGGGA | CATGTGGGCGTTGGGGCCTGTA |
| 37 | 38 | 39 |
| GGTCCACACCCAGTGTGGGTGA | CCCTCCCTCTAACCTGGGTCCA | GCCCGGCTGGAGATGGGTGGGA |
| 40 | 41 | 42 |
| GTGCGACCTAGGGCTGGCGGGC | AGGCGGGCACTGTGTCTCCCTG | ACTGTGTCCTCCTGTGTCCCTC |
| 43 | 44 | 45 |
| TGCCTCGCCGCTGTTCCGGAAC | CTGCTCTGCGCGGCACGTCCTG | GCAGTGGGGCAGGTGGAGCTGG |
| 46 | 47 | 48 |
| GCGGGGGCCCTGGTGCAGGCAG | CCTGCAGCCCTTGGCCCTGGAG | GGGTCCCTGCAGAAGCGTGGCA |
| 49 | 50 | 51 |
| TTGTGGAACAATGCTGTACCAG | CATCTGCTCCCTCTACCAGCTG | GAGAACTACTGCAACTAG |

Each sequence was built vertically using the 22 base pair ***Molymod Advanced Mini DNA kit.*** The first letter on the left of each sequence corresponded to the bottom of mini DNA kit and the last letter corresponded to the top.

### 1.8. How the event was organised

Planning meeting were organised through the undergraduate Bioscience Society. The group met six times in the spring term to practice building the model. This led to set of resources being made for each of the 51 pairs of record breakers. This included instructions, a 22 base pair code and a checking sheet.

The group also focused on trouble shooting so that mistakes in the model could be identified and corrected. Each of the 51 sequences had to be correctly built so that the chains formed a right handed helix and were anti-parallel otherwise they would be incorrect and would not fit together. On the day only one sequence was built with an incorrect backbone, a mistake that led to a 10 minute delay. The group also practiced threading the model onto the wire rope.

Figure 5. The Bioscience Society.

**1.9. Itinerary on the 13th March 2008.**

# DNA World Record Attempt

## Thursday 13th March 2008

| | |
|---|---|
| 8.45 – 9.10 | Arrival and registration at Quayside. |
| 9.30 | All University and Sixth-form students seated |
| 9.30 – 9.50 | Welcome and Overview of the day with warm-up activities – Jeremy Hopwood |
| 9.50 – 10.05 | First talk – ***The Discovery of Insulin***. Shamus Burns |
| 10.05 – 10.40 | Practice session 1 |
| 10.40 – 11.10 | BREAK. Drinks and Biscuits |
| 11.10 – 11.50 | Practice session 2 |
| 11.50– 12.00 | Second talk – ***The DNA model.*** Mike Saul |
| 12.00 – 12.40 | LUNCH. Jacket potato and fillings |
| 12.45 – 1.30 | Timed session : Building the Sequences |
| 1.15 – 2.00 | Threading the sequences onto the cable<br>Quiz – Mike Morgan<br>Third Talk – ***Diabetes a Personal Perspective.*** Andy Adams |
| 2.00 – 2.10 | Lifting and suspending the DNA |
| 2.10 | Target finish time |
| 2.10 – 2.45 | Placing of the last piece by Dickie Bird, short speech, press and university photos<br>-Last DNA talk in reserve |
| 2.45 | End speech and poster prize |
| 3.00 | Finish |

RECORD ATTEMPT

In practice, we commenced the record attempt at 13.00 and finished at 13.51pm. The record took 51 minutes to complete.

### 1.10. The Record Breakers

The following students, teachers and lecturers were all involved in building the DNA model.

# Sixth form students and teachers

**Huddersfield New College**
Teacher 1
Participant 1
Participant 2
Participant 3
Participant 4
Participant 5
Participant 6
Participant 7
Participant 8
Participant 9
Participant 10
Participant 11

**Rastrick High School**
Teacher 2
Participant 12
Participant 13
Participant 14
Participant 15
Participant 16
Participant 17
Participant 18
Participant 19
Participant 20
Participant 21

**Shelley High School**
Teacher 3
Participant 22
Participant 23
Participant 24
Participant 25
Participant 26
Participant 27
Participant 28
Participant 29
Participant 30
Participant 31

**Heckmondwike Grammar School**
Teacher 4
Participant 32
Participant 33
Participant 34
Participant 35
Participant 36
Participant 37
Participant 38
Participant 39
Participant 40
Participant 41

