CARBOHYDRATE NEWS LETTER

Association of Carbohydrate Chemists & Technologists, India (ACCTI)
Head Quarters Office: Forest Research Institute, Dehra Dun - 248 006
Issue: 1 July, 1998

As an introduction to the first issue of the Carbohydrate News Letter, I thought, it might be of interest to let the readers know how the News Letter first started. In 1984, the Association of Carbohydrate Chemists & Technologists (India) was formed by Dr. H. C. Srivastava, and it was him who started the yearly conference to focus attention on industrial applications of carbohydrates of Indian origin and to bring together carbohydrate scientists and technologists for exchange of information. In recent years, carbohydrate has gained tremendous importance both in bio-medical and industrial applications. On the 50th year of our Independence, considering the national interest related to the development and application of carbohydrates in industrial and bio-medical aspects, a decision was taken at the XIIth Carbohydrate Conference, held at Lucknow, to publish this Carbohydrate News Letter.

The primary objectives of CNL are (1) to highlight the new developments in carbohydrate research, (2) to focus the achievements in both basic and applied fields, and (3) to provide a better means for the scientists, technologists and industrialists to exchange their ideas. Besides this, there will be some regular features such as short articles of current interest (two pages), conferences & symposiums, honours & awards, tributes, obituary, research news etc. We will be glad to publish news of extraordinary achievement, necessary requirements of scientists and technologists, expertise available in the country, various research activities going on in the country, current national and international research activities related to any branch of carbohydrate chemistry. In this connection I would like to request you to send in your valuable advice, relevant information and suggestions for the CNL.

To meet the publication expenses and postal charges (on no loss no profit basis) it was decided to collect advertisements for the CNL. The charges are nominal (Full page Rs. 1000.00 and Half page Rs. 500.00). For publication of other items of commercial significance, a proportionate rate will be charged. I request our industrial patrons to come forward and render their help generously towards the development and growth of CNL.

As the importance of carbohydrate is increasing day by day, more and more people are becoming interested in this area. I am sure many of you would like to become members of this Association. A membership form is included for your convenience. If you are still not a member of the Association, kindly fill up the form and send it in. You may use xerox copies of this form for your friend or colleagues. We are also updating our membership list and mailing addresses, for which separate forms are included. Please fill up these forms and send it to the Secretariat to make our effort a success.

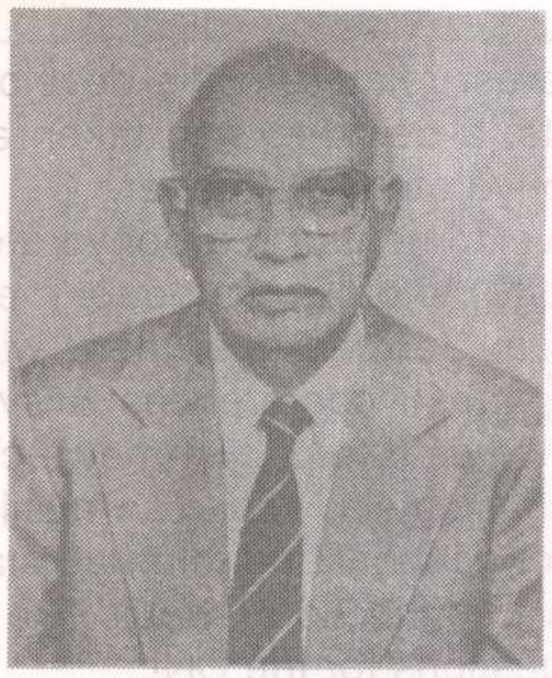
I am thankful to the members of the Advisory Board who have kindly consented to help us in our endeavours. Without their active support it would not have been possible to publish this News Letter. I sincerely regret our inability to include all the regular features in the first issue for unavoidable circumstances.

Finally, I welcome your comments and suggestion for improving the Carbohydrate news Letter. It is our sincere hope that you will enjoy reading the CNL and it will be helpful for you.

Dr. Asish Kumar Sen Jr.

TRIBUTE

We take this opportunity to recall the contribution of Dr. Harish C. Srivastava, Ph.D.(Minnesota), C. Chem, FRSC, FGSA, founder president of the Association of Carbohydrate Chemists and Technologists (India). India, he felt, has a great potential in carbohydrate chemistry and so formed the Association in 1984. He remained as the president of the Association until his death. The first conference of the Association, Industrial carbohydrate conference, was held at Ahmedabad Textile Industries Research Association, Ahmedabad, during January 28-29, 1984. In the preface he wrote `The objective of the conference was to focus attention on industrial applications of carbohydrates of Indian origin and to bring together carbohydrate scientists and technologists for exchange of information.....'. It was only his idea that prompted us to publish the Carbohydrate News Letter to create more awareness and interaction among persons in this area and by doing so we pay our tribute to this great soul.



