Cleveland Clinic

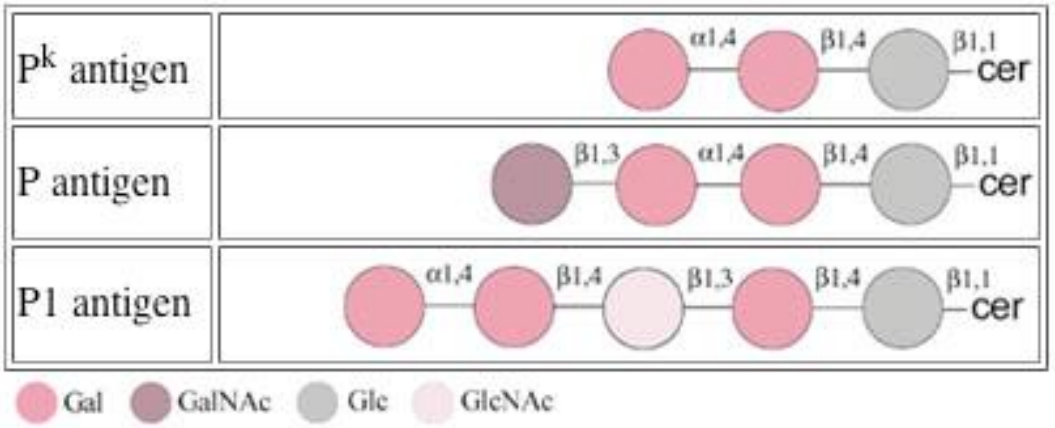
The P Blood Group System

P Blood Group System

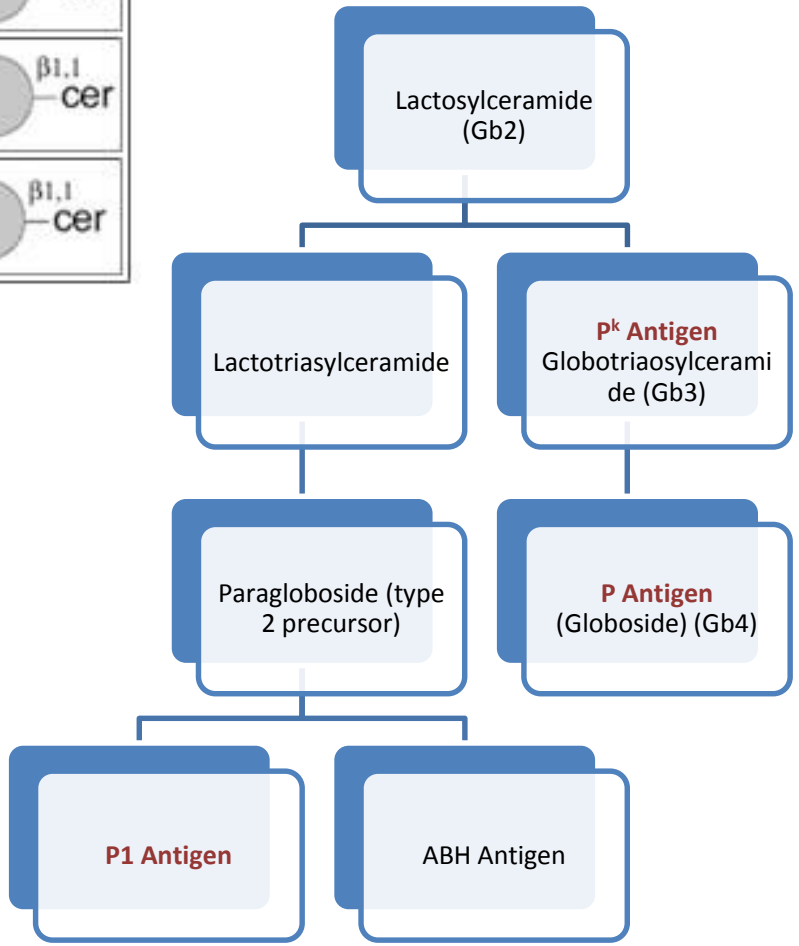
- 3 Antigens: P_1, P, P^k
- 5 Phenotypes: P_1, P_2, p, P_1^k, P_2^k

P1Pk system (003 P1PK)	Globoside System (028 GLOB)
• P1 antigen • P^k antigen	• P antigen • LKE (Globoside collection-209 GLOB)