**Greenhead College**
Teacher 5
Participant 42
Participant 43
Participant 44
Participant 45
Participant 46
Participant 47
Participant 48
Participant 49
Participant 50
Participant 51

**Huddersfield Technical College**
Participant 52
Participant 53
Participant 54
Participant 55
Participant 56
Participant 57
Participant 58
Participant 59
Participant 60
Participant 61

# University students and lecturers

**1st year Biologists**

Participant 62
Participant 63
Participant 64
Participant 65
Participant 66
Participant 67
Participant 68
Participant 69
Participant 70
Participant 71
Participant 72
Participant 73
Participant 74
Participant 75
Participant 76
Participant 77
Participant 78
Participant 79

**2nd year Biologists**

Participant 80
Participant 81
Participant 82
Participant 83
Participant 84

**Final year Biologists**

Participant 85
Participant 86
Participant 87
Participant 88
Participant 89
Participant 90
Participant 91
Participant 92
Participant 93
Participant 94

**Other**

Participant 95

**Bioscience society**

Participant 96
Participant 97
Participant 98
Participant 99
Participant 100
Participant 101
Participant 102
Participant 103
Participant 104
Participant 105
Participant 106
Participant 107
Participant 108
Participant 109
Participant 110
Participant 111
Participant 112

**Lecturers**

Prof. Rob Smith
Dr Dougie Clarke
Dr Mike Saul
Dr Cathy Garner
Dr Shamus Burns
Dr Jeremy Hopwood
Mr Andy Adams

**University Surveyor**

Tony Lelliot

**1.11. Sponsorship.**

The Physiological Society donated £500.

Peer House
Verulam Street
London.
WC1X 8LZ
Tel 020 7269 5710
www.physoc.org

SETPOINT West Yorkshire donated £500.

The Business and Innovation Centre
Angel Way
Bradford
BD7 1BX
01274841345
www.setpoint.org

The University of Huddersfield allocated £2000 for direct costs and £8500 for indirect costs.

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## 2.The Evidence

### 2.1.Letters of authentication

Three respected members of the local community were asked to adjudicate.

**Harold "Dickie" Bird.** MBE, Hon.D(Univ). LLD is a famous retired world cup cricket referee, who is from West Yorkshire. He is a prominent and respected member of the community whose job was to referee / adjudicate international cricket matches.

**Graham Andrew Leslie.** Honorary D.B.A. Founder of the pharmaceutical company Galpharm (www.galpharm.co.uk). Galpharm, sponsor Huddersfield Town Football Club and Rugby league club (The Galpharm Stadium). Graham Leslie is a prominent and respected member of the community.

**Susan Margaret Suddick.** Secretary of the Diabetes UK Huddersfield Voluntary Support Group. She is a respected member of the community and a representative of a major U.K. Diabetes Charity. Our DNA model represented the gene that is associated with diabetes.

Figure 5. Graham Leslie (near left) counts the number of base pairs with Harold "Dickie" Bird.

# HAROLD "DICKIE" BIRD MBE, Hon.D(Univ). LLD.

FREEMAN OF THE BOROUGH OF BARNSLEY
TEST & WORLD CUP FINAL UMPIRE

RETIRED.
Date that I observed at work
13th March 2008.
Arrived at Venue 11-30 Am.
Left Venue 4-55 pm.

19th May 2008

Dear Sirs

Here is my authentication letter. I saw Sixth form students build a model of DNA with 1118 base pairs there was a video that pictures showing the entire sequence. The pictures what I saw was a true reflection. It was just amazing what I saw.

I saw people making the model and that it did stretch the length of the Quayside Venture (24 metres).

I also examined the 51 sections that were made up by different groups of students counted the base pairs in sections and multiplied up to confirm that the whole that consisted of 1,118 base pairs when joined to gether on the cable

It was an amazing effort, just tremendous by the students. You had to see it to believe it. "Well Done"

Yours sincerely.

H. Dickie Bird

P.S. Some of the people present myself Graham Leslie, Colin Dennis, Professor RH Smith and many other people. The date was June.

HONORARY LIFE MEMBER: MCC
YORKSHIRE CCC LEICESTERSHIRE CCC

**Graham Andrew Leslie.**

Babyway International Ltd

***LETTER OF AUTHENTICATION***

***School of Applied Sciences, Huddersfield University***

***Thursday 13th March 2008***

This event was indeed a pleasure and delight to attend and act as a verifier in the attempt by Huddersfield University to accurately and scientifically make a model representing the insulin gene of 1,118 base pairs. The model was built in 57 minutes beginning at around 1:15pm and I am deeply honoured to confirm that this was successfully achieved in my presence.

