Principles of Biology: A Compendium of

Video Lectures

BY IBAD-UR-RAHMAN

Foreword

The single most important factor determining the quality of education at school, college or university levels is the quality of available faculty. At good universities the ratio of PhD level faculty to students is 1: 10 or even less. At the University of Cambridge where I happen be an Honorary Life Fellow (Kings College) it is 1:6. The quality of education and research at Cambridge is reflected from the fact that over 90 Nobel Prizes have been awarded to senior researchers associated with Cambridge University. Clearly it will take decades for universities in developing countries to reach those standards even if there are visionary governments providing liberal financial support.

However, there is hope. The manner in which education is being imparted is undergoing radical changes and distance education is allowing developing countries to benefit from lectures delivered by leading academicians from top Western Universities through Massive Open Online Courses (MOOCs). We launched an integrated version of MOOCs a few years ago which contains tens of thousands of lectures in various disciplines at school, college and university level from MIT, Stanford, Yale, University of California, Khan Academy and other institutions. These are freely available at www.lej4learning.com.pk

Another exciting initiative by us is the in the form of books without any text --- containing just video links under different headings and sub headings to lectures by leading professors. This should bring about a paradigm shift in the manner in which teaching is imparted as it will allow both students and teachers to study the materials in advance and free the class room time for discussion sessions so that concepts can be discussed and clarified. The first such book on chemical sciences, entitled “Basic Principles of Organic Chemistry – A Compendium of Video-Lectures”, was published early in 2016 and it has a Foreword by the Nobel Laureate Prof. Jean-Marie Lehn (Strasbourg, France). The present book by my grandson Ibad-Ur-Rahman represents a valiant effort in biology, and it is suitable for undergraduate and postgraduate students. It contains lectures by leading professors from MIT, Yale, University of California and other institutions.

I would like to congratulate Ibad, who is studying at A-levels in Karachi Grammar School, for the excellent work done and hope that it will be useful for students and researchers all over the world.

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Preface

I am a Student at Karachi Grammar School and am currently doing my A-Levels from there. I study Mathematics and Sciences and enjoy learning about new developments in the world of science. During my summer vacations I decided to make an efficient use of my time, learning about science from the best teachers at top universities in the world through easily accessible video lectures. What is better than having free access to lectures given at top universities such as MIT, Berkeley and more. Furthermore I decided to benefit other students like me to gain access to these eye-opening lectures. My grandfather has developed a program through which students all over the world can have free access to these lectures. The best way to do this was to compile a video library with lectures on many subjects where a lecture by an esteemed teacher was just a click away. This is what I devoted my vacations to.

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15.1) Structure

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https://www.khanacademy.org/science/biology/dna-as-the-genetic-material/structure-of-dna/v/dna-deoxyribonucleic-acid

b)
https://www.khanacademy.org/science/biology/dna-as-the-genetic-material/structure-of-dna/v/molecular-structure-of-dna

c)
https://www.khanacademy.org/science/biology/dna-as-the-genetic-material/structure-of-dna/v/antiparallel-structure-of-dna-strands

15.1) Discovery

a)
https://www.khanacademy.org/science/biology/dna-as-the-genetic-material/dna-discovery-and-structure/v/establishing-dna-as-transformation-principle

b)
https://www.khanacademy.org/science/biology/dna-as-the-genetic-material/dna-discovery-and-structure/v/hershey-and-chase-conclusively-show-dna-genetic-material

c)
https://www.khanacademy.org/science/biology/dna-as-the-genetic-material/dna-discovery-and-structure/v/the-discovery-of-the-double-helix-structure-of-dna

15.3) DNA Replication

a)
https://www.khanacademy.org/science/biology/dna-as-the-genetic-material/dna-replication/v/rna-transcription-and-translation

b)
https://www.khanacademy.org/science/biology/dna-as-the-genetic-material/dna-replication/v/leading-and-lagging-strands-in-dna-replication

c)
https://www.khanacademy.org/science/biology/dna-as-the-genetic-material/dna-replication/v/speed-and-precision-of-dna-replication

d)
https://www.khanacademy.org/science/biology/dna-as-the-genetic-material/dna-replication/v/molecular-structure-of-rna

16) Stem Cells/Cloning

16.1)

http://ocw.mit.edu/courses/biology/7-012-introduction-to-biology-fall-2004/video-lectures/lecture-29-stem-cells-cloning-1/

16.2)

http://ocw.mit.edu/courses/biology/7-012-introduction-to-biology-fall-2004/video-lectures/lecture-30-stem-cells-cloning-2/

