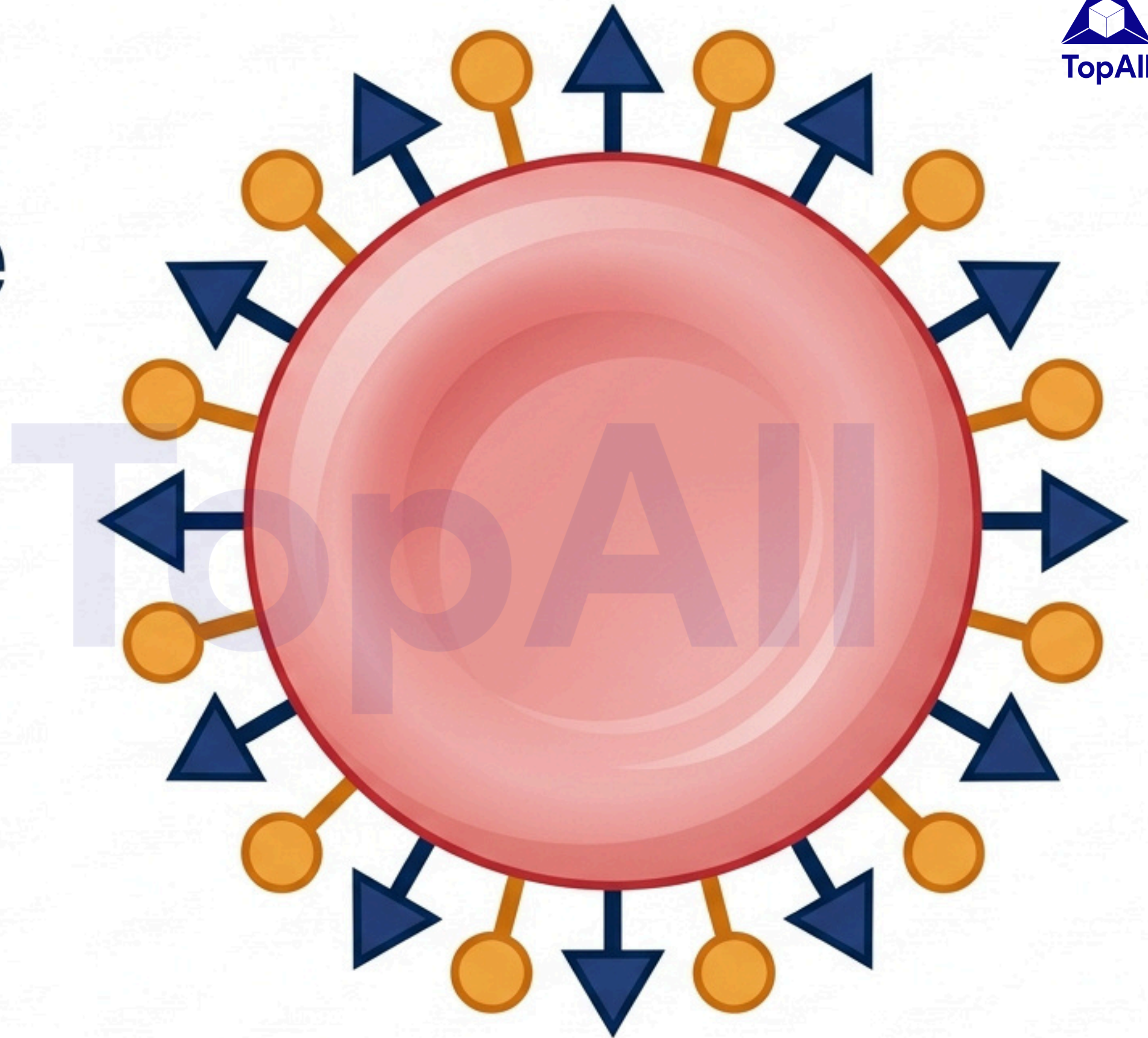


Co-dominance and ABO Blood Group

How three alleles construct
the cellular surface.

