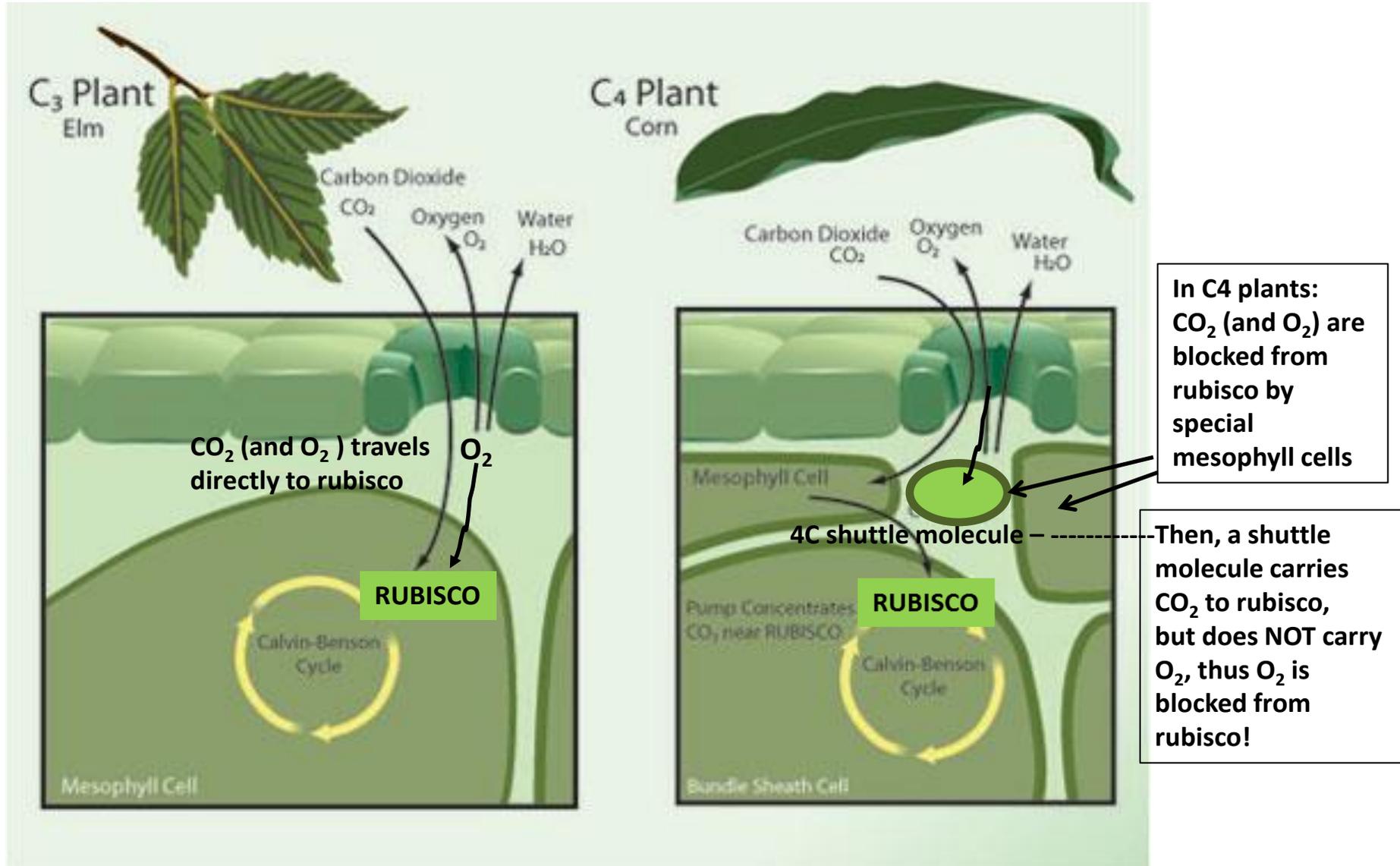


	<b>C<sub>3</sub></b>	<b>C<sub>4</sub></b>	<b>CAM</b>
How CO <sub>2</sub> gets introduced to Rubisco	'Randomly' (cells'open' to ATM via stomata)	Delivered on "shuttle" molecule (4C, thus C <sub>4</sub> )	Delivered on "shuttle" molecule
How Rubisco isolated from O <sub>2</sub>	Not! (Picture 1)	Spatial separation (Picture 2)	Time separation (Picture 3)
Plants that do this	MOST! ~ 90%	Few: 3% Ex: Many grasses: Corn, sugar cane	Few: 7% Ex: Succulents (Cacti, Crassulaceae), orchids, pineapple
Stomata	No strict day/night pattern	No strict day/night pattern	Day = closed Night = open
When it evolved	1 <sup>st</sup> (before C <sub>4</sub> and CAM)	After C <sub>3</sub> , independently of CAM	After C <sub>3</sub> , independently of C <sub>4</sub>
Especially well suited for:	Generalist, lower temps (<25°C)	Hot (>30°C); high light; low [CO <sub>2</sub> ]; dry periods; (tropics)	Hot and dry (stomata closed during day)

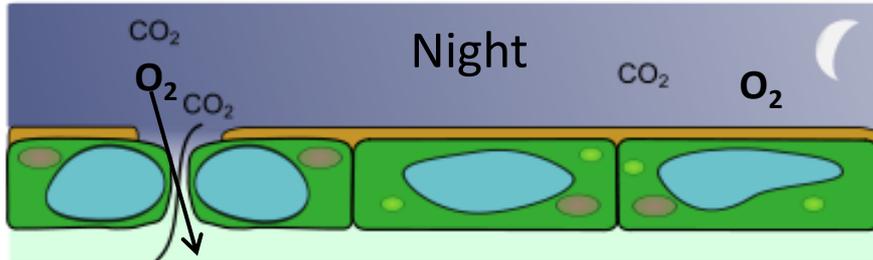
