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Effects of low-energy electrons on DNA constituents: effective cross sections for condensed thymidine

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Since the first experiments of low-energy electron scattering from condensed DNA [1] have been performed, the interest in studying low-energy electron-biomolecule interactions has been increasing. Knowledge of effective cross sections for single- and double-strand breaks of DNA and for vibrational and electronic excitation of nucleic bases and nucleosides are opening the door to better understanding of effects of radiation on live tissue and possibly indicating interaction pathways leading to gene mutations and cancer. The strong variation of effective cross sections for DNA single-strand breaks with incident electron energy and the resonant enhancement at 1 eV suggested that considerable damage is inflicted by very low-energy electrons to DNA, and indicates the important role of π^* shape resonances in the bond-breaking process. However, the complexity of DNA, even if studied as a short single-strand chain, imposes a need to perform measurements on its isolated constituents, such as nucleic bases and nucleosides. Thymidine is one of the most important nucleosides of DNA and an important component of antiviral compounds. In the condensed phase, thymidine's 2'-deoxyribose ring is in the pentose sugar ring form, which is a true conformation of this nucleoside in DNA. Results from High-Resolution Electron Energy Loss [2] study of monomolecular films of thymidine will be discussed and the presence of resonances in the effective cross sections at incident energy below 5 eV will be commented as a possible indication of the dissociative electron attachment. In addition, results on the resonance structures in the effective cross sections for electronic excitations for the incident electron energy from 1.5 to 12 eV will be discussed as a possible pathway for strand brakes in DNA.

[1] Boudaiffa B, Cloutier P, Hunting D, Huels M A and Sanche L 2002 *Rad. Res.* **157** 227-234
[2] Panajotovic R, Martin F, Cloutier P, Hunting, D, and Sanche L, 2006 *Rad.Res.* **165** 452-459; Levesque P L, Michaud M, Sanche L 2003 *Nuc. Instr. Meth. Phys. Res. B* **208** 225