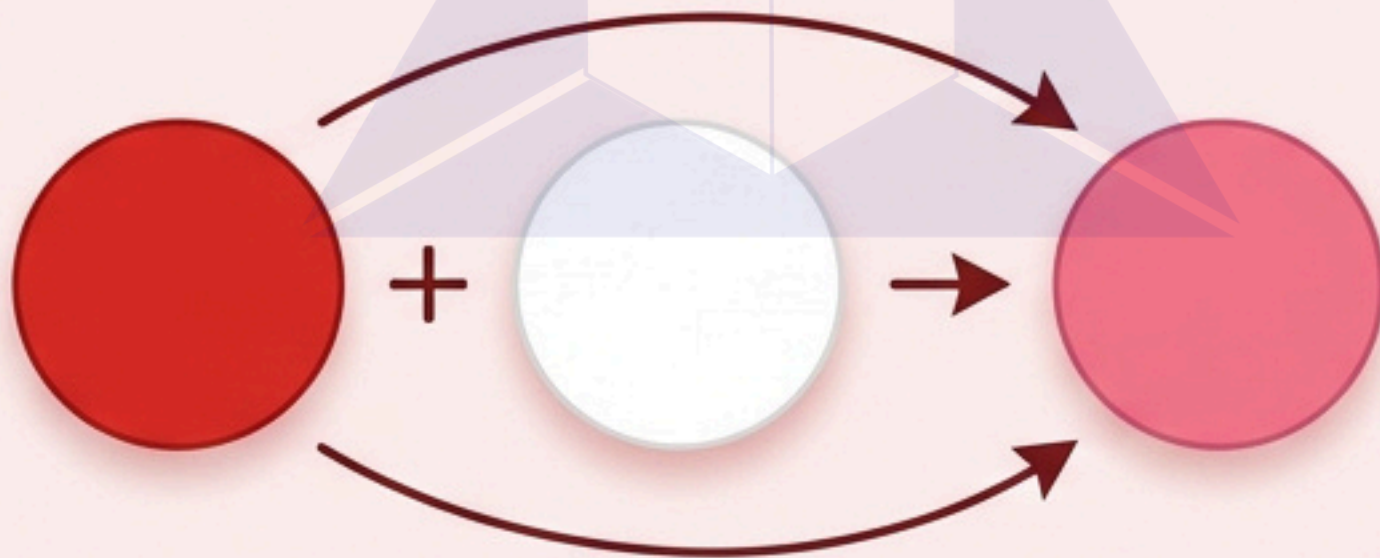


Defining Co-dominance

The Misconception



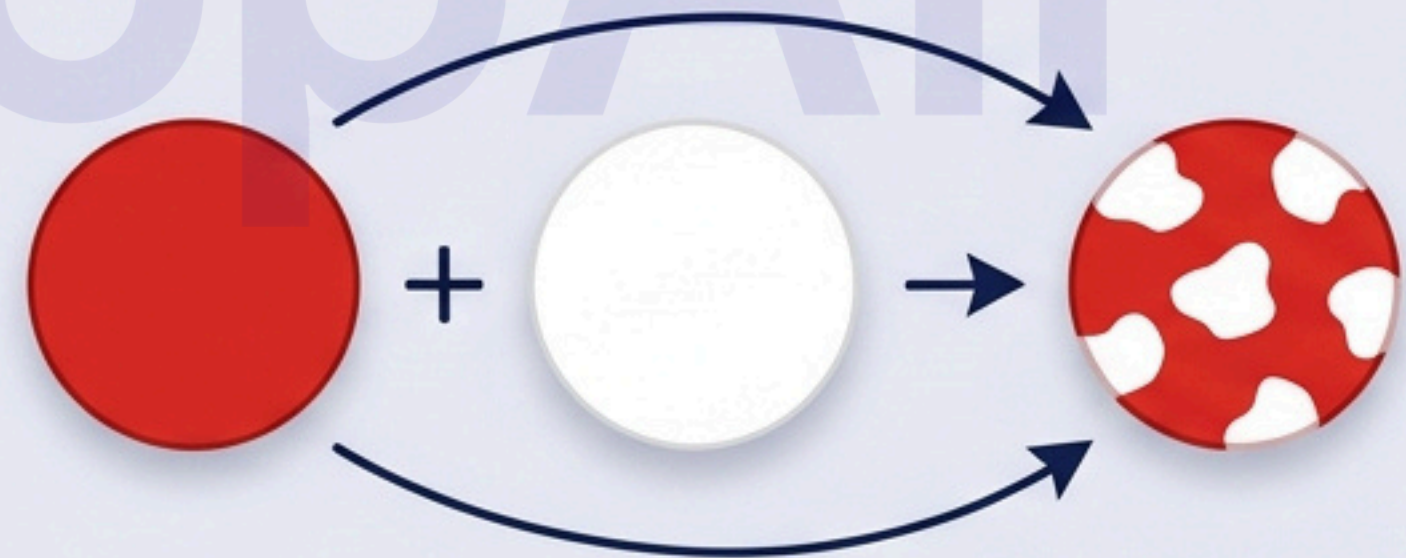
The traits blend together to form an intermediate phenotype.



