CERTIFICATE of RECOGNITION

This is to certify that

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participated as

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Plant sterols/phytosterol as functional food and its genetic study

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Phytosterol containing products

Black Currant Beet Belgian White Chocolate, 34% cocoa, with phytosterols and Chaga

Tropicana Slim Non Fat Milk Phytosterol is a non fat milk with good taste for your heart health.

Contains **phytosterol** which can decrease the absorption of cholesterol in the body,

Phytosterol-enriched foods and dietary supplements have been marketed for decade

Why plant sterols is popular?

- Plant-sterols have received much attention in the last several years because of their **cholesterol-lowering properties**.

- They are very important for human consumptions because of their benefit in reducing cholesterol absorption and serum LDL-cholesterol level.

- The prospect of lowering cholesterol levels by consuming ‘‘functional’’ foods fortified with natural phytonutrients would seem more attractive to many than use of drugs or dietary restrictions.

Clinical study of phytosterol

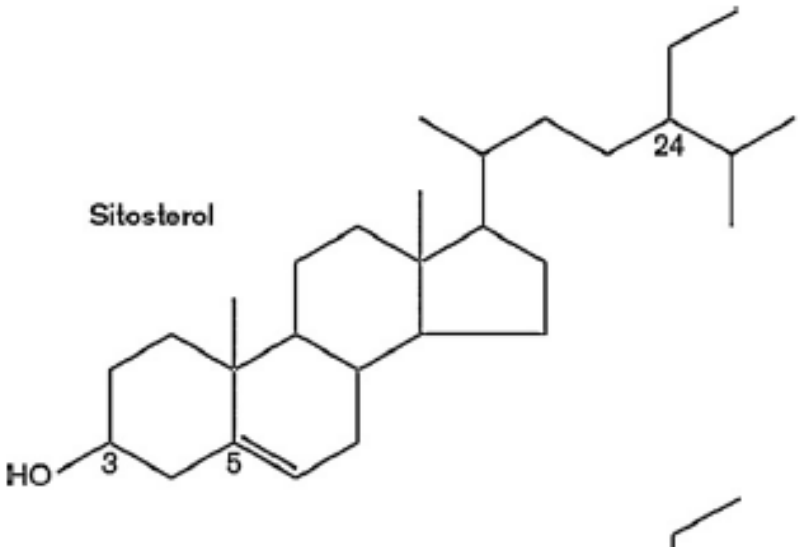
- A daily intake of plant sterols or stanols of 1.6–2 g/day, is able to reduce cholesterol absorption from the gut by about 30%, and plasma LDL cholesterol levels by 8–10% (Moreau et al., 2002; Thompson and Grundy 2005; Marangoni and Poli, 2010).

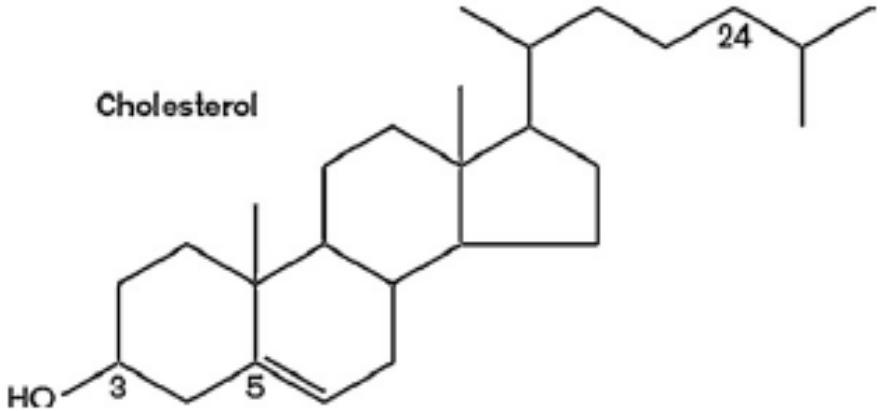
- US Food & Drug Administration (FDA) legalize the health claim sterol ester in reducing the risk of heart disease.

- It also prevents abdomen cancer (De Stefani, Eduardo, et al (2000).

How.....

- Phytosterol reduce cholesterol absorption from the gut, due to their structural similarity with cholesterol.



