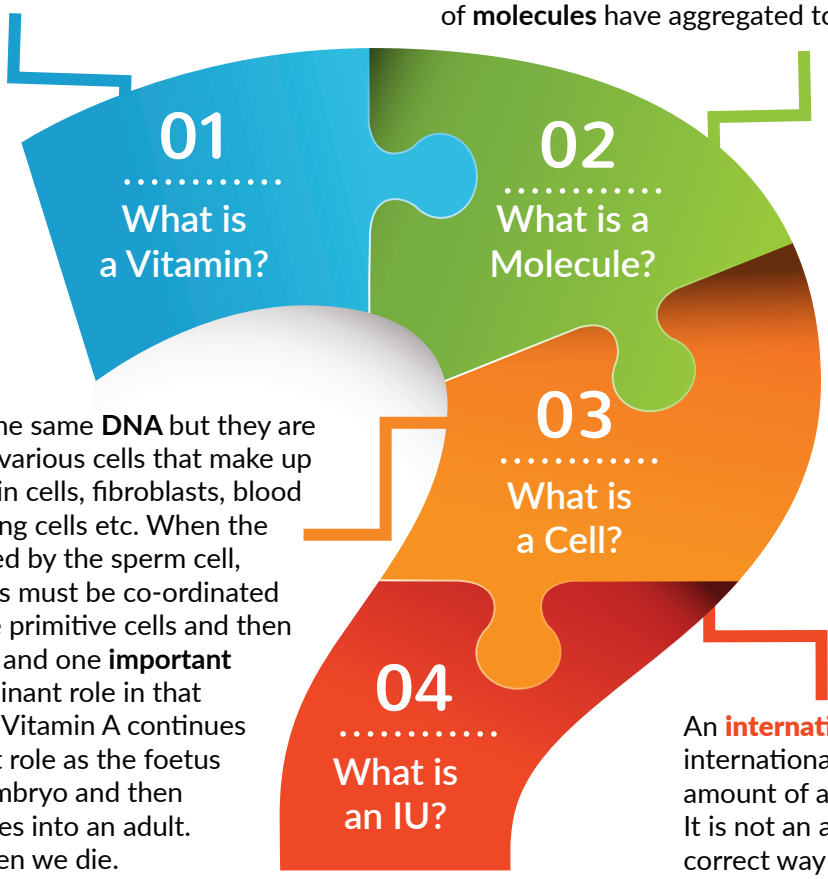
VITAMIN A
Precious Molecule

By Jennifer Munro, Professor Des Fernandes,
Dr Ernst Eiselen and Candace Noonan

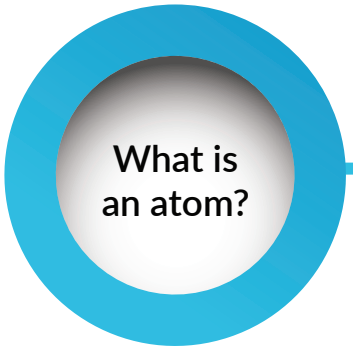
Vitamin A is only made by animals. The carotenoid pre-cursors of vitamin A like beta-carotene are made by plants and are incorrectly labelled as vitamin A. Other animals and even humans can convert beta-carotene etc into vitamin A, but in humans, this is on a limited scale that only prevents clinical vitamin A deficiency.

Atoms join up with other atoms to make **molecules**, which then may have very different properties from the component atoms e.g. water: 2 atoms of an explosive gas with one atom of a corrosive gas, or salt: Sodium a highly reactive soft metal mixed with a toxic gas. Some **molecules** have tens or hundreds of atoms in them. The commonest form of Vitamin A has 98 atoms arranged together in a particular pattern. In life, millions of **molecules** have aggregated together to make cells.



