

Internet in Education: Chemical changes during the extrusion process



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About...

- Internet in Chemical Education
- Extrusion
- Chemical changes

Internet in Chemical Education

- quick overview

- history

- present ...

- future ...

History ...

```
uuencode filename filename | mailx -s filename.uue user@host
```



Present ...

- MIME (Multipurpose Internet Mail Extensions)
- Chemical MIME
 - chemical/x-pdb; rasmol %s
 - chemical/x-xyz; rasmol xyz %s
- VRML, Java
- Video on Internet (mpeg, avi, asf, divx ...)

NCSA Mosaic: Document View

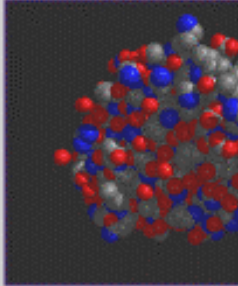
File Options Navigate Annotate Help

Document Title: MIME types for Chemistry

Document URL: http://chem.leeds.ac.uk/Project/MIME.html

specifications

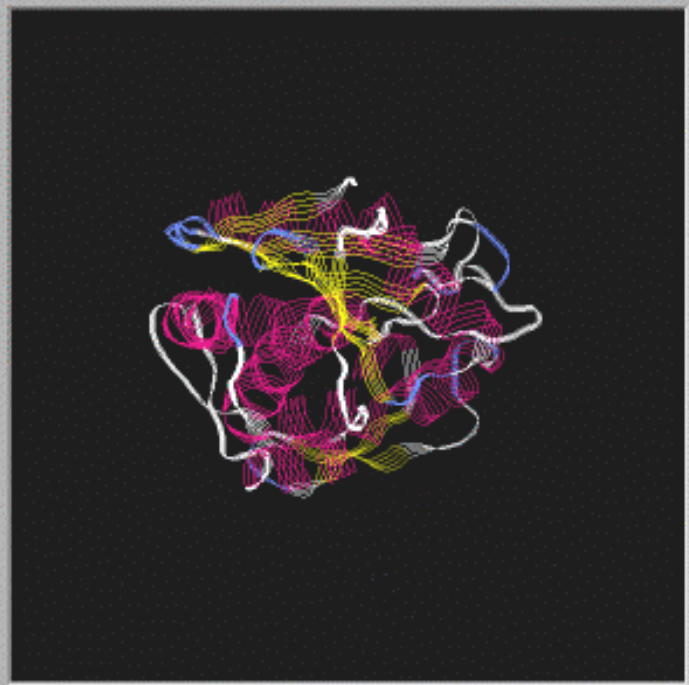
Assuming that you have edited your configuration "Options" drop down menu below.



(H.Ago,J.Kataoka,H.Tsuge M.Miyano, "Three dimensional protein at 2.3 angstroms resolution" Brookhaven Protein Data Bank)

