3. DNA DISCOVERY

1. What is science?
Work in pairs. Try to define the word "Science".
Science is ...

2. Speaking. Work in small groups. Ask and answer these questions:

a) The following is a list of discoveries and inventions:

writing / telephone / fire / wheel / electricity / printing / cooking

- Which of them do you find most useful and why? Why is it important?
- Which of these inventions is NOT important for you?
- How did people manage before they had these inventions / discoveries?

b) In your opinion, what is the greatest technological invention? Why?
c) How have scientific inventions and discoveries affected your life? Give examples.
d) What science fiction movies have you seen? Do you think that what you have seen in these movies is possible? Have you read any sci-fi books? Which ones?
e) Do you think technological advances are always good? Or can they sometimes be bad and harmful? Give examples.
f) Do you think the stereotype of the 'mad scientist' is true?[1]
g) What famous scientists do you know? What do you know about them?

3. Which verb is correct in the following sentences?
Complete the relevant name to each invention or discovery.

The electric bulb was *invented / discovered* **by** …

The first antibiotic drug, penicilin, was *invented / discovered* **by** …

The telephone was *invented / discovered* **by** …

America was *invented / discovered* **by** ….

4. Connect words that go together. There are more possible options.

1) invent	d) mass / density
2) discover	g) research
3) formulate	f) a new law / principle
4) calculate	c) a theory / hypothesis
5) develop	e) a new technique
6) propose	b) a new drug
7) carry out	a) a new machine

5. What was invented / discovered / developed / formulated … and by whom?

a) the law of gravity	1. John Dalton, chemist
c) the structure of DNA	2. Charles Darwin, biologist
d) the modern theory of evolution	3. Marie Curie, chemist and physicist
e) the theory of relativity	4. Isac Newton, mathematician, physicist
f) steam engine	5. James Watt, inventor
g) radioactivity	6. Watson, Crick and Wilkins, biologists
h) x-rays	7. Wilhelm Conrad Rontgen, physicist
i) atomic theory	8. Albert Einstein, physicist

In pairs, ask and answer questions. Choose the right verbs.

Example:
*A: Who **formulated** the law of gravity?*
*B: The law of gravity **was formulated by** Newton. He was a mathematician and a physicist.*

LIFE OF A SCIENTIST

6. Work with your neighbour (A/B). Read a text about James Watson who discovered the molecular structure of DNA (together with Crick and Wilkins) and who is still alive today. You don´t have the same information. Ask and answer questions to complete your text.

Example: **A:** James Watson was born ... *(When?)*
When was James Watson born?
B:James Watson was born on April 6, 1928, in Chicago. *When* did he start studying at the university of Chicago?

Student A

James Dewey Watson was born ..... *(When?)*. He started studying at the University of Chicago at the age of fifteen. Then he studied ..... *(Where?)*. He received a Ph.D.in Zoology in 1950.

Then he worked ..... *(Where?)*. Together with Crick and Wilkins he discovered the structure of the DNA. He was awarded the Nobel Prize in Physiology or Medicine ..... *(When?)*. Since then, he has received 14 honorary degrees from different universities. During his lifetime, James Watson has written ..... *(How many?)* books. There names are: Molecular Biology of the Gene, The Double Helix, The DNA Story, Molecular Biology of the Cell, and Recombinant DNA: A Short Course.

James Watson has been working as a head of Cold Harbor Laboratory since 1994. He published his genome online ..... *(When?)*. At the moment he is carrying research on autism.

James Watson lives ..... *(Where?)*. Since childhood, he has been interested in bird-watching. He is married to Elizabeth Lewis and he has ..... *(How many?)* sons.

Student B

James Dewey Watson was born on April 6, 1928, in Chicago. He started studying at the University of Chicago …….. *(When?)*. Then he studied at Indiana University. He received a Ph.D.in Zoology ……. *(When?)*.

Then he worked at Cavendish Laboratory at the University of Cambridge. Together with Crick and Wilkins he discovered ..... *(What?)*. He was awarded the Nobel Prize in Physiology or Medicine in 1962. Since then, he has received ..... *(How many?)* honorary degrees from different universities.

During his lifetime, James Watson has written five books. There names are: Molecular Biology of the Gene, The Double Helix, The DNA Story, Molecular Biology of the Cell, and Recombinant DNA: A Short Course.

James Watson has been working as a head of Cold Harbor Laboratory since ……. *(Since when?)*. He published his genome online on May 31, 2007. At the moment he is carrying out research on …… *(What kind of research?)*

James Watson lives in Cold Spring Harbor, a whaling village on the North Shore of Long Island. Since childhood, he has been interested in …… *(What?)*. He is married to Elizabeth Lewis and he has 2 sons, Rufus and Duncan.

7. Listening/watching. The DNA Story – 1973.
Listen to Francis Crick speaking about his work at the Cavendish Laboratory and fill in the gaps with the missing words.[2]

Crick: I wasn't so sure, I think, at that time, as to whether DNA or ……. was the genetic material. Of course I knew about Avery's ……., and they were very suggestive, but you could ……. that they weren't watertight. I knew Maurice Wilkins, I'd known him before I went to the Cavendish, and he ……. on DNA and I'd gone to talk to him, but I didn't actually myself work on it, mainly because at the Cavendish they were working on protein ……..... . So I learnt about polypeptide ……, x-ray diffraction, and things of that sort, and essentially continued to be interested in ……..... rather than doing any experiments or …… .

James Watson

Francis Crick

Maurice Wilkins

8. Read the text about Francis Crick (Student A) or Maurice Wilkins (Student B).[3] Underline any words that you need to understand the text and find them in the dictionary. Answer these questions. Take notes.

a) When and where was he born?

b) What do you know about his family (parents, brothers…)?

c) What was his education?

d) What degrees did he obtain?

e) What did he do during the war?

f) Where did he work during his lifetime?

g) What kind of research did he carry out?

h) Was he married? Did he have any children?

i) When did he die? How old was he at the time of his death?