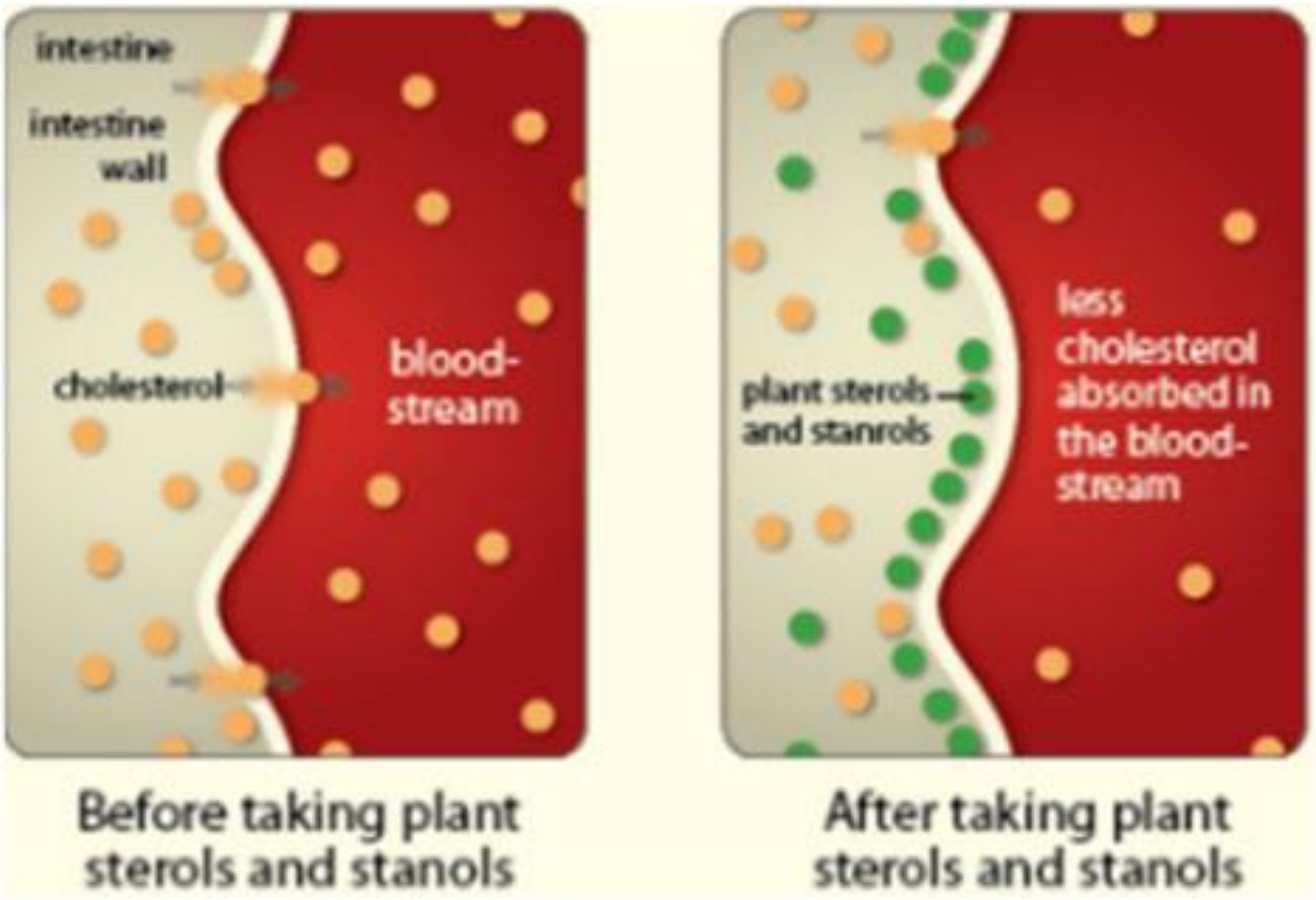


Phytosterols are similar in structure to cholesterol but include a methyl or ethyl group at C-24.

How……

- One of the main mechanisms for cholesterol reduction is prevention of cholesterol absorption by its replacement with plant sterols in the intestinal-micellar phase (Heftman, 1971).

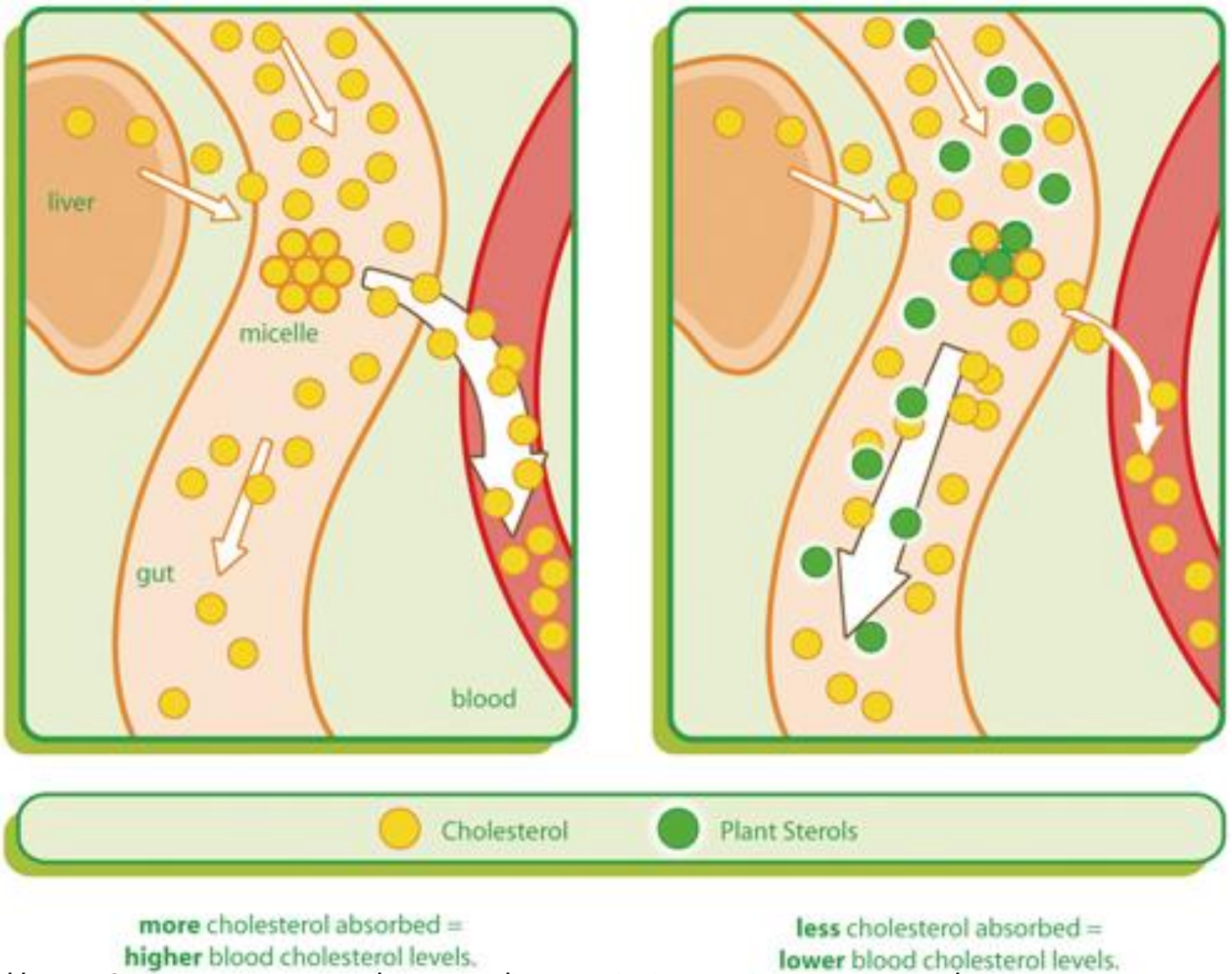
Plant sterols vs cholesterol



http://www.medifoodsco.com/phytosterols-and-your-health/

phytosterols have the capability to act directly inside the digestive system, their competitiveness allows them to block cholesterol absorption by up to 30%-40%.

