



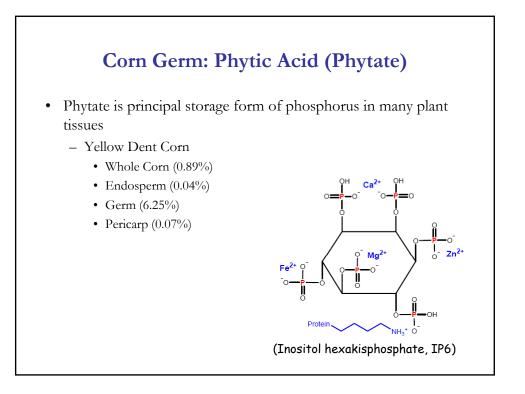
# Aleurone layer

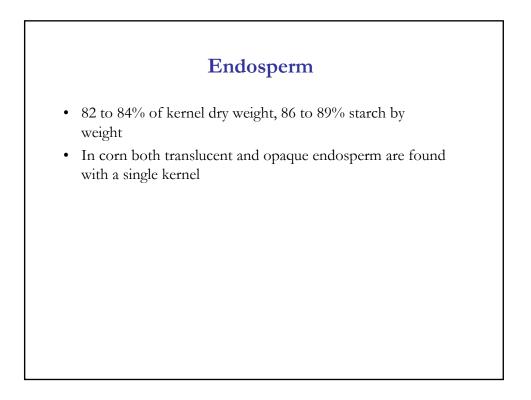
- Aleurone layer beneath seed coat
- Aleurone layer cells contain protein bodies (good amino acid profile), oil bodies, and no starch. It is rich in minerals (phytin)
- Removed with pericarp in wet milling

# Germ

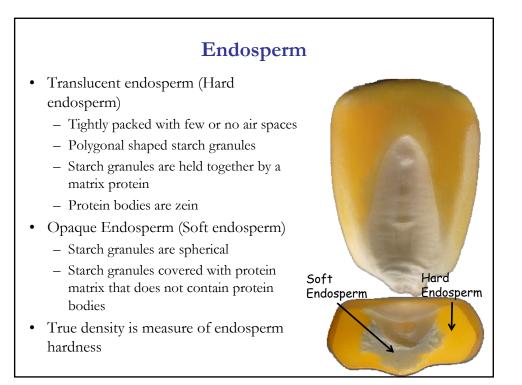
- 10 to 12% of kernel dry weight
- Stores nutrients and minerals
- Contains 81 to 85% of total kernel oil (mostly triglycerides)
- Composed of embryo and scutellum
- Scutellum contains oil bodies