Antigen Structures

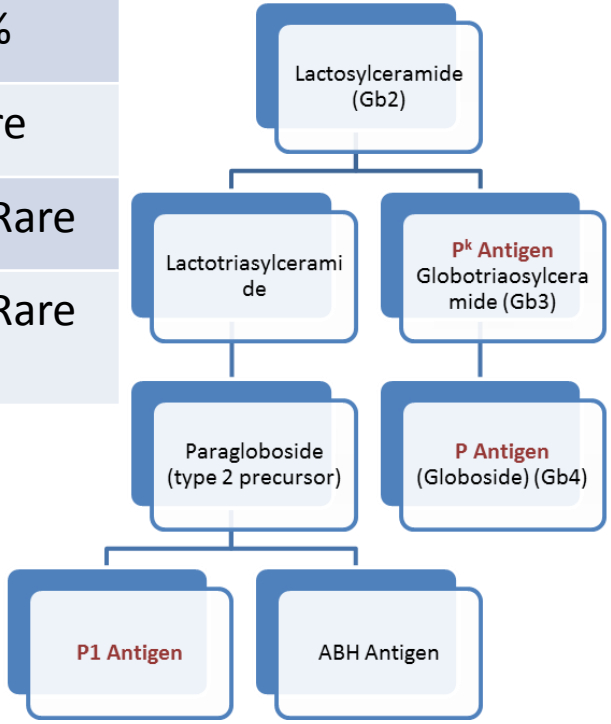


- Genes code for glycosyltransferases (like ABH)
- Add sugars to precursor substances



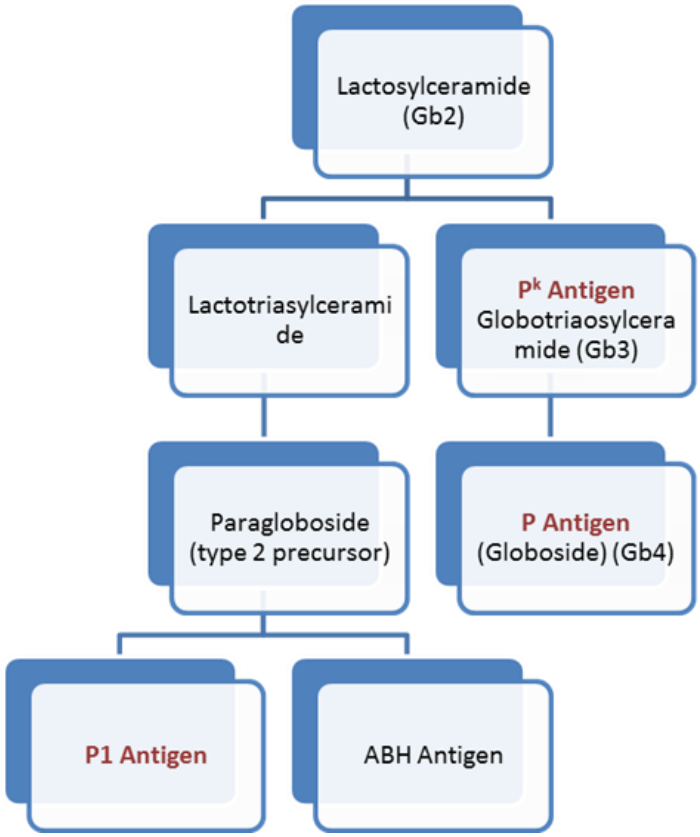
P Antigens/Antibodies

Phenotype	Antigens Present	Possible Antibodies	Prevalence	
			Whites	Blacks
P_1	P1, P, (P^k)	None	79%	94%
P_2	P, (P^k)	Anti-P1	21%	6%
p	None	Anti-PP1P^k	Rare	Rare
P_1^k	P1, P^k	Anti-P	Very Rare	Very Rare
P_2^k	P^k	Anti-P, Anti-P1	Very Rare	Very Rare



P1 Phenotype

- Have P1, P, P^k antigens
- Varies between $P1+^s$ and $P1+^w$
  - Either strong or weak
  - Due to genetic variation, heterozygous vs. homozygous, and ethnicity
- Deteriorates on stored cells