In C<sub>3</sub> plants, CO<sub>2</sub> and O<sub>2</sub> travel to rubisco (via diffusion) and the C atoms from CO<sub>2</sub> are used to build sugar (carbon fixation).



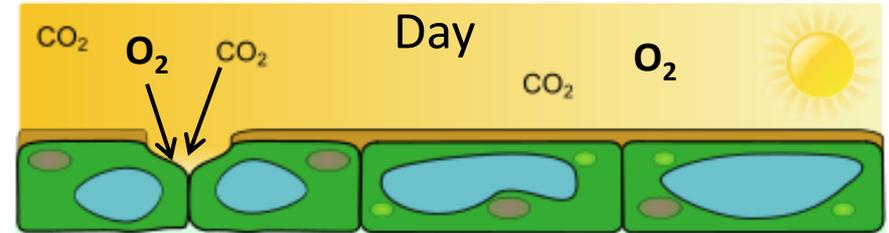
C<sub>4</sub> plants exclude O<sub>2</sub> from rubisco by blocking its direct path of travel, and then shuttling CO<sub>2</sub> to rubisco with special shuttle molecules

# CAM Plants

CAM plants exclude  $O_2$  from rubisco by closing stomata during the day (when rubisco is active), and to do this they must open stomata and stockpile  $CO_2$  at night



- Stomata OPEN at night
- $CO_2$  stockpiled in cell vacuoles; ( $CO_2$  is carried there by shuttle molecules)
- $O_2$  also present, but... $O_2$  not stockpiled in vacuole, and, remember...
- No ATP for Rubisco to operate and thus grab  $O_2$  (no light reactions at night!!)



- Stomata CLOSED during day
- $CO_2$  mobilized from vacuole to rubisco
- Light reactions fire up and provide ATP for Rubisco
- A little bit of  $O_2$  also present, but...
- No "new"  $O_2$  enters once stomata are closed, thus [ $CO_2$ ] remains high

