Deoxyribonucleic Acid commonly known as DNA is the genetic material found in all living organisms and is responsible for passing hereditary characteristics from one generation to the next. In doing so, it is "constantly subjected to alteration by cellular metabolites and exogenous DNA-damaging agents" (Sancar, Lindsay-Boltz, Ünsal-Kaçmaz, & Linn, 2004).

Not only can the process of DNA replication cause frequent chemical changes but also exposure to the following agents can alter the DNA of an organism: ionizing radiation (gamma rays and x-rays), ultraviolet rays, oxygen radicals, chemicals in the environment, and chemotherapy (Mullenders, Stary, & Sarasin, 2001). These agents can have severe affects on an organism's genetic material by covalently or non-covalently modifying the bases of DNA at different positions thus resulting in, base pair mismatches, breaks in the backbone, and cross-links where covalent linkages are formed between bases (Sancar et al. , 2004).

For the genetic information within DNA to remain uncorrupted, it is vital that any chemical changes made to the DNA of a cell be repaired in order to continue proper cell function. Not repairing DNA results in mutation, cancer, and the death of the cell or organism (Sancar et al. , 2004). The damage DNA of an organism contains DNA system repairs that stimulate cell responses to deal with numerous DNA damages by eliminating them (Sancar et al. , 2004). One of the many DNA repair mechanisms in living organisms is Nucleotide Excision Repair, otherwise known as NER. NER "is the major repair system for removing bulky DNA lesions formed by exposure to radiation or chemicals, or by protein addition to DNA" (Sancar et al. , 2004). This universally repaired pathway used to recognize and remove "a variety of bulky lesions" basic steps include first the recognition of the damage by a protein factor, the separation of the double helix at the DNA lesion site by transcription factor TFIIH, a single strand incision is made at both sides of the lesion, the excision of the lesion-containing single stranded DNA

fragment is carried out, next the gap left by the DNA repair synthesis is replaced, and finally ligation of the remaining single stranded nick (Mullenders et al. , 2001).

RPA, XPA, XPC, TFIIH, XPG, and XPF•ERCC1 are six repair factors used in humans to perform the task of excision repair (Sancar et al. , 2004). TFIIH plays a role in basal transcription initiation of mRNA as well as in NER where it unwinds the damage containing region (Mullenders et al. , 2001). In mammals TFIIH contains six subunit cores XPB, XPD, p62, p52, p44, and p34, and in these subunits, XPB and XPD are specifically responsible for the unwinding of DNA (Sancar et al. , 2004). The genes XPB and XPD can cause mutations that "lead to different human syndromes with a surprising range of photosensitivities, cancer susceptibilities, and developmental abnormalities" (Araújo, Tirode, & Coin, 2010). These syndromes include Xeroderma Pigmentosum (XP), Cockayne syndrome (CS), and Trichothiodystrophy (TTD), and though they exist because of defects in NER their symptoms differ (Araújo et al. , 2010).

With the frequent occurrence of changes in a cell it is important to have DNA repair mechanisms like NER, to prevent mutations, cancer, and the death of the cell or organism. Although NER may lead to the possibility of a human syndrome, DNA mechanism repairs are still essential in living organisms for the preservation and transmission of genetic information.

Works Citied

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DNA Repair Mechanism: Nucleotide Excision Repair (NER)

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