Back Forward Home Reload

RasMol Version 2.3



Load

Display

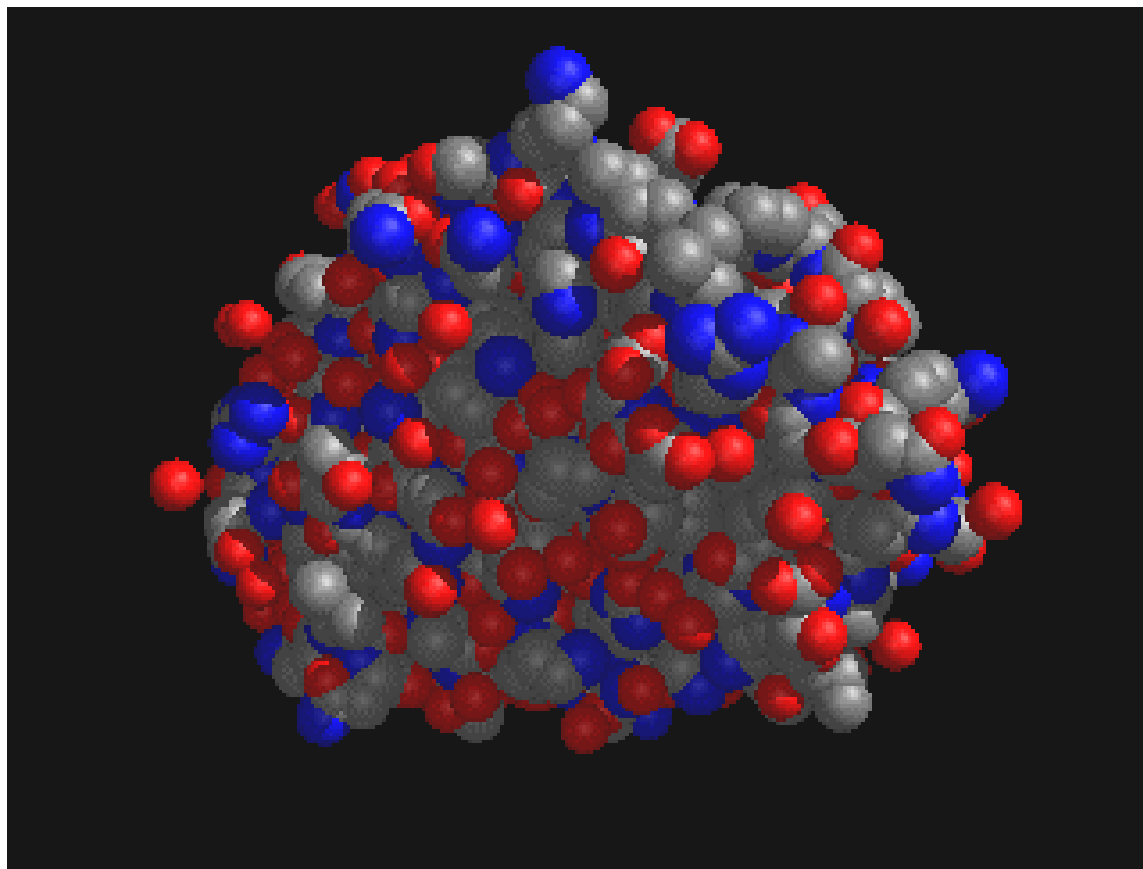
Colours

