

ECOTOXICOLOGIA

AULA TP 8

...the interaction between DNA and the environment is a complex and multifaceted process that involves various mechanisms of DNA damage and repair. This section will explore the types of DNA damage, the factors that influence DNA stability, and the cellular mechanisms that maintain genomic integrity.

Chemically induced DNA damage is a major cause of genetic alterations in cells. Various agents, such as reactive oxygen species, alkylating agents, and cross-linking agents, can interact with DNA to cause structural changes that may lead to mutations or other cellular consequences.

random][plasmid

Within cells, DNA is organized into a highly structured chromatin. This organization is essential for the efficient replication and transcription of the genome. The DNA double helix is wrapped around histone cores to form nucleosomes, which are further organized into higher-order structures. The dynamic nature of chromatin allows for the regulation of gene expression and provides a mechanism for protecting DNA from damage.



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The first published reports of a DNA X-ray diffraction pattern were obtained by Rosalind Franklin and Maurice Wilkins in 1953. Their work provided crucial evidence for the three-dimensional structure of DNA, which was later refined by James Watson and Francis Crick in 1954.

The B-DNA form is the most common under physiological conditions. It is characterized by a right-handed helix with a pitch of approximately 3.4 nanometers. The major and minor grooves are well-defined, and the base pairs are stacked in a regular fashion.

The Z-DNA form is a left-handed helix with a pitch of approximately 4.5 nanometers. It is typically found in regions of high negative supercoiling or in sequences with alternating purine and pyrimidine nucleotides. The Z-DNA form is more compact and rigid than the B-DNA form.

PLANEAMENTO DAS AULAS

AULA 1 – INTRODUÇÃO AOS TESTES DE ECOTOXICOLOGIA. BIOMARCADORES E DELINEAMENTO EXPERIMENTAL

AULA 2 – EFEITOS DO GLIFOSATO NO CRESCIMENTO DOS ORGANISMOS TESTE (TAXAS DE INIBIÇÃO E CONSTANTES DE INIBIÇÃO IC50). MARCADORES BIOFÍSICOS DE TOXICIDADE I

AULA 3 – MARCADORES BIOFÍSICOS DE TOXICIDADE II

AULA 4 – MARCADORES BIOQUÍMICOS DE TOXICIDADE I – PIGMENTOS VEGETAIS

AULA 5 – MARCADORES BIOQUÍMICOS DE TOXICIDADE II – PIGMENTOS VEGETAIS II

AULA 6 - MARCADORES BIOQUÍMICOS DE TOXICIDADE III – DANO MEMBRANAR

AULA 7 – MARCADORES BIOQUÍMICOS DE TOXICIDADE IV – DANO MEMBRANAR E ÁCIDOS GORDOS

AULA 8 - MARCADORES BIOQUÍMICOS DE TOXICIDADE III – SOD

AULA 9 – TÉCNICAS DE EXTRAÇÃO E ANÁLISE DE METAIS PESADOS

AULA 10 - NANOTOXICOLOGIA

TODA A VIDA NA TERRA É BASEADA EM REAÇÕES DE OXIDAÇÃO –REDUÇÃO (REDOX), ATRAVÉS DE PROCESSOS DE ARMAZENAMENTO DE ENERGIA E DE OXIDAÇÃO DE COMPOSTOS ENERGÉTICOS PARA LIBERTAÇÃO DA MESMA. A INVULGAR QUÍMICA DO O₂ TORNA POSSÍVEL INTEGRAR ESTA ESPÉCIE QUÍMICA ALTAMENTE REATIVA EM METABOLISMOS REDOX.

- *O OXIGÉNIO É ESSENCIAL À VIDA MAS TÓXICO*
- *CÉLULAS AERÓBICAS ENFRENTAR CONSTANTEMENTE O PERIGO DAS ESPÉCIES REATIVAS DE OXIGÉNIO (REACTIVE OXYGEN SPECIES, ROS).*
- *ROS SÃO MUTAGÉNICOS, DISRUPTORES, OXIDATIVOS E DESNATURANTES.*

O PLANETA TERRA ERA INICIALMENTE ANÓXICO, HABITADA POR ORGANISMOS COM METABOLISMO ANAERÓBICO

O OXIGÉNIO MOLECULAR (O_2) APARECEU APENAS À CERCA DE 2 500 M.A.

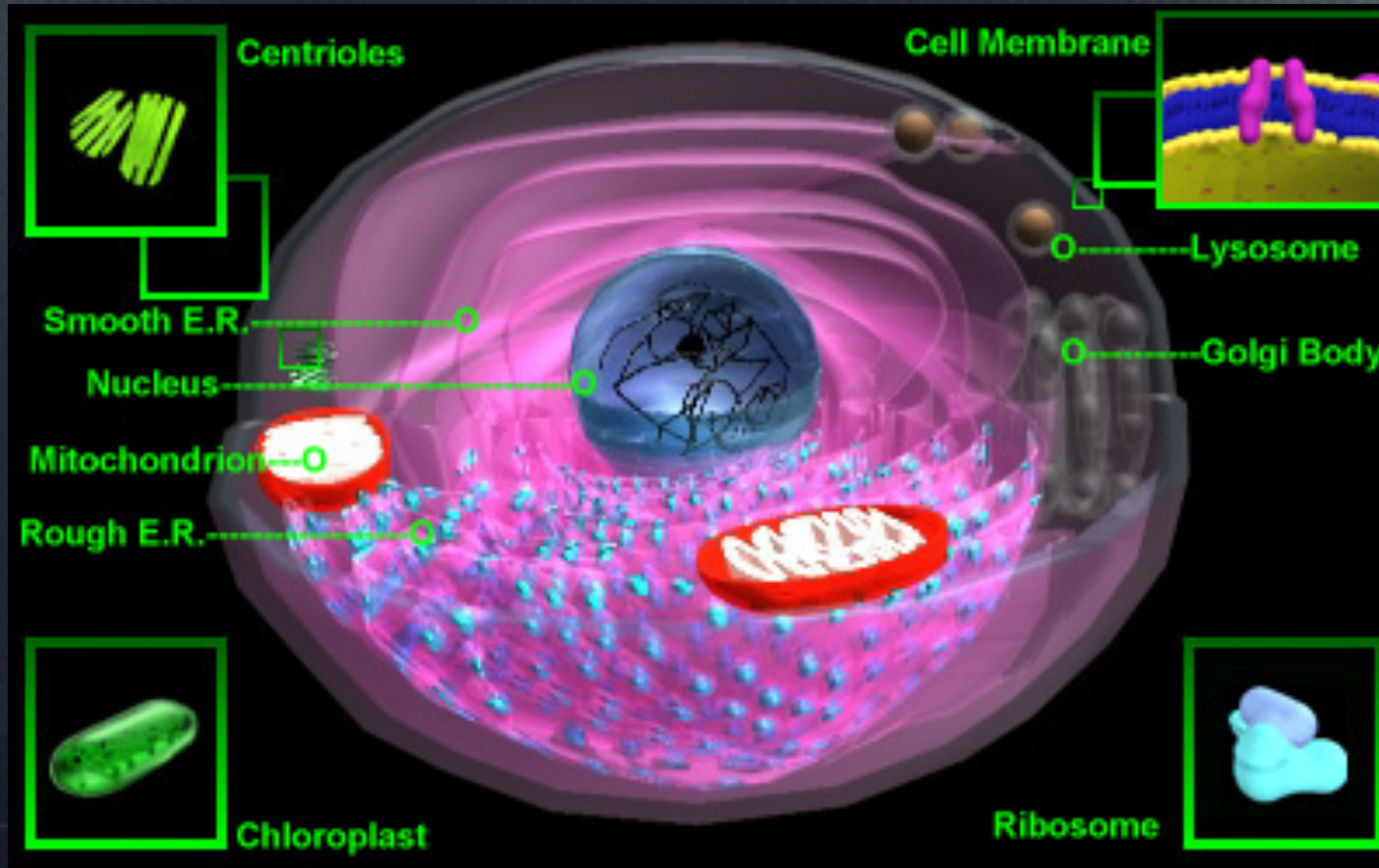
METABOLISMO ANAERÓBICO (GLICÓLISE)