The Reality

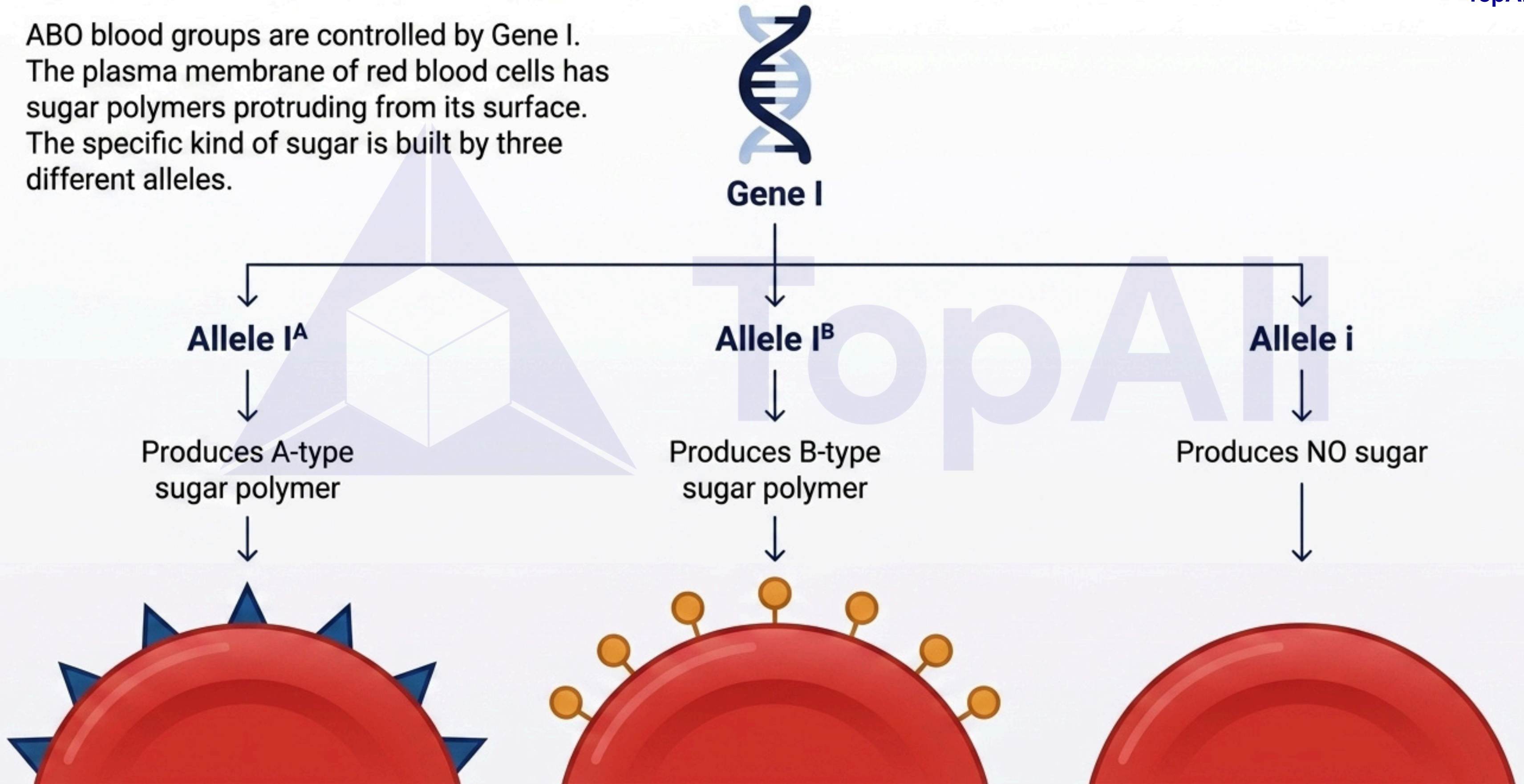


The F_1 generation resembles BOTH parents. Both traits express their own phenotypes completely and simultaneously without blending.



Gene I and the Cellular Canvas

ABO blood groups are controlled by Gene I.
The plasma membrane of red blood cells has
sugar polymers protruding from its surface.
The specific kind of sugar is built by three