After completing his M.Sc. in chemistry form Lucknow University in 1947, he joined University of Minnesota/Minneapolis, St. Paul USA for Ph.D. After he received his Ph.D. degree in 1957, he worked as a post-doctoral fellow at National Research Council, Ottawa from 1958-60. In 1960 he joined ATIRA from where he retired in 1988 as the Senior Deputy Director and Head of the Chemistry and Chemical Technology Division. He returned as an Emeritus Scientist, CSIR in 1989 and remained actively associated with carbohydrate chemistry.

Dr. Srivastava was well known in the scientific community. His kind and informal personality, great knowledge, well considered arguments, brought international recognition, not only for himself, but also to Indian carbohydrate chemists in general. Twentynine students got their Ph.D. degree under his guidance.

He had published 150 papers in Indian and International Journals besides chapters in several books and monographs. He was also the co-author of the book called `Structural polysaccharide Chemistry'. He was a fellow of the Royal Society of Chemistry & Chartered Chemistry, UK and fellow of the Gujrat Science Academy. He was honoured by several awards.

The man with warm and charming personality passed away on the 10th February, 1995, in Kanpur.

REPORT

XII Carbohydrate Conference

November 20-21, 1997

Department of Chemistry, University of Lucknow, Lucknow -226 007.

Dr. S. C. Rai, Mayor of Lucknow, inaugurated the conference, while, Prof. Ramesh Chandra, Vice-chancellor of Lucknow University presided over the function. The chairperson of the XII Carbohydrate Conference, Prof. (Ms) A. Khare, Head, Department of Chemistry, Lucknow University, Lucknow, gave a welcome address and emphasized on the increased appreciation of the role of carbohydrate in biological and pharmaceutical sciences. The souvenir of the XII Carbohydrate Conference and a book entitled "Trends in Carbohydrate Chemistry" Ed. P. L. Soni, were released on the opening day of the conference by Dr. S. C. Rai and Prof. Ramesh Chandra, respectively.

The participation of large number of delegates (Approx. 150) in the conference including chemists, biochemists, biologists, technologists and persons from industries engaged in carbohydrate related fields from all over the country made the conference a grand success.

The theme of XII Carbohydrate Conference, "Emerging Trends in Carbohydrate Chemistry", received overwhelming response both from scientists and industrialists. Various emerging problems from carbohydrate spectrum were presented and discussed, for example bio-transformation on carbohydrates, glycotechnology for discovery of novel therapeutics, complex bacterial oligosaccharide synthesis as antigens, recent trends in oligonucleotide synthesis, chitosan and its biomedical application, glucose homeostasis, glycobiology, structural studies of LPS from *Vibrio cholerae,* chemistry and biology of transition metal-saccharide complexes, hyperglycemia and carbohydrates as anticancer agents.

For the first time in XII Carbohydrate Conference, an emerging topic - transition metal-saccharide Chemistry and Biology was included in the spectrum of carbohydrate chemistry. It concerns with the interaction of saccharide with transition metal ions which is expected to have influence in the field of agriculture, metal nutrients, medicines and medical diagnosis, asymmetric synthesis and as bioorganic models.

A large numbers of papers and posters (40) of high standard were presented in seven technical sessions during the conference. There were two plenary lectures of 45 min. and fourteen invited lectures of 30 min. duration. Considering the large number of requests by participants for oral presentations (15 min. each), the organizers made two simultaneous sessions for oral presentations in two different auditoria. The valedictory address was delivered by Dr. Nitya Nand, FNA on "Importance of carbohydrate in biological research today".

The participants of XII Carbohydrate Conference thanked the members of Organizing Committee for their ardent and dedicated commitment and making this conference a memorable one.

Outcome of the panel discussion on Emerging Trends in Carbohydrate Chemistry'

Coordinator: Dr. D. K. Kulshrestha, CDRI, Lucknow
Members: Dr. P. L. Soni, FRI, Dehra Dun, Dr. P. P. Singh, ITC, Bangalore, Prof. D. Loganathan, IIT, Chennai, Prof. A. Khare, Lucknow University, Lucknow.

The panel discussion was centered on identifying the emerging trends in carbohydrate chemistry and how the scientists and industrialists should interact on the research and results of current problems being faced by the carbohydrate chemists. The coordinator initiated the discussion and emphasized upon the wide spectrum of and current applications of carbohydrate chemistry.

Prof. Ms. A. Khare focused on the interaction of academician and industry for the beneficial development of carbohydrate chemistry in a larger perspective.

Dr. P. L. Soni while emphasizing on the funding of research projects on emerging frontiers of carbohydrate chemistry to scientists by industrialists, impressed upon the problems being faced by industrialists: (1) projects are not result oriented, and (2) projects do not complete on given time schedule.