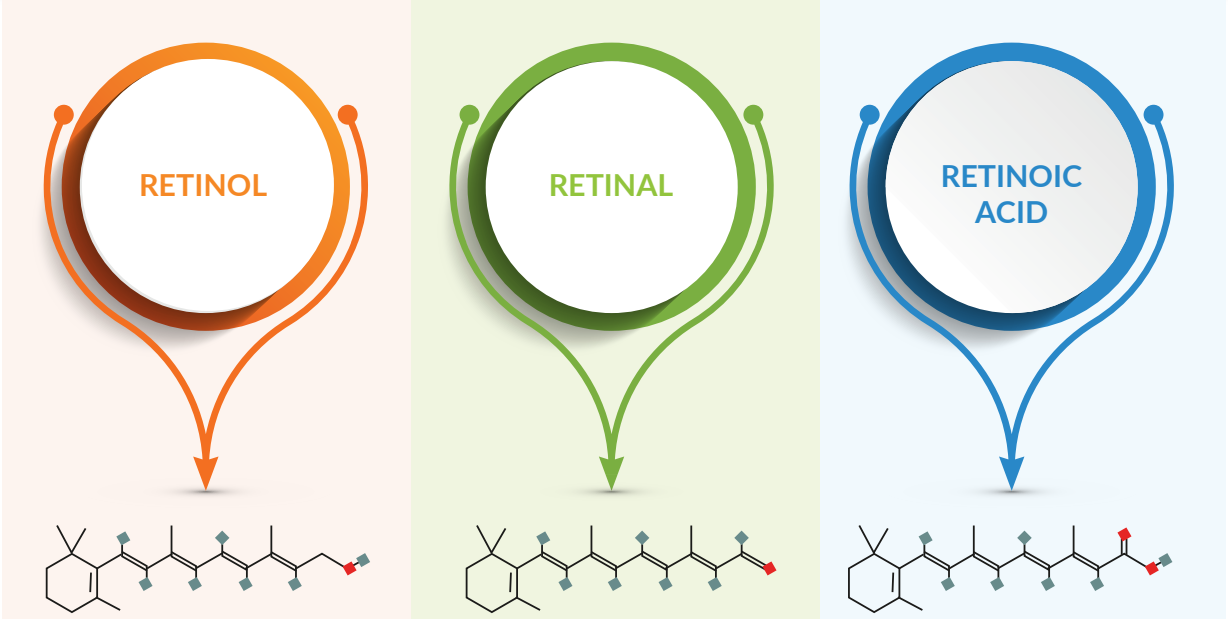
All **cells** may carry the same **DNA** but they are specialised into the various cells that make up the human body: skin cells, fibroblasts, blood cells, muscle cells lung cells etc. When the ovum/egg is fertilized by the sperm cell, millions of molecules must be co-ordinated into making first the primitive cells and then the specialised cells and one **important vitamin** plays a dominant role in that process: **vitamin A**. Vitamin A continues to play its important role as the foetus develops into the embryo and then the baby that matures into an adult. It stops its work when we die.

An **international unit (IU)** is an internationally and scientifically accepted amount of a substance.
It is not an alternative to %. It is the correct way to talk about chemicals.



Atoms are defined as the smallest identifiable unit with the chemical properties of that atom and they are composed of layers or 'shells' of electrons and an inner nucleus of protons and neutrons. The character of the outer shells of the atom define the electrical properties of the atom.