It reduces the cholesterol amount entering the bloodstream, resulting in lower levels of LDL (bad) cholesterol.



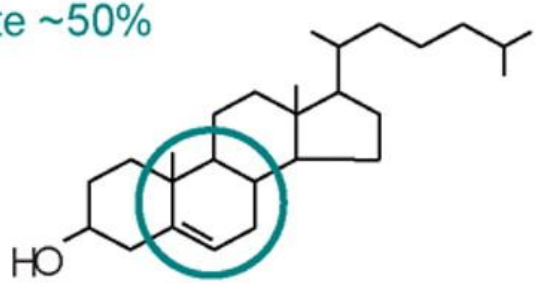
http://www.floraproactiv.co.uk/proactiv/lower-cholesterol-through-diet/plant-sterols.aspx

- It helps in lowering cholesterol levels and reducing the risk of cardiovascular disease.

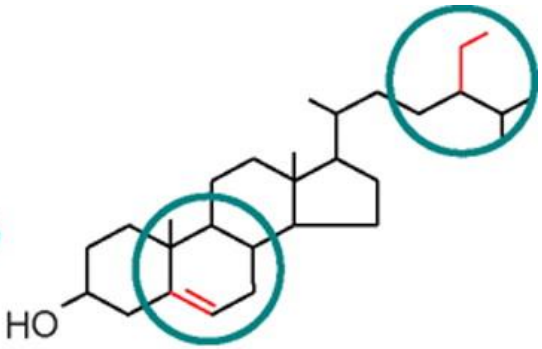
- Another important characteristic of Phytosterols, is that they will not interfere with the development and absorption of HDL (good cholesterol).

Plant sterol is less efficient absorpted than cholesterol

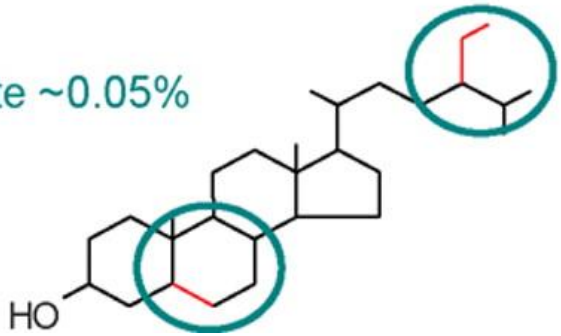
Cholesterol
Absorption rate ~50%



Plant sterol
Main component:
sitosterol
Absorption rate ~0.5%



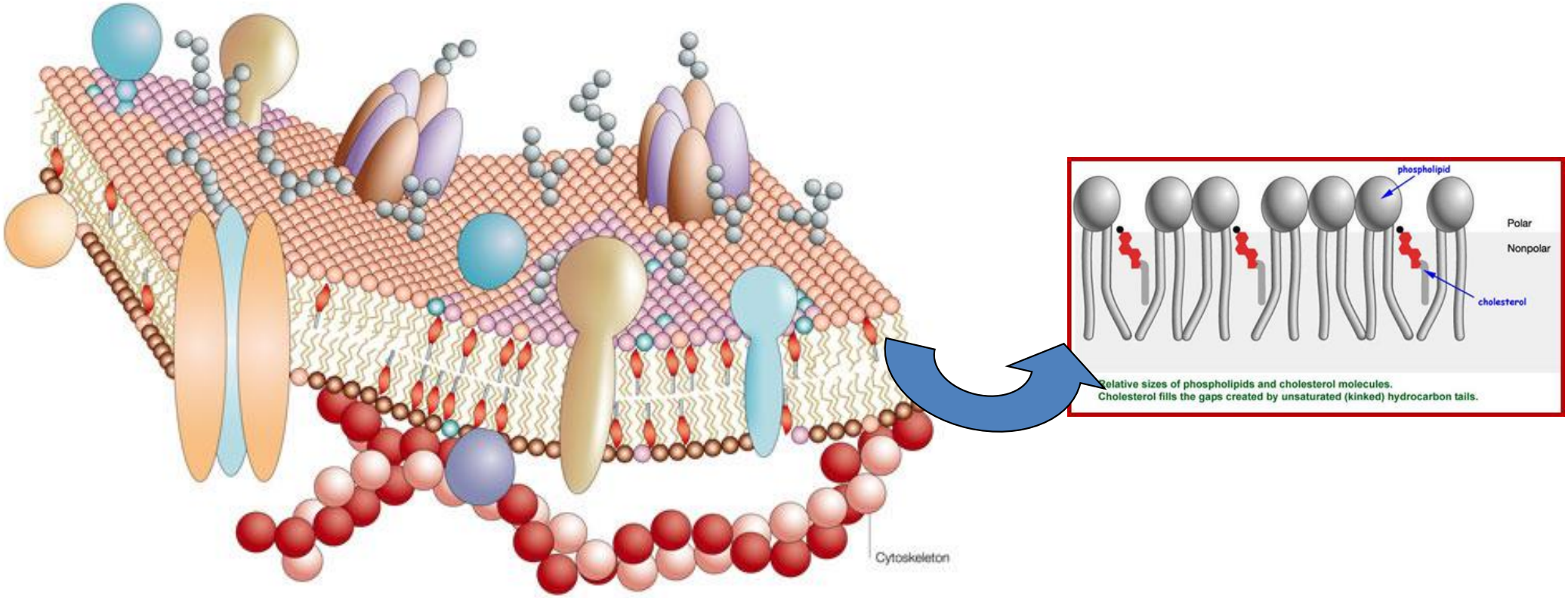
Plant stanol
Main component:
sitostanol
Absorption rate ~0.05%

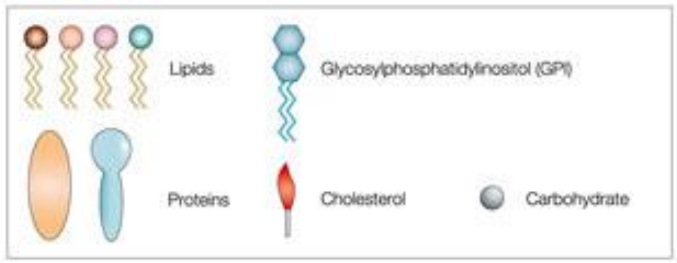


Their longer side chain makes phytosterol/stanol are less absorbed than cholesterol (

What is Plantsterol ???