17) Recombinant DNA

17.1)

http://ocw.mit.edu/courses/biology/7-012-introduction-to-biology-fall-2004/video-lectures/lecture-15-recombinant-dna-1/

17.2)

http://ocw.mit.edu/courses/biology/7-012-introduction-to-biology-fall-2004/video-lectures/lecture-16-recombinant-dna-2/

17.3)

http://ocw.mit.edu/courses/biology/7-012-introduction-to-biology-fall-2004/video-lectures/lecture-17-recombinant-dna-3/

17.4)

http://ocw.mit.edu/courses/biology/7-012-introduction-to-biology-fall-2004/video-lectures/lecture-18-recombinant-dna-4/

UC Berkeley)

https://www.youtube.com/watch?v=qDf4VeUYUbA&index=15&list=PL-XXv-cvA_iDuZ4BUn54ujg2kZttNk27L

https://www.youtube.com/watch?v=XYqxiJIDqPs&list=PL-XXv-cvA_iDuZ4BUn54ujg2kZttNk27L&index=21

18) Biotechnology

18.1) DNA Cloning

https://www.khanacademy.org/science/biology/biotech-dna-technology/dna-cloning-tutorial/v/dna-cloning-and-recombinant-dna

18.2) DNA Analysis Methods

a)
https://www.khanacademy.org/science/biology/biotech-dna-technology/dna-sequencing-pcr-electrophoresis/v/the-polymerase-chain-reaction-pcr

b)
https://www.khanacademy.org/science/biology/biotech-dna-technology/dna-sequencing-pcr-electrophoresis/v/gel-electrophoresis-dna

18.3) Stem Cells

https://www.khanacademy.org/science/biology/biotech-dna-technology/stem-cells/v/embryonic-stem-cells

https://www.youtube.com/watch?v=wXIVblCvysU&index=26&list=PL-XXv-cvA_iDuZ4BUn54ujg2kZttNk27L

https://www.youtube.com/watch?v=4hKWcmerUEY&index=27&list=PL-XXv-cvA_iDuZ4BUn54ujg2kZttNk27L

19) Immunology

19.1)

http://ocw.mit.edu/courses/biology/7-012-introduction-to-biology-fall-2004/video-lectures/lecture-22-immunology-1/

19.2)

http://ocw.mit.edu/courses/biology/7-012-introduction-to-biology-fall-2004/video-lectures/lecture-23-immunology-2/

19.3)

https://www.youtube.com/watch?v=o8Pk0bRZ2FQ&index=25&list=PL-XXv-cvA_iDuZ4BUn54ujg2kZttNk27L

20) Biological Systems

20.1) The Nervous System

20.11)

http://ocw.mit.edu/courses/biology/7-012-introduction-to-biology-fall-2004/video-lectures/lecture-26-nervous-system-1/

20.12)

http://ocw.mit.edu/courses/biology/7-012-introduction-to-biology-fall-2004/video-lectures/lecture-27-nervous-system-2/

20.13)

http://ocw.mit.edu/courses/biology/7-012-introduction-to-biology-fall-2004/video-lectures/lecture-28-nervous-system-3/

20.14)

https://www.youtube.com/watch?v=Vn1ej6PKIrk&index=28&list=PL-XXv-cvA_iDuZ4BUn54ujg2kZttNk27L

20.2) Endocrine System

20.21)

https://www.youtube.com/watch?v=JCA-MUc14Hk&list=PL-XXv-cvA_iDuZ4BUn54ujg2kZttNk27L&index=29

20.22)

https://www.youtube.com/watch?v=_hNeZx1mUss&index=30&list=PL-XXv-cvA_iDuZ4BUn54ujg2kZttNk27L

20.23

https://www.youtube.com/watch?v=Pjbjgg_Wcl4&index=31&list=PL-XXv-cvA_iDuZ4BUn54ujg2kZttNk27L

20.3) Reproductive System

20.31)

https://www.youtube.com/watch?v=di0ws4B1hq0&index=32&list=PL-XXv-cvA_iDuZ4BUn54ujg2kZttNk27L

20.32)

https://www.youtube.com/watch?v=fr4KWmkUviE&index=33&list=PL-XXv-cvA_iDuZ4BUn54ujg2kZttNk27L

20.33)

https://www.youtube.com/watch?v=27lKNyauc6k&index=34&list=PL-XXv-cvA_iDuZ4BUn54ujg2kZttNk27L