Dr. D. Loganathan said that awareness in the chemists and industrialists is increasing in this field and interdisciplinary research is need of the hour. He also stressed that ACCT(I) should fill the gap between scientists and industrialists. He is of the view that younger scientists should be encouraged to work on the current problems in carbohydrate chemistry and for this a good training is needed. He also remarked that extra emphasis should be given on bacterial antigens (vaccines).

Dr. P. P. Singh reiterated that considering the impact of emerging trends in carbohydrate chemistry, the XII Carbohydrate Conference is changed in content and matter to synthetic carbohydrate chemistry while, previous Carbohydrate Conferences were mainly centered on polysaccharides, application of starch and guar gum etc. He also mentioned that funding the research projects to scientists is not a problem for industry, provided they are of biomedical applications and should be concluded after objectives are met. The Central Government should plan a strategy to check the brain drain in this field. He stressed that he is happy that the trends in carbohydrate chemistry is changing but unhappy with the abrupt end of research projects on conclusion which is very important for industry.

Proposal and Recommendations

* The present concern should not only ascertain and elucidate the biological information contained in sugars and glycoconjugates but to generate the awareness of the masses of the utility of these compounds through biomedical research.
* A Carbohydrate News Letter (CNL) will be initiated and published by ACCTI twice a year. The CNL will be published under the overall supervision of Dr. A. K. Sen (Jr.), Joint Secretary of the Association.
* The house proposed for setting up a `Advanced Centre for Carbohydrate Chemistry' at Chemistry Department, Lucknow University, Lucknow considering the expertise available in the department.
* A new chapter "Transition metal saccharide chemistry and biology" is introduced in the diverse field of carbohydrate chemistry.
* To create a data bank of the expertise and know-how available on carbohydrate related fields.
* More emphasis should be given on the synthesis of oligosaccharide related to bacterial antigens.
* Research projects should be result oriented and should conclude on a given time schedule to earn the confidence of the industry for positive interaction between scientists and industrialists.
* Protection of IPR.

May 2, 1998 Dr. Naveen K. Khare, Secretary

HONOURS AND AWARDS

Dr. Nirmolendu Roy, Professor, Department of Biological Chemistry, Indian Association for the Cultivation of Science, Calcutta, has been selected as member of the Editorial Board of the Journal of Carbohydrate Chemistry, USA from January 1998. He has also been a member of the editorial Advisory Board, Indian Journal of Chemistry from January 1998.

Dr. B. P. Chatterjee, Professor and Head, Department of Biological Chemistry, Indian Association for the Cultivation of Science, Calcutta, has been elected President of Biochemistry, Biophysics and Molecular Biology section of 86th Indian Science Congress, 1999, Chennai.

Dr. M. M. Gharia has been appointed as Director of Ahmedabad Textile Industries Research Association, Ahmedabad.

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Preparation and use of *Cassia tora* Gum

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Galactomannan gums from leguminous seeds are useful for many industrial purposes such as sizing, thickening, wet-end additive, and as stabilizing agents. Galactomannans from various sources having similar chemical structures with β-(1→4)-D-mannose backbone are substituted to varying degree at the 6-position by single α-linked D-galactose residues, the extent of galactose substitution being a function of the source species. Commercially available guar gum from *Cyamopsis tetragonolobus* has a mannose:galactose ratio (M:G) of approximately 2, whereas, locust bean gum from *Ceratonia siliqua* has a M:G ratio of about 3.5.

During the past several years, numerous cultivated crops and forestry species have been investigated for their galactomannan content to give a boost to Indian gum industry which is mainly exploiting guar[1-3].

Cassia tora Linn. is a common herbaceous annual occurring as a weed throughout India. The pods are 15-22.5 cm long and up to 0.625 cm in diameter containing flattened dark seeds. The seeds can be used as a coffee substitute and protein rich feed for cattles[4].

There are many methods reported for the production of gum. Separation of guar gum may be accomplished by flaming the seeds or roasting in a rotary furnace for few minutes to loosen the seed coat, removing it by scouring or peeling, then, milling and shifting to separate endosperm from the germ[5]. *C. tora* gum was separated by a dry milling process from the seeds. The process included heating, impact grinding, screening to separate endosperm, flaking and mill grinding of the endosperm to flour. The yield of the gum was ~ 32 per cent of the original seed weight. Flour was heat treated to stabilize the viscosity of aqueous dispersion. Gum dispersed in hot water to form viscous solution which was fairly stable from pH 5 to 9. Higher concentration of gum have self gelling property while non-gelling concentration of the gum with xanthan gum forms weak gel. Water soluble polysaccharides isolated from the seeds showed low viscosity at higher concentration and its rheology resembles with exudate gum. Gum acted as a flocculant when used for mud settling in sugar cane juice and in treatment of backwater of paper mill.

Rheology

Viscosity of the *C. tora* gum increased with the concentration of gum. It showed very low viscosity at lower concentration in comparison of *C. tora* to gums from other Cassia species[6]. However, rapid increase in the viscosity occurred at higher concentration and forms weak to moderately strong gel (Table-1).

