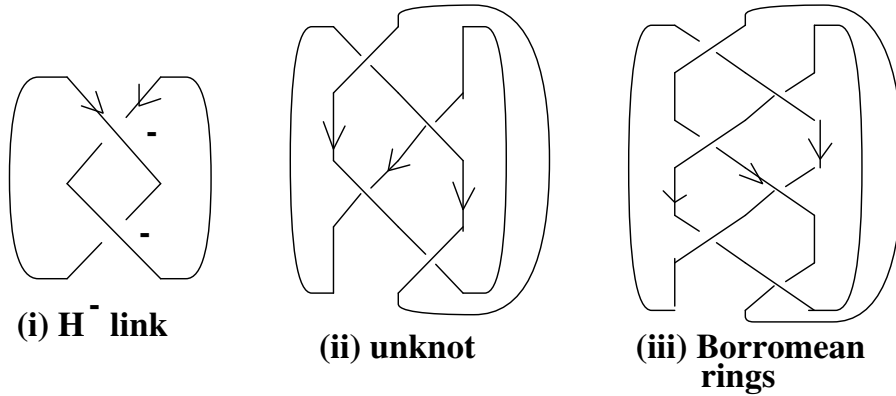
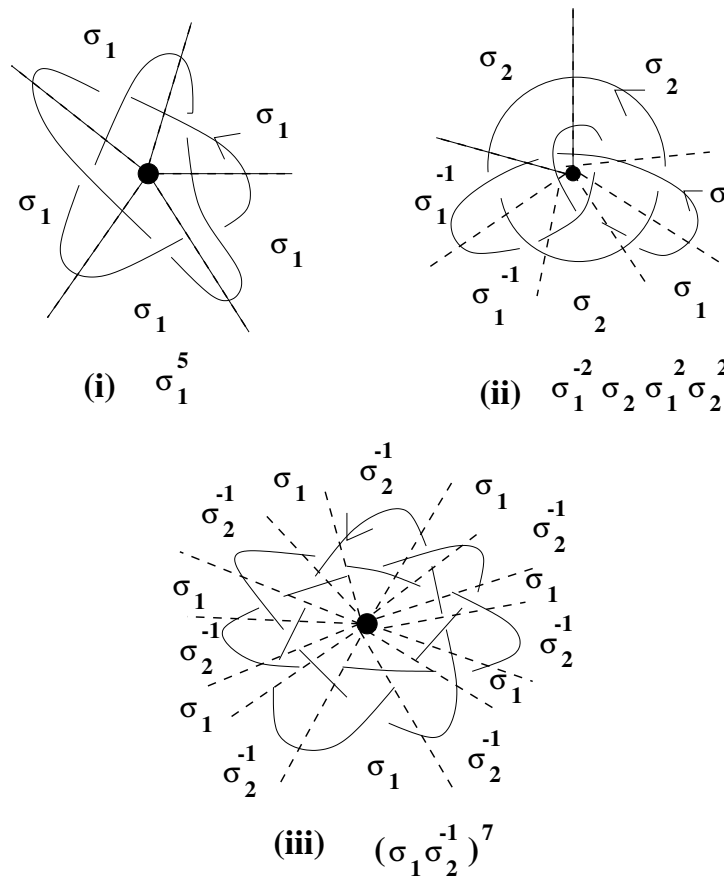


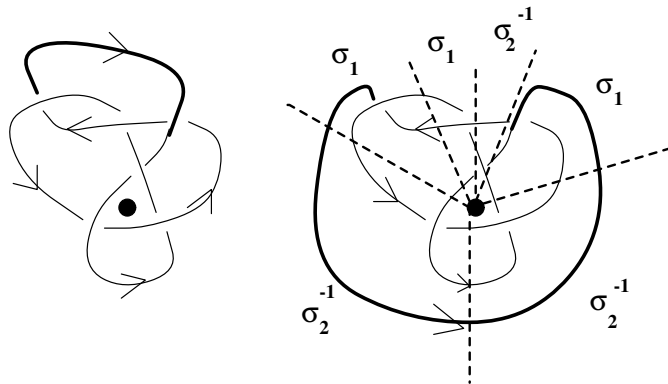
1. (i) The closure of σ_1^2 is the negative Hopf link H^- .
- (ii) The closure of $\sigma_1^{-1}\sigma_2\sigma_1\sigma_2^{-1}$ is the unknot.
- (iii) The closure of $(\sigma_1^{-1}\sigma_2)^3$ is the Borromean rings.