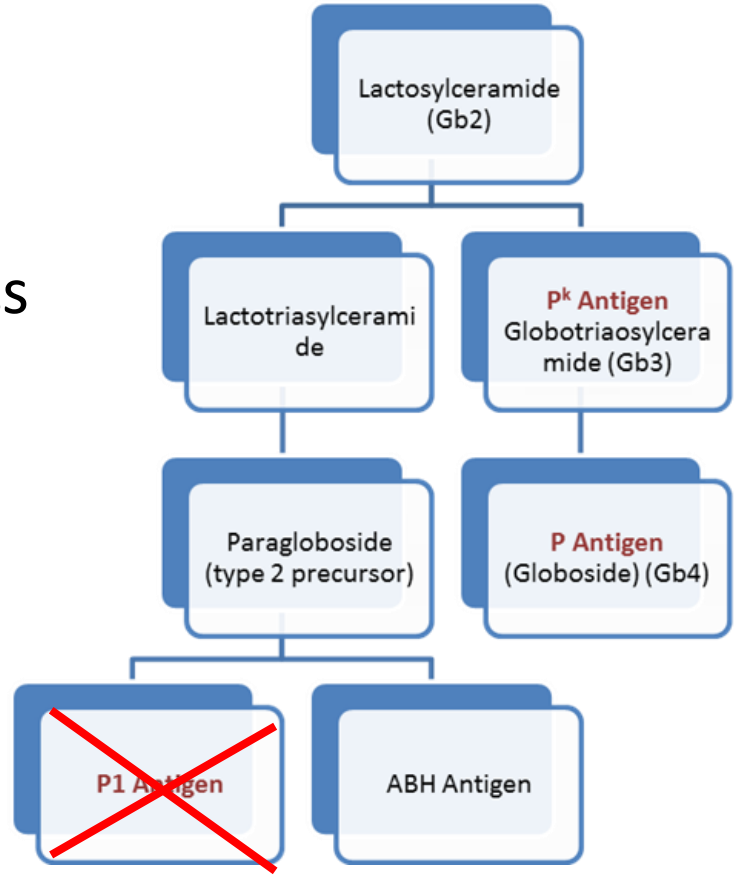
Newborns and P1

- P1 antigen- poorly developed at birth
- 7 years to be fully expressed
- Therefore: no HDN- no antigen for antibody to bind to

Anti-P1

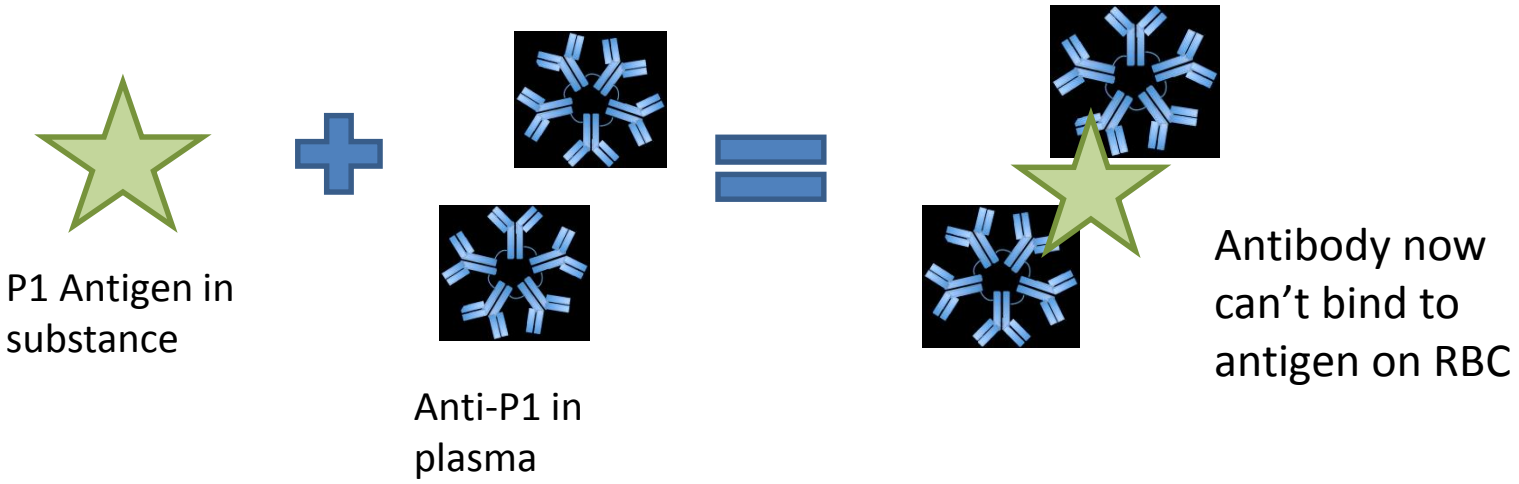
- Naturally occurring in P2 and $P2^k$ people
- No HDN
  - IgM (can't cross placenta)
  - Poorly developed on fetal RBCs