VITAMIN A



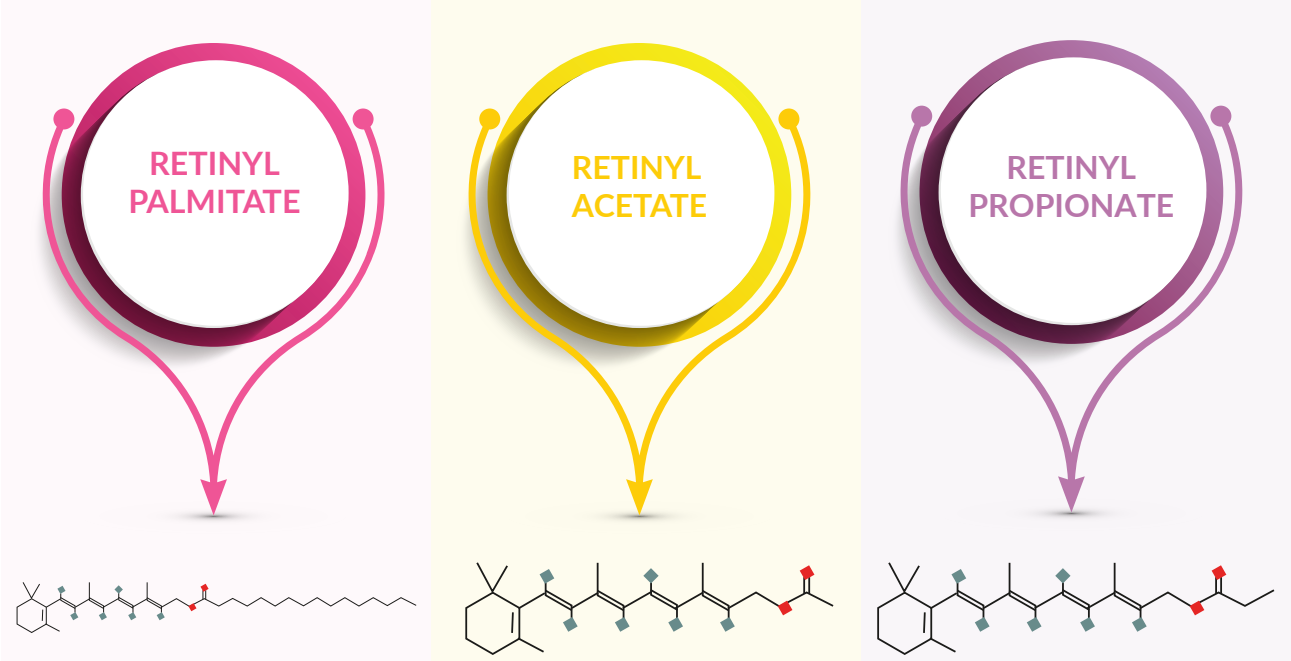
	RETINOL	RETINAL	RETINOIC ACID
FORMULA	$C_{20}H_{30}O$	$C_{20}H_{28}O$	$C_{20}H_{28}O_{2}$*
MOLAR MASS*	286,45g/mol	284,436g/mol	300,4351g/mol
	Retinol is the smallest molecule of vitamin A and because this is the simplest form, it is the official form of vitamin A, however it is not a common form of vitamin A and represents at most about 3% of the vitamin A in the body or piece of meat or fish. The reason why physiologically it is in such low concentrations is that it is rather toxic at higher doses to cellular walls etc. The body purposely keeps the level of retinol down in about the same low concentrations as retinoic acid (and also retinaldehyde/retinal). Retinol is the basic structural component and does not change at all in between all the different forms. Retinol is composed of a six carbon ring with a single double bond and a special chain of carbon and hydrogen atoms. **All other metabolic versions of vitamin A are retinol plus some other atoms.**	Retinal is virtually the same as retinol and only 1 oxygen atom short of retinoic acid. This is also only found in very low quantities in the body (abut 3%) but takes a special role in the eyes because of its sensitivity to light.	In nature we virtually never find retinoic acid in our food, except in the tiniest quantities in animal tissues. At maximum it represents 3% of the vitamin A in the body. It is a very small molecule.

*__Molecular mass__ is __defined__ as the __mass__ in grams of one mole of a substance.
The units of __molar mass__ are grams per mole, abbreviated as g/__mol__.