different alleles.





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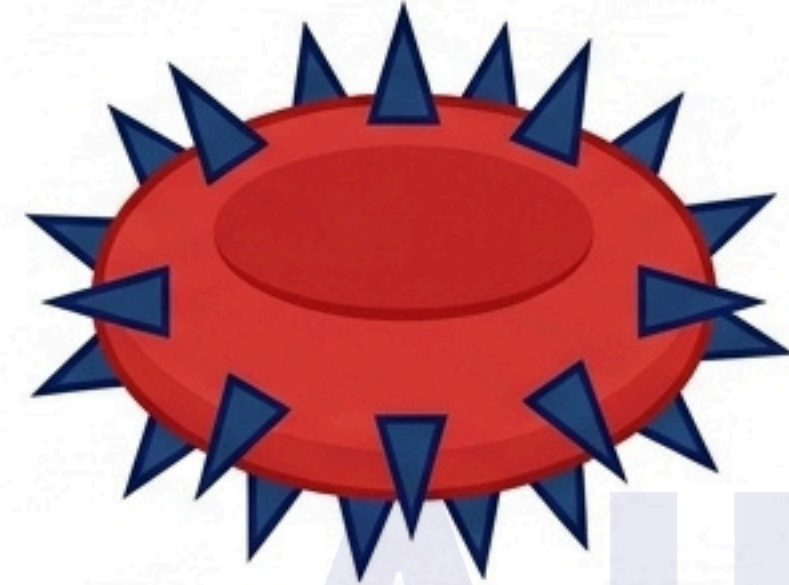
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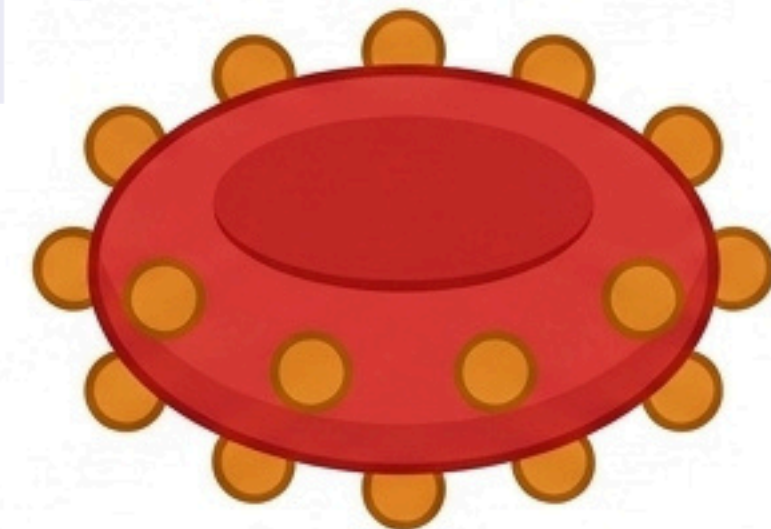
The Dominance Hierarchy

$I^A + i$



I^A is completely dominant over i .
When I^A and i are present, only I^A expresses because i produces no sugar.