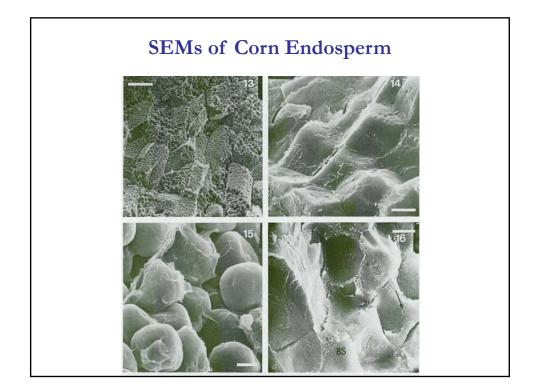




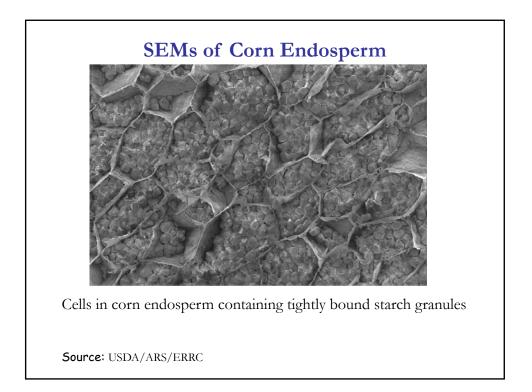


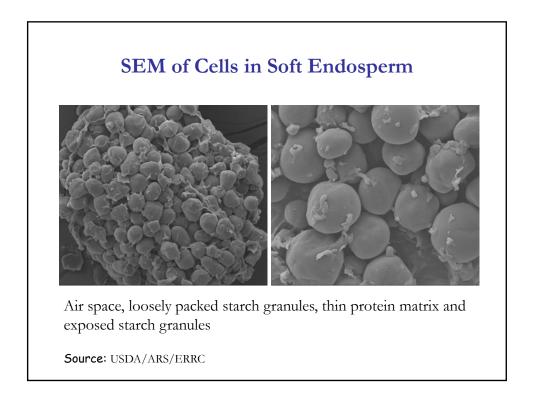




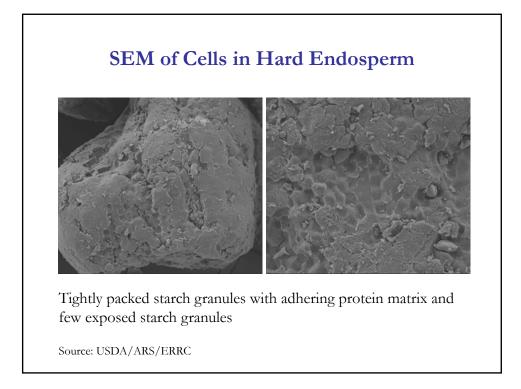


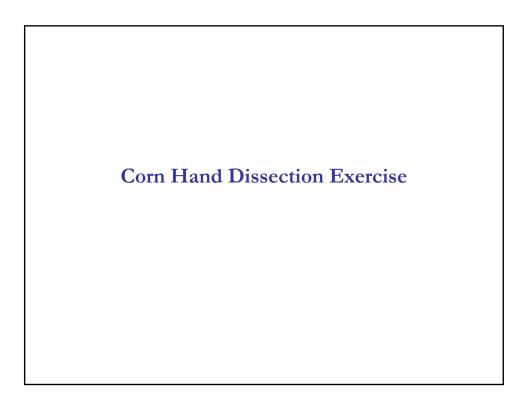






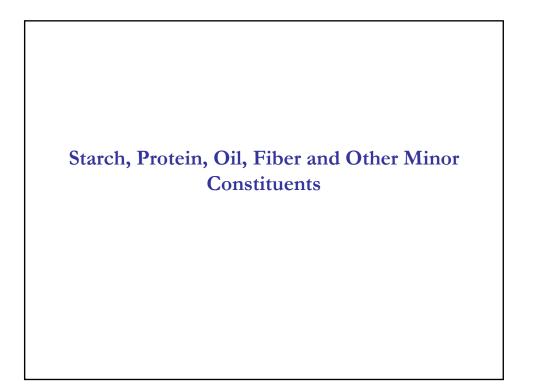














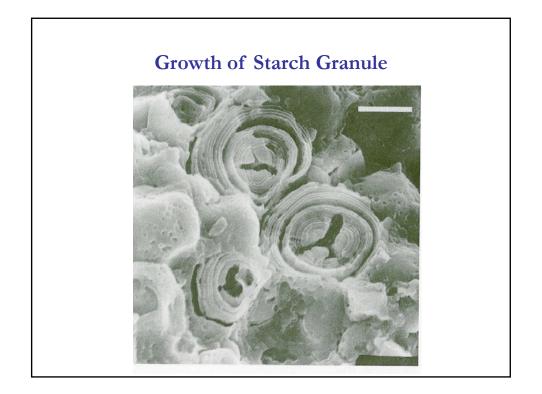
### Starch

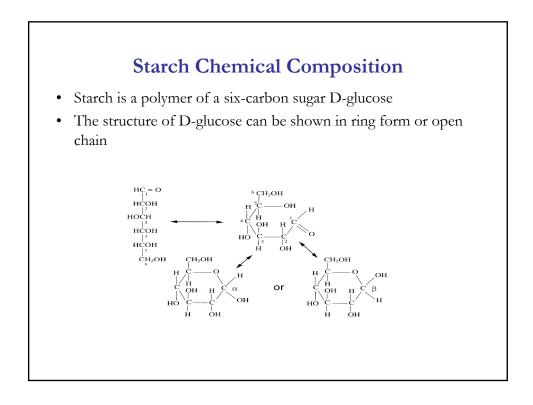
- Primary source of stored energy in cereal grains
- 60-75% weight of grain
- Used in several food and industrial applications