Enzymes	Increased
IgM vs. IgG	IgM
Cold or Warm	4^oC
Natural vs. Immune	Natural
HTR	Rare
HDN	No



Neutralization with P1 Substance

- P1 nuisance in blood bank- interferes with testing
- Remove antibody by incubating with substance containing P1 antigen
- Commercially available

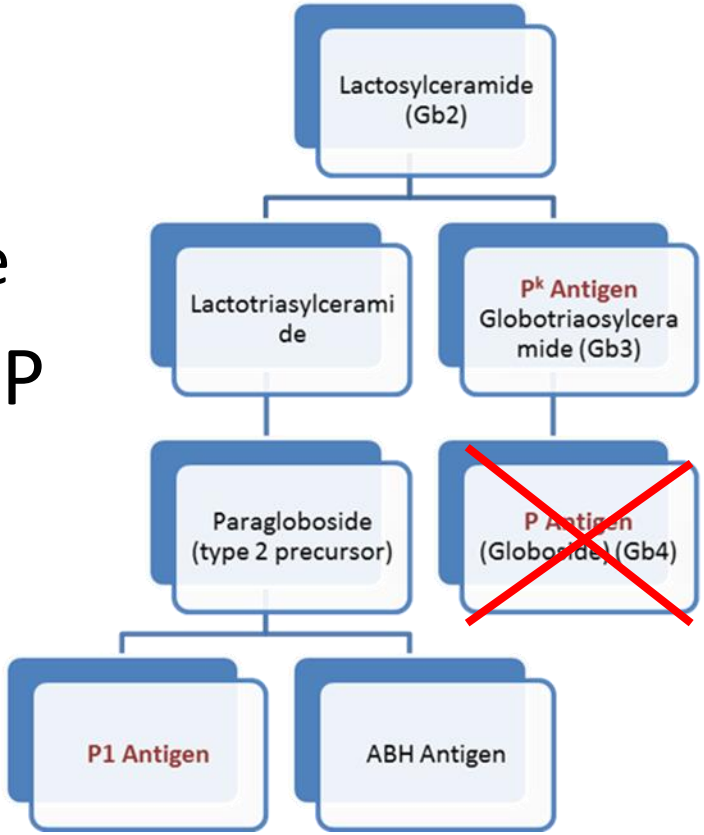


Other Sources of P1 Substance

- Hydatid Cyst Fluid- cyst of tapeworm *Echinococcus granulosus*
  - Can make Anti-P1 if infected
- Avian P1 Substance- P1-like antigen in dropping of pigeons and turtle doves

P^k Phenotype

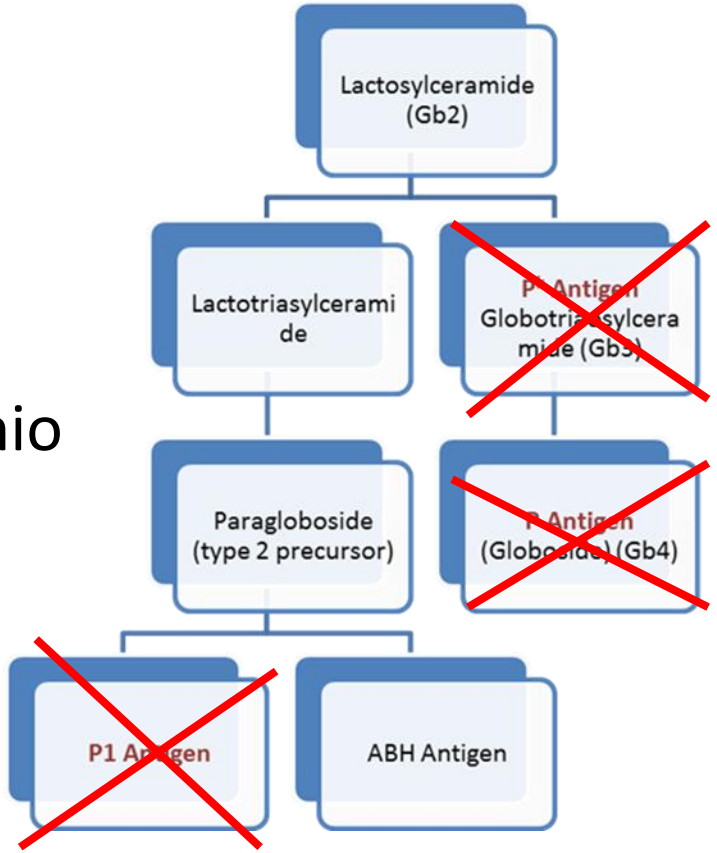
- P^k gene
  - Codes for $P1^k$ if also inherit P1 gene
  - Codes for $P2^k$ if P1 negative
- Lack P antigen- make Anti-P
- Anti-P^k- never found alone
  - Separated from Anti-P$P1P^k$



