[Music]
me
[Music]
[Applause]
[Music]
[Music]
molecular recombination and molecular taxonomy
course name models for reciprocal and non-reciprocal recombination
fox and holidays model
evidence for fox and holidays model
i'm joanna goncalves assistant professor of microbiology from government college of arts science and common scandal
the outline for today's lecture is
types of recombinations
models of recombination
and evidence for the model of recombination
the learning outcomes for this lecture are
the students will be able to
understand strand invasion
branch migration and resolution of holidays model
compare reciprocal and non-reciprocal recombination
what is recombination
recombination is the breaking and rejoining of two parental dna sequences to produce a new dna molecule
which are the different types of recombination
the first one is the homologous recombination which we also call reciprocal recombination
this recombination it occurs between complementary stents of two homologous dna molecules
which means these two dna molecules are similar
non-reciprocal recombination
recombination which occurs between two non-homologous chromosomes that is dissimilar sequences
the third type is the side specific recombination
that is recombination between short sequences of about 12 to 24 base pairs present on dissimilar parental molecules
example of this is the integration of bacteriophage lambda into a bacterial chromosome
the fourth type is the replicative recombination wherein a new copy of a transposable element is generated at a new site in the same chromosome
now let us look at the reciprocal recombination
reciprocal recombination is also known as homologous as it occurs

in the homologous regions of dna
here equal exchange of genetic
information takes place
the new dna molecule carry genetic
information from both parental dna
molecules so you can see in the figure
how two dna duplexes are being
recombined to form a duplex which is
having both the sequences
this occurs
in bacteria after conjugal transfer that
is after conjugation
it also occurs at the chiasmata during
meiosis of eukaryotic cells
and for post replication transfer via
retrieval system that is for repair
now let us look at the non-reciprocal
recombinations
this occurs between non-homologous
regions of dna and
there is addition or insertion of a
small dna sequence in a recipient dna
which you can see in the pickup
this occurs in jumping genes or
transposons and also in repair of
chromosomal double strand breaks in the
dna of somatic cells
now let us move on to the holidays model
of homologous recombination
so this model was proposed by robin
in 1964. according to it there are five
steps which takes place during
recombination the first step is dna
pairing
two homologous chromosomes are paired
with similar sequences adjacent to each
other so you can see in the picture
there are two dna duplexes one is shown
in red and the other one is in blue so
the red one is named with capital a
capital b and capital c for the
different genes and the blue one is in
small letters
so all these genes which are similar are
adjacent to each other
and the third step is strand invasion
the knit ends dissociate from their
complementary strengths and invades the
other duplex this occurs in a reciprocal
manner to produce a heteroduplex region
so in the third image you can see how
the strands will invade each other
then the fourth step is ligation dna
ligase will seal the necks and one
strand of each parental duplex crosses
over the other duplex and so you will
get this x shape joint
which is called as the holiday junction
or also the chi structure which means x
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the fifth step is branch migration the
stable joint moves along the paired

duplexes feeding in more of each
invading strand and extend extending the
region of heteroduplex as you can see in
the image
after this resolution takes place the
recombination intermediate is then
resolved by nicking a strand in each
duplex and this is then followed by
ligation
so you can see the chi form is shown in
a bigger image down
and it is going to be now resolved so
for the resolution
and better visualization we will
twist this to get a better image
without any crossovers
now resolution can occur in two ways
in vertical mode of resolution or
horizontal mode of resolution
so let us look at the first one that is
vertical mode
so here you can see a line passing
through the guide form
which means that this structure can be
cut vertically so nicks are made in the
strands which were not nicked in the
original parental duplexes
and here after ligation of these ends
you will get a patch of heteroduplex
which causes recombination of flanking
regions so you can see in the picture
there is recombination
in the parental dna and that is why
looking at the two dna duplexes the
first one has got
genes from the second so we have got red
and blue chains joined together so we
have a capital a capital b and small c
in the first sequence and so on
now the second type of resolution is
horizontal mode here nicks are made in
the same dna strands that were
originally nicked in the parental duplex
ligation of these ends gives two duplex
molecules with a patch of heterodiplex
so here we will get a patch but there is
no recombination of the flanking regions
as you can see in the image
now the evidence for fox and holidays
model
the recombinant joint which was proposed
by holiday has been visualized in
electron micrographs of recombining dna
duplexes so this was done by an
experiment
e coli was treated with chloramphenicol
which inhibited
chromosomal replication but plasmid
replication occurred
this led to the presence of a large
number of plasmids in the cell which
could recombine

so the electron micrographs of the
showed dimers having the shape of a
figure eight
these dimers were then cleaved by eco-r1
restriction enzyme at unique size
and they should have formed a double
lens circle if they were interlocked
but this did not happen instead it gave
a structure with four arms resembling
the greek letter char
this showed that the two plasmid circles
were covalently joined at the point of
homology
all the figure eights were converted
into chi
form which suggested that the contact
point always divides the structure into
pairs of equal length
arms and that the genomes are joined at
the region of homology
there would be no relation between the
size of the forearms if the plasmids
were joined at unrelated sequences the
contact point occurred with nearly equal
probability along the entire plasmid so
this showed that the bearing could occur
at many locations
now the next step by denaturing with
former mind the strand connections at
the crossover regions were visualized
four duplexes emerged
from a ring of connecting single strands
at the junction between the two genomes
so something like what you can see in
the image
the intermediate could then be cleaved
and ligated to generate two different
sets of recombinant molecules that is
the resolution step
[Music]
so now we'll move on to the model for
non-reciprocal recombination
in non-reciprocal recombination a nick
is made in one of the strands
so you can see in the picture there are
two dna molecules which are not
homologous
and a nick is made in one of the
molecules
dna polymerase synthesizes an extra copy
of a strand and replaces the original
copy as a single strand
this single strand starts pairing with
the homologous region to another dna
duplex
the short unpaired strand produced is
degraded when the transfer of nucleotide
sequences is completed
and dna replication then separates the
two non-matching strands
these are the references
thank you

English (auto-generated)

All

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