# **Starch Physical Structure**

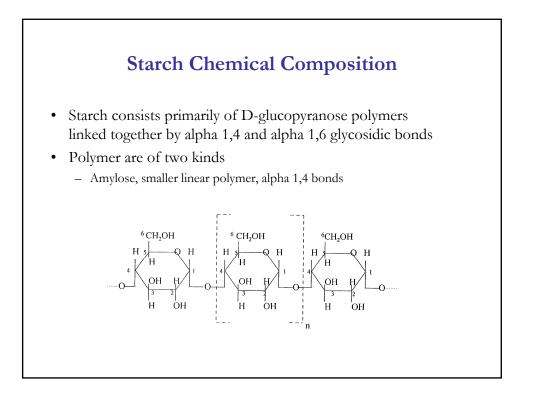
- Found in form of granule in cereal grains
- Granules are formed inside plastids
- In wheat, rye, barley, sorghum inside a plastid there is a single starch granule
- In rice and oats there are several or compounds starch granules
- Starch granules grow in layers

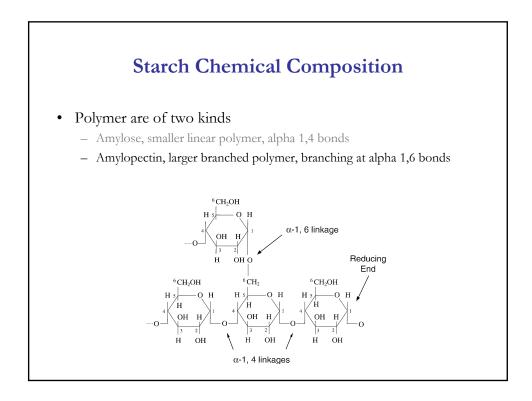




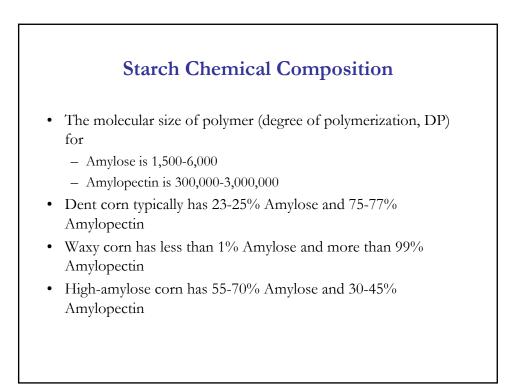


