the precipitate dissolved by the addition of a small amount of cold N HCl, about 6 ml. being found sufficient. A small amount of *insoluble material was removed by centri*fuging. To remove inorganic phosphates, the barium salt was again precipitated as described before by adding an equal volume of alcohol (75 ml. approx.) and then 25% barium acetate solution until the suspension was just alkaline to Congo Red, centrifuged and the dissolution, precipitation and centrifuging repeated two more times. Each dissolution required less HCl than the previous one, and more and more of the nucleotide salt was precipitated by alcohol each time. For the last precipitation no barium acetate or at most one drop was required to render alkaline to Congo Red. This is due to the formation of a mixture of the mono and the di-barium salts of A.T.P.,[9] of which the former is soluble and the latter insoluble in water. It also explains the rather high phosphorus and nitrogen percentages of the product. The product is finally centrifuged, washed with alcohol of increasing strength and then with ether and dried *in vacuo* over sulphuric acid, at room temperature. 286 milligrams of a product containing only traces of inorganic phosphate were obtained from 3 bull frogs yielding 100 grams of muscle. The purity of the product was determined by estimating the ratio of labile or hydrolysable phosphate by hydrolysis with N HCl on boiling water-bath for 7 minutes—to stable phosphate by the method of Fiske and Subbarow,[10] and also the total nitrogen. The data obtained from the analyses of two of the preparations are given below:—

Prep. 1. 572 mg. Ba-salt were obtained from 202 grams of muscle derived from 6 bull frogs.

Total phosphate	.. 11·58%
Hydrolysable phosphate	.. 7·83%
Hence, hydrolysable P : stable P :: 7·83 : 3·75, *i.e.*, 2·09 : 1 (Theory, 2 : 1).	
Nitrogen	.. .. 8·91%

Prep. 2. Similar yield.

Total phosphate	.. 11·36%
Hydrolysable phosphate	.. 7·49%
Hence, hydrolysable P : stable P :: 1·94 : 1. (Theory, 2 : 1).	
Nitrogen ..	.. 8·77%
$C_{10}H_{14}O_{13}N_5P_3,Ba_14H_2O$ requires N ..	.. 9·8%
$C_{10}H_{12}O_{13}N_5P_3,Ba_24H_2O$ requires N ..	.. 8·2%

In all preparations, inorganic phosphate directly estimated was negligible.

The sodium salt of A.T.P. was readily prepared from the barium salt by removing the barium directly with the calculated amount of N sulphuric acid, neutralising with N NaOH to pH 7·0 and centrifuging off the precipitated barium sulphate; as little as 1 ml. of solution can thus be prepared in 15 ml. graduated centrifuge tubes. For such small volumes a loss of A.T.P. due to adsorption on the barium sulphate[11] is unavoidable. The A.T.P. content of the solution is determined by estimation of the total phosphate. The salt is stored as barium salt in desiccator and solutions are prepared just before use. The compound appears most stable as sodium salt, stored in solution (pH 6·8) at —12°[12].

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NOR'WESTERS IN BENGAL

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THE arguments and the results from a study of winter rain in the U.P. are applicable to a study of nor'westers in Bengal. Bengal is a densely populated part of India where flat bottomed river craft form a chief mode of transport. The nor'westers cause damage to these river craft and sometimes cause loss of life.

Intensive meteorological observations have been taken in Bengal to study the nor'westers. Many workers have studied the various aspects of the phenomenon.[2] Quoting from Pramanik "Nor'westers or Kalbaisakhis (calamities of the month of Baisakh) are severe thunderstorms which occur in Bengal during the summer months March to May, some of which reach Tordanic violence and cause considerable damage to property and sometimes even loss of life. The winds in these thunderstorms come generally from some north-westerly direction and hence they are called nor'westers. In some cases, funnel-shaped clouds characteristic of tornadoes have been noticed.....It is generally agreed that the nor'westers are not 'local heat' thunderstorms. This appears to have been recognised by Eliot as early as 1876. They also do not occur when the whole of north-east India is over-run by one air mass, *i.e.*, during winter when west to north-west winds prevail and during the periods of strong monsoon when moist winds from the Bay prevail. They occur mostly during the transition period from the winter season to the rainy season, i.e., when two different air-masses, west to northwest winds of land origin and moist winds from the Bay co-exist over Bengal".