Options

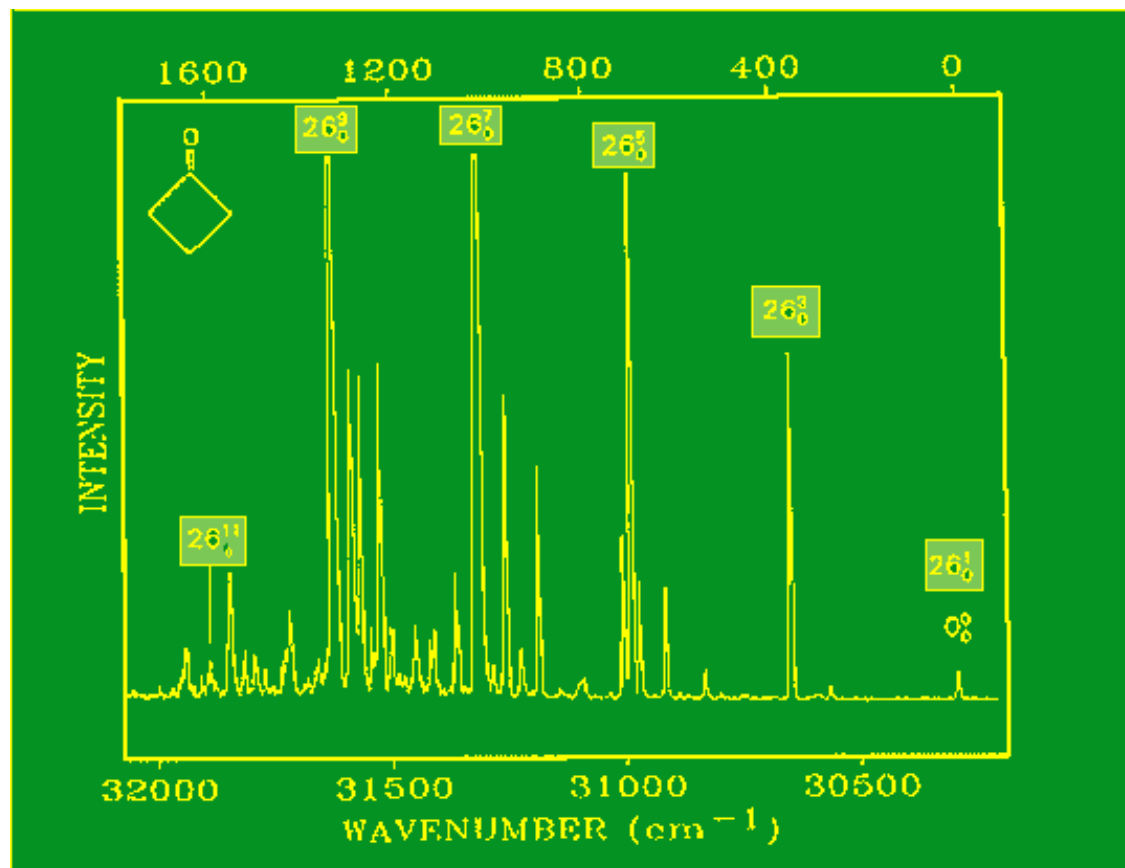
Export

Quit

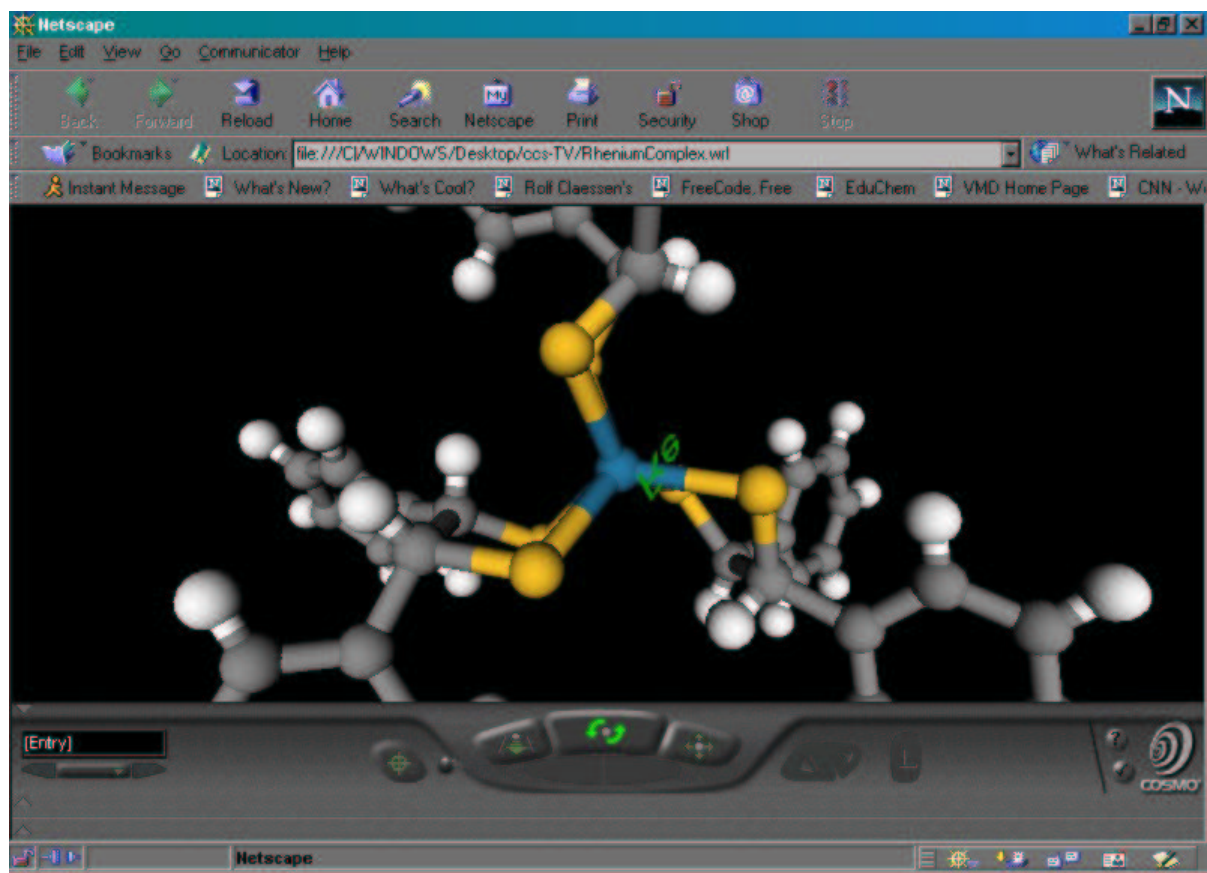