Self gelling property of *C. tora* gum may be due to its unique structure having a backbone of cellulose (17.6%) and mannan (82.4%). β-D-xylopyranose and α-D-galactopyranose units are attached by a 1→6 linkage as a side chain to D-glucose and D-mannose of the backbone respectively. Thus, tora gum structure is partly akin to both tamarind gum and locust bean gum.

Table-1: Effect of the concentration on the gel strength of *C. tora* gum.

Gum concentration(%)	Gel strength (g/cm^2)
2.5	56.3
3.0	234.0
3.5	431.5

Xanthan-tora gum interaction

Non-gelling concentration of tora gum and xanthan gum when mixed together after heating and cooling formed weak gel (Table-2).

Table-2: Effect of addition of xanthan gum to *C. tora* gum on its gelling property.

Tora gum concentration(%)	Xanthan concentration (%)	Total polysaccharide(%)	Gel strength (g/cm^2)
1.0	0.1	1.1	14
	0.2	1.2	57
1.5	0.1	1.6	13
	0.2	1.7	50
2.0	0.1	2.1	11.5
	0.2	2.2	34.5

On comparison of the gel strength data in table 1 and 2, it is amply evident that addition of 0.2 per cent of xanthan gum to 1 per cent tora gum will produce the gel strength equivalent to 2.5 per cent of tora gum alone. Ideal ratio for optimum interaction of tora gum and xanthan gum was 5:1.

Tora gum as flocculant

In sugar factories, generally, a flocculant is added to sulphited sugarcane juice to hasten the settling of mud. Performance of modified tora gum as a mud settling agent was compared with guar gum, CMC and Mafloc, a synthetic polyacrylamide compound. Mud settled by addition of these flocculants (3 ppm) at different time intervals is shown in Table-3.

Table-3: Clarification of sulphited sugarcane juice by the addition of *C. tora* gum.

Time (min.)	Mud volume (mL)			
	Tora gum	Guar gum	CMC	Mafloc
0	1000	1000	1000	1000
5	510	730	560	260
10	320	540	340	220
20	280	410	310	200

It is evident from Table-3 that mud settling rate with *C. tora* gum is faster in comparison to guar gum and CMC. However, settling rate in comparison to Mafloc is less, which could be attributed to the high molecular weight of Mafloc. Results shows that modified *C. tora* gum can be effectively used in khandsari and gur industries.

In paper sheet formation, a suspension of solid particles of varied size, shape, and composition is caused to flow onto a forming screen. In addition to the more or less whole fibers present in the stock, there is present an appreciable quantity of pulp fines derived from small wood cells and fragments or debris torn from the fibers. The fibers in the head box stock will be retained on a normal machine wire wesh (75 (m hole) merely as a result of their physical size; therefore, it is the pulp fines and mineral fillers that pass the wire and follow the white water system. In a mill that has an efficient white-water and broke recovery system, this should run above 95 per cent. Synthetic polymers cationic in nature are normally used by mills to flocculate suspended fines in back water. *Cassia tora* gum modified (CTM) was used to treat the back water (Satia Paper Mill, Muktsar) to recover the suspended fines and its performance compared with Trufloc and Deftech 706. Performance of CTM vis-à-vis synthetic flocculants is shown in Table-4.

Tora gum as thickener in textile printing

Thickeners used in textile printing are high molecular weight compounds giving viscous pastes in water. Their main function is to hold or adhere the dye particles in the desired place on the fabric until the transfer of the dye into the fabric and its fixation is complete. *C. tora* gum (CTG), sodium alginate (SA) and blends of CTG and SA were taken as thickener for printing using hot and cold brand reactive dyes. Colour value (K/S), stiffness and fastness of the prints were determined. Results showed that general trend of the maximum dye uptake in the case of prints obtained using sodium alginate and minimum dye uptake in the case of prints obtained using CTG persisted.

Table-4: Back water (pH 5.5, suspended solid 3936 mg/L) treatment with flocculants.

Flocculants	Backwater initial volume (mL)	Dosage(mg/L) time to 150 mL level(Min.)	Flocs settling (mg/L)	Suspended solid	Settling %
Trufloc	500	4	1.30	50	98.7
Deftech 706	500	4	2.10	50	98.7
	500	6	1.50	25	99.36
CTM	500	4	3.3	13.0	99.6
	500	6	2.4	22.5	99.4
	500	8	3.05	27.5	99.1

However, when these two thickener pastes were blended in 1:1 ratio, the K/S value of the prints did not get impaired beyond the level of 10-12%. This loss could be compensated by taking 10% extra dye in the printing paste and still the printing paste using *C. tora* gum along with sodium alginate offers promise of industrial applications.