METABOLISMO AERÓBICO (FOSFORILAÇÃO OXIDATIVA)



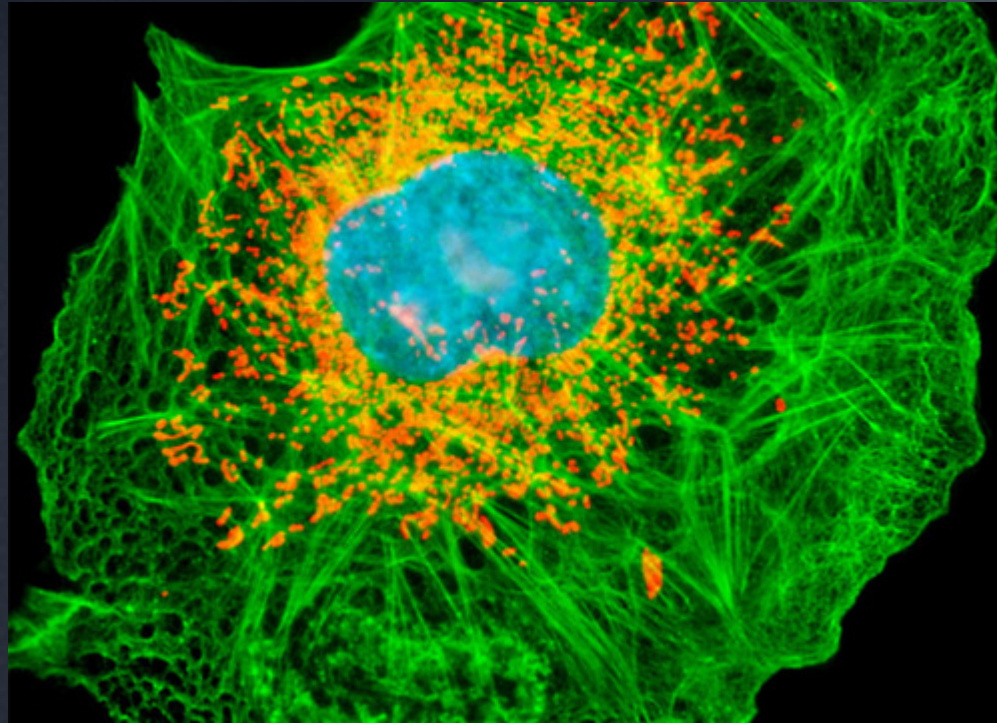
Os ROS ENCONTRAM-SE POR TODA A CÉLULA OCORRENDO COMO RESULTADO DE PROCESSOS METABÓLICOS ESSENCIAIS COMO A FOTOSÍNTESE E A RESPIRAÇÃO, MAS TAMBÉM COMO ELEMENTOS ESSENCIAIS DOS MECANISMOS DE COMUNICAÇÃO INTRA E INTERCELULAR.



AS REAÇÕES REDOX COMPREENDEM A MAIOR PARTE DAS REAÇÕES METABÓLICAS

1. BIOENERGÉTICAS PRODUZINDO CERCA DE 95% DA ENERGIA UTILIZADA PELOS ORGANISMOS AERÓBICOS.
2. TRANSFORMAÇÕES QUÍMICAS
3. DESINTOXICAÇÃO

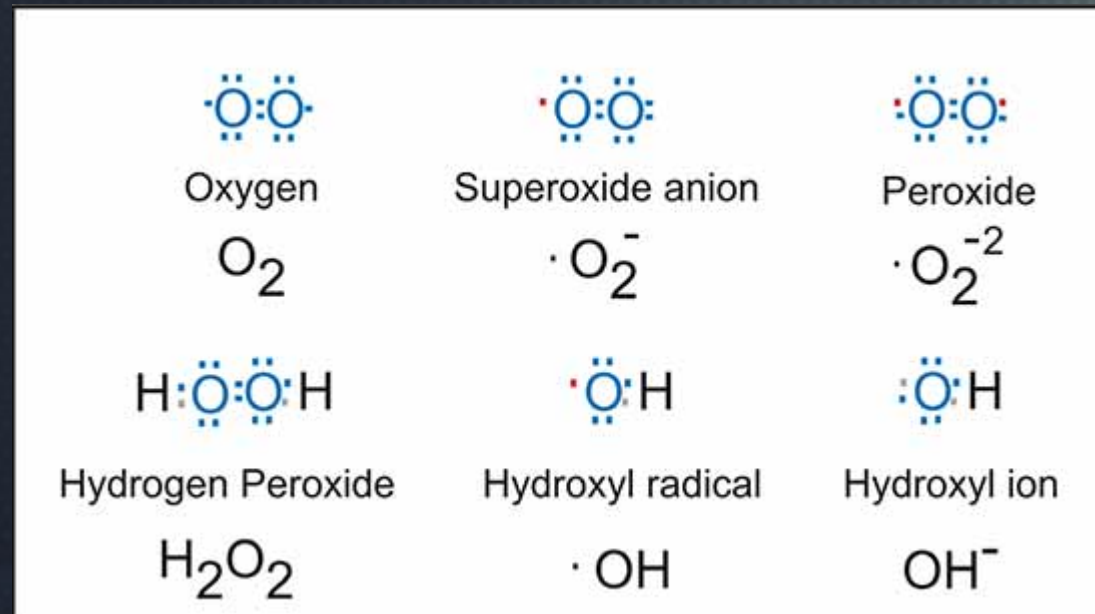
DESTA FORMA É DE ESPERAR QUE SENDO A GERAÇÃO DE ROS UM PROCESSO NORMAL QUE A CÉLULA APRESENTE MECANISMOS PARA SE DESINTOXICAR DOS MESMOS.