VITAMIN A

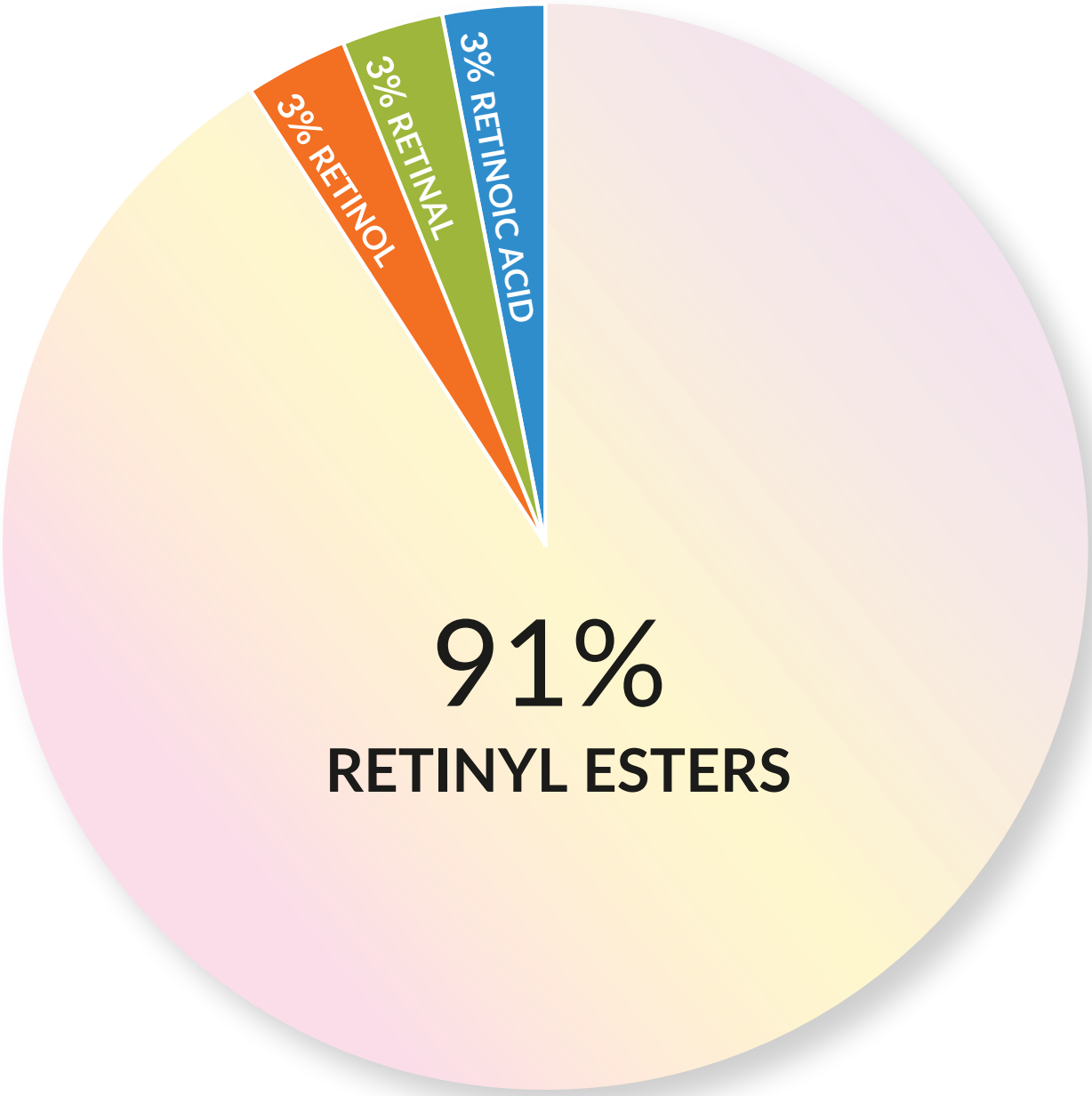
ESTERS OR STORAGE FORMS – CYTOPLASMIC VITAMIN A

