Centre de Biophysiqe Moléculaire - CNRS

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Team : Radiobiology of Nucleic Acids and Proteins

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Our main interest : indirect effects of ionising radiation on biomolecules

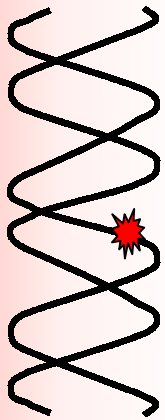
Photon

Matter

Compton electron

Direct effect

Ionization of DNA and protein atoms



Indirect effects

Ionization

$H_2O \rightarrow e^- + H_2O^+$

e^- + H_3O^+ → H_2O + $H^\cdot$

e^- + H_2O → e^-_{aq}

H_2O^+ + H_2O → H_3O^+ + $OH^\cdot$

Reducing agents: $H^\cdot$, e^-_{aq}

Oxidizing agent: $OH^\cdot$

Excitation

$H_2O \rightarrow H_2O^* \rightarrow H^\cdot + OH^\cdot$

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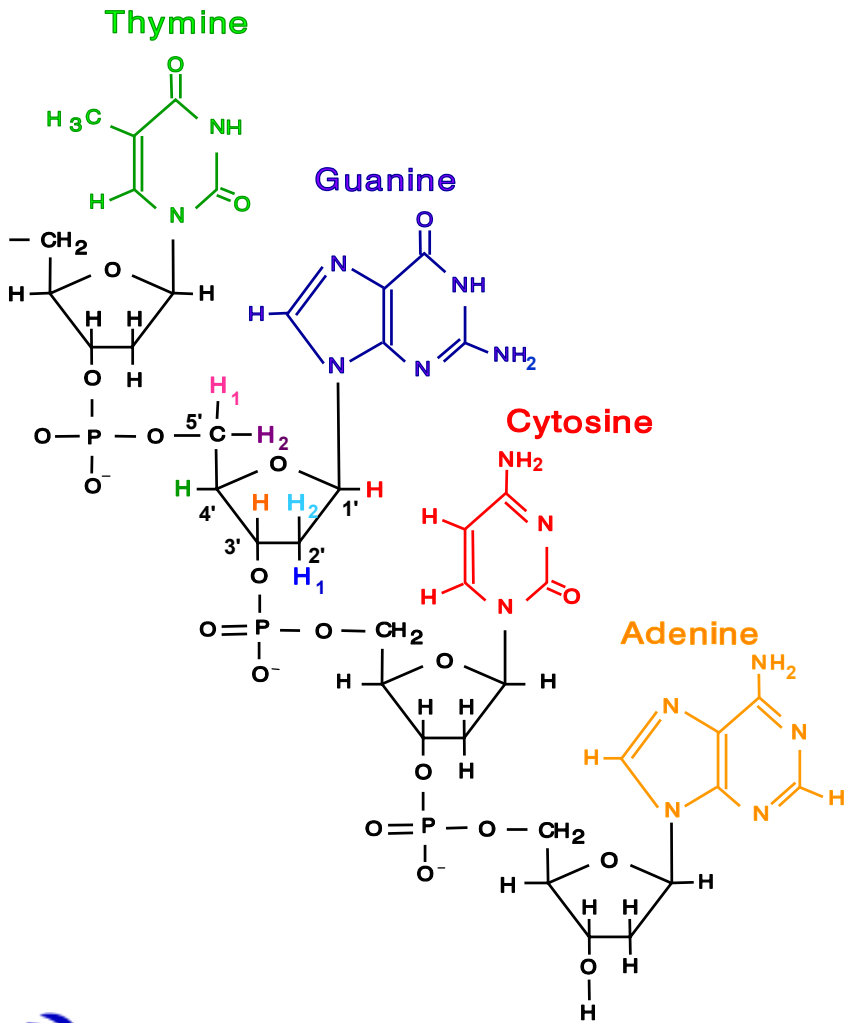
DNA : sites of OH radical attack and types of damage



- abstraction of H atoms from the sugar moiety
- addition to bases

- single and double strand breaks (FSB)
- modified bases (e.g. G/ 8-oxoG) or abasic site (ARB)
- modified sugars

