eg60411 <mark>Bio</mark>	-Material Science
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Biomaterial Science (Schedule)		
#	Date	Content
1	4/15	History of papermaking
2	4/22	Pulps – Beating and fiber properties
3	5/9, Fri	Pulps – Additives and functions
4	5/13	Papermaking processes & interfiber bonding
5	5/20	Paper- Structural and absorption properties
6	5/27	Paper- Mechanical and optical properties
7	6/3	Recent trend of paper science and technology
8-9	6/10, 17	Pulping science and technology by Professor Hiroshi Ohi
10	6/24	Polysaccharide chemistry by Assoc Prof Akiko Nakagawa

Lecture information and contact

- Homepage of "Biomaterial Science (T. Enomae)"
- http://www.enomae.com/
 → Handouts in lecture(講義資料)

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 for any questions and visit to laboratory
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Biomaterial and Biomaterial Science

What biomaterial is

Materials constituting components and the structure of organisms processed to provide properties required for the use such as:

Wood, paper, cellophane, rubber, leather, polylactic acid



What biomaterial science is

Science and technology for providing high performance to biomaterials

"Paper" – Definition

- "A thin, flat material obtained by sheetforming and drying fibers especially of plants"
- "A thin, flat material made from crushed wood or cloth used especially for writing and printing on and in packaging"
 Cambridge Dict.
- Plant fibers, especially wood-sourced, as a raw material of paper are called "a pulp"



Who has affected you most?

- "Who has affected you most in your life so far?" was voted in an internet site.
- Jesus Christ received the second largest numbers of votes
 - (A) received the largest.
- Without paper, printing technology would not have developed, nor would wealthy life today be guaranteed.

Origin of paper

 Ts'ai Lun is traditionally regarded as the inventor of paper. Exactly, however, he invented the composition for paper along with the papermaking in A.D. 105.



 The fibrous materials used in those day were bark, hemp, silk, and fishing net.

Origin of paper

- The world oldest paper found in that is estimated to be between 179 and 142 BC (early Western Han 漢朝).
- It was used as a map, where mountains, waterways and roads are drawn.



Fangmatan (放馬灘) paper







Origin of Printing technology

Gutenberg (1395? -1468)

invented a printing press in around 1445.

The invention consisted of

- mass-producing movable type;
- oil-based ink from linseed oil; and
 a wooden printing press similar to the agricultural screw presses

and allowed the mass production of printed books and was economically viable for printers and readers alike.



able type





History of papermaking tech. – Machine		
1670	Hollander beater invented [Holland]	
1719	Reaumur submitted his invention - paper can be made from wasp hives- to the Academy [France]	
1798	Louis-Nicolas Robert invented manufacture of continuous paper [France]	
1844	Keller invented ground wood pulp [Germany]	
1851	Burgess [USA] and Watts [England]invented soda pulping to make wood pulp.	
1856	Healey received a patent of corrugated [England]	
1856	Tilghman invented the sulfite pulping [USA]	
1879	Dahl invented Kraft pulping [Germany]	
1950	Hardwood pulping initiated[Japan]	
1968	Thermo-Mechanical Pulping (TMP) Developed[Sweden]	
1977	Quinone-added pulping invented [Japan]	



Old printed material in Japan In 764, Emperor Koken had holy texts (無垢浄光陀 羅尼経) printed on paper one million copies for

peace of Japan, contained in one million wooden miniatures of a three story tower, and laid out in the ten great temples like Horyu-temple and Todaitemple.



The world oldest printed material

In 1966, printed holy texts was discovered in the Buddha tower of Bukkoku-temple (仏国寺) of Keishu, Shinra (新羅慶 州), currelty Korea(韓国). This tower is known to have been built in 751.



The world oldest printed material Paper with holy texts (華厳経) written in 755, Silla era (新羅) was analyzed.

















Kind of pulp

Pulp

- Fibers mainly consisting of cellulose extracted from plant such as wood by mechanical or chemical treatment
- Mechanical pulp [MP]
- Fibers extracted from wood by crushing
- Chemical pulp [CP]
- Fibers extracted from wood by dissolving lignin
- Deinked pulp [DIP] (recycled pulp)
- Fibers extracted from waste paper by removing ink