Retinol esters are the mildest type of retinoids on skin

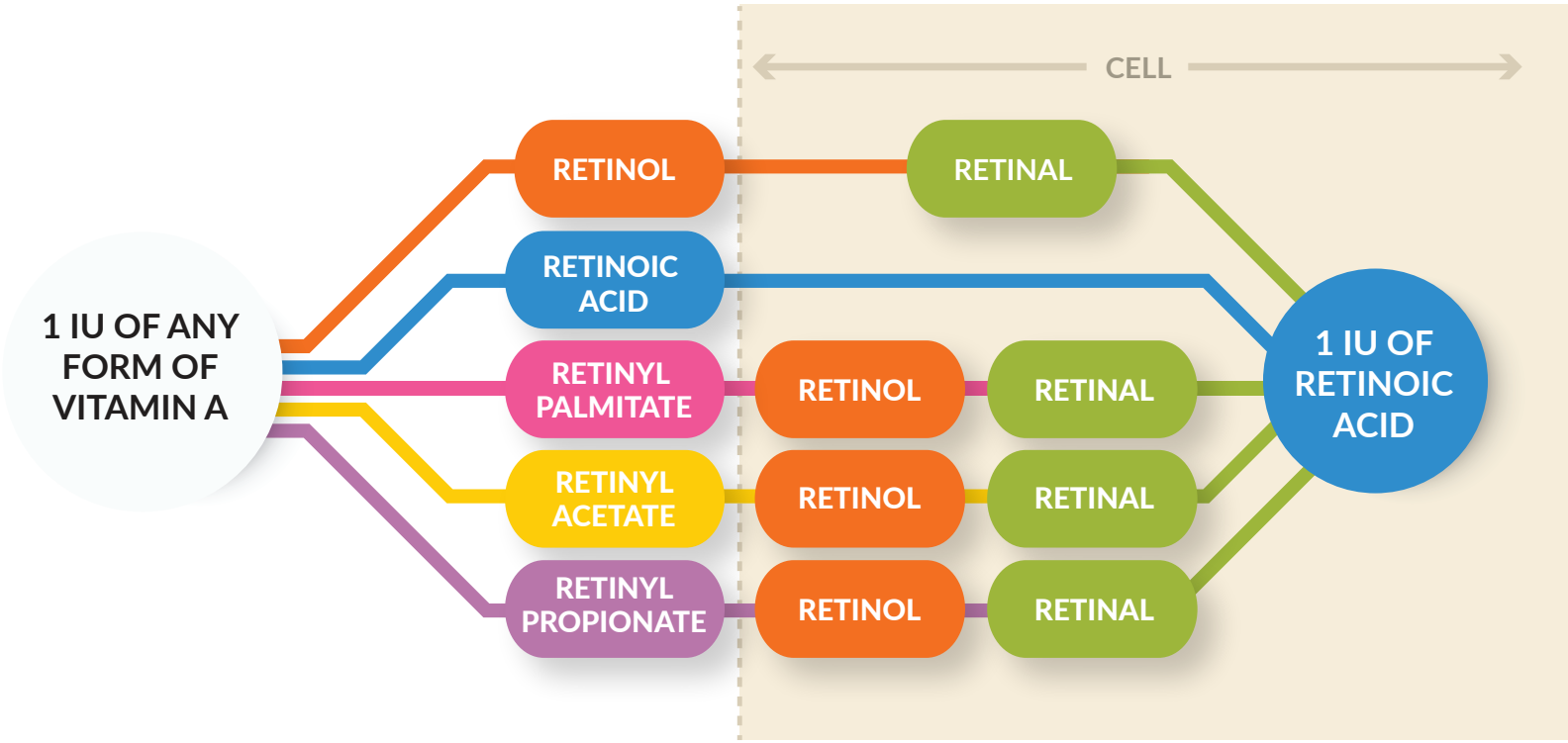


	RETINYL PALMITATE	RETINYL ACETATE	RETINYL PROPIONATE
FORMULA	$C_{36}H_{60}O_2$	$C_{22}H_{32}O_2$	$C_{23}H_{34}O_2$
MOLAR MASS*	524.9g/mol	328,49g/mol	342,51g/mol
	That is 16 carbon atoms, 30 hydrogen atoms and one oxygen atom in addition to retinol. This is the commonest and most complex form of vitamin A in nature because it is so stable except when exposed to light. It is about 80-85% of all vitamin A. Retinyl Palmitate acts as a sunscreen because it absorbs UVA and UVB light and is destroyed by the UV rays.	This is the simplest ester form (2 extra hydrogen atoms and 1 extra oxygen atom from retinol). Retinyl Acetate is more active on skin and is rapidly absorbed into the depths of skin. It is easily converted into Retinol and Retinoic Acid.	Retinyl Propionate is a – light – stable ester unlike retinyl palmitate which needs to be protected from light. Like Retinyl Palmitate, it is gentle on skin and is easily converted to Retinol and Retinoic Acid. It does NOT act as a sunscreen in the same way as Retinyl Palmitate does.