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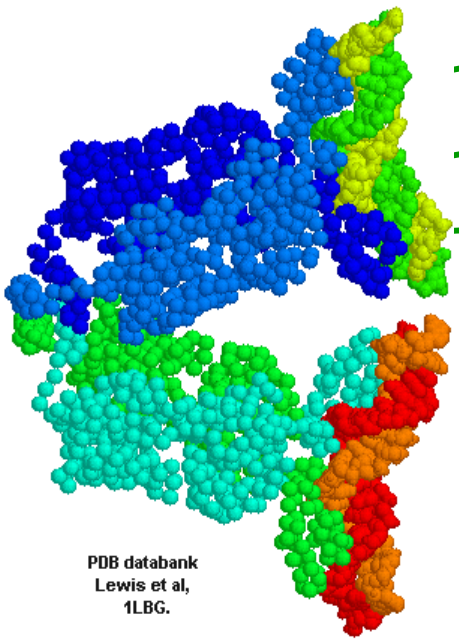
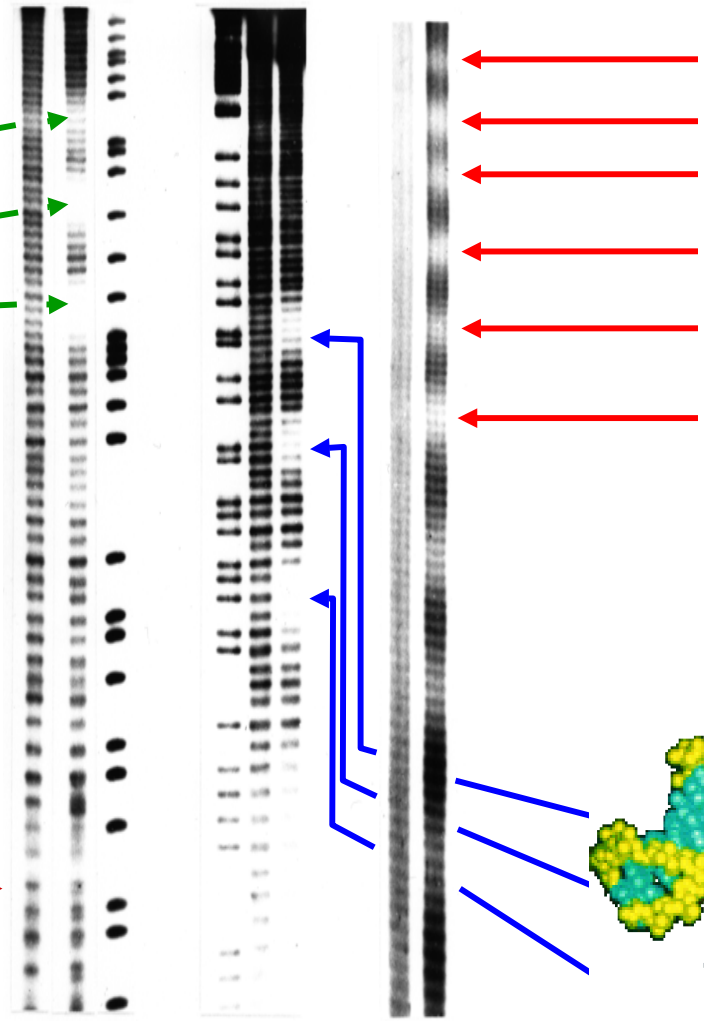
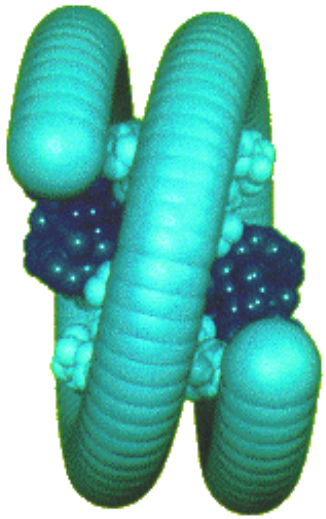
Location of damages on free DNA or on DNA bound to another molecule. Radiolytic footprinting method.



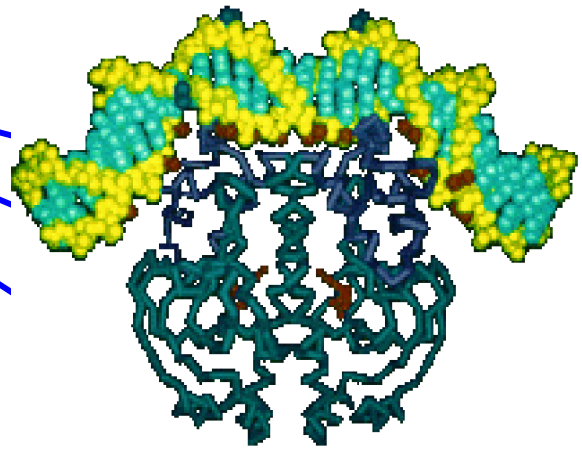
PDB databank
Lewis et al,
1LBG.





Arends and Moudrianakis,
Proc. Natl. Acad. Sci. USA. (1993)
90, 10491.

Sequence and structure dependent damage in a free DNA



Schultz et al., Science (1991), 253, 1003.