21) Evolution

21.1) Evolution and Natural Selection

a)
https://www.khanacademy.org/science/biology/her/evolution-and-natural-selection/v/introduction-to-evolution-and-natural-selection

b)
https://www.khanacademy.org/science/biology/her/evolution-and-natural-selection/v/ape-clarification

c)
https://www.khanacademy.org/science/biology/her/evolution-and-natural-selection/v/intelligent-design-and-evolution

d)
https://www.khanacademy.org/science/biology/her/evolution-and-natural-selection/v/evolution-clarification

e)
https://www.khanacademy.org/science/biology/her/evolution-and-natural-selection/v/evolution-clarification

f)
https://www.khanacademy.org/science/biology/her/evolution-and-natural-selection/v/variation-in-a-species

21.2) Population Genetics

a) https://www.khanacademy.org/science/biology/her/heredity-and-genetics/v/allele-frequency

b) https://www.khanacademy.org/science/biology/her/heredity-and-genetics/v/hardy-weinberg

c)
https://www.khanacademy.org/science/biology/her/heredity-and-genetics/v/applying-hardy-weinberg

21.2) Tree of Life

a)
https://www.khanacademy.org/science/biology/her/heredity-and-genetics/v/applying-hardy-weinberg

b) https://www.khanacademy.org/science/biology/her/tree-of-life/v/species

c) https://www.khanacademy.org/science/biology/her/tree-of-life/v/bacteria

d) https://www.khanacademy.org/science/biology/her/tree-of-life/v/viruses

22) History of Life

22.1) Formation of Earth and Early Life

a)
https://www.khanacademy.org/science/biology/history-of-life-on-earth/history-life-on-earth/v/earth-formation

b)
https://www.khanacademy.org/science/biology/history-of-life-on-earth/history-life-on-earth/v/beginnings-of-life

22.2) Diversification of Life

a)
https://www.khanacademy.org/science/biology/history-of-life-on-earth/the-diversification-of-life/v/ozone-layer-and-eukaryotes-show-up-in-the-proterozoic-eon

b)
https://www.khanacademy.org/science/biology/history-of-life-on-earth/the-diversification-of-life/v/first-living-things-on-land-clarification

c)
https://www.khanacademy.org/science/biology/history-of-life-on-earth/the-diversification-of-life/v/biodiversity-flourishes-in-phanerozoic-eon

d)
https://www.khanacademy.org/science/biology/history-of-life-on-earth/the-diversification-of-life/v/human-evolution-overview

22.3) Radiometric Dating

a)
https://www.khanacademy.org/science/biology/history-of-life-on-earth/radiometric-dating/v/chronometric-revolution

b)
https://www.khanacademy.org/science/biology/history-of-life-on-earth/radiometric-dating/v/carbon-14-dating-1

c)
https://www.khanacademy.org/science/biology/history-of-life-on-earth/radiometric-dating/v/carbon-14-dating-2

d)
https://www.khanacademy.org/science/biology/history-of-life-on-earth/radiometric-dating/v/potassium-argon-k-ar-dating

e)
https://www.khanacademy.org/science/biology/history-of-life-on-earth/radiometric-dating/v/k-ar-dating-calculation

23) Viruses

http://ocw.mit.edu/courses/biology/7-012-introduction-to-biology-fall-2004/video-lectures/lecture-21-virology-tumor-viruses/

24) Bacteria and Archaea

24.1) Prokaryote Structure

a) https://www.khanacademy.org/science/biology/bacteria-archaea/prokaryote-structure/v/bacteria

b)
https://www.khanacademy.org/science/biology/bacteria-archaea/prokaryote-structure/v/prokaryotic-and-eukaryotic-cells

UC Berkeley)

https://www.youtube.com/watch?v=NUcMBhiou7M&index=14&list=PL-XXv-cvA_iDuZ4BUn54ujg2kZttNk27L

25) Diseases

25.1) AIDS

http://ocw.mit.edu/courses/biology/7-012-introduction-to-biology-fall-2004/video-lectures/lecture-24-aids/

25.2) Cancer

http://ocw.mit.edu/courses/biology/7-012-introduction-to-biology-fall-2004/video-lectures/lecture-20-cancer/

25.3) Human Polymorphisms and Cancer Classification

a)
http://ocw.mit.edu/courses/biology/7-012-introduction-to-biology-fall-2004/video-lectures/lecture-34-human-polymorphisms-and-cancer-classification/

b)
http://ocw.mit.edu/courses/biology/7-012-introduction-to-biology-fall-2004/video-lectures/lecture-35-human-polymorphisms-and-cancer-classification/