Plant sterols (phytosterols) are important structural components of plant cell membranes.

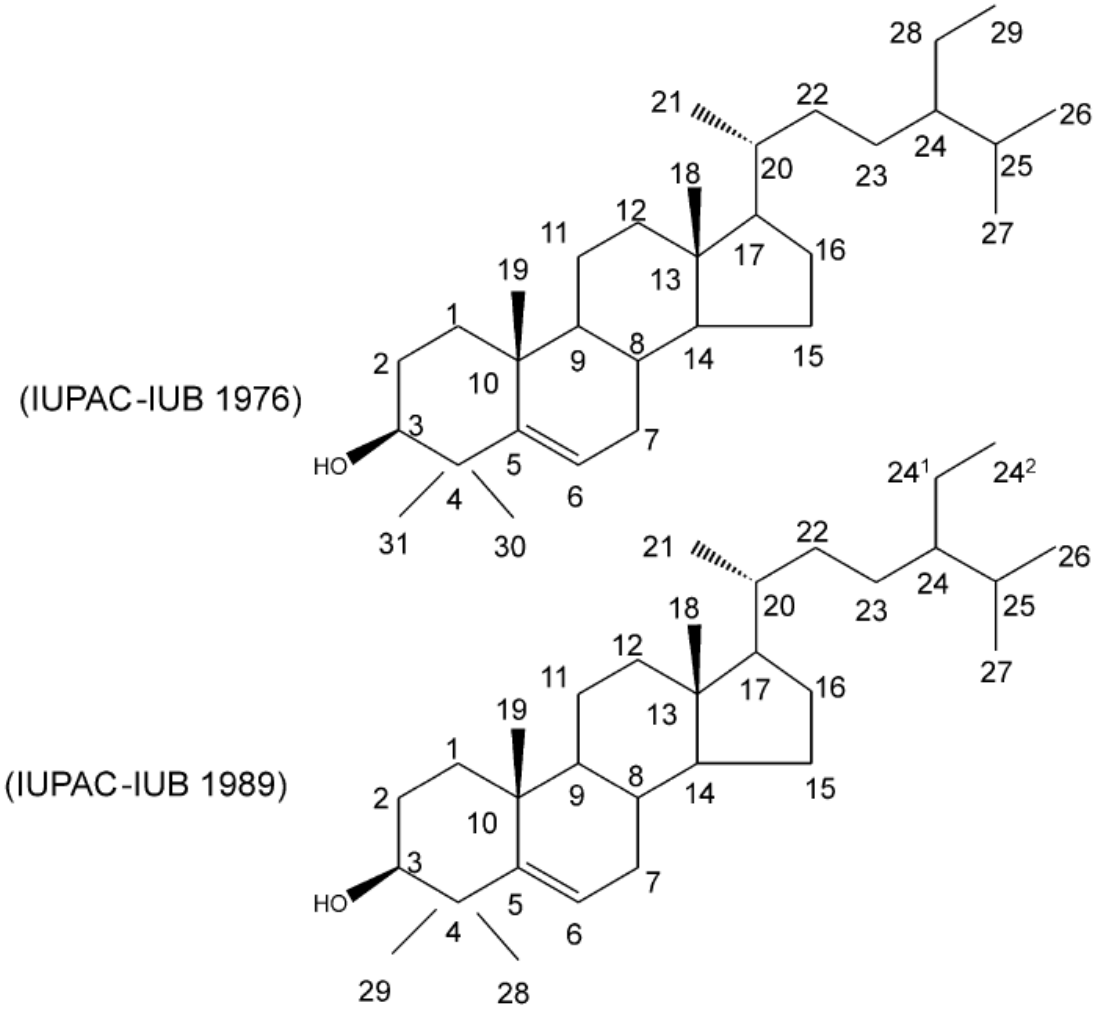




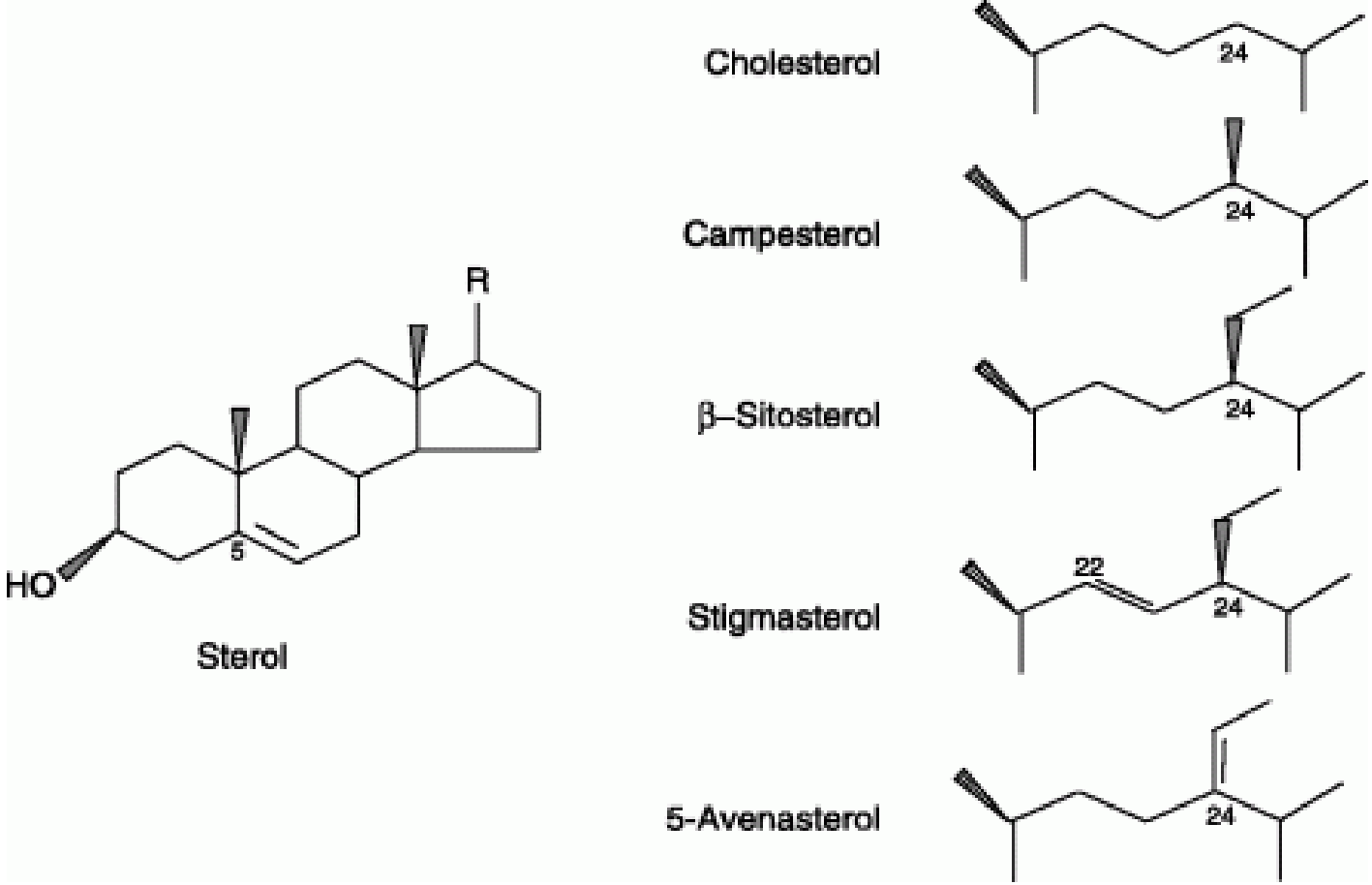
Free phytosterols stabilize phospholipid bilayers in plant cell membranes just as cholesterol does in animal cell membranes.

http://plantcellbiology.masters.grkraj.org/html/Plant_Cellular_Structures3-Plasma_membrane.htm

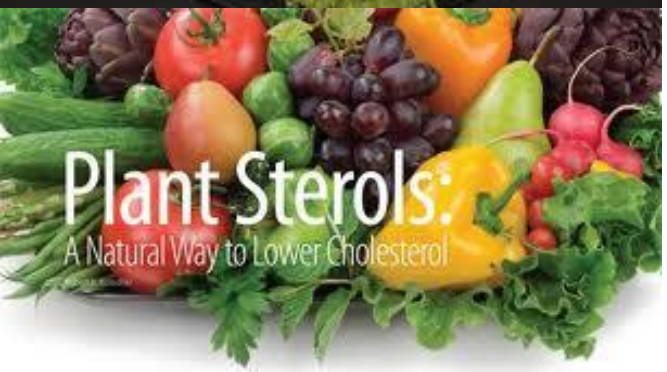
Phytosterol chemical structure



Marangoni and Poli et al., 2010



- Phytosterol profile varying between species.
- Phytosterols are difficult to quantify in foods because more than 200 of them exist.
- The most commonly found phytosterols in foods: sitosterol, stigmasterol, avenasterol, brassicasterol, and campesterol - that are usually measured.



Phytosterol dietary source

The following foods contain the highest amounts of phytosterols (Chen et al., 2008):

- Oilseed
- Nuts
- Whole grain products
- Vegetables