Eliot brought in the idea of a cold wedge. M. G. Subramanyam used to say that though there was a southerly feed in the lower levels

of upper air, there would be no nor'wester unless a low pressure wave (shown by the movement of a negative pressure change or negative pressure departure or an actual low pressure area) passed over Bengal. Sohoni found that nor'westers occurred mainly when there was a passage of depression or low pressure wave from the west towards N.E. India and there was a west to east pressure gradient over Bengal. Sen suggested that cold wedges of air from Assam coming down the valleys and undercutting the warm moist winds from the Bay of Bengal gave the nor'westers. Ramanathan used to talk of an incursion of Chinese or Mongolian air but to the author's knowledge did not further pursue the problem. Chatterjee and Sur tried explaining the inversions over lower Bengal in April and May as similar in type to those first observed by J. H. Field over Karachi in August and September 1905. The inversion over Karachi was, they said, due to the same cause, but the history of the dry air over-running the moist air over Karachi was different from that of the dry air over Bengal. They also said that one nor'wester may act as a 'trigger' for a neighbouring one.

The actual method, the writer used in the course of his routine work was based on the analysis of the western disturbance into a number of secondary low pressure areas. When any of these low pressure areas were expected to cross Bengal or its longitude, and when sharp wedges[3] of high pressure formed whose tips were directed in some westerly or southerly direction the situation was watched as being favourable for the production of nor'westers.

Most of the workers are convinced about a shallow layer of southerly feed from the Bay of Bengal, and about the eastward passage of a low pressure wave. Both these are satisfied if a split up low pressure area of a western disturbance (as analysed above) is passing over Bengal. The secondary is situated in about the lstitude of 25° N. The effect of it on upper air circulation would be confined to about 2 or 3 kms, and this would give the "shallow" moist feed. Above the height of 2 or 3 km., as before, the circulation is determined by the rear of a more northerly secondary low pressure area of the western disturbance. Colder air than what was existing previously at those levels must be flowing at those higher levels. When the 'cold front' of the secondary low pressure area reaches the given locality, both the favourable conditions and an initial cause of convection are present as in the U.P. and thunderstorms should occur if no other circumstance intervened. This extraneous circumstance is due to the temperature inversion which persists all the time in the pre-monsoon months and gets broken only during the thunderstorms.

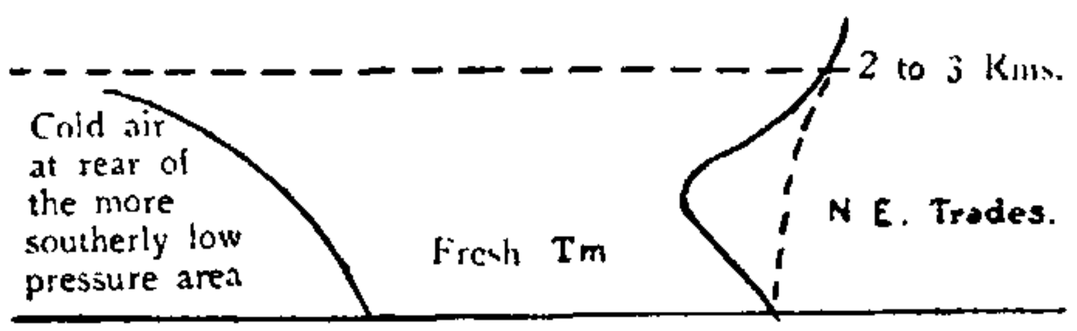
The southerly feed is from the sea and is naturally more moist than the corresponding feed in the U.P. The air can generally be classed as tropical Maritime air (Tm). It undergoes latitudinal convergence and should produce rain easily if other circumstances like temperature inversion did not stand in the way. The Tropical Maritime air may also get sometimes mixed up with Equatorial Maritime air (En). The En which would have come from the other side of the equator, would be very moist and could be made easily unstable. Tm may also be fed by the bent back 'N.E. Trades' (Tr) which in the premonsoon months would be over Bengal. The situation would then resemble wet western disturbances[4].

The role of tropical continental air over Bengal is similar to that in the U.P. At the higher level the rear of the more northerly secondary low pressure areas determine the circulation and the air is Tc. After the passage of the 'cold front' at the lower levels or the surface over a locality, the air even at lower level is Tc and hence homogeneous with the air above 2 km. It is quite explicable how if one depended on only available observational material, confusion could arise that the downward squall of one nor'wester acted as a 'trigger' for the next nor'wester in the neighbourhood.

Regarding the temperature inversion.—The temperature inversions at Karachi occur later in the year (June onwards). In between Karachi and south Bengal there is hardly any inversion. The 'N.E. Trades' are winds that have an equatorward motion and hence undergo latitudinal divergence, and exhibit temperature inversions.[5] In the pre-monsoon months the N.E. Trades get displaced to South Bengal. The N.E. Trades may not be as hot and moist during the pre-monsoon months as in the monsoon. When the low pressure areas of a western disturbance moves eastwards, the N.E Trades or Tr get an eastward displacement and at the