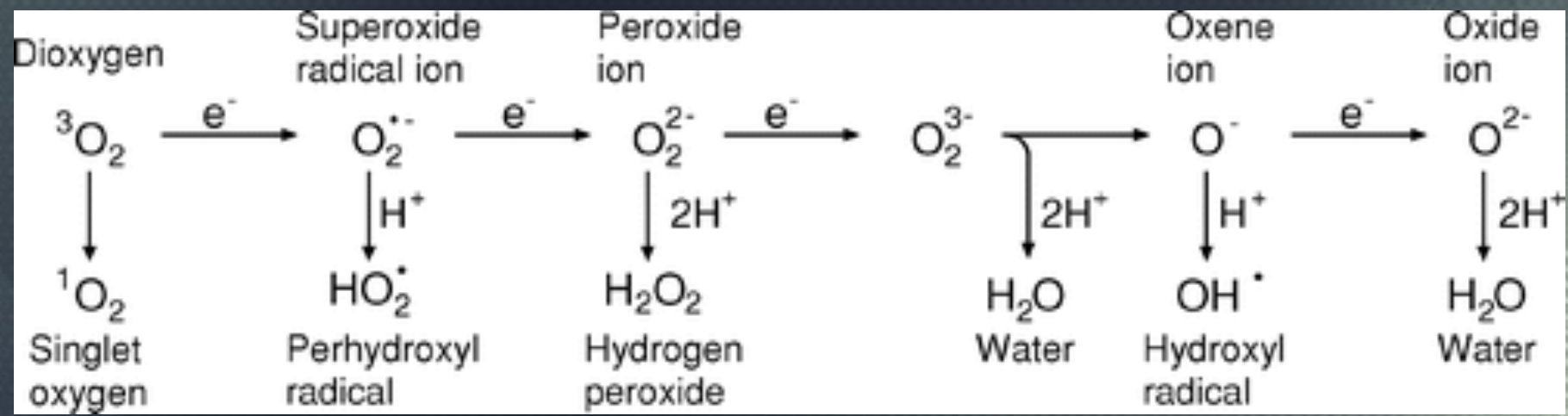


RADICAIS LIVRES

QUALQUER ESPÉCIE QUÍMICA QUE APRESENTA ELETRÕES DESEMPARELHADOS, OU SEJA QUE OCUPAM UMA ORBITA MOLECULAR POR SI PRÓPRIOS. ESTES RADICAIS LIVRES (EX. ROS) TEM UMA EXISTÊNCIA INDEPENDENTE.

- POSITIVOS
- NEGATIVOS
- NEUTROS





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Chemically, DNA consists of two complementary strands of simple units called nucleotides. Each nucleotide is composed of a sugar and phosphate group. The two strands are joined together and are therefore not free to move independently. The sequence of these two strands is called the genetic code. This information is used to synthesize proteins and other molecules that are essential for the cell's survival.

When cells divide, DNA is replicated very accurately. This process is called DNA replication. In a process called DNA replication, eukaryotic organisms produce two identical copies of their DNA. This process is called DNA replication. In a process called DNA replication, eukaryotic organisms produce two identical copies of their DNA. This process is called DNA replication.

ROS:

$O_2^{\cdot-}$	Superóxido
OH^{\cdot}	Hidróxido
RO_2^{\cdot}	Peróxido
RO^{\cdot}	Alcóxido
HO_2^{\cdot}	Hidroperóxido

Não Radicais:

H_2O_2	Peróxido de Hidrogénio
$HOCl^{\cdot}$	Ácido Hipoclorítico
O_3	Ozono
1O_2	<i>Singlet</i> de Oxigénio
$ONOO^-$	Peroxinitrito

RNS:

NO^{\cdot}	Óxido Nitroso
NO_2^{\cdot}	Dióxido de Azoto

Não Radicais:

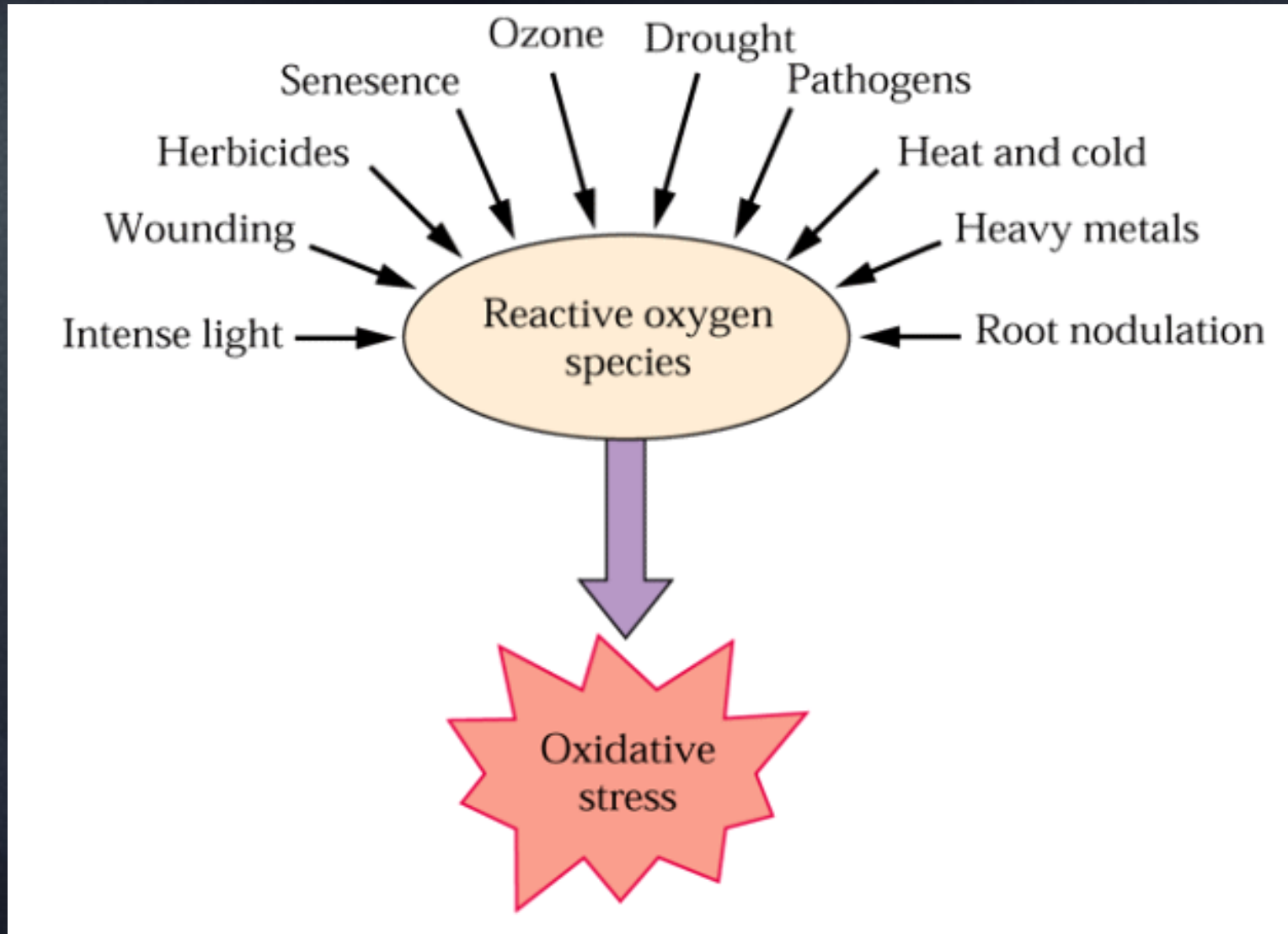
$ONOO^-$	Peroxinitrito
$ROONO$	Alcali-peroxinitritos
N_2O_3	Trióxido de Azoto
N_2O_4	Tetróxido de Azoto
HNO_2	Ácido Nítrico
NO_2^+	Nitrónio
NO^-	Nitróxilo
NO^+	Nitrossilo
NO_2Cl	Cloreto de Nitrilo

