# New insight into DNA damage by cisplatin at the atomic scale

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Cisplatin is cis-diamminedichloroplatinum (II), an inorganic compound of chemical formula, $Pt(NH_3)_2Cl_2$, abbreviated as cis-DDP and known commercially as platinol. It is used widely as an anticancer drug for various types of cancers, ever since its discovery two centuries ago and has become a target of extensive researches. Transplatin, trans-DDP on the other hand, is found to be less or ineffective to treat cancers. Cisplatin is known to interact mainly with the N(7) nitrogen of guanine in nucleic acids, after a water molecule takes away one of the chlorines by hydrolysis. This initiates the damage of nucleic acids and eventually leads to apoptosis. However, the way how this happens and why transplatin is less effective is not completely clear.

Here, the author brings some new insights, using the precise structures of these molecules at the atomic level, how cisplatin can interact with the nitrogens N(7) of guanine and N(3) of adenine and rupture the hydrogen bonding in the Watson-Crick base pairs and causing damage to the structure of DNA. See Figure 1 (left) from [1] given below, of intact DNA with the AT and CG Watson-Crick base pairs, where all the bond lengths are sums of the covalent radii of the adjacent atoms. The lengths of the hydrogen bonds have been accounted for in an earlier article. Figure 1 (right) shows the rupture of the AT hydrogen bonds and damage to the structure of DNA caused by $[=Pt(NH_3)_2]$ after cisplatin is dechlorinated by water molecules.

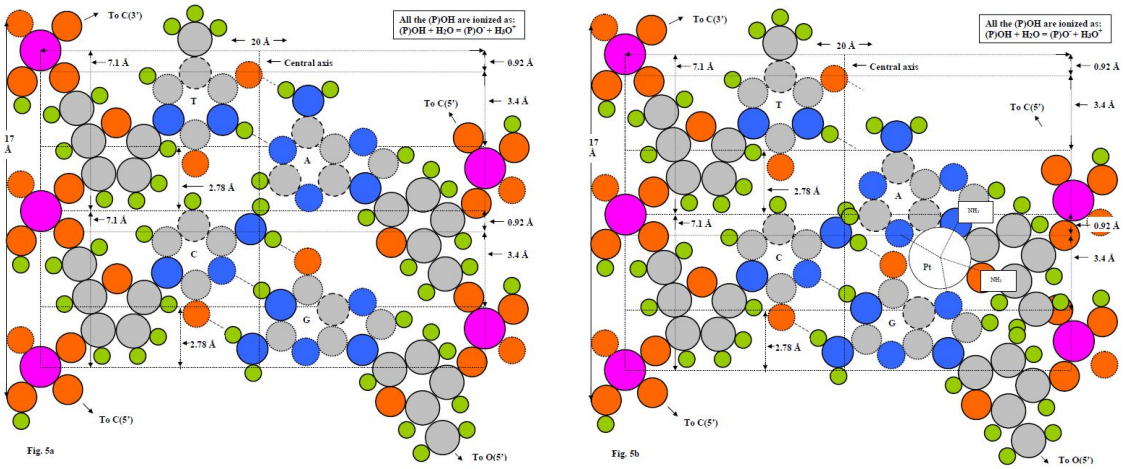


Figure 1. Left: Two dimensional representation of the atomic structure of DNA (cross section: 20 Å x 17 Å) with the Watson-Crick base pairs, AT and CG. Right: structure of DNA damaged by bonding of $[=Pt(NH_3)_2]$ with N(7) and N(3) of guanine and adenine respectively.

It is hoped that the results presented here will contribute to a better atomistic insight into the structure, bonding and feasibility of the biochemical reactions involving these compounds and their derivates for the alleviation of cancer. See [1] for a preliminary report and all references.

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**References**

[1] R. Heyrovska, http://precedings.nature.com/documents/6891/version/1