- Fruits

Plant sterols cannot be endogenously synthesized by humans, their circulating levels are only dependent upon diet and absorption efficiency.

Sterol concentration of the various dietary fats

Sterol	Test diet[1]			
	CA	SO	CO	OO
	mg/100 g diet			
Cholesterol	0.5	0.2	0.2	0.0
Brassicasterol	9.2	0.2	0.1	0.0
24-Methylene cholesterol	2.2	0.2	1.9	0.0
Campesterol	30.6	8.2	22.7	1.0
Stigmasterol	0.5	5.7	8.3	0.3
Δ7-Campesterol	0.8	0.9	0.9	0.5
Clerosterol	1.5	0.0	1.3	0.6
β-Sitosterol	48.1	19.2	66.6	21.4
Sitostanol	0.7	1.5	3.5	0.0
Δ5-Avenasterol	2.5	0.0	6.9	3.1
Δ5,24-Stigmastadienol	1.4	0.5	1.7	0.5
Total phytosterols	97.4	36.3	114.0	27.4
Total sterols	97.9	36.5	114.1	27.4

[1] Test diets: CA, canola oil; SO, soybean oil; CO, corn oil; OO, olive oil;

Walisundera et.al., 2000. Vegetable Oils High in Phytosterols Make Erythrocytes Less Deformable and Shorten the Life Span of Stroke-Prone Spontaneously Hypertensive Rats. *Nutr. 130 (5) 1166-1178*

GENETICS ???