chemical/x-pdb



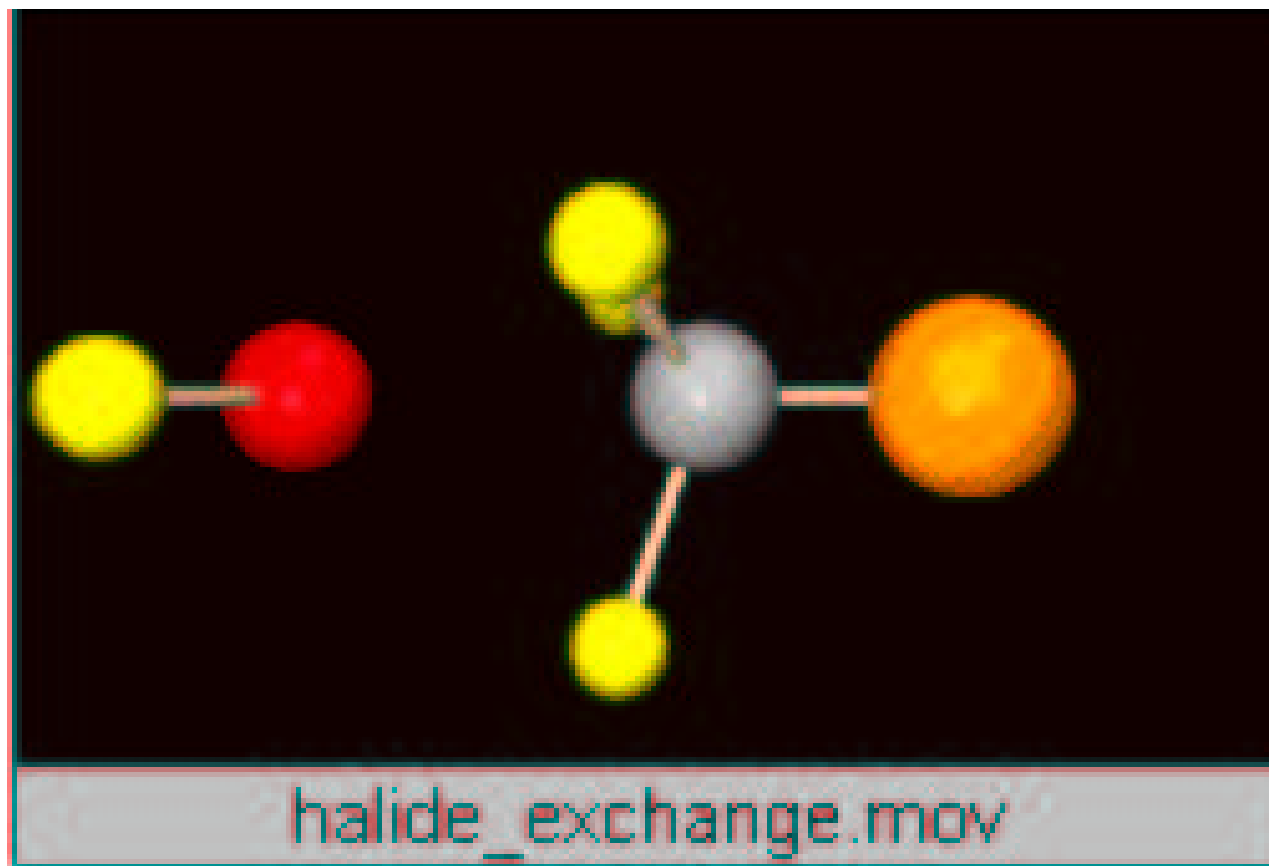
IR spectrum



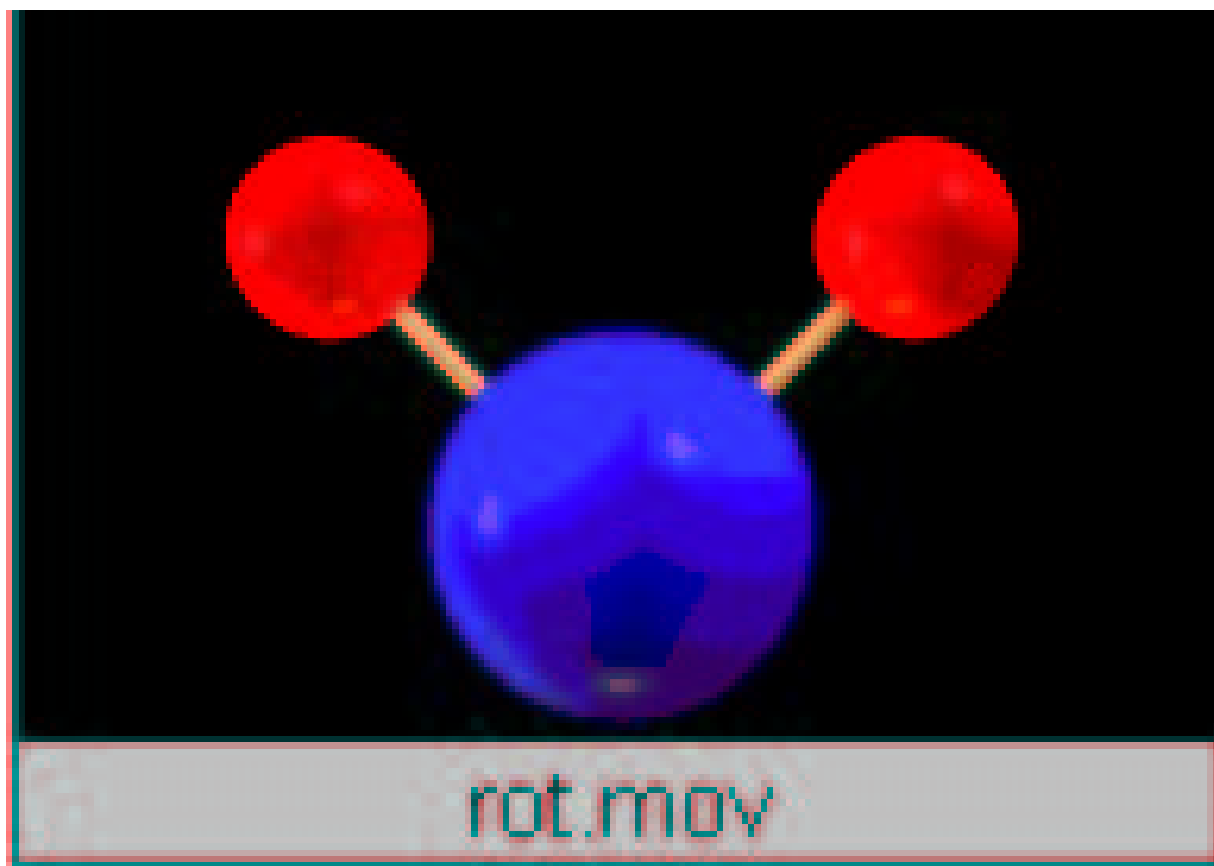