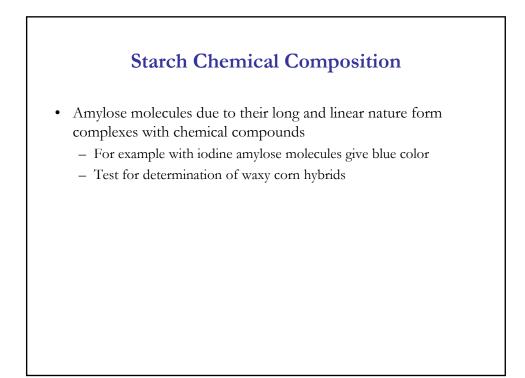




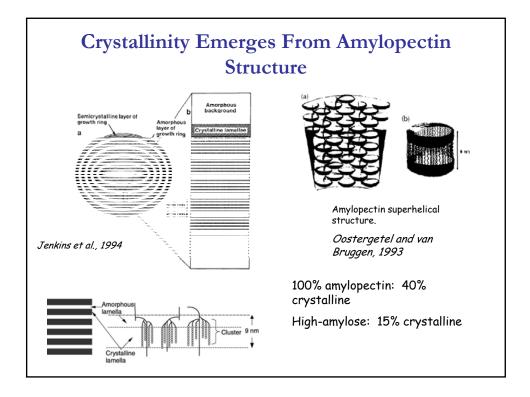


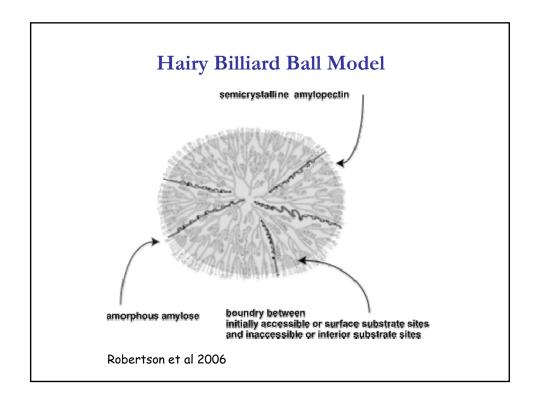




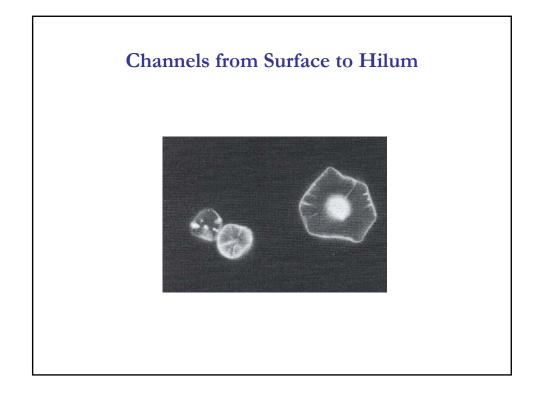


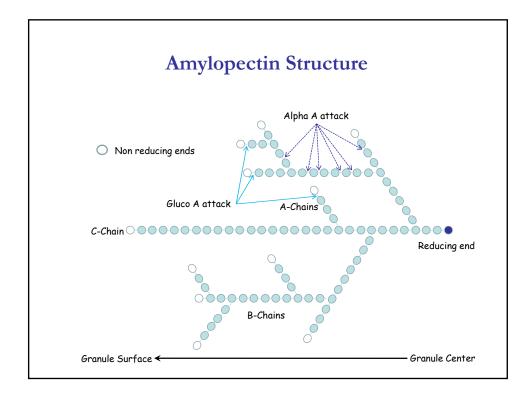




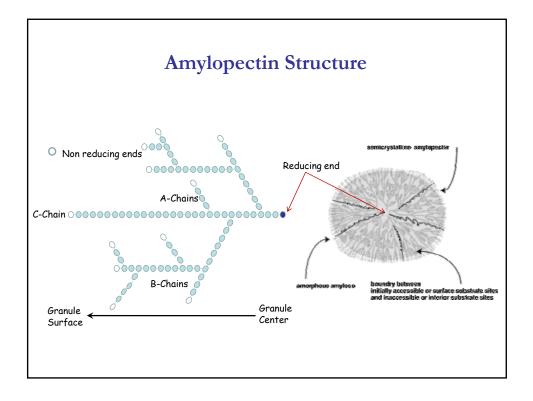


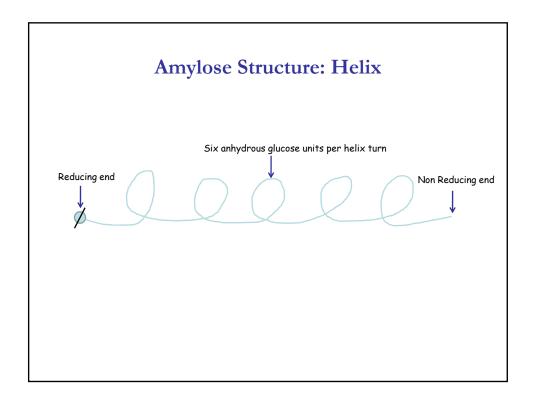




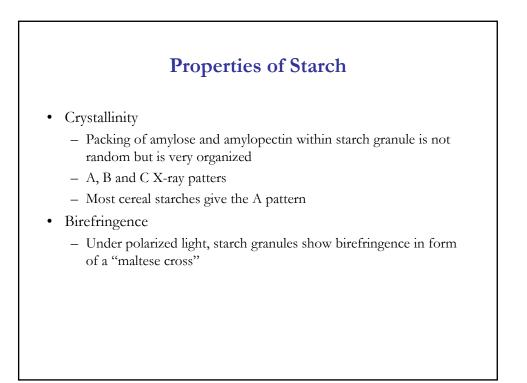


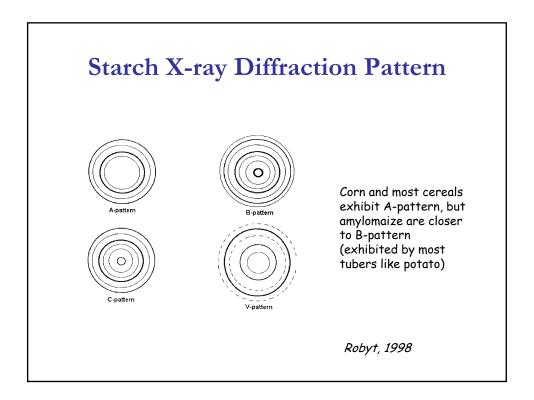




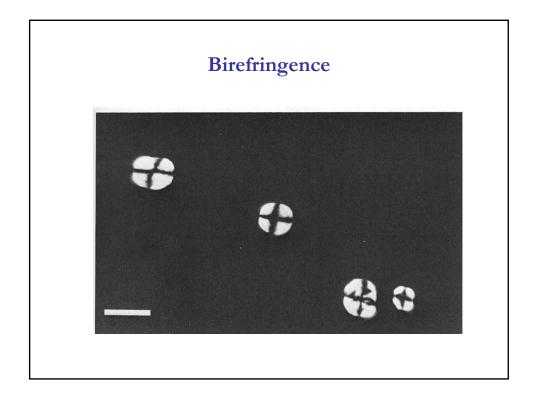