Conclusion

C. tora seeds yield about 32 per cent gum. Gum has self gelling property at higher concentration and forms weak gel with xanthan. Lower concentrations of gum have poor viscosity while viscosity of higher concentration of gum dispersions is comparable with the gums of other species. Gum acts as flocculant in clarification of sugar cane juice and backwater, as well as thickener in textile printing.

References:

1. P. L Soni, Attar Singh, S. K. Kapoor, & K. S. Murty, IPPTA, 24 (3 suppl.) (1987) 14.
2. Subodh Sharma & P. L. Soni, Indian J. Chem, 33B (1995), 335.
3. P. L. Soni, Trends Carbohydr. Chem, 3 (1997) 111.
4. Wealth of India. Raw Materials, CSIR Publications, New Delhi (1950).
5. Whistler R. L., Advance Chem. Ser., 11 (1954). 45; Chem. Ind., 62 (1948) 60.
6. P. L. Soni & Rajendra Pal, Trends Carbohydr. Chem, 2 (1996) 33.

CONFERENCE NEWS

XIIIth Carbohydrate Conference, November 19-20, 1998 at Forest Research Institute, Dehra Dun-248 006. For more details please write to Dr. P. L. Soni, Head,Chemistry Division, FRI, Dehra Dun- 248 006. E.Mail. icíre-mis@x400.nicgw.nic.in

European Carbohydrate Conference-Eurocarb 10, July 11-16, 1999, Galway, Ireland, Write to Eurocarb Secretariat, National University of Ireland, Galway, Ireland.
Fax: +353-91-525700, E.Mail:eurocarb@ucg.ie

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Stereoselective synthesis of some recent biologically important carbohydrate analogs

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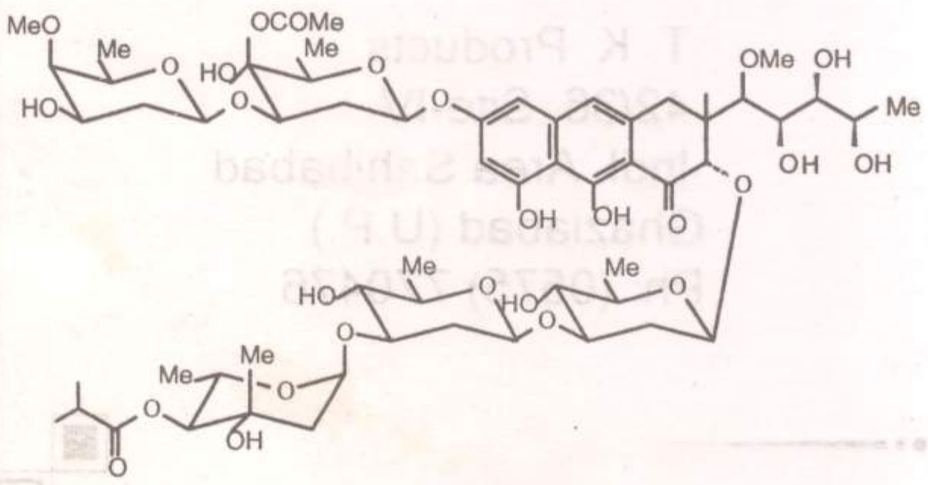
The synthesis of carbohydrate based compounds is emerging as a frontier area in organic chemistry. In addition to their well documented roles in supporting structural matrices, in energy storage and as biosynthetic starting materials, carbohydrates are cast in a variety of interesting settings as antibiotics[1], antitumor agents[2], bacterial O-antigens[3], blood group determinants[4], glycoconjugates[5] (glycoproteins, glycolipids and proteoglycans) and cardiotonic glycosides[6]. Furthermore, carbohydrates are also capable of inducing a protective antibody response and this immunological reaction is a major contributor to the survival of the organism during infection[7].

The emerging role of carbohydrates and their analogs as central determinants[8] of biological function, has stimulated tremendous interest in the oligosaccharide synthesis[9] with therapeutic potentials. The chemical synthesis of oligosaccharides is much more complicated than the synthesis of other biopolymers such as peptide and nucleic acids. The difficulties in the preparation of complex oligosaccharides are a result of a greater number of possibilities for the combination of monomeric units to form oligosaccharides. Stereoselective glycosylation reactions[9] have been regarded as of central importance in carbohydrate chemistry. The outcome of a glycosylation reaction is heavily dependent on the reactants and protecting group strategies. This article gives an overview of some carbohydrate based compounds of biological significance, recently appeared in literature.