p Phenotype

- Amorph: negative for P1, P, P^k
- Make Anti-PP1P^k
  - Associated with increase in spontaneous abortions
- Rare, but common in Amish in Ohio

Enzymes	Increased
IgM vs. IgG	both
Cold or Warm	4°C (some 37)
Natural vs. Immune	Natural
HTR	Yes
HDN	Yes

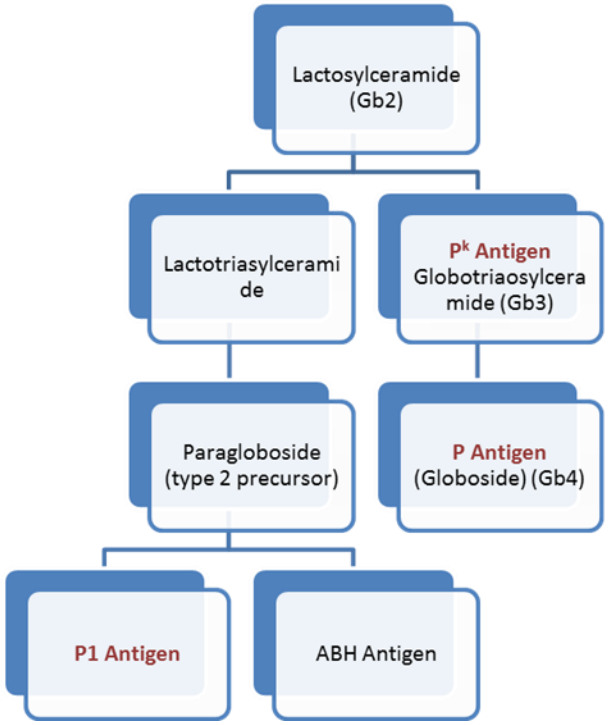


Anti-p: rarely formed by P1 pos people reacting at cold and warm temperatures

Anti-P

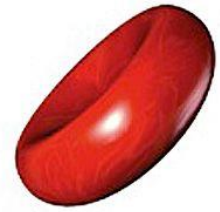
- Everyone has antigen except P^k and p people
- Naturally occurs in:
  - P^k individuals
  - Part of anti-PP_1P^k
- Rarely see alloanti-P, usually autoanti-P
- IgG- HTR

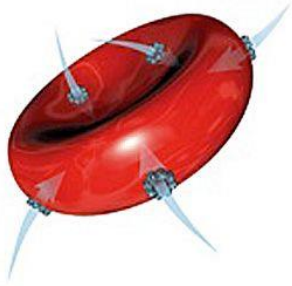
Enzymes	Increased
IgM vs. IgG	both
Cold or Warm	4°C (some 37)
Natural vs. Immune	Natural
HTR	Yes
HDN	Rare



Paroxysmal Cold Hemoglobinuria (PCH)

- Autoanti-P
- Biphasic- bind to RBC in cold, lyse when body temp rises
- Secondary to viral infection- young children
- Treatment- stay away from cold





Autoanti-P binds in cold

Lyses when reaches body temp 37°C

Donath-Landsteiner Test

- Identifies PCH

Add patient serum (autoanti-P) to P+ cells

- 1st tube: incubate 37°C for 60 min. → This is control- no hemolysis
- 2nd tube: incubate at 4°C for 30 min. then 37°C for 30 min. → If positive: serum will hemolyze

IgG	C3d
0	+

Luke (LKE) Antigen

- Genetically independent
- Structurally related to P
- Part of Globoside collection (NOT system)
- Three phenotypes:
  - Luke (-): all people with p and P^k phenotypes
  - Luke (w): common with P1 and P2
  - Luke (+): Dominant phenotype (84% of population)

Cleveland Clinic

Every life deserves world class care.