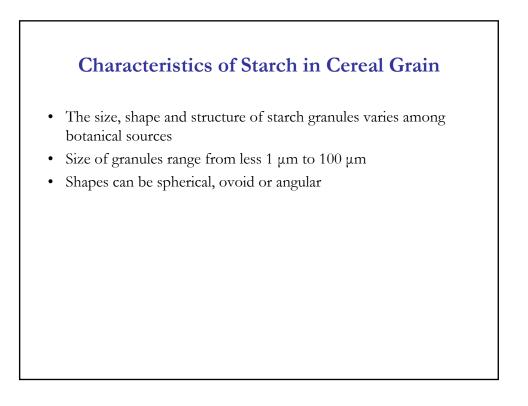






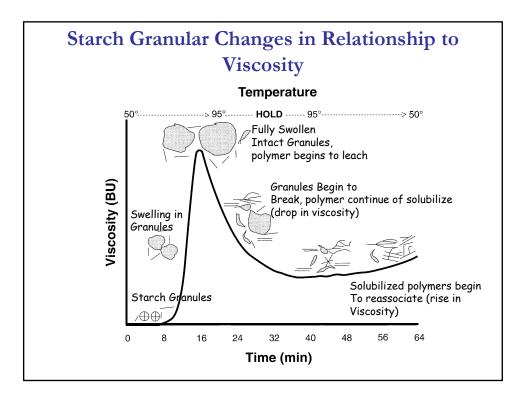








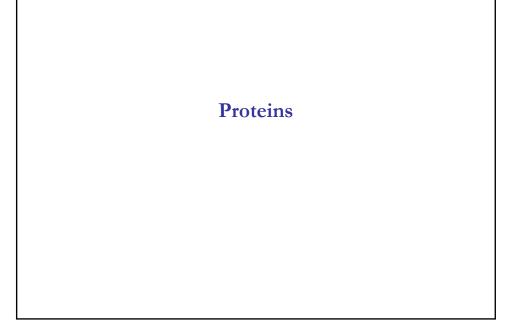
Cereal Grain	Gelantinization Temperature	Shape	Granule Size
	(°C)		(μm)
Barley	51-60	Ellipitical	20-25
		Spherical	2-6
Wheat	58-64	Lenticular	25-35
		Round	2-10
Corn	62-72	Round/Polyhedral	15
Rice*	68-78	Polygonal	3-8
Sorghum	68-78	Round	15
Oats*	53-59	Polyhedral	3-10
Rye	57-78	Round/Lenticular	28