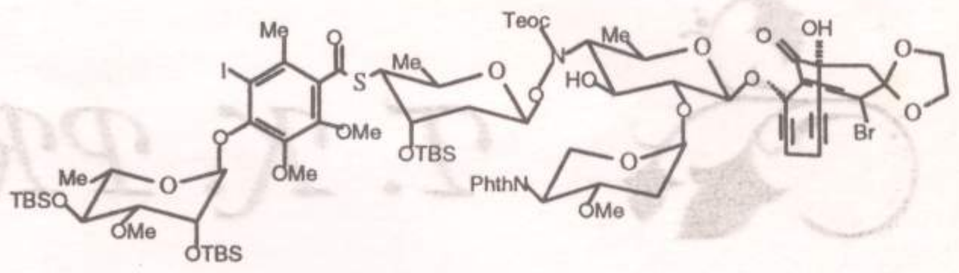
ANTIBIOTICS

Aureolic acids: The aureolic acid group of compounds are highly potent antimicrobial agents which are active against Gram positive bacteria and mycobacterium and also act as antitumor agents. Roush et. al.[10] synthesized Olivomycin A via silver silicate mediated glycosylation reaction.



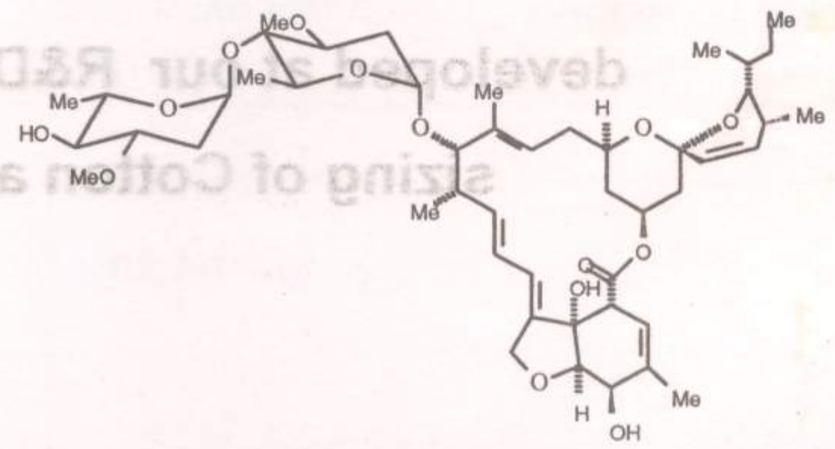
OLIVOMYCIN A

Calcheamicins: It possesses activity against Gram positive and Gram negative bacteria and also shows unprecedented activity against murine tumors and solid neoplasms. This antibiotic was synthesized by Nicolaou[11] and Danishefsky et. al.[12] by using trichloroacetimidate method of glycosylation under Lewis acid (BF_3:OEt_2) conditions.



CALICHEAMICIN

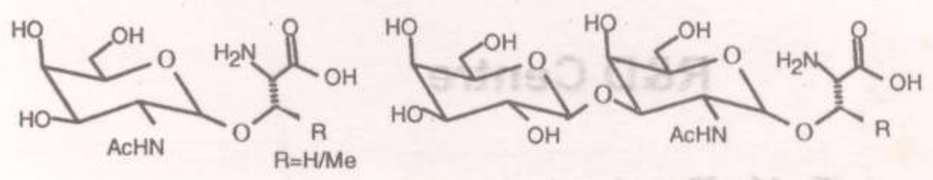
Avermectins: The avermectins are obtained as fermentation products of *Streptomyces avermitilis* and showed extraordinary activity against endo and ectoparasites. Nicolaou et. al.[13] synthesized Avermectin B_{1a} by using glycosyl fluoride as glycosyl donor in the presence of $SnCl_2$-$AgCl_4$.



AVERMECTIN B_{1a}

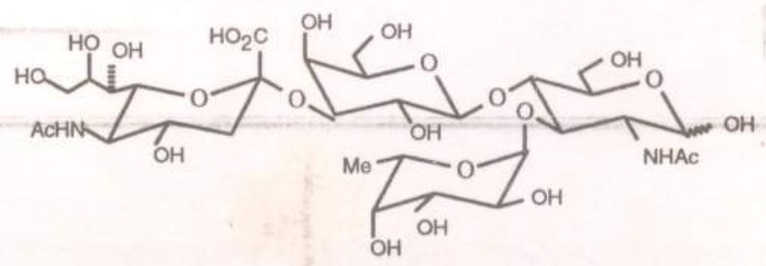
TUMOR-ASSOCIATED CARBOHYDRATE ANTIGENS (TACSs)

Cell surface carbohydrates undergo dramatic changes as a consequence of malignant transformations. These antigens are widely detected in the most common human cancers including lung, gastrointestinal, breast, colorectal, liver and pancreatic cancer. Tn, sTn, and T antigens are expressed in carcinoma-associated mucins and all of them have recently been synthesised[14].



T_N -ANTIGEN **T- ANTIGEN**

Sialyl Lewis X (Sle^x) antigenic determinant, synthesized by Danishefsky et. al.[15], is present to an abnormal extent in cancerous stomach, colon, lung, oesophageal, ovarian, pancreatic and breast cells.