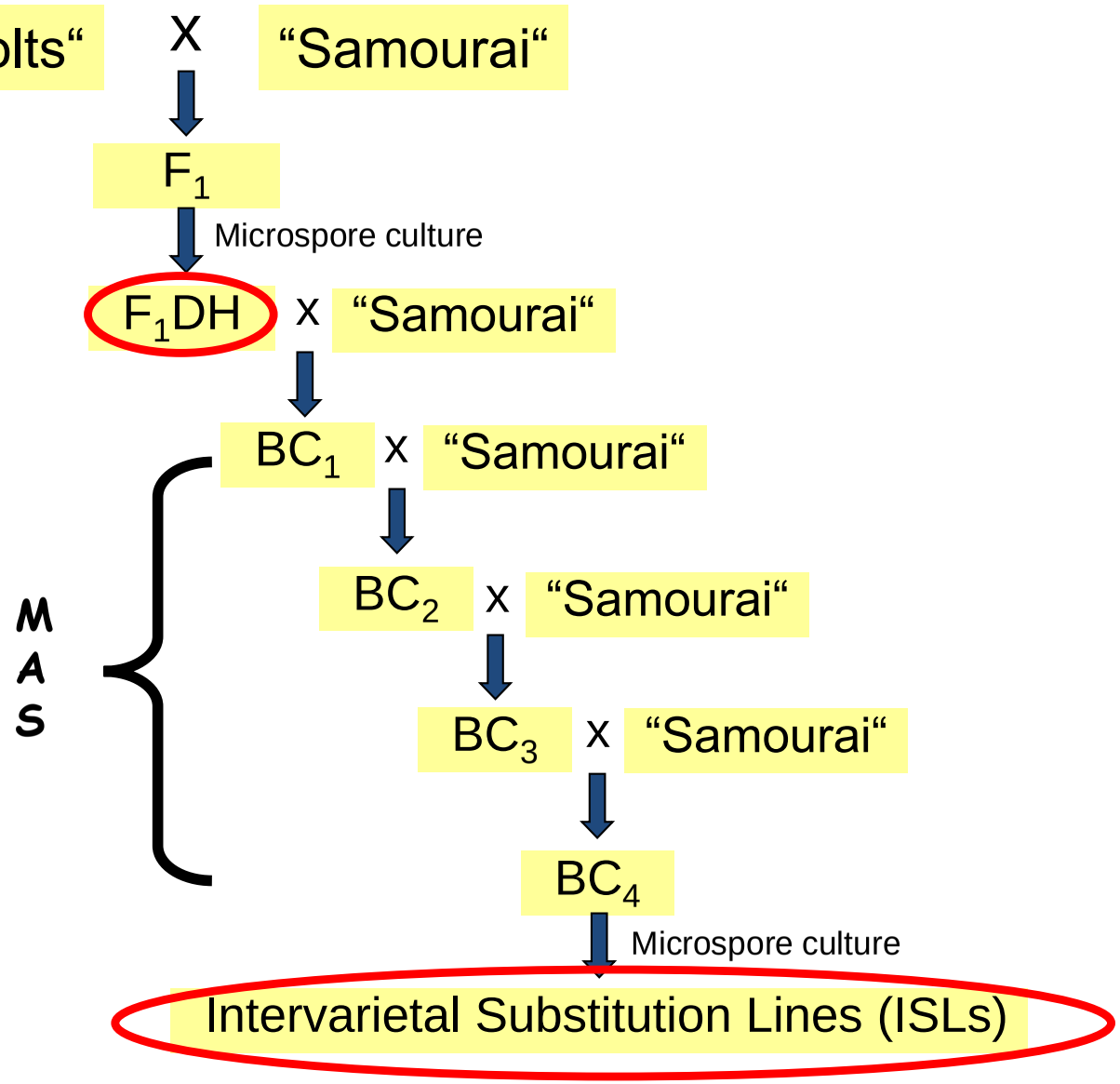
- Only few studies reporting about genetic variation on phytosterol.

- Whereas possible correlations between phytosterols and other seed quality traits have not been well investigated.

Genetic study of phytosterol in rape seed

Genetic mapping of phytosterol in early and advance population

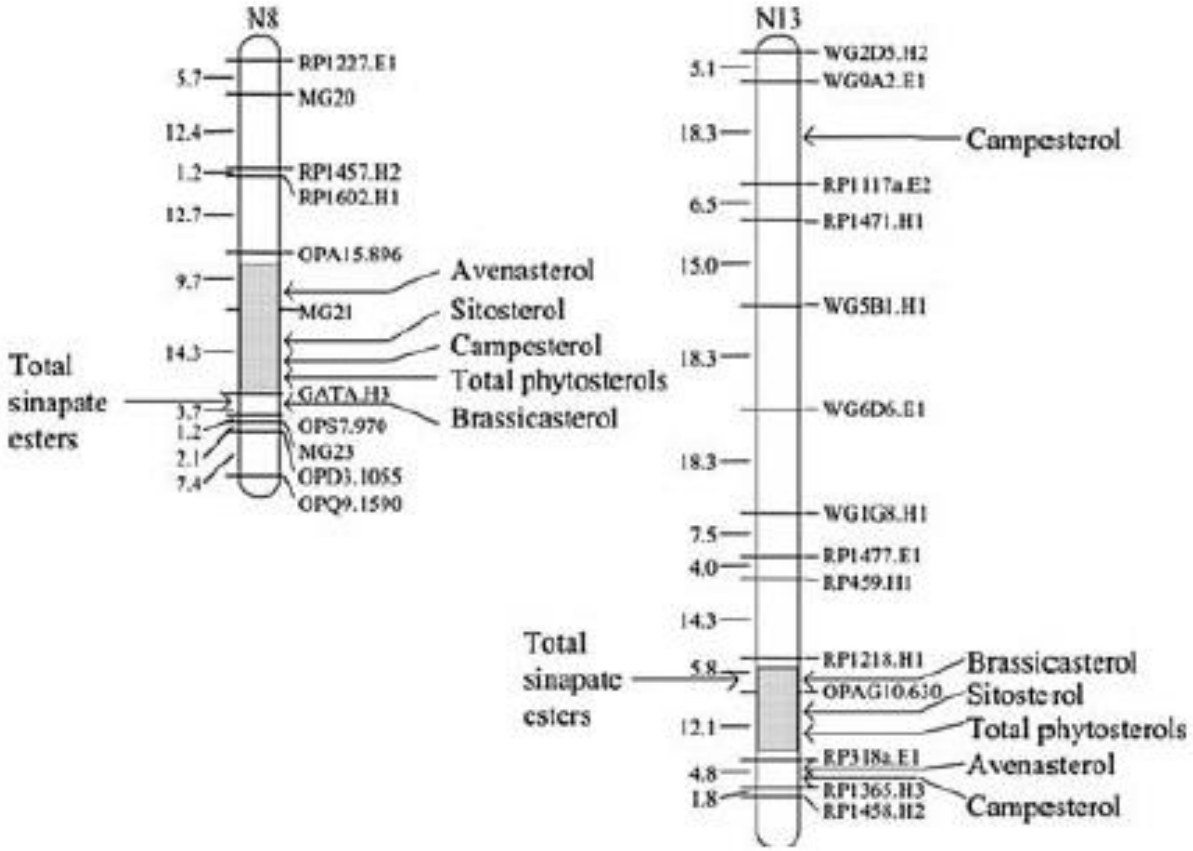
Mapping of phytosterol in early population by Amar et al. 2008