VRML



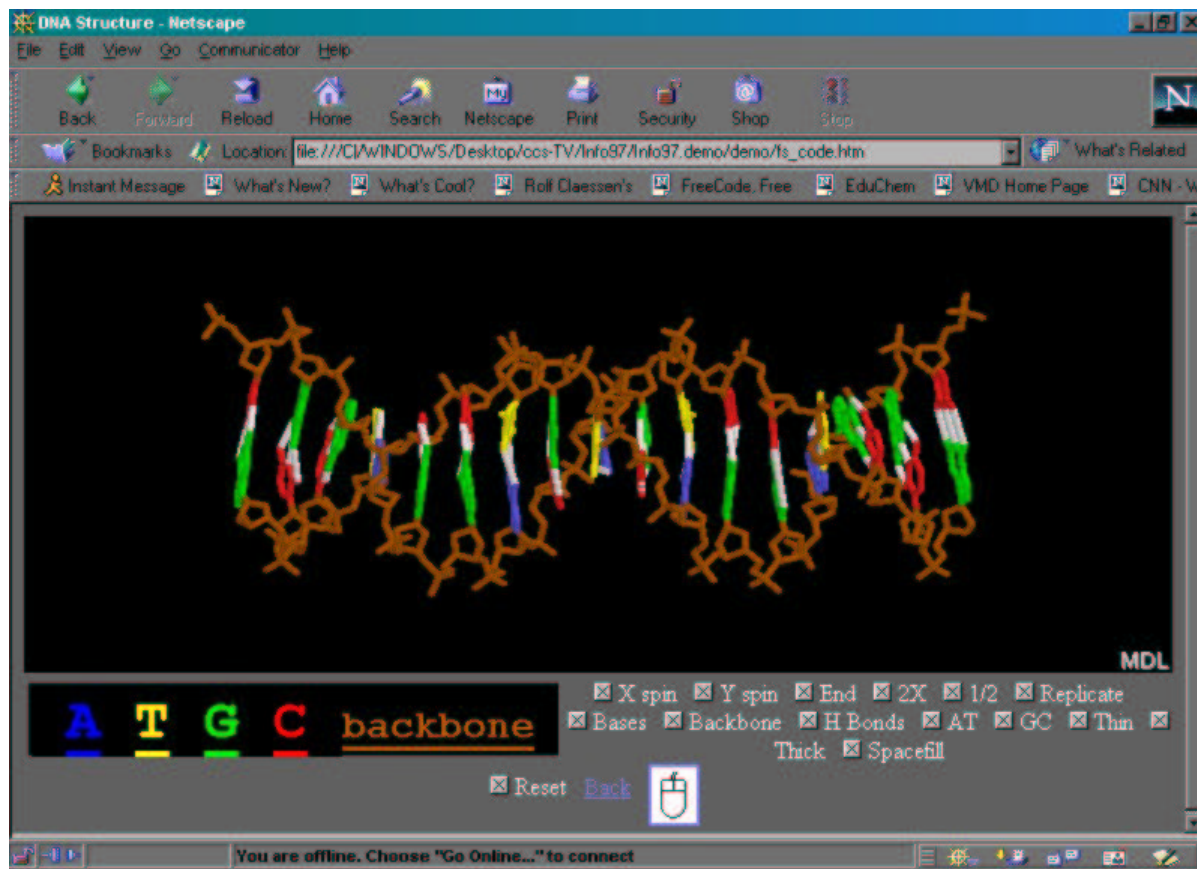
Teaching Chemistry with QuickTime Movies - Halide Exchange