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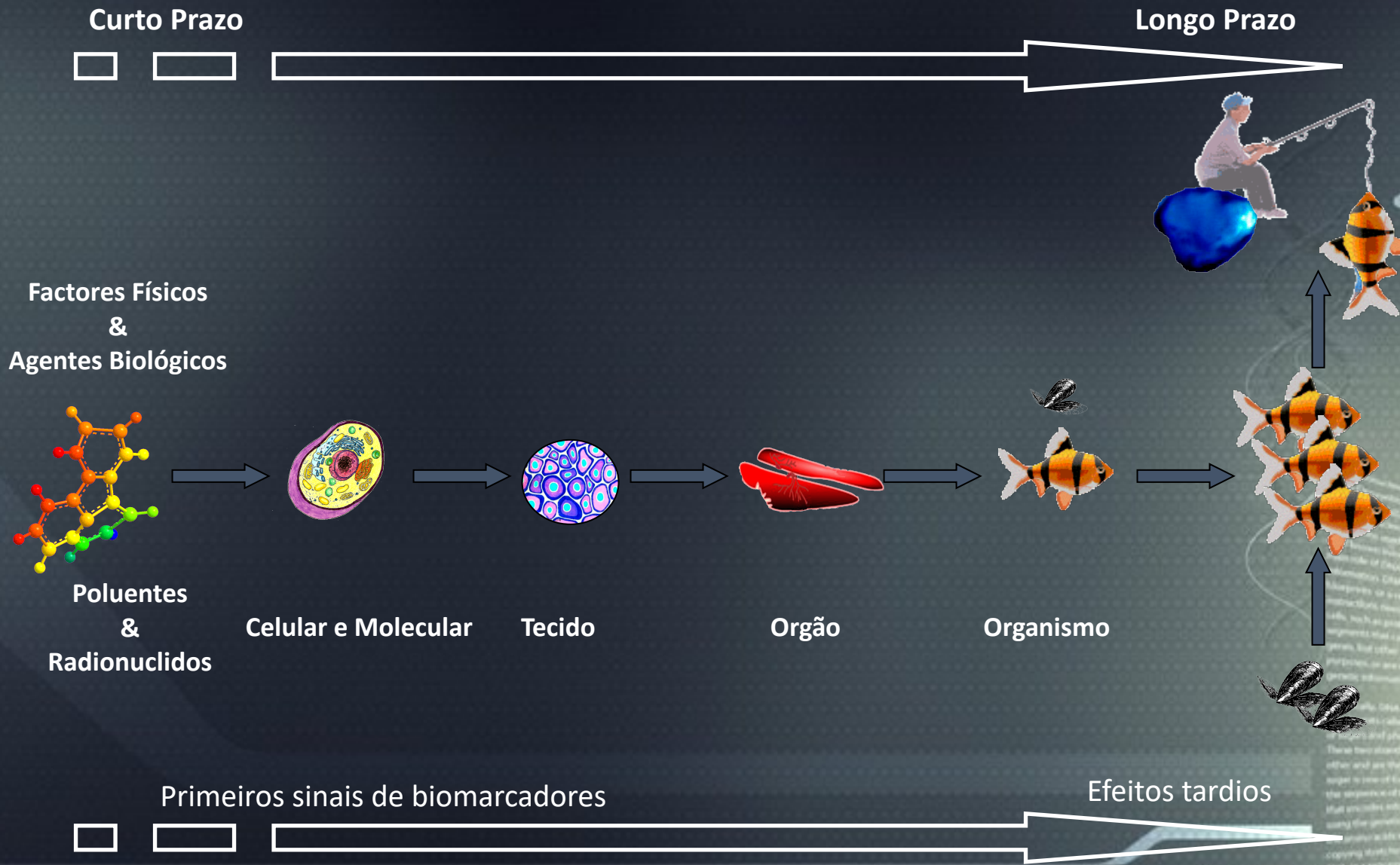


ROS	SEMI-VIDA
PERÓXIDO DE HIDROGÉNIO	
HIDROPERÓXIDOS ORGÂNICOS	~ MINUTOS
RADICAIS PERÓXIDO	~ SEGUNDOS
ÓXIDO NITROSO	
PERÓXINITRITO	~ MILISEGUNDOS
SUPERÓXIDO	
SINGLET DE OXIGÉNIO	~ MICROSEGUNDOS
RADICAL HIDRÓXIDO	~ NANOSEGUNDOS





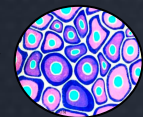
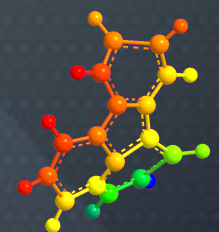
AGENTES AMBIENTAIS GERADORES DE ROS