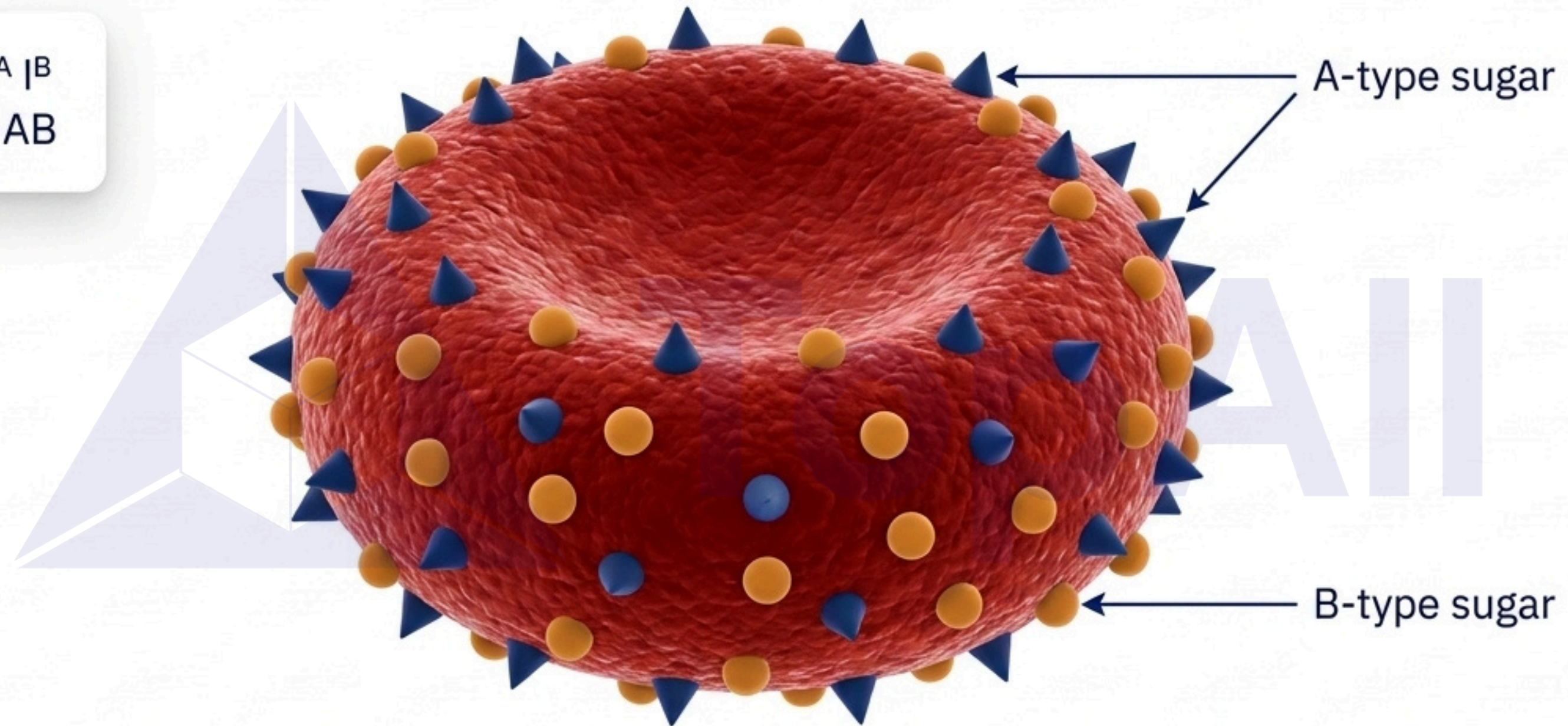
$I^B + i$



I^B is completely dominant over i . When I^B and i are present, only I^B expresses.