Teaching Chemistry with QuickTime Movies - Vibrations and Rotations of Molecules



JAVA



From Videotape to Internet

■ First idea

- 1999. during the organization of the first Dubrovnik NMR Course in Interuniversity Center in Dubrovnik
- Dr. sc. Dražen Vikić-Topić - director

Hardware & Software

- Video tape
- Graphic card with audio and video input
- Computer - strong enough (PII, Celeron ...)
- Extremely big hard disk
- Video capturing software (Virtualdub)
- DiVX codec
- Virtualdub

Next step ...

- using Internet for teaching in new and modern way
- subject of interest was extrusion
- In Croatian community and in these room we have a lot of people interested in extrusion products ...

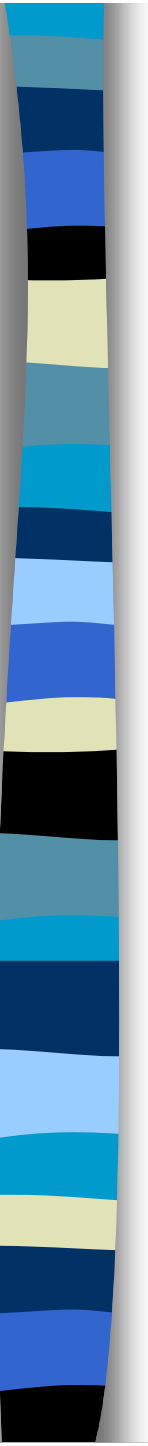
What is Extrusion ?

- Tu još treba ubacit sliku ekstrudata koja doleti nakon što ovo pitanje stoji sekundu-dvije



Extrusion ...

- Extrusion is one of many techniques used to manufacture RTE (ready to eat) cereals, snacks, pet foods,...
- Extruder is **HTST** (high temperature short time) **bioreactor** that transform a variety of raw ingredients into modified intermediate and finished products.

- 
- Tu još treba ubaciti animaciju o ekstruziji ...

Physical and chemical changes in proteins

- Extrusion exposes proteins to a combine treatment of heat and pressure may result in structural changes such as:
 - hydrolysis of peptide bonds
 - modification of amino side chains
 - formation of covalent bonds that cross-links proteins:
 - a. disulfide bonds
 - b. nondisulfide bonds





■ Nondisulfide bonds

Normal peptide bond: $P-CHR_1-CO-NH-CH_2-P$

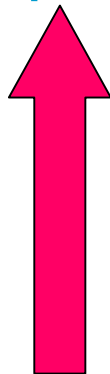
Intermolecular crosslinks:

LAL-type: $P-CH_2-NH-CHR-P$

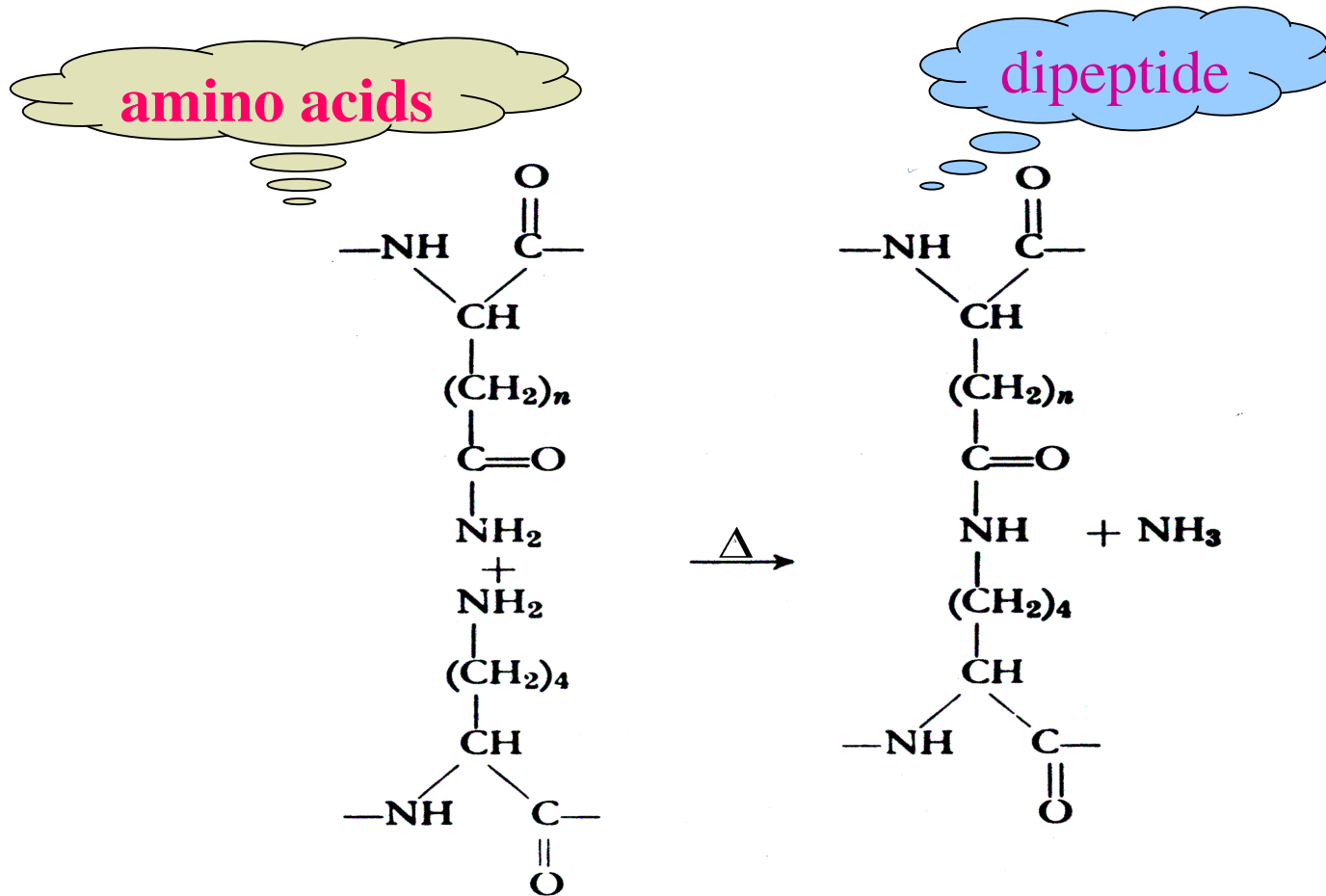
LAT-type: $P-CH_2-S-CHR-P$

Maillard products: $P-CH_2-NH-CH_2CO-R---P$

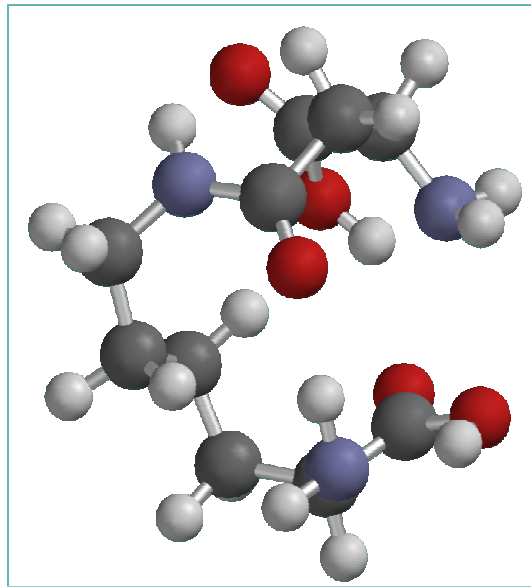
Isopeptide bond: $P-CHR_1-CONH-CHR_2-P$



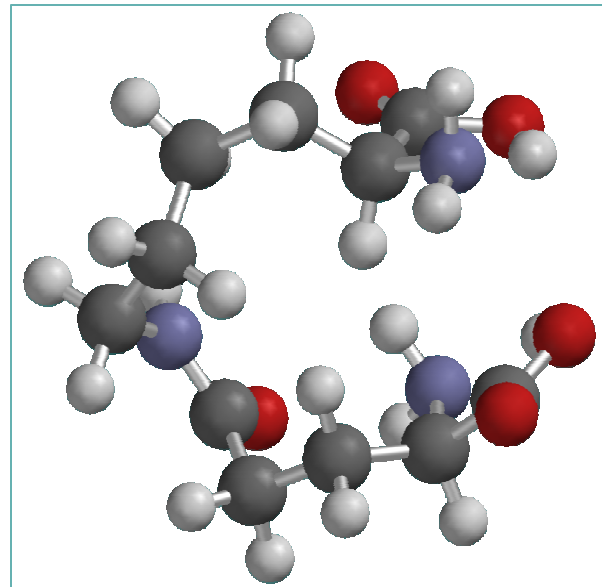
- Formation of isopeptide bond by reaction of ϵ -amino group of lysine with amino group of asparagine ($n = 1$) or glutamine ($n = 2$).



- Dipeptides with isopeptide bonds formed by reaction of asparagine-lysine and glutamine-lysine.