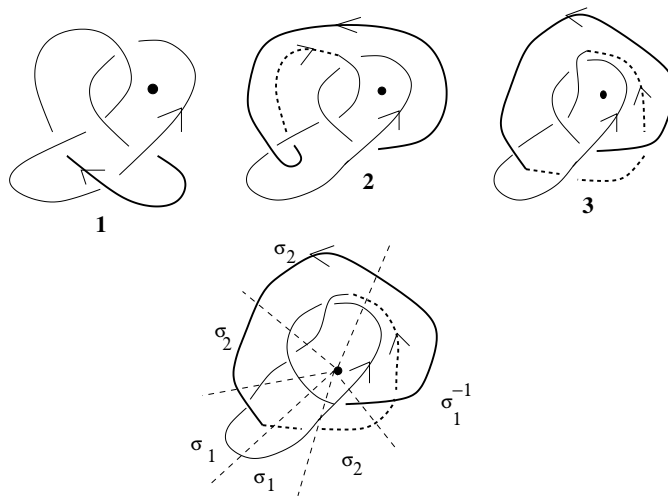
2. The diagrams below show that the obvious choice of centre works in each case. Note the efficiency of the braid representation when the knot has a high degree of symmetry about this centre.



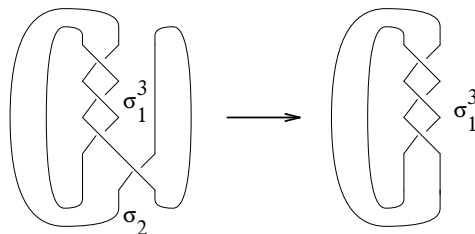
3. The 6_3 knot has a closed braid representation as $\sigma_1^2 \sigma_2^{-2} \sigma_1 \sigma_2^{-1}$. This can be seen by passing the arc drawn as a thick line in the left hand diagram below around the axis, to give the right hand diagram.



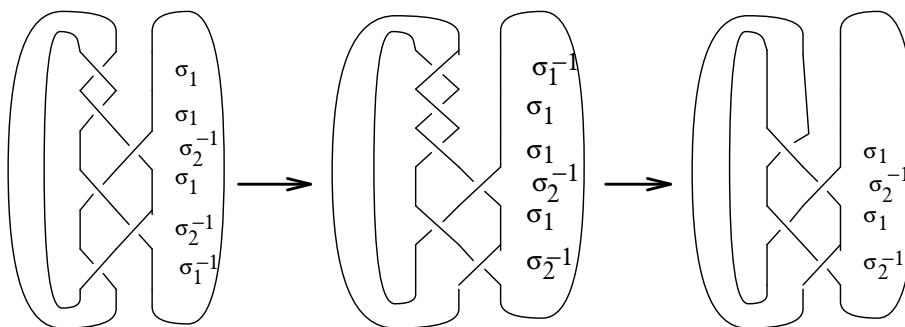
A similar procedure works for the 5_2 knot, but in this case we need to pass two loops around the axis indicated, to obtain the closure of the braid $\sigma_2^2 \sigma_1^2 \sigma_2 \sigma_1^{-1}$.



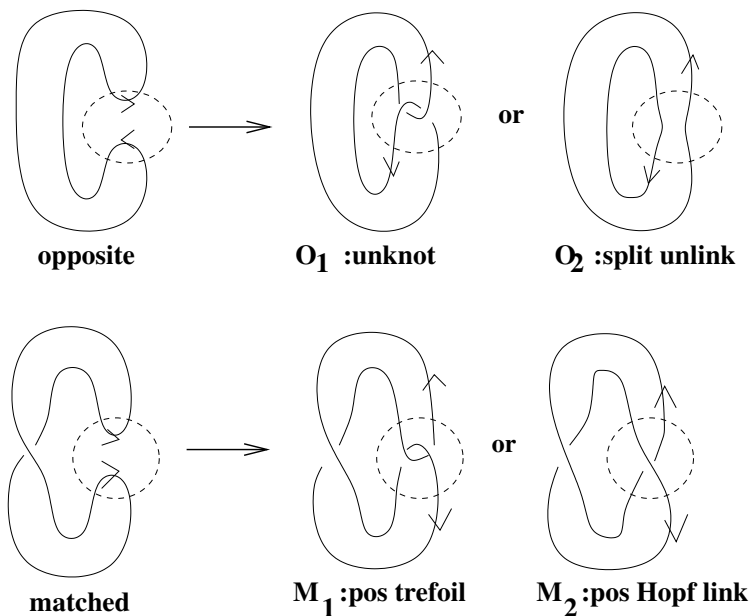
4. (a) This is an example of a more general result: the closure of any braid w on n strings is equivalent to the closure of the braid $w\sigma_n$ on $n + 1$ strings. The extra string provides a loop which can be untwisted. With the loop twisted in the opposite direction, we have the corresponding result with σ_n^{-1} in place of σ_n .