Curto Prazo

Longo Prazo

Factores Físicos & Agentes Biológicos



Poluentes & Radionuclidos

Celular e Molecular

Tecido

Orgão

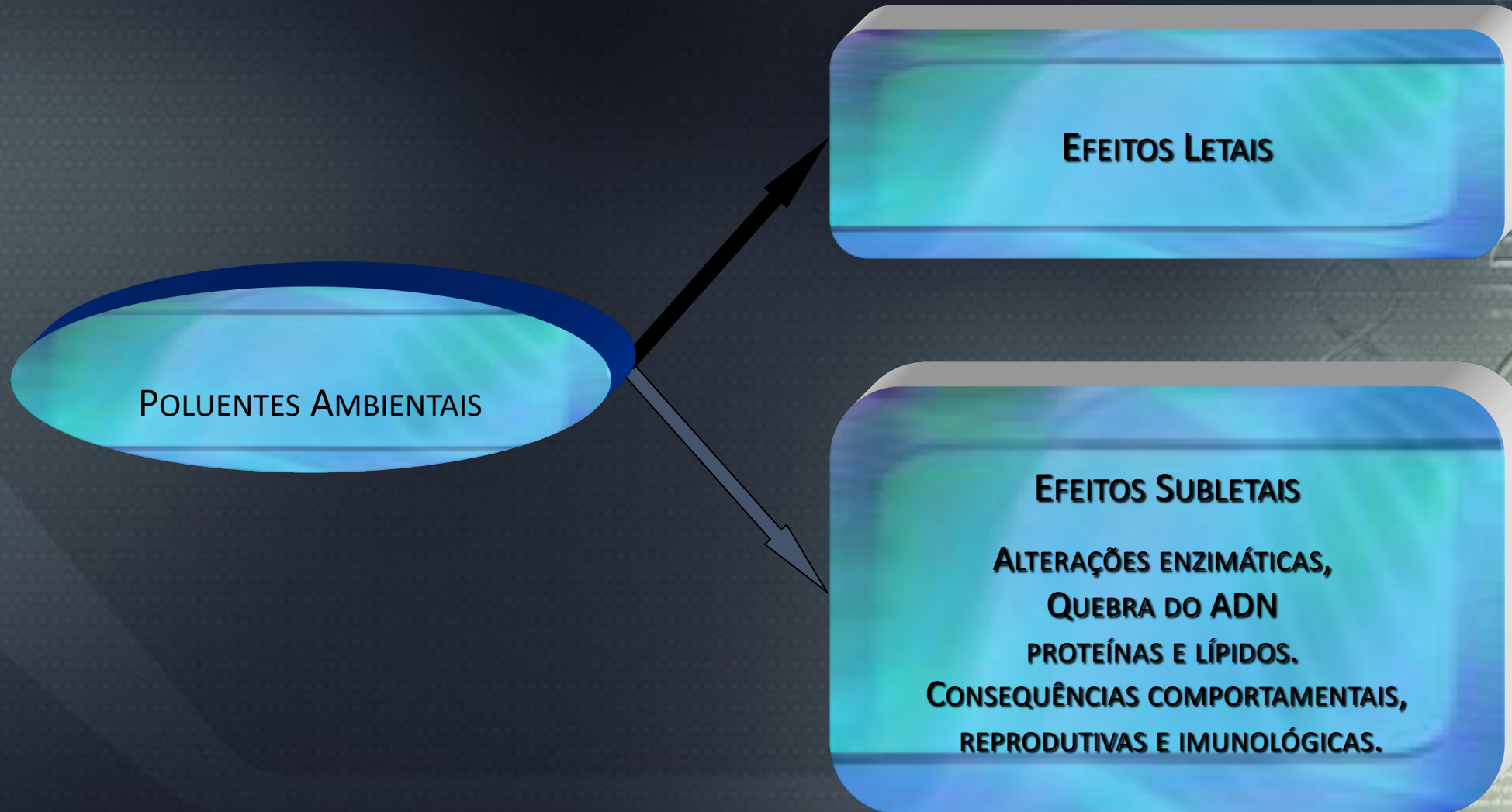
Organismo

Primeiros sinais de biomarcadores

Efeitos tardios



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the sequence of these has been used to identify
that encodes information. This information is used
using the genetic code to build a specific sequence of
the protein as its amino acid sequence. The process of
copying this has of DNA into the messenger RNA
step is a process called transcription.

Within cells, DNA is organized into very condensed
called chromosomes. These chromosomes are
duplicated before cells divide. In a process called
mitosis, eukaryotic organisms produce many
cells, and prokaryotes divide most of their cells to make
cell nuclei and some of their cells to make
spores or other specialized cells.

DEFINIÇÃO DE ANTIOXIDANTE

- *CHEMICAL DEFINITION: "A SUBSTANCE THAT OPPOSES OXIDATION OR INHIBITS REACTIONS PROMOTED BY OXYGEN OR PEROXIDES"*
- *BIOLOGICAL DEFINITION: "SYNTHETIC OR NATURAL SUBSTANCES THAT PREVENT OR DELAY DETERIORATION OF A PRODUCT, OR ARE CAPABLE OF COUNTERACTING THE DAMAGING EFFECTS OF OXIDATION IN ANIMAL TISSUES"*
- *INSTITUTE OF MEDICINE DEFINITION: "A SUBSTANCE THAT SIGNIFICANTLY DECREASES THE ADVERSE EFFECTS OF REACTIVE SPECIES SUCH AS ROS OR RNS ON NORMAL PHYSIOLOGICAL FUNCTION IN HUMANS"*

ANTIOXIDANTES:

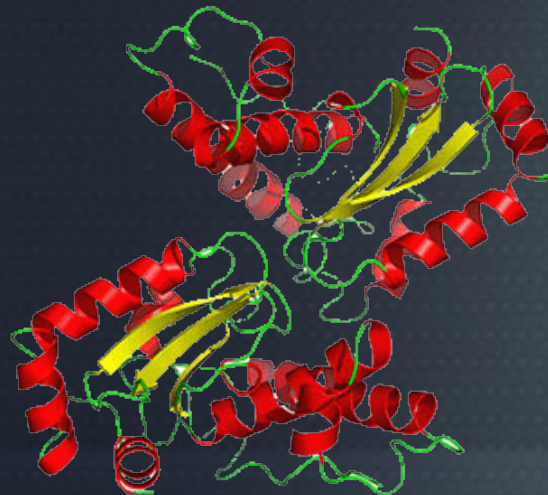
1. ENZIMÁTICOS

- *CATALASE*
- *SUPEROXIDO DISMUTASE*
- *ASCORBATO E GUAIIACOL PEROXIDASE*

2. NÃO ENZIMÁTICOS

- *FENÓIS E FLAVENÓIDES*
- *VITAMINA E E C*
- *TOCOFEROL, REVERASTROL*

Superoxide dismutase (SOD)