EVERY SKIN CELL CONTAINS ~91% RETINYL ESTERS



VITAMIN A
EQUIVALENTS

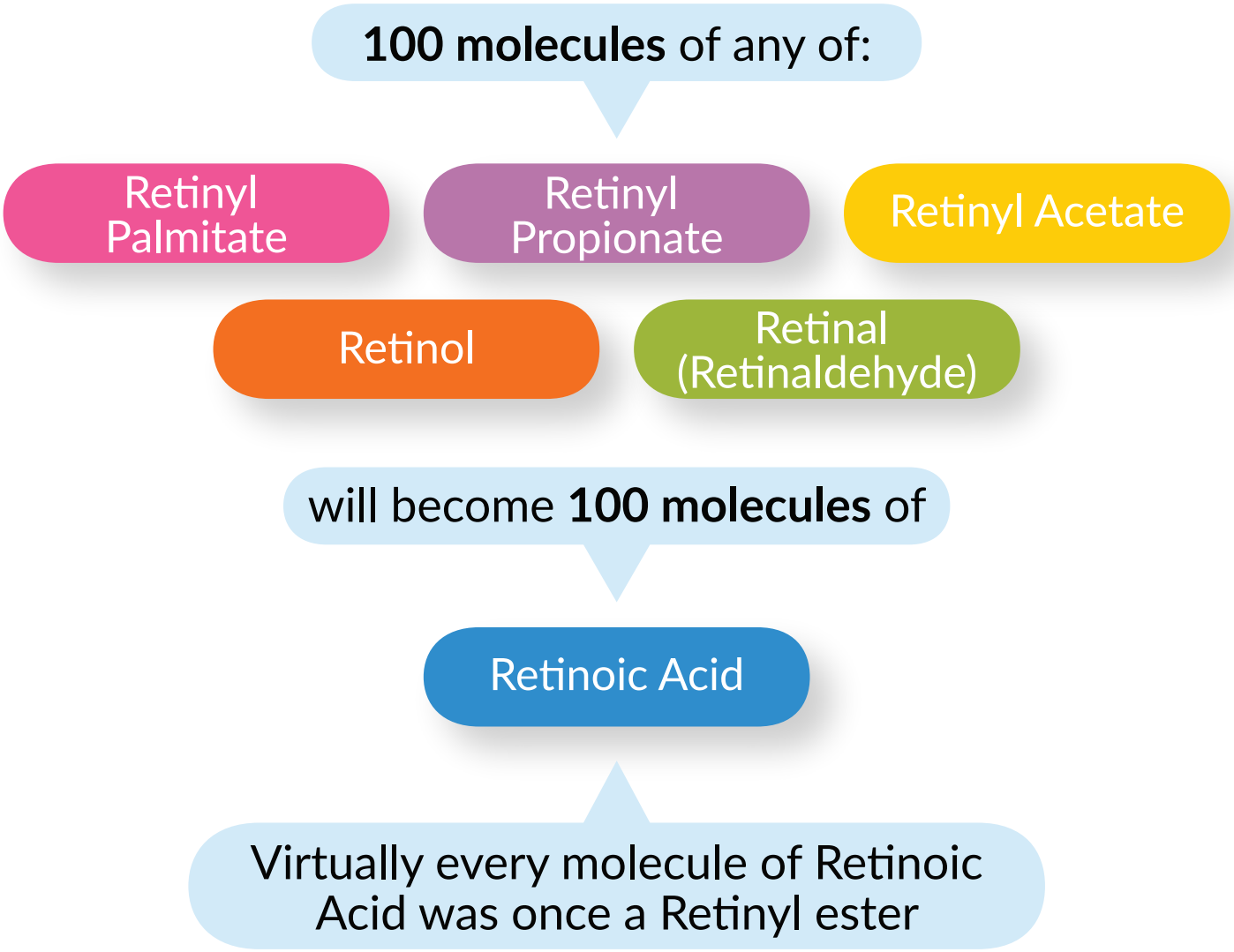


If we put Retinol onto the skin, only a tiny fraction — depending on the cellular levels — will be converted to Retinal and then onto Retinoic Acid.

Importantly however, virtually all of the Retinol will be converted to Retinyl Esters — mainly Retinyl Palmitate.