Mapping of phytosterol in advance population by Nurhasanah, 2010

In early mapping population

- In rapeseed, two major of three QTL detected for total phytosterol content, with the strongest additive effect, map on the same linkage group and within the confidence intervals of two erucic acid genes (Ammar et al., 2008).



There is a strong negative correlation between phytosterol and erucic acid

	Oil	Protein	GSL	C18:1	C18:3	C22:1	S	SE
Protein	-0.77**							
GSL	-0.19**	0.21**						
C18:1	-0.37**	-0.12*	0.01					
C18:3	-0.56**	0.43**	0.14*	0.10				
C22:1	0.56**	-0.02	-0.05	-0.92**	-0.36**			
S	-0.48**	0.46**	0.92**	0.13*	0.29**	-0.21**		
SE	-0.19**	-0.14*	0.02	0.58**	0.43**	-0.59**	0.09	
Phyto	-0.42**	-0.15*	-0.03	0.87**	0.34**	-0.96**	0.07	0.59**

*, **: Significant at p=0.05 and p=0.01, respectively (according to Pearson correlation)

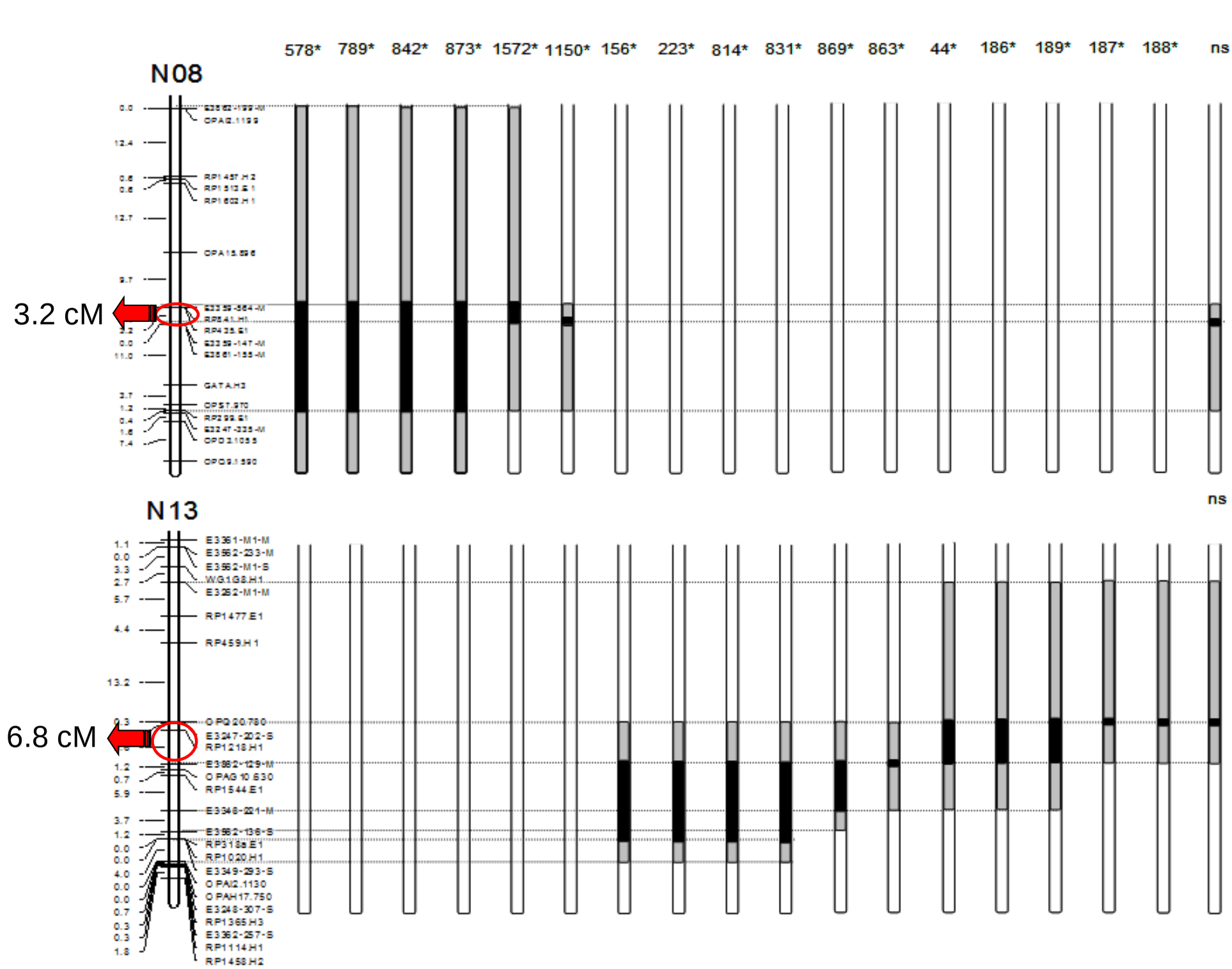
Suggested that the two erucic acid genes exert a negative pleiotropic effect on phytosterol.