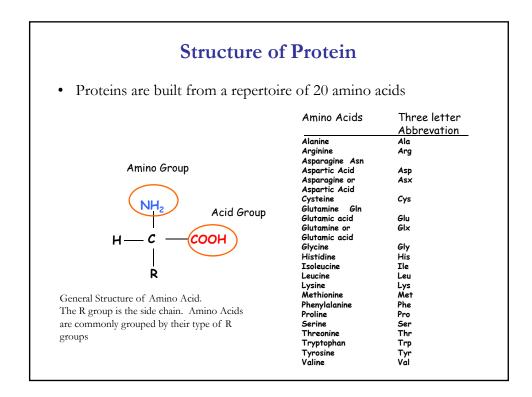




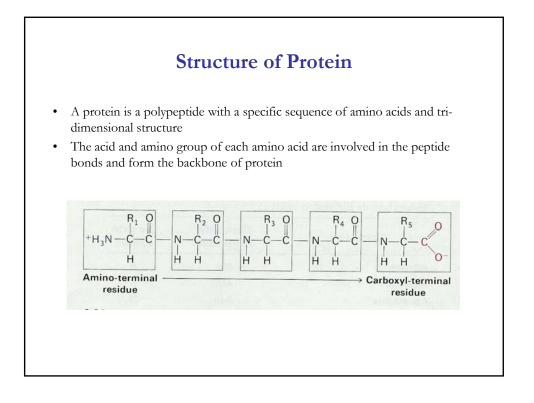


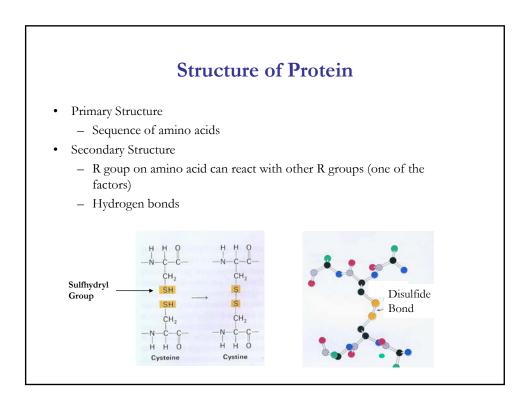
Singh – Corn Structure and Composition



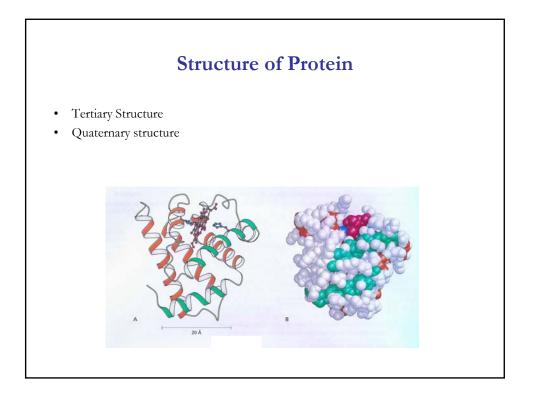


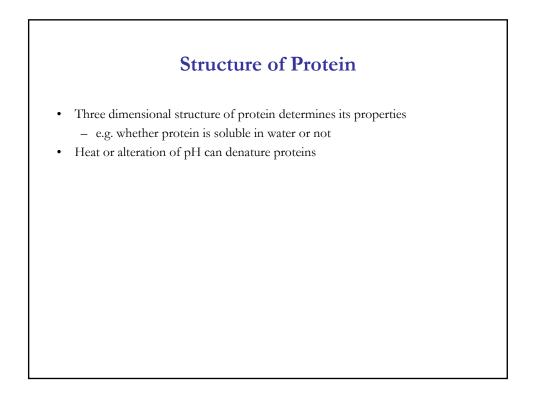














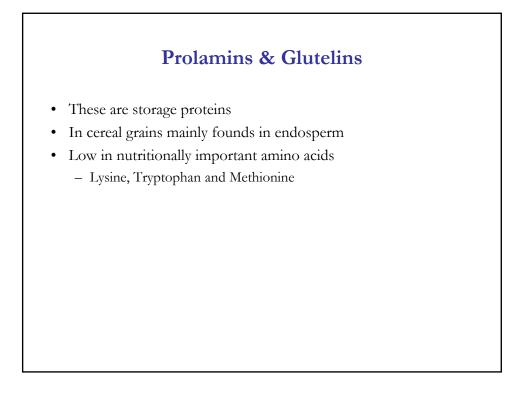
### **Classification of Protein**

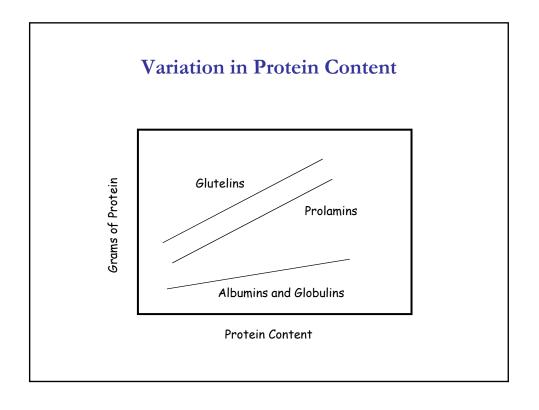
- Generally classified into four types according to their solubility (work by T. B. Osborne)
  - Albumins: soluble in water e.g. egg white
  - Globulins: soluble in dilute salt solutions
  - Prolamins: soluble in 70% alcohol
  - Glutelins: soluble in dilute acid or base
- This classification is widely used but the fractions obtained are not clear cut
  - e.g. prolamins have limited solubility in water at low ionic strength
  - better classification can be done by several analytical techniques such as electrophoresis, isoelectric focussing, gel filtration etc.