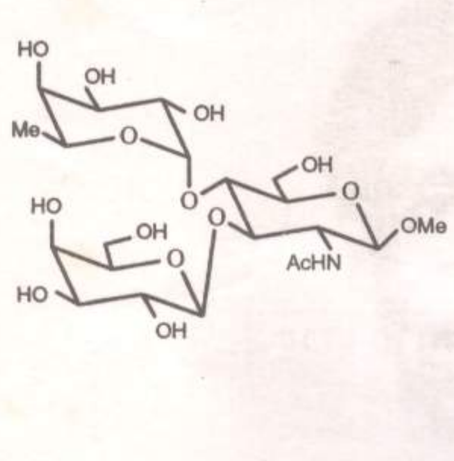


LEWIS X ANTIGENIC DETERMINANT

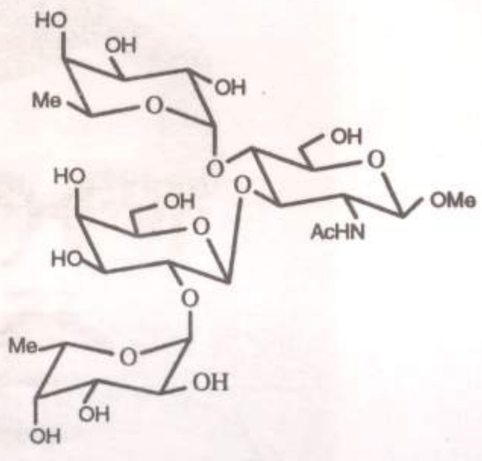
Tumor cells expressing SLe^x bind to areas of the vascular endothelium expressing E-selectin. This suggests a mechanism for tumor metastasis as well as new therapeutic approaches.

LEWIS BLOOD GROUP ANTIGENS

These are biologically important oligosaccharides in which oligosaccharides with both Sialyl Le^a and blood group H structure exhibit high affinity to an antibody directed to human squamous lung carcinoma. Kahne et al[16] synthesized the blood group antigens Le^a, Le^b using sulfoxide glycosylation methodology and have been exploring it's potential for the synthesis of oligosaccharides both in solution and on the solid phase.



Le^A

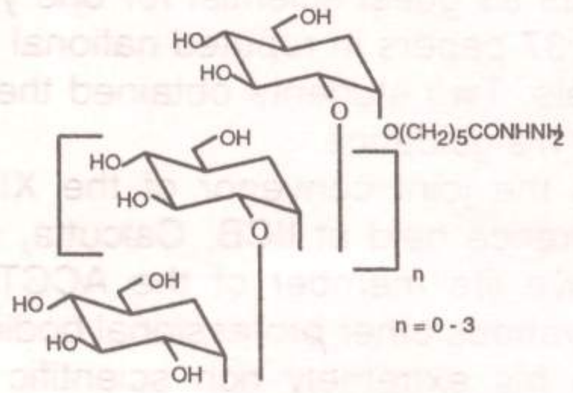


Le^B

BACTERIAL O-ANTIGENS

The synthesis of oligosaccharides related to bacterial lipopolysaccharides(LPS)[17] is of paramount importance as it opens the way to many biologically and clinically active substances like vaccines and antigens. The antibodies produced against cell surface antigens are useful as diagnostic markers for early detection of specific infections by serodiagnosis and may even serve as vaccines[18].

Tuberculosis and leprosy caused by *Mycobacterium tuberculosis* and *Mycobacterium leprae* continues to be a major public health problem worldwide causing three millions of deaths annually[19] and the patients