The same happens for Retinal (Retinaldehyde).

Whatever vitamin A you put on the skin gets converted to Retinyl Esters.
Every single molecule of vitamin A can only become a single molecule of Retinoic Acid.



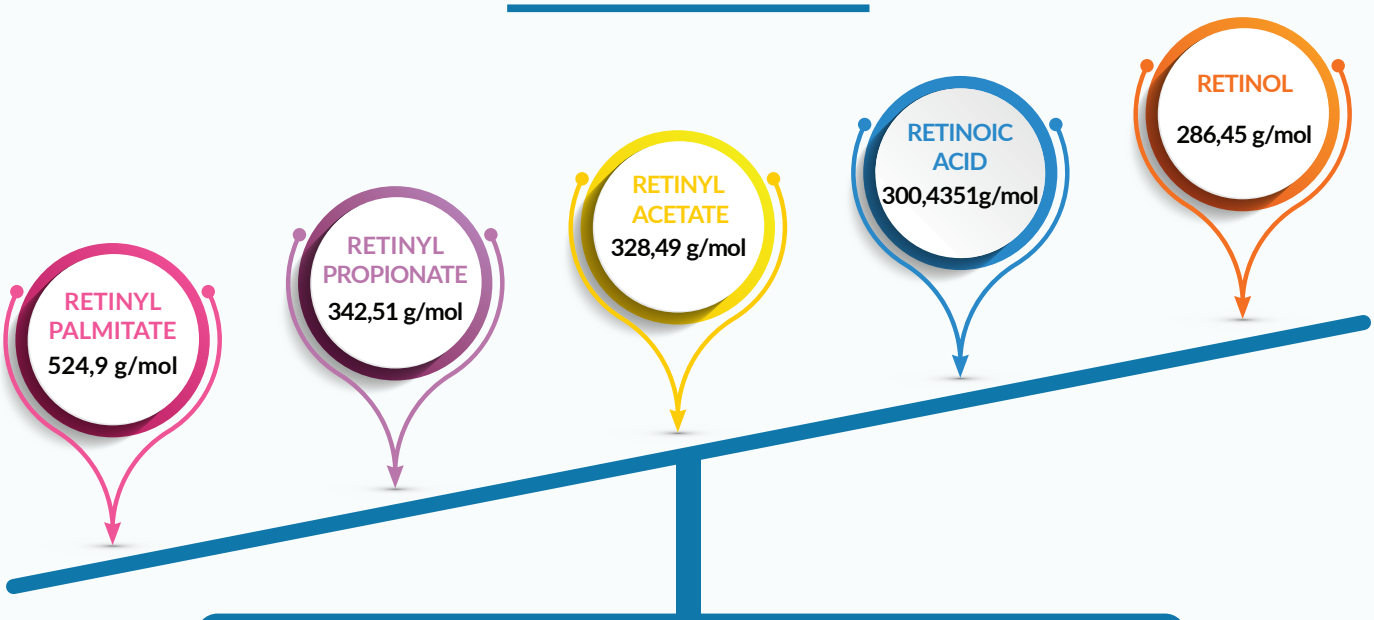
They all weigh differently and that is why we need to work with International units (iu) or retinol equivalents (RE) and not percentages.