Text A:

Francis Harry Compton Crick was born on June 8th, 1916, at Northampton, England, being the elder child of Harry Crick and Annie Elizabeth Wilkins. He had one brother, A. F. Crick, who is a doctor in New Zealand.

Crick was educated at Northampton Grammar School and Mill Hill School, London. He studied physics at University College, London, obtained a B.Sc. in 1937, and started research for a Ph.D. under Prof E. N. da C. Andrade, but this was interrupted by the outbreak of war in 1939. During the war he worked as a scientist for the British Admiralty, mainly in connection with magnetic and acoustic mines.

Supported by a studentship from the Medical Research Council and with some financial help from his family, Crick went to Cambridge and worked at the Strangeways Research Laboratory. He became a research student for the second time in 1950, being accepted as a member of Caius College, Cambridge, and obtained a Ph.D. in 1954 on a thesis entitled «X-ray diffraction: polypeptides and proteins».

In 1947 Crick knew no biology and practically no organic chemistry or crystallography, so that much of the next few years was spent learning these subjects. During this period, together with W. Cochran and V. Vand he worked out the general theory of X-ray diffraction by a helix.

A critical influence in Crick's career was his friendship, beginning in 1951, with J. D. Watson, then a young man of 23, leading in 1953 to the proposal of the double-helical structure for DNA and the replication scheme. Crick and Watson subsequently suggested a general theory for the structure of small viruses.

Later he concentrated more on biochemistry and genetics leading to ideas about protein synthesis (the «adaptor hypothesis»), and the genetic code.

In 1940 Crick married Ruth Doreen Dodd. Their son, Michael F. C. Crick is a scientist. They were divorced in 1947. In 1949 Crick married Odile Speed. They had two daughters, Gabrielle A. Crick and Jacqueline M. T. Crick. The family lived in a house appropriately called «The Golden Helix».

On the 28 th July 2004, Francis Crick died of cancer. He was 88 years old.

Text B:

Maurice Hugh Frederick Wilkins was born at Pongaroa, New Zealand, on December 15th, 1916. His parents came from Ireland; his father Edgar Henry Wilkins was a doctor in the School Medical Service and was very interested in research but had little opportunity for it.

At the age of 6, Wilkins was brought to England and educated at King Edward's School, Birmingham. He studied physics at St. John's College, Cambridge, taking his degree in 1938. He then went to Birmingham University where he became research assistant in the Physics Department. He studied the luminescence of solids and obtained a Ph.D. in 1940, his thesis being mainly on the study of thermal stability of trapped electrons in phosphors, and on the theory of phosphorescence. He then applied these ideas to various war-time problems such as improvement of cathoderay tube screens for radar.

In 1945, when the war was over, he was a lecturer in physics at St. Andrews' University, Scotland. He had spent seven years in physics research and now began in biophysics. The biophysics project moved in 1946 to King's College, London. He was first concerned with genetic effects of ultrasonics; after one or two years, he changed his research to development of reflecting microscopes for ultraviolet microspectrophotometric study of nucleic acids in cells. He then began X-ray diffraction studies of DNA. The discovery of the well-defined patterns led to the deriving of the molecular structure of DNA. Further X-ray studies established the correctness of the Watson-Crick proposal for DNA structure.

Wilkins became Assistant Director of the Medical Research Council Unit in 1950 and Deputy Director in 1955. A sub-department of Biophysics was formed in King's College, and he was made Honorary Lecturer in it. In 1961 a full Department of Biophysics was established.

He married Patricia Ann Chidgey in 1959; they had four children: Sarah, George, Emily and William. He died on 5th October 2004 in London.

12. Find a partner from the other group (Student A/B). Tell him the answers to your questions. From your notes, describe the life of Francis Crick/Maurice Wilkins.

Compare the two people. What do they have in common? What are the differences?

Sources: Available at http://iteslj.org/questions/

[2] **Available at:** http://osulibrary.oregonstate.edu/specialcollections/coll/pauling/dna/videos/dnastory01.html

[3] **Based on** wikipedia.org and nobelprize.org

Week 8 – Vocabulary - DNA Discovery	
invention	vynález
invent a new technique	vynalézt novou techniku
discover a new drug	objevit nový lék
discovery	objev
formulate a theory / hypothesis	formulovat teorii / hypotézu
calculate mass / density	vpočítat hmotnost / hustotu
calculations	výpočty
develop a new machine	vyvinout nový stroj
development	vývoj
propose a new law / principle	
carry out research	provádět výzkum
create	vytvořit
define	definovat
Aspirin was discovered by Alexander Fleming.	Aspirin byl objeven Alexandrem Flemingem.
The modern theory of evolution was formulated by Charles Darwin.	Moderní teorie evoluce byla formulována Charlesem Darwinem.
He was awarded the Nobel Prize in Chemistry.	Dostal Nobelovu cenu za chemii.
the law of gravity	gravitační zákon
the theory of relativity	teorie relativity
the modern theory of evolution	moderní teorie evoluce
DNA (deoxyribonucleic acid)	DNA (deoxyribonukleová kyselina)
study of nucleic acids	studium nukleových kyselin
protein structure	struktura bílkovin
polypeptide chains	polypeptidové řetězce
X-ray diffraction	rentgenová difrakce
double helix	dvojitá šroubovice
influence	vliv
in recent years / recently	v posledních letech
in particular / particularly	obzvláště
opportunity	příležitost
research assistant	výzkumný asistent
apply to …	aplikovat na
concerned with …	zabývající se
derive	derivovat, odvozovat