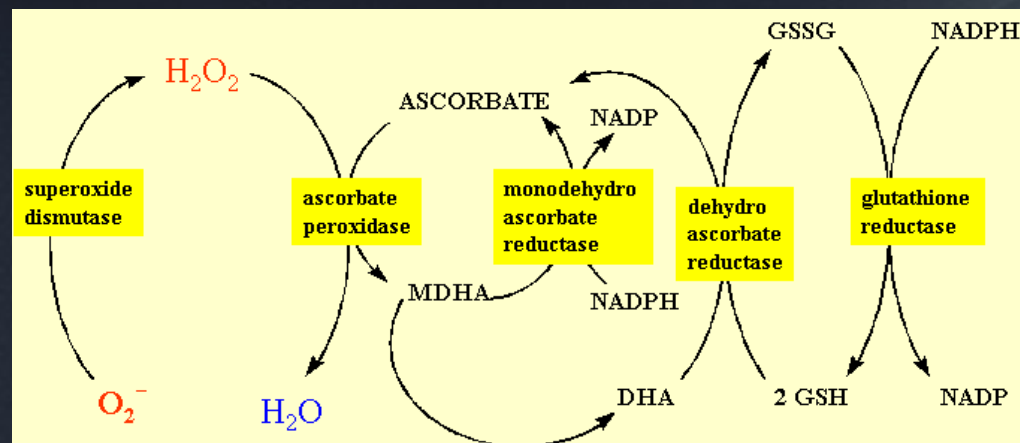
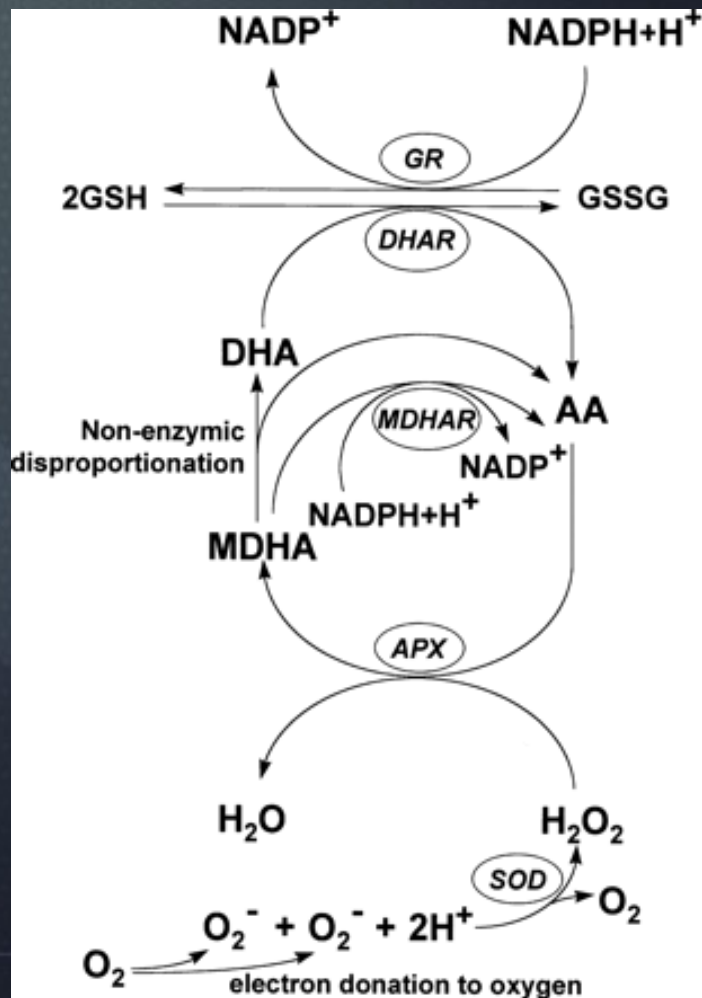
SOD

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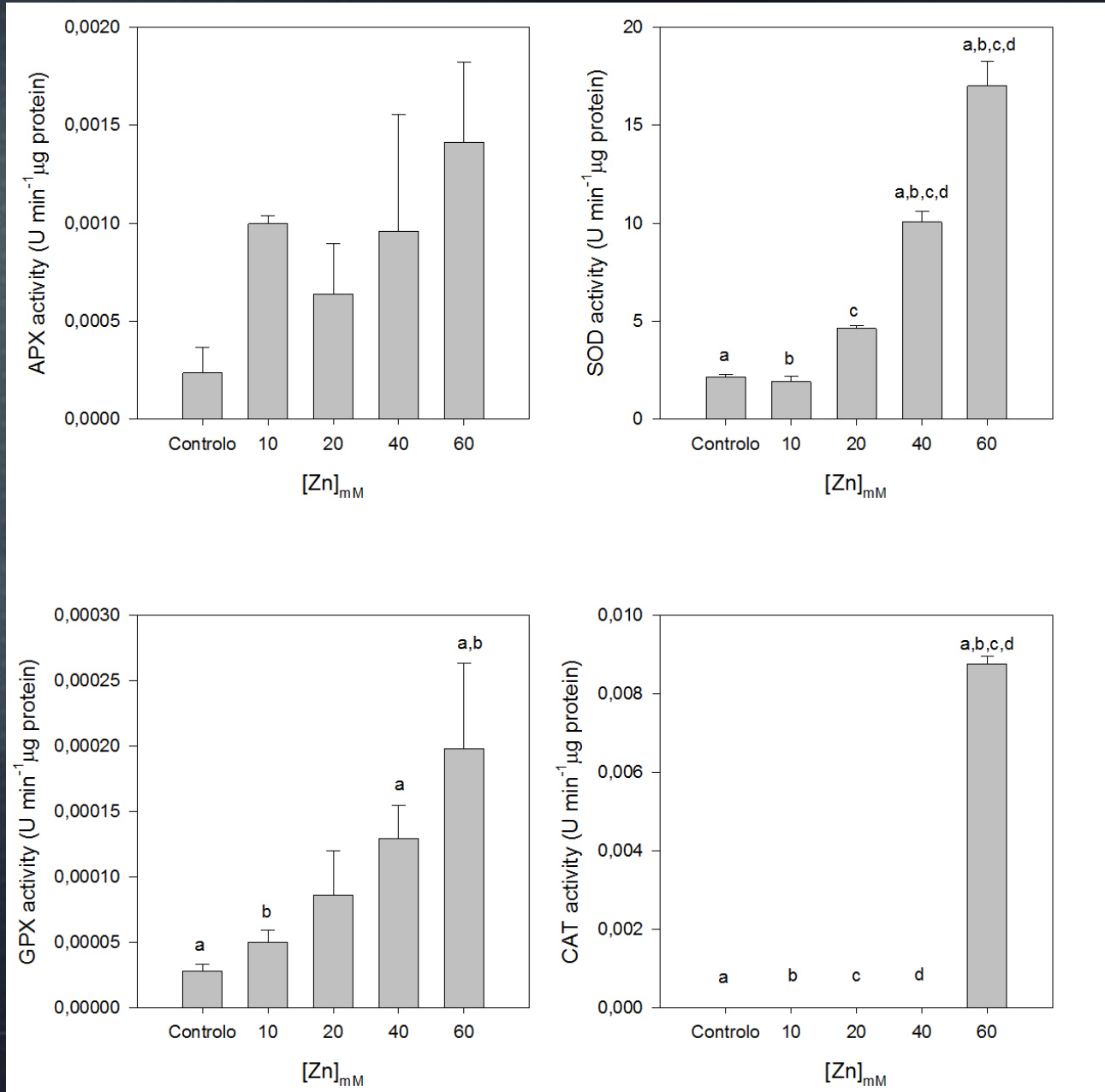
Chemically, DNA consists of two complementary strands of simple units called nucleotides, which are joined together by hydrogen bonds. Each nucleotide is composed of a phosphate group, a five-carbon sugar, and a nitrogenous base. The two strands are antiparallel to each other and are therefore said to be complementary. The sequence of these two bases on one strand determines the sequence of the other. This information is used to synthesize proteins and other molecules. The process of copying this information into a new strand is called transcription.