To assist in this mission were 61 students and 5 teachers from local schools and colleges representing a community cross section from Huddersfield New College, Greenhead College, Shelley College and Heckmondwike Grammar School who were complimented by 60 of the undergraduate students from the biological science department at the University of Huddersfield. The enthusiasm and success of all the student's efforts was then displayed by stretching 24 metres along the quayside and I can confirm that the pictures sent to me reflect all aspects of a successful record being achieved.

I can also confirm that on close examination of the 51 sections, counting the base pairs in each section resulted in 1,118 base pairs being joined together. I was also delighted to have alongside me at the event world renowned cricket umpire Mr Dickie Bird MBE as joint adjudicator.

**GRAHAM A LESLIE Hon. D.B.A.**
Chairman

1

Babyway House, Galpharm Way, Upper Cliffe Road, Dodworth Business Park, Dodworth, Barnsley, South Yorkshire, England, S75 3SP.
Telephone: +44 (0) 1226 288333 · Facsimile: +44 (0) 1226 288220 · E-mail: enquiries@babywayint.co.uk · Website: www.babywayint.co.uk
Registered Office . As above. Registered in England and Wales. REG. No: 3841036 · VAT No: 918 2295 12

| | |
|---|---|
| Name: | Graham Andrew Leslie |
| Address: | Babyway International Limited<br>Babyway House<br>Galpaharm Way<br>Upper Cliffe Road<br>Dodworth Business Park<br>Dodworth<br>Barnsley<br>South Yorkshire<br>S75 3SP |
| Tel. No: | 01226288333 |
| Email Address: | g.leslie@babywayint.co.uk |
| Position: | Honorary D.B.A.<br>Embassador of Huddersfield<br>Lord of the Manor of Greetland |
| Date observed: | Thursday 13th March 2008 |
| Time of arrival: | 12:30 hours |
| Time of leaving: | 17:00 hours |

**Susan Margaret Suddick**


Figure 6. Susan Suddick from Diabetes UK is shown beneath a section of DNA.

Susan Margaret Suddick.

3/4/2008

Dear Sir,

As secretary of the Diabetes UK Huddersfield Voluntary Support Group, I was delighted to be invited to witness the building of the longest model of DNA, Insulin gene, on Thursday 13th March 2008.

I arrived at the venue at 8.30 that morning and set up a small stand for Diabetes UK. From my vantage point at the front of the venue, I was able to watch the proceedings with much interest.

The students were given lectures before starting the event, and I certainly learnt a lot more about Insulin, which is so important to Diabetics.

After a couple of practice sessions during the morning, the main business got underway after lunch.

During the afternoon, I was able to mingle and watch as students from local Sixth form colleges, and Undergraduate students from the University began building the 1118 base pairs model. In just over two hours, the final part was threaded onto the wire holding the whole thing together, by Ex-Cricket umpire Dickie Bird, to much cheering from both builders and audience !

The model was then very carefully lifted onto hooks stretching the length of the "Quayside" venue, some 24 metres. A very impressive sight, and a marvellous achievement for Huddersfield University and organisers including Dr. Jeremy Hopwood, Prof. Rob Smith & Shamus Burns.

My thanks again to Jeremy for inviting me to this wonderful event.

Yours sincerely,

Susan M. Suddick.

## 2.2.Media Coverage

### 2.2.1. Newspaper coverage

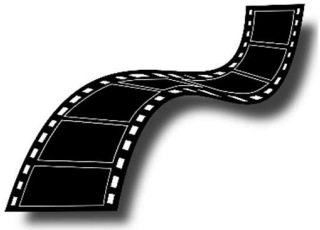
1. The Huddersfield,Examiner, Friday, March 14th 2008. “A World Record !”
2. The Huddersfield Weekly News, Tuesday, March 18th 2008. “Howzat … It’s a World Record for Students”
3. Evening Courier, March 19th 2008. “Rastrick students create world's longest DNA model”
4. Physiology News, Issue 71, Summer 2008.
5. Huddersfield Student, news section, page 5, March 2008.