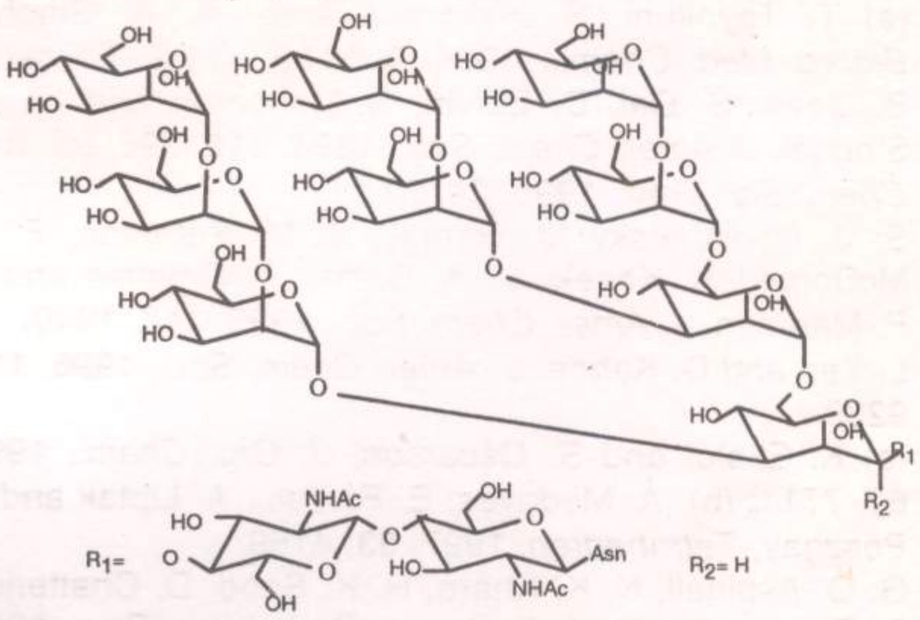


infected by human immunodeficiency virus (HIV) are increasingly susceptible to infection by *Mycobacterium* species. Pozsgay et. al.[20] synthesized neoglycoproteins related to bacterial O-antigens of *M. tuberculosis,* for use in serodiagnosis and as immunogen.

GLYCOPROTEINS

The complex oligosaccharides viz. glycolipids and glycoproteins[5] are ubiquitous in nature and occur as components of cell membranes. The oligosaccharide protrudes from the cell membrane and represents the determinant which is responsible for the specificity of the immune reactions and the protein or lipid serve as a means of anchorage in the double layer of cell membrane.

Despite an extensive international research effort, the HIV infection in AIDS patients remains incurable. The heavily glycosylated surface glycoprotein gp120 plays a critical role for HIV infection to cells. gp120 is responsible not only for attachment and penetration of target cells, but also for the antiviral immune response. There is evidence that the glycans of the viral envelope are possible targets for immunotherapy and/or vaccine development[21].



In view of the remarkable activity of antibodies directed against the mannose residues of HIV-1 glycoprotein gp120, Lee et. al.[22] synthesized the undecasaccharide by using thioglycoside and phenyl selenoglycoside as glycosyl donors.

This article is intended to give a brief overview of the recent progress in synthetic carbohydrate chemistry for the synthesis of biologically important carbohydrate analogs. Inspite of recent advances, oligosaccharide syntheses are still not quantitatively diastereospecific reactions, thus further development of available methods is desirable.

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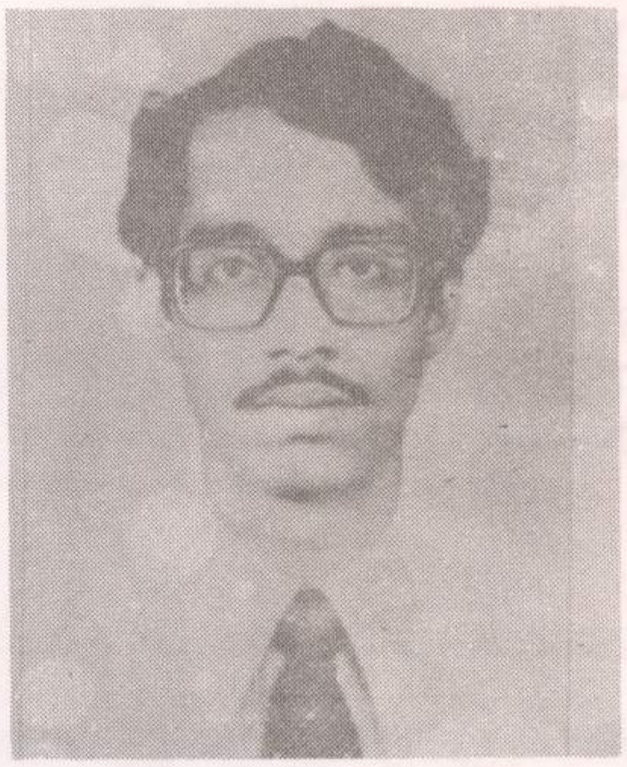
OBITUARY

Dr. Sumanta Basu

An eminent carbohydrate chemist and Reader, Department of Biological Science, Indian Association for the Cultivation of Science, Calcutta, Dr. Basu, left for his heavenly abode in Calcutta on March 8, 1998 , after a brief illness. He was only forty-four years old and is survived by his wife and two daughters.



Dr. Basu had obtained his Master's degree (Gold Medalist) in Organic Chemistry from Burdwan University in 1974 and worked on polysaccharide chemistry at IACS, to obtain the Ph.D. degree from Jadavpur University in 1982. He joined IACS as Research Assistant in 1981 and became Reader in 1994.

He visited Max-Planck Institut für Immunobiologie, Freiburg, Germany, during 1983-85, as post doctoral fellow with prestigious Max-Planck Fellowship and again in 1989 as guest scientist for one year. He had to his credit 37 papers in reputed national and international journals. Two students obtained their Ph.D. degrees under his guidance.

He was the joint convenor of the XIth Carbohydrate Conference held at IICB, Calcutta, in 1996 and was an active life member of the ACCT(I). He was member of various other professional bodies.

Besides his extremely rich scientific carrier and devotion, he was very active in social, voluntary and cultural activities. With him we have lost a very talented scientist and a true friend. May his soul rest in peace.

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