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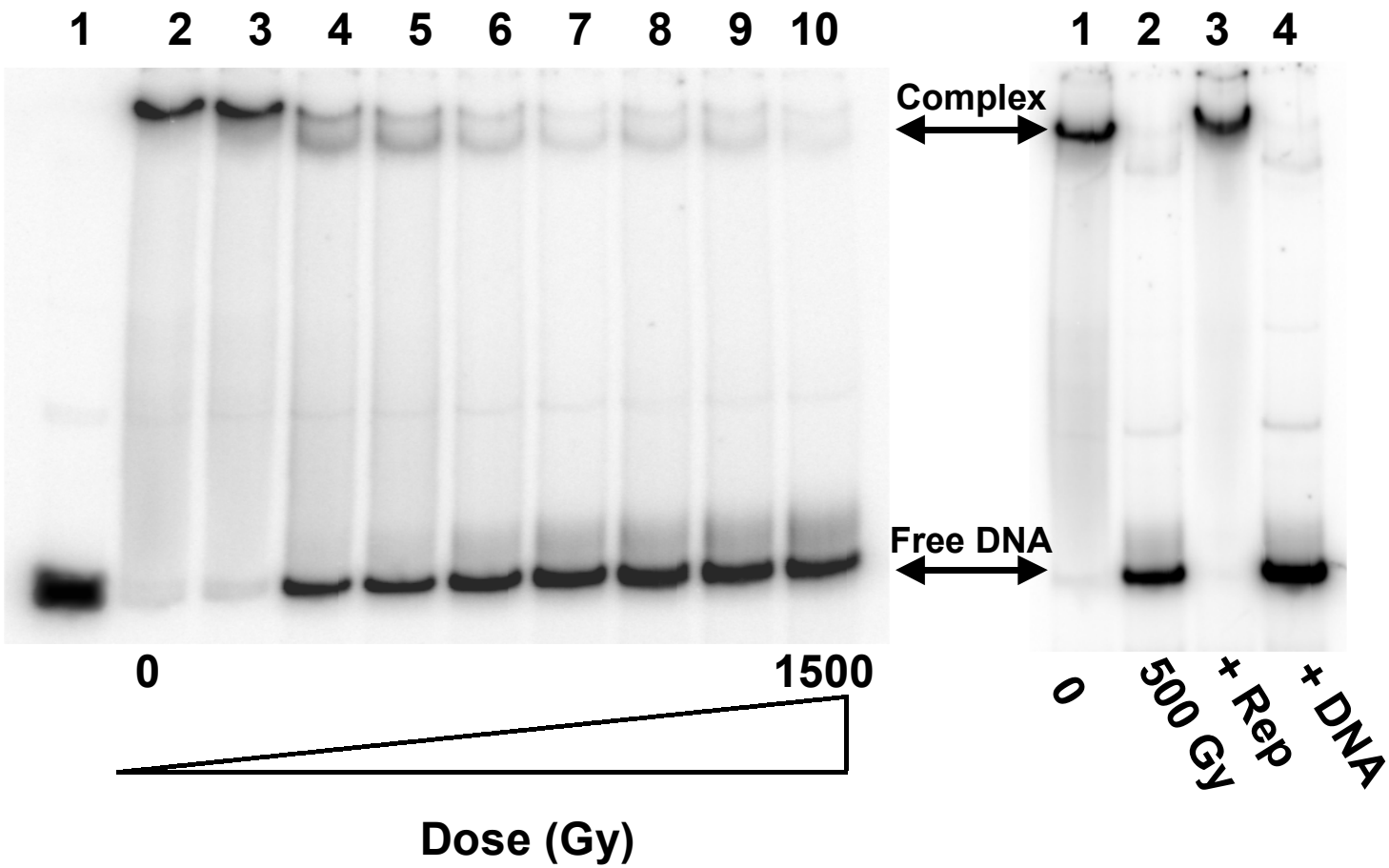
Radiation destroys a DNA-protein complex mainly by damaging the protein



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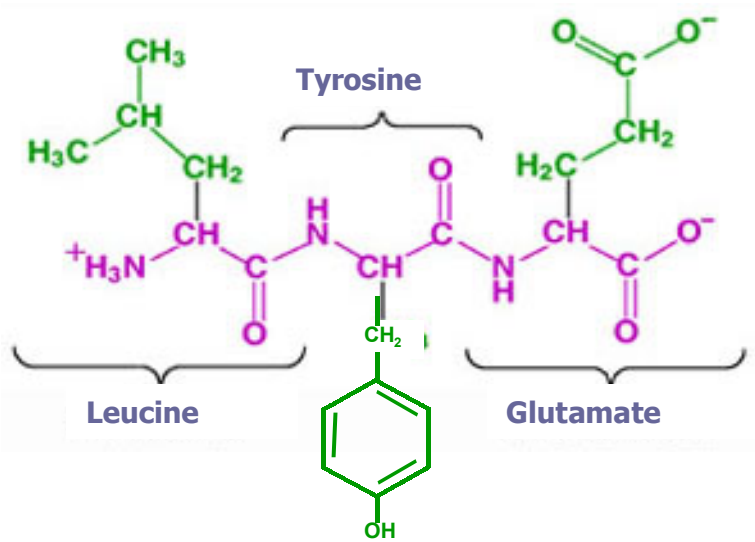
Proteins : sites of OH radical attack and types of damage

- abstraction of H atoms from the peptide bond or from side chains

- addition to aromatic rings



- **peptide chain fragmentation**

- **modified amino-acid side chains** (e.g.Trp/formyl-kynurenine, Tyr/bityrosine, Cys/disulfide)

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