

# เอกสารเผยแพร่ความรู้ทางจุลชีววิทยา

## BACTERIA CONVERT BLOOD GROUP

A-G28P29



*Bacteriodes fragilis*



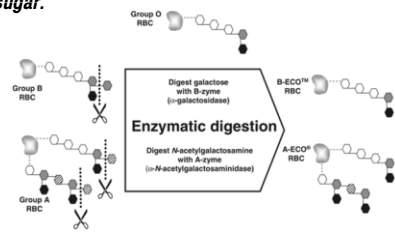
BLOOD TRANSFUSION

Blood is the most important fluid in body. Losing more than 2L of blood can lead to hypotension and death. When accident occurred and patient losing blood we have to test patient blood group before transfusion because incompatible blood can cause fatal transfusion reaction.

Blood group O also known as universal blood group because it can be donated to any recipient so its usually use in fatal accident patient which patient has lost a lot of blood to treat immediately.

So the scientist has a thought about converting blood group A and B to group O, especially blood group A which apparently has the 2nd highest incidence in population, so that it can be use to treat any patient.

The major distinction between the four human blood groups – A, B, AB and O – lies with an additional  $\alpha$ 1-3-linked sugar that branches off from the penultimate galactose. On A cells, this sugar is  $\alpha$ 1-3- linked N-acetylgalactosamine. On B cells, it is an  $\alpha$ 1-3-linked galactose. Group O cells have no additional sugar, while AB blood cells bear a mix of A and B chains. These mean if we want to convert blood group A, B or AB into group O, we have to cut the additional branches sugar.



Enzymes for conversion of group B RBCs (B-ECO) is  $\alpha$ -galactosidase GH110. Due to the lack of sequence similarity between the newly identified  $\alpha$ -galactosidases and any known glycosidase in database, scientist define this enzyme as the glycosidase family GH110. This enzyme found in *Streptomyces avermitilis*, *Streptomyces griseoplanus*, *Bacteriodes fragilis* and *Bacteriodes thetaiotaomicron*.

They found that *B. fragilis*  $\alpha$ -galactosidase A (FragA) (recombinant with *E.coli*) has the most substrate specificity and kinetic properties. The enzyme has a broad pH optimum between 5 and 7.5. The substrate specificity was remarkably stringent for  $\alpha$ -1,3-linked galactose in the branched blood group B structure. The FragA  $\alpha$ -galactosidase has more than 300-fold higher activity with the blood group B than the coffee bean enzyme.

Enzymes for conversion of group A RBCs (A-ECO) is  $\alpha$ -N-acetylgalactosaminidase. This enzyme can be found in *Elizabethkingia meningosepticum* (*Chryseobacterium meningosepticum*). The conversion of group A RBCs has not been completely successful because the biochemistry of A antigens is more complex. Moreover blood group A has more subgroups than that of B antigens.

It is now possible to remove the terminal  $\alpha$ -GalNAc and  $\alpha$ -Gal residues of blood group A and B antigens from intact RBCs so that they type as group O. It is practically possible to convert whole RBC units with low doses of enzyme because of the high-specific activity of the members of the new enzyme families.

Proof of concept for the ECO technology has been established for B-ECO through successful phase I and II clinical trials performed previously. Phase I trials to establish the safety of the A-ECO product.

### SINCE 1980s

The idea of converting blood types has existed

**NEWYORK**  
enzyme extracted from green coffee beans remove B antigens from red blood cells

**Steve Withers**  
scientists from the University of British Columbia created an enzyme works in the same way

**David Kwan**  
mutant enzyme is very efficient at cutting off the sugars in A and B blood and is much more proficient for A-antigen subtypes

**TODAY**  
It is now possible to remove all of blood group A and B antigens

**FAILURE**  
the enzyme reaction was too inefficient. It requires too large volume at too high temperature to convert all the blood cells

**Mutant Enzymes**  
Starting with an original enzyme and inserted mutations into the gene that codes for it

**ECO**  
The enzyme was able to remove the majority of antigen but not able to remove all of them

## References

- <http://www.nature.com/nbt/journal/v25/n4/full/nbt1298.html>
- <http://www.iflscience.com/health-and-medicine/scientistsedge-closer-being-able-change-blood-types/>
- <http://onlinelibrary.wiley.com/doi/10.1111/j.1365-2141.2007.06839.x/full>

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