ASN-LYS



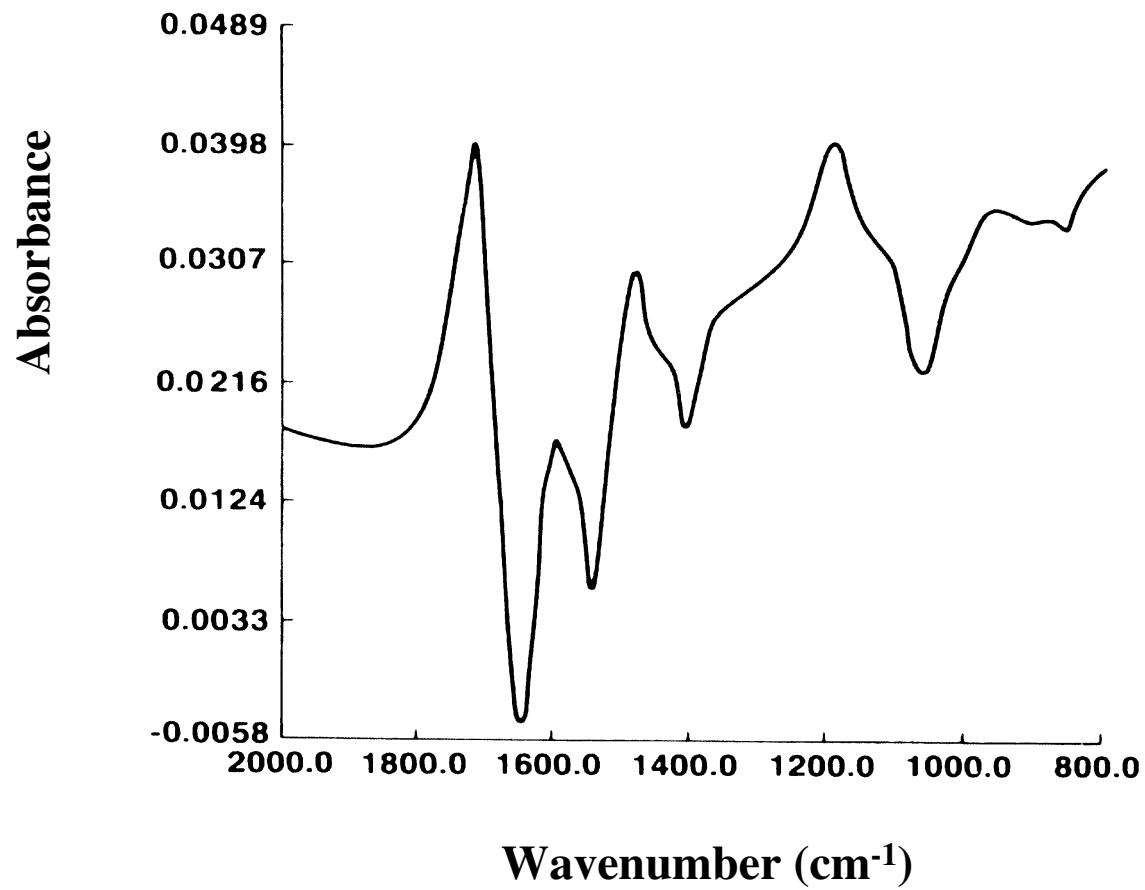
GLN-LYS



Methods

- Molecular modeling
- FTIR spectroscopy

■ FTIR difference spectrum of commercially extruded soy meal



Work in Progress ...

Internet in education

- web edition and e-book edition
 - with hendouts
 - CD ROM
 - or web prepared presentation
 - AVI files

Acknowledgement

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Questions