### Albumins & Globulins

- Most of the physiologically active proteins (enzymes) are present in albumins and globulins
- These proteins in cereal grains are mainly in aleurone layer, bran & germ fractions
  - Very low in endosperm
- Good amino acid balance
- High in Lysine, Tryptophan and Methionine







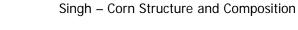


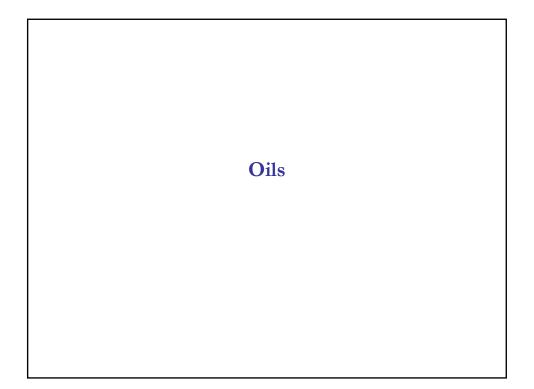
### **Protein Content Determination**

- Protein content of cereal grains is estimated as the nitrogen content times 6.25
  - This factor is used for all cereals except for rice and wheat

# Corn Proteins Protein in Corn Endosperm 5% Albumins and Globulins 44% Zein 28% Glutelin 17% is not classified by Osborne technique Protein not classified by Osborne technique is mainly zein fraction cross linked by disulfide bonds





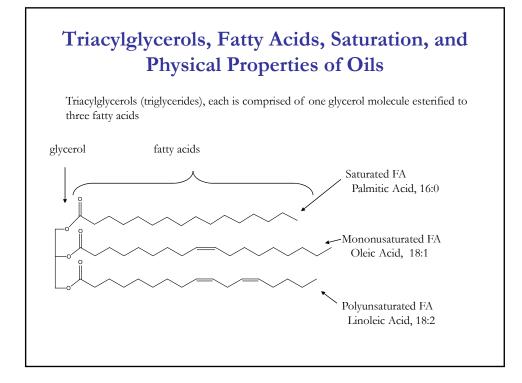


# Oil in Corn Kernels and Corn Germ?% Extractable Oil• Corn Kernels3-4• Corn Germ, from wet mills44-50• Corn Germ, from dry mills18-22

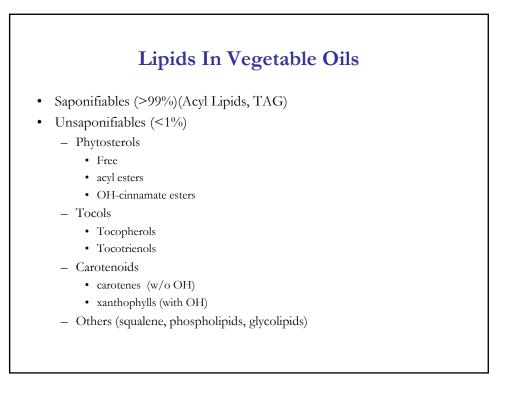


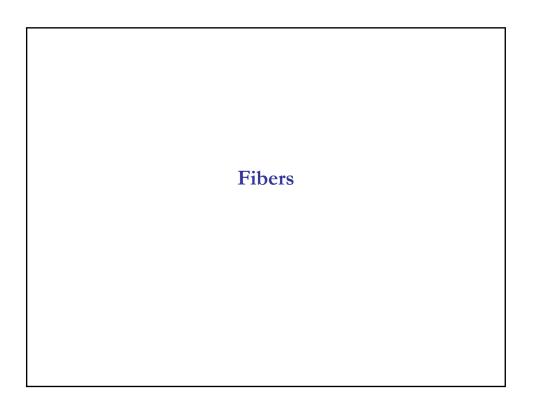
## **Chemical Composition of Vegetable Oils**