Nr	DH lines	Phytosterol (mg/kg) [1]	Erucic acid (%)[1]	Linkage Group
1.	578	-672.73	33.75	N08
2.	789	-544.05	29.32	N08
3.	842	-638.99	30.44	N08
4.	873	-681.42	31.76	N08
5.	1150	-559.28	27.02	N08
6.	1572	-630.53	30.55	N08
7.	44	-573.56	32.22	N13
8.	156	-563.60	31.22	N13
9.	186	-622.37	31.42	N13
10.	187	-524.58	26.98	N13
11.	188	-644.78	32.39	N13
12.	189	-549.16	31.38	N13
13.	223	-520.53	29.18	N13
14.	814	-535.28	31.96	N13
15.	831	-624.69	34.26	N13
16.	863	-546.27	28.83	N13
17.	869	-517.66	31.50	N13

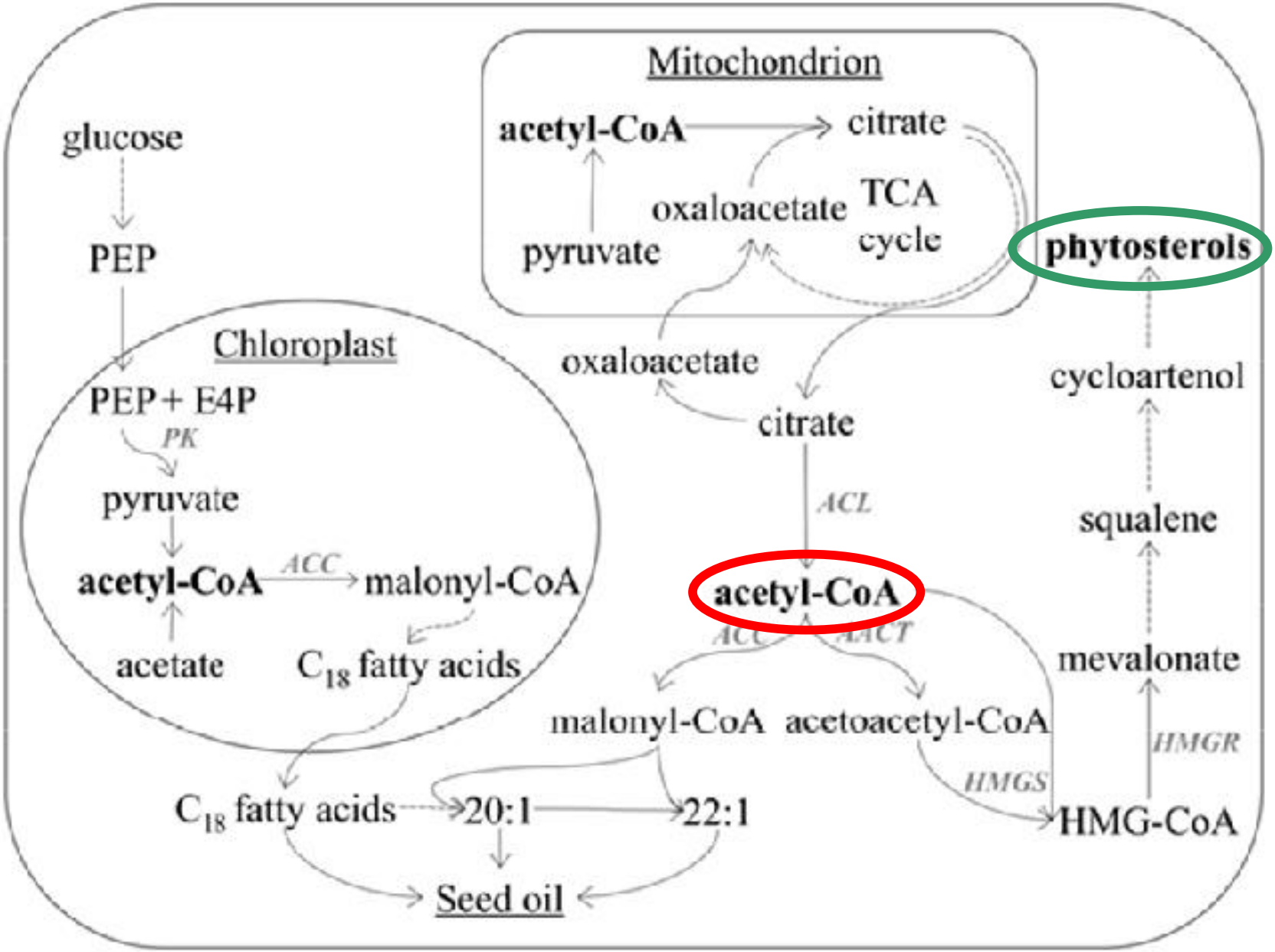
In advance mapping population

- Using intervarietal substitution lines of rapeseed, the QTL for Phytosterol content were mapped on N08 and N13 with maximally interval of 3.2 and 6.8 cM, respectively,

- which co-located with the two seed erucic acid genes (Nurhasanah 2010).


578*
789*
842*
873*
1572*
1150*
156*
223*
814*
831*
869*
863*
44*
186*
189*
187*
188*
ns
N08
3.2 cM
GATA.H2
N13
ns
6.8 cM

Biosynthetic pathway of phytosterol



(Fatland et al. 2005)

Phytosterol biosynthetic pathway

- The negative pleiotropic effect between these traits is explained based on biosynthetic pathway by the competition for cytoplasmic acetyl-CoA, an early essential precursor for erucic acid and phytosterol content, and the competition for plastidic phosphoenolpyruvate, a common precursor for de novo fatty acid biosynthesis.

- This suggested either a pleiotropic effect of the erucic acid genes on the phytosterol content or they could be closely linked to the two erucic acid genes.


Phytosterols - Plant Sterols
Thank you
Terima Kasih
Thank you
Lowering Cholesterol Naturally
www.HealthAdvisoryCenter.com