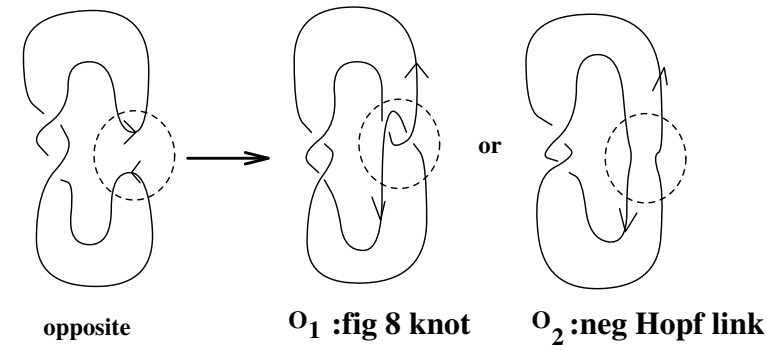
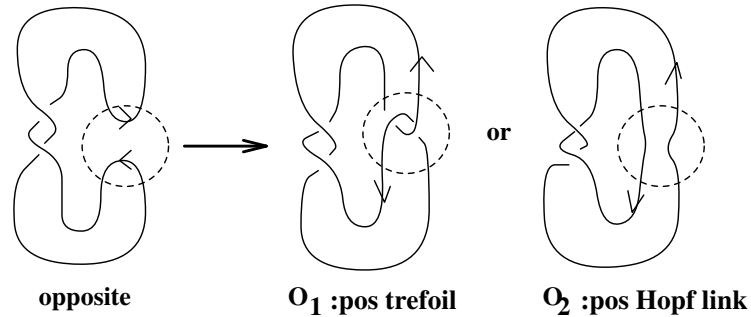
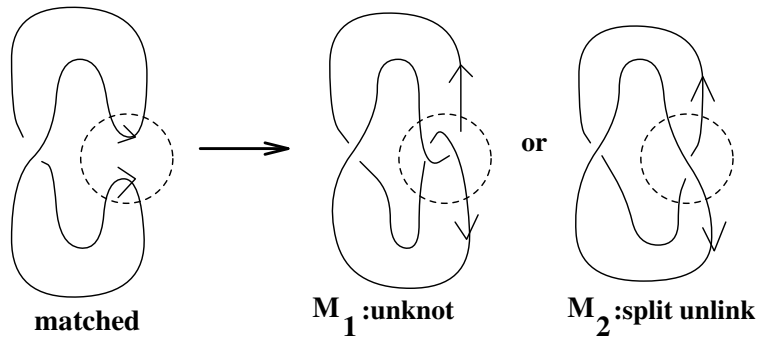


- (b) (i) The word $(\sigma_2^{-1}\sigma_1)^2$ is a cyclic permutation of the word $(\sigma_1\sigma_2^{-1})^2$. Since we can cut a closed braid between any two crossings to obtain an ordinary braid, cyclic permutations of braids have the same closure.
- (ii) The word $\sigma_1^2\sigma_2^{-1}\sigma_1\sigma_2^{-1}\sigma_1^{-1}$ is the conjugate of the word $(\sigma_1\sigma_2^{-1})^2$ by the element σ_1 of the braid group, *i.e.* it is $\sigma_1(\sigma_1\sigma_2^{-1})^2\sigma_1^{-1}$. This is a cyclic permutation of the word $\sigma_1^{-1}\sigma_1(\sigma_1\sigma_2^{-1})^2$. Now the first two factors cancel (compare the Reidemeister II move).



5. The sequence of diagrams below show the outcomes of the two proposed actions for each of the five types of substrate molecule.





The expected proportions of various knot and link types in the product are therefore as in the table below.

Action	trefoils T	Hopf links H	ratio $n(T) : n(H)$
(M_1, O_1)	$2/5$	0	1 : 0
(M_1, O_2)	$1/5$	$2/5$	1 : 2
(M_2, O_1)	$1/5$	$1/5$	1 : 1
(M_2, O_2)	0	$3/5$	0 : 1

We can conclude that (M_1, O_2) is the only possible enzyme action compatible with the experimental result.