• 98-99% triacylglycerols, triglycerides, TAG

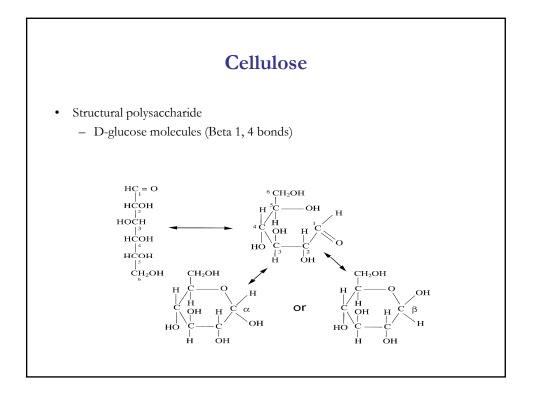


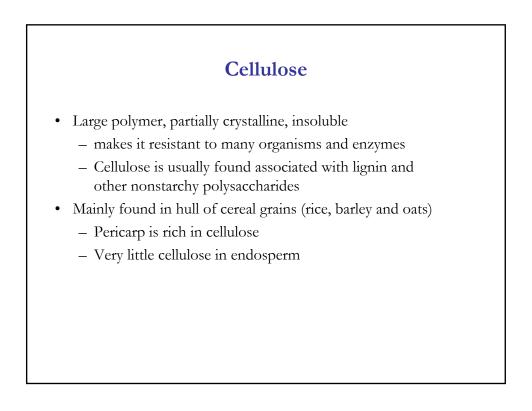




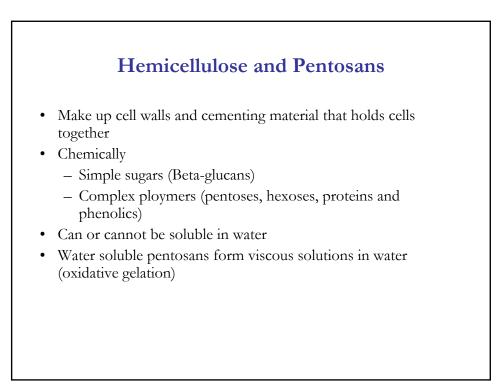


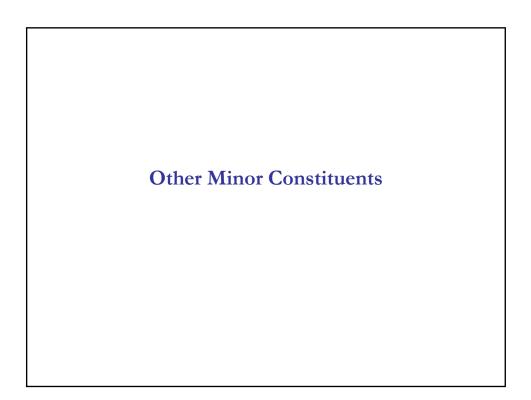














### **Other Minor Constituents**

- Sugars
- Lipids
- Enzymes
- Vitamins and Minerals

# Lipids

- Five most abundant fatty acids found in TAGs of corn oil are palmitic, stearic, oleic, linoleic and linolenic acid.
- Corn oil has high linoleic acid, essential polyunsaturated fatty acid
- Corn oil is fairly stable to oxidation
- Has low levels of saturated fatty acids, palmitic and stearic
- Contains high levels of antioxidants, tocols and other phenolic compounds
- Phytosterols

Vitamin and Mineral Composition (mg/100 g) for a Number of Cereal Grains <sup>a</sup>									
Vitamin or Mineral	Wheat	Rye	Barley	Oats	Rice	Corn	Sorghur		
Vitamins									
Thiamine	0.55	0.44	0.57	0.70	0.33	0.44	0.58		
Riboflavin	0.13	0.18	0.22	0.18	0.09	0.13	0.17		
Niacin	6.4	1.5	6.4	1.8	4.9	2.6	4.8		
Pantothenic acid	1.36	0.77	0.73	1.4	1.2	0.70	1.0		
Pyridoxine	0.53	0.33	0.33	0.13	0.79	0.57	0.60		
Minerals						_			
Phosphorus	410	380	470	340	285	(310)	405		
Potassium	580	520	630	460	340	(330)	400		
Calcium	60	70	90	95	68	30	20		
Magnesium	180	130	140	140	90	140	150		
Iron	6	9	6	7		2	6		
Copper	0.8	0.9	0.9	4	0.3	0.2	0.5		
Manganese	5.5	7.5	1.8	5	6	0.6	1.5		