Each different molecule, despite weighing differently and having different properties will have the exact same effect once it becomes Retinoic Acid.

Nothing is stronger than anything else.

VITAMIN A
HOW MUCH?

CHALLENGE NO. 1



THE DIFFERENT FORMS OF VITAMIN A DO NOT WEIGH THE SAME
THEY HAVE DIFFERENT MOLECULAR WEIGHTS

CHALLENGE NO. 2

THE RAW INGREDIENT OF VITAMIN A COMES IN VARIOUS STRENGTHS FROM THE MANUFACTURERS

If I use 1% of this to make a product, I have a stronger product

If I use 1% of this to make a product, I have a weaker product

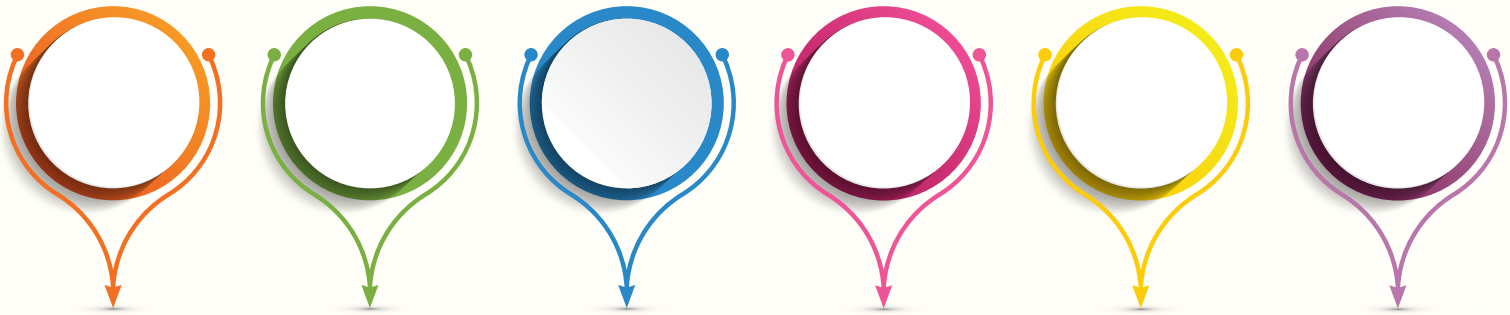
THIS IS WHY WE DO NOT USE PERCENTAGES — IT WOULD
BE IMPOSSIBLE TO BE HONEST ABOUT PRODUCT STRENGTH

SCIENTIST TEAM

Scientists ensured that 1 International Unit of Retinyl Palmitate works the same as 1 iu of Retinol or 1 iu of Retinal to give the effects of Retinoic Acid at 1 iu.*

*https://en.wikipedia.org/wiki/International_unit

NO MATTER HOW DIFFERENT THEY ARE IN COMPOSITION OR WEIGHT **THEY ARE ALL EQUAL** – WHEN INTERACTING WITH A CELL **1 IU** OF EACH BECOMES **RETINOIC ACID** (OR STAYS RETINOIC ACID IF THAT IS HOW IT STARTED) AND HAS THE **SAME EFFECT** ON THE CELL



1 IU RETINOL | **1 IU RETINAL** | **1 IU RETINOIC ACID** | **1 IU RETINYL PALMITATE** | **1 IU RETINYL ACETATE** | **1 IU RETINYL PROPIONATE**

YOUR SKIN FACTORY

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