The Co-dominance Event: Blood Group AB

Genotype: $I^A I^B$
Phenotype: AB



Because humans are diploid, an individual possesses two alleles. When I^A and I^B are present together, they both express their own types of sugars. Neither dominates the other. The RBC features both A and B sugars simultaneously.

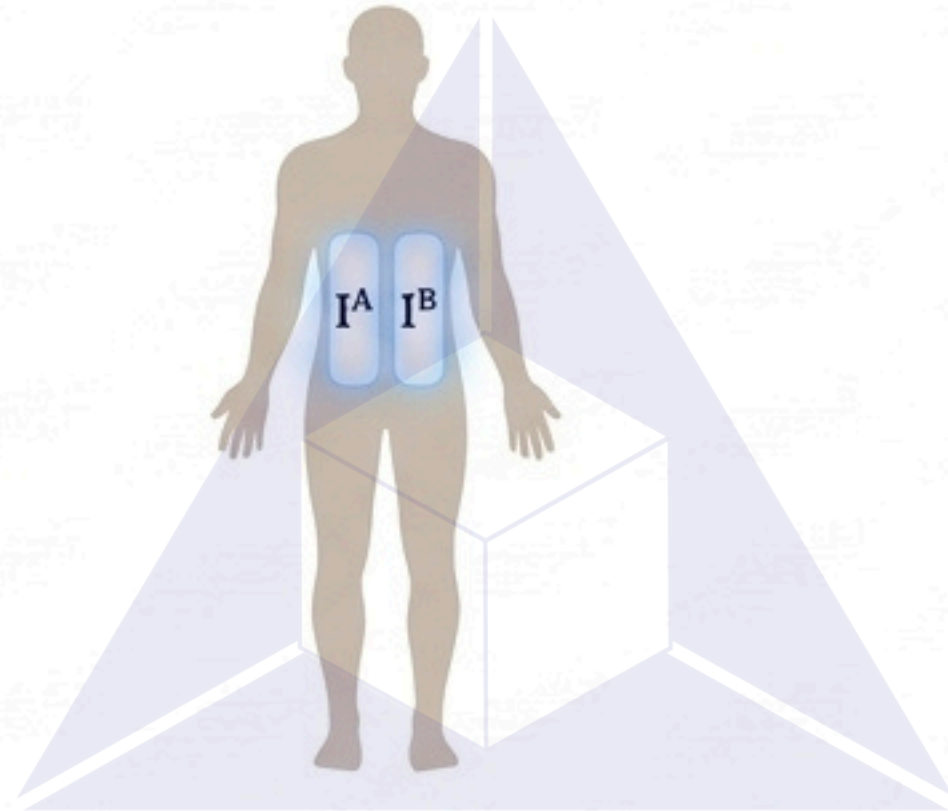
Genetic Basis of Human Blood Groups

The six possible genotype combinations derived from three alleles.

Parent 1 Allele	Parent 2 Allele	Offspring Genotype	Blood Type (Phenotype)
I ^A	I ^A	I ^A I ^A	Type A
I ^A	I ^B	I ^A I ^B	Type AB
I ^A	i	I ^A i	Type A
I ^B	I ^A	I ^A I ^B	Type AB
I ^B	I ^B	I ^B I ^B	Type B
I ^B	i	I ^B i	Type B
i	i	ii	Type O

The Rule of Multiple Alleles

Individual Scale



Because humans are **diploid**, one individual can only carry a maximum of **TWO alleles**.

Population Scale



To observe **multiple alleles** (more than two alleles governing the same character), **population studies** must be made.



Quick Tip

While Gene I has three different alleles in the human population, any single person only ever holds **two of them**.

Synthesis



Key Takeaway: ABO blood grouping is the definitive demonstration of both co-dominance and multiple alleles.

- **1. Co-dominance:** I^A and I^B do not blend; both express their specific sugar polymers on the RBC surface simultaneously.
- **2. Multiple Alleles:** While an individual only holds two alleles, the human population relies on a pool of three distinct alleles (I^A , I^B , i) to dictate the trait.



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