### 2.2.2 Internet coverage[4]

1. www.examiner.co.uk/news/local-west-yorkshire-news/2008/03/14/dickie-bird-dna-and-a-world-record-86081-20623428/*
2. www.halifaxcourier.co.uk/young-people/Rastrick-students-create-world39s-longest.3890692.jp
3. www.physoc.org/site/cms/contentviewarticle.asp?article=779
4. www.biochemist.org/news/page.htm?item=28347
5. www.youtube.com/watch?v=x6FSO4hp0BM*
6. www.ycf.org.uk/NewsDetail.aspx?newsId=149

## 2.3.Video footage of the Record Attempt

A video / DVD of the event is available on request from the School of Applied Sciences. A video is also available on You Tube (www.youtube.com/watch?v=x6FSO4hp0BM).



[4] The Internet links were initially checked on the 22 July 2008. On the 23 May 2024, only those marked * were still available.

Article printed in the Huddersfield Examiner

Title: **A World Record – students' DNA model impresses Dickie** by news reporter Sam Casey.

Page: 3, full colour page.

Date: Friday March 14, 2008

Publisher: Huddersfield Examiner

Contains photos of the participants and an article

Article not shown, whilst awaiting permission from The Examiner to publish.

## 2.4.High quality colour photographs[5]

Photos of the event are available on request from the School of Applied Sciences.

Practice session 2

*11.26*

*11.26*

*11.26*

*11.30*

*11.30*

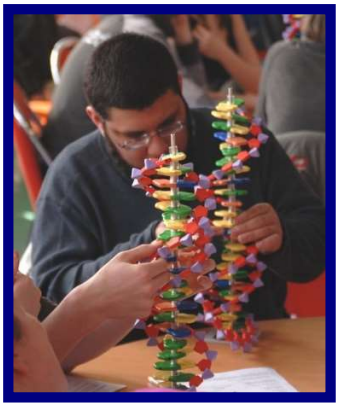
*11.32*

*11.35*

Time of photo

*11.38*

*11.35*



[5] Photographs by David Casson, University of Huddersfield.

11.45

11.48

11.48

11.51

The Record Attempt

13.09

13.09

13.17

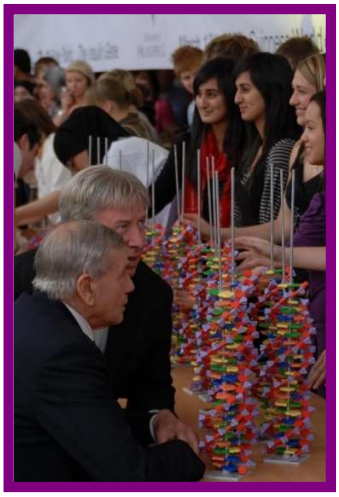
13.25

13.26

13.26

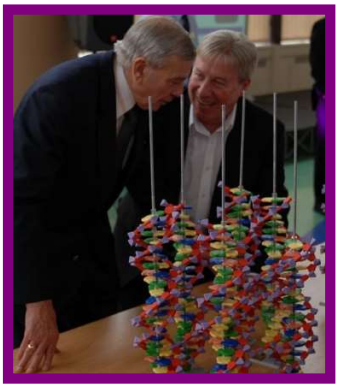
13.30

13.50



13.47

13.50



13.51


Hanging the DNA model

14.01

14.07

14.07

15.11

14.13

## 2.5.Logbook

An itinerary for the day is shown in section 1.7. The record attempt started at 13.00 and finished 51 minutes later when the final 1118$^{th}$ base pair was added. The model was then lifted onto hooks and hung off the mezzanine of the Quayside conference centre,

## 2.6.Measurements

A Visual inspection of the completed model was made by the adjudicators. They confirmed by writing that the model was held together in the correct manner and comprised 1118 base pairs. The video of the model also shows this to be true.

The model is 13cm in diameter, weighs 22 kg (not including the weight of the wire rope) and is 23m long.

The completed model is currently on display in the School of Applied Sciences. A photo is shown below.

### 3.1.The academic team

The academic members of staff involved with the event are shown below.


From Left to right. Dr Shamus Burns, Dr Dougie Clarke (Head of Biology and Nutrition), Dr Jeremy Hopwood, Prof. Rob Smith (Dean of the School of Applied Sciences), Dr Cathy Garner, Dr Mike Saul.

Tony Lelliot, the university surveyor who provided vital construction and engineering advice, is pictured left.

University of HUDDERSFIELD

School of Applied Sciences