

The slide header features a large green circular arrow graphic. Inside the arrow, the word "biopolymers" is written in a green, lowercase, sans-serif font. The "bio" part of the word is smaller and has a leaf icon above the "i". The "poly" part is larger and has a circular arrow icon above the "o". The "mers" part is the same size as "poly". Above the main graphic, the text "Biopolymers" is written in red, and "Chem 563" is written in blue. In the top right corner, there is a blue box with the King Saud University logo and text: "جامعة الملك سعود King Saud University Department of Chemistry College of Science". In the bottom right corner, there is a white box with the text "Dr. Mohamed El-Newehy" and the URL "http://fac.ksu.edu.sa/melnewehy". Below the URL, there is some faint, illegible text in Arabic and English.

Biopolymers  
Chem 563

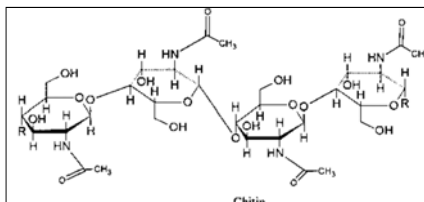
جامعة الملك سعود  
King Saud University  
Department of Chemistry  
College of Science

Dr. Mohamed El-Newehy  
<http://fac.ksu.edu.sa/melnewehy>

المعهد السعودي للعلوم والدراسات  
Dr. Mohamed El-Newehy

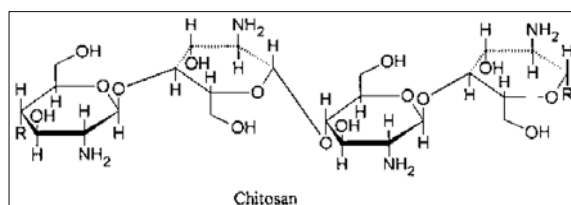
## *Chitin and Chitosan*

- **Chitin** is generally a homopolymer of 2-acetamido-2-deoxy-D-glucose (*N*-acetylglucosamine) 1-4 linked in a  $\beta$  configuration.
- It is thus an amino sugar analog of cellulose.

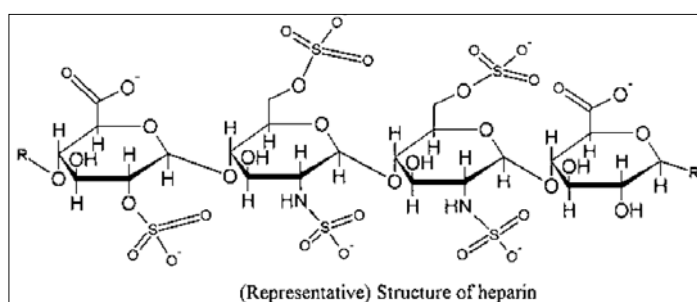


- While it is widely distributed in bacteria and fungi, the major source is crustaceans.
- In fact, **chitin** is the most abundant organic skeletal component of invertebrates.
- It is generally found covalently bonded to protein.
- Invertebrate exoskeletons often contain chitin that provides strength with some flexibility along with inorganic salts such as calcium carbonate that provide strength.
- In a real sense this is a composite where the chitin holds together the calcium carbonate domains.

- **Chitosan** is produced from the deacetylation of chitin.
- Chitosan is employed in the food industry.
- It is a hemostatic from which blood anticoagulants and antithrombogenic have been formed.
- It is often sold as a body fat reducing agent or to be taken along with eating to encapsulate fat particles.



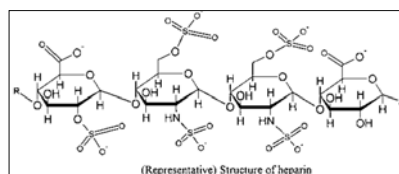
- **Chitin and chitosan** can be safely ingested by us and often we eat some since mushrooms, crabs, shrimp, many breads, and beer contain some chitin.
- **Chitin and chitosan** are believed to accelerate wound healing.
- **Chitosan** is also reported to exhibit bacteriicidal and fungicidal properties. Chitosan solutions are reported to be effective against topical fungal infections such as athlete's foot.
- **Chitosan** is a hemostatic material (stops bleeding by enhancing clotting), **chitosan sulfate** has the same anticoagulant behavior as heparin.
- **Heparin** is an anticoagulant, nontoxic material that prevents clot formation when coated on vascular implants.



- **Chitosan** dissolves in the low pH found in the stomach and reprecipitates in the more alkaline intestinal fluid entrapping cholic acid as an ionic salt preventing its absorption by the liver. The cholic acid is then digested by bacteria in the large intestine.
- **Chitosan** may also act to increase the ratio of high density lipoprotein to total cholesterol.
- **Chitosan** has been studied in the formation of films including membrane gels that immobilize enzymes and other materials because of the mild conditions under which they can be formed.
- **Chitosan** has been used in [wastewater treatment](#).  
*The amine groups capture metal ions, in particular polyvalent and heavy metal ions such as iron, lead, mercury, and uranium.*
- **Chitosan** can chelate with platinum salts to form materials with structures similar to the anticancer drug *cis*-dichlorodiamineplatinum II chloride.
- The amine and hydroxyl groups can be modified through use of a wide range of reactions including formation of amides and esters.
- *Thus, there exists sufficient reason to consider these abundant materials in dietary, biomedical, cosmetic, etc., applications.*

## Heteropolysaccharides

- Heteropolysaccharides contain two or more different monosaccharides.
- Glycosaminoglycans are polysaccharides that contain aminosugar units.
- Most are of animal origin.
- **Heparin** that is complex containing D-glucuronic acid, L-iduronic acid, and D-glucosamine units. The



- **Hyaluronic acid** is found in connective tissues, umbilical cord, skin, and it is the synovial fluid of joints.
- It can have very large molecular weights, to 107 Daltons making solutions of hyaluronic acid quite viscous.
- They can form gels.