When cells, DNA is organized into long molecules called chromosomes. These chromosomes are duplicated before cells divide. In a process called cell replication, eukaryotic organisms produce many copies of their DNA. In prokaryotes, the cell nucleus and some of their DNA are organized into chromosomes or loops of DNA. In some cases, the DNA is organized into a single strand that is called a plasmid.

Ciclo Halliwell-Asada Reciclagem REDOX do Ascorbato

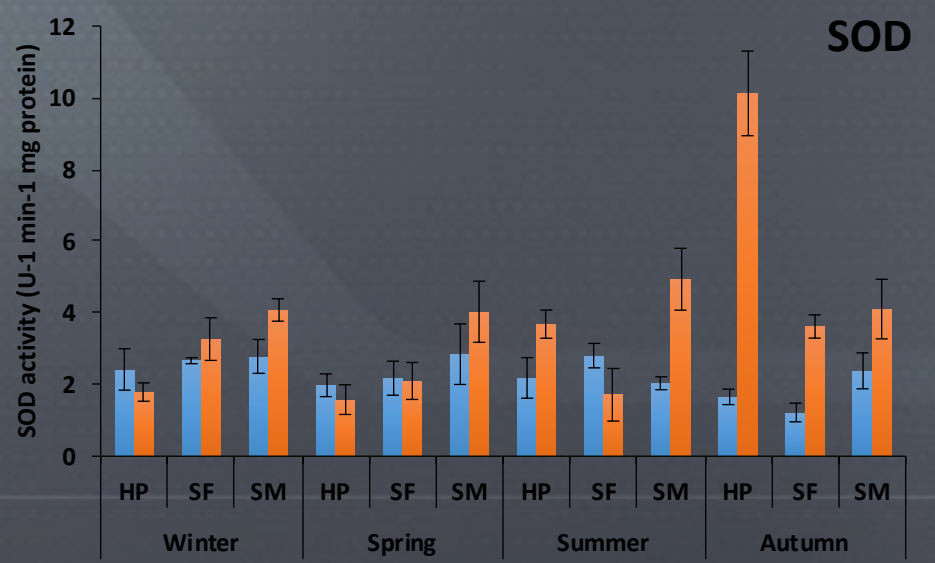
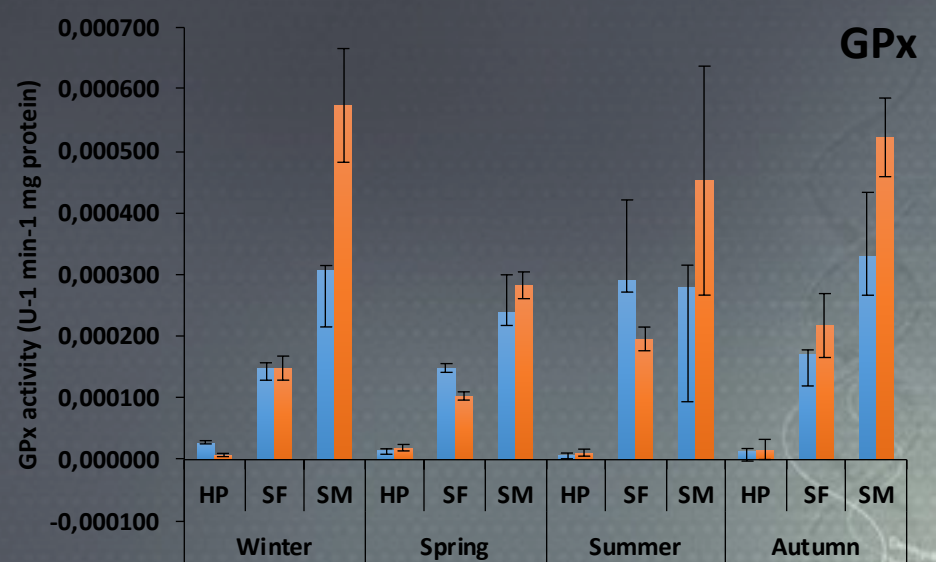
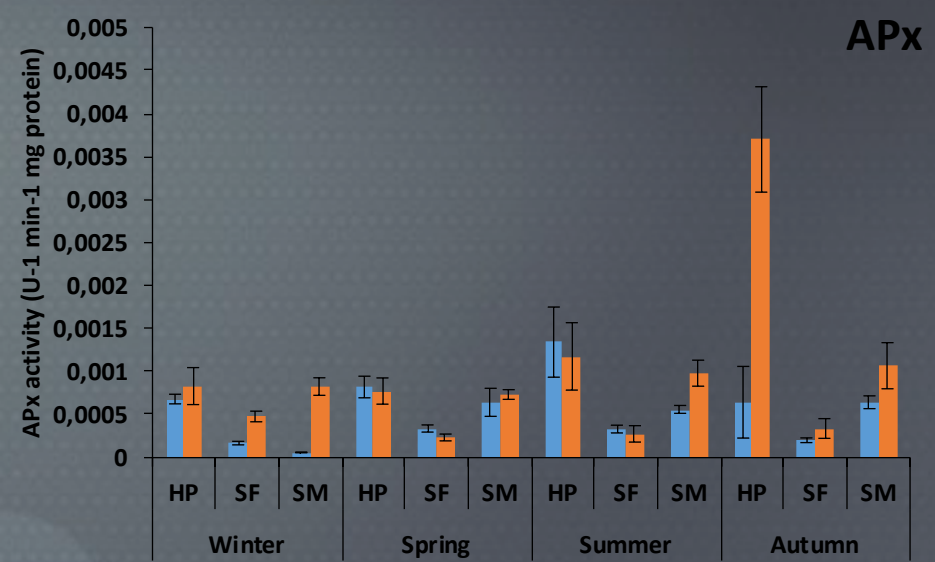


Chemically, DNA consists of long, unbranched chains of simple units called nucleotides. Each nucleotide is composed of a sugar and phosphate groups. The sugar and phosphate groups are linked together by phosphodiester bonds. The sugar and phosphate groups are also linked to a nitrogenous base. The nitrogenous bases are linked to each other by hydrogen bonds. The sequence of these bases is the genetic code. The genetic code is the sequence of bases that codes for the amino acids in a protein. The amino acids are the building blocks of proteins. The genetic code is universal, meaning that all living organisms use the same code. The genetic code is also degenerate, meaning that many different sequences of bases can code for the same amino acid. The genetic code is also non-overlapping, meaning that each base is only read once. The genetic code is also commaless, meaning that there are no gaps between the bases. The genetic code is also non-punctuated, meaning that there are no stop codons. The genetic code is also non-ambiguous, meaning that each base only codes for one amino acid. The genetic code is also non-variant, meaning that it is the same in all living organisms. The genetic code is also non-transferable, meaning that it cannot be passed from one organism to another. The genetic code is also non-erasing, meaning that it cannot be deleted. The genetic code is also non-repeating, meaning that it is not the same in all living organisms. The genetic code is also non-identical, meaning that it is different in different living organisms. The genetic code is also non-constant, meaning that it can change over time. The genetic code is also non-stable, meaning that it can be altered. The genetic code is also non-secure, meaning that it can be hacked. The genetic code is also non-protected, meaning that it can be stolen. The genetic code is also non-encrypted, meaning that it can be read. The genetic code is also non-secure, meaning that it can be hacked. The genetic code is also non-protected, meaning that it can be stolen. The genetic code is also non-encrypted, meaning that it can be read.



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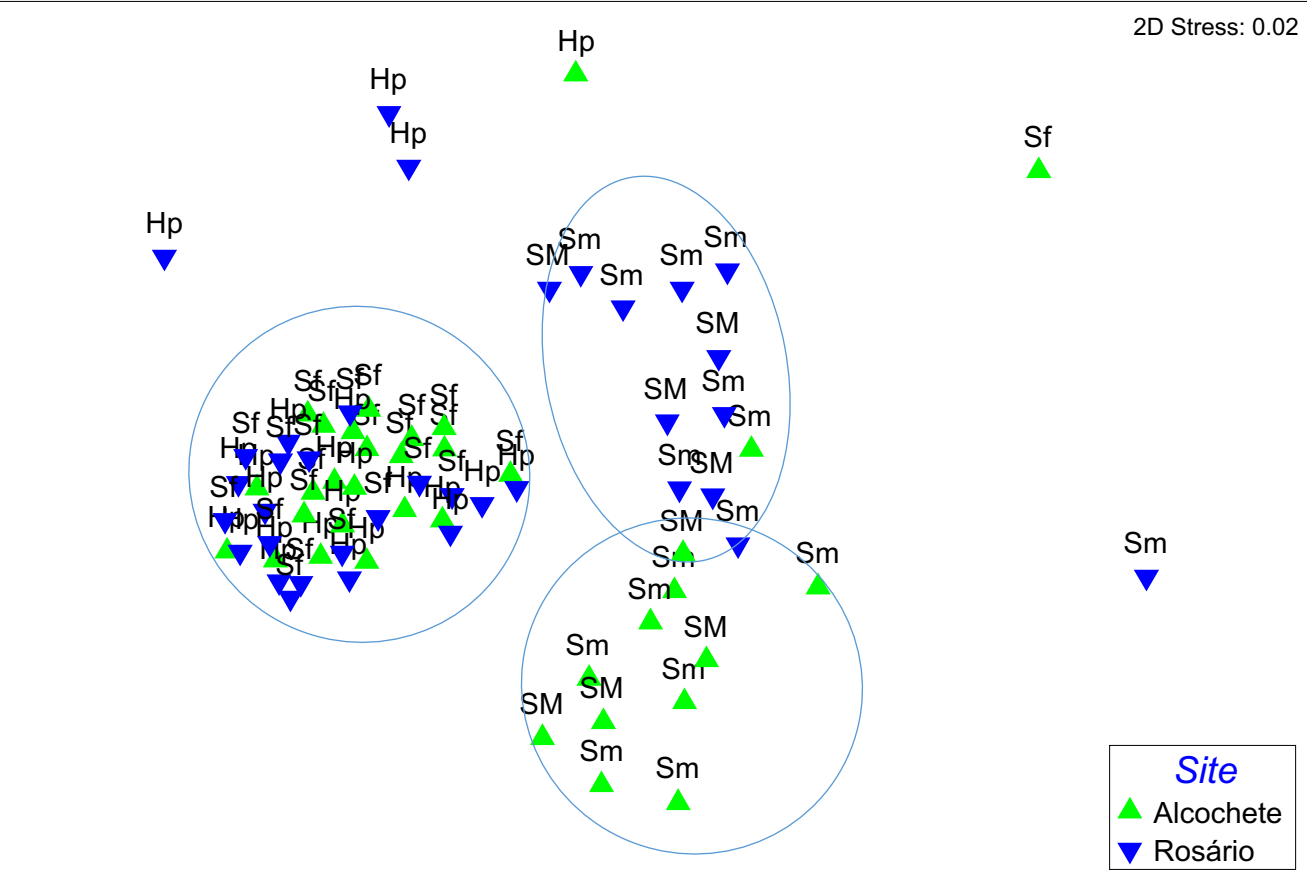


The chromosome and DNA molecules are...
 DNA is a long, thin, double-stranded molecule...
 The two strands are joined together by hydrogen bonds...
 The sequence of these base pairs in the backbone...
 provides information. This information is used...
 to synthesize proteins. The process of...
 copying the DNA into the messenger RNA...
 is a process called transcription.

Chemically, DNA consists of two complementary...
 single-stranded nucleotides. Each nucleotide...
 consists of a sugar and phosphate group...
 These two strands are joined together...
 and as therefore are joined to each...
 other in one of four types of base...
 pairs: adenine-thymine, guanine-cytosine...
 The sequence of these base pairs...
 provides information. This information is used...
 to synthesize proteins. The process of...
 copying the DNA into the messenger RNA...
 is a process called transcription.

When cells, DNA is organized into long...
 chromosomes. These chromosomes are...
 duplicated before cells divide. In a process called...
 replication, eukaryotic organisms produce...
 four, and prokaryotes divide most of their...
 DNA inside the cell nucleus and some of their...
 DNA in the cytoplasm (in chloroplasts and...
 mitochondria).





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PROTOCOLO DE ENSAIO DA SUPERÓXIDO DISMUTASE (SOD)

- *EXTRAIR O PELLETT COM 500 ML DE TAMPÃO.*
- *SONICAR.*
- *CENTRIFUGAR*

	CÉLULA BRANCO	CÉLULA REACÇÃO
Tampão de Ensaio	870 μ L	870 μ L
Extracto Vegetal	50 μ L	50 μ L
Pirogalolol	0 μ L	80 μ L

- *LER A ABSORVÂNCIA A 325 NM DURANTE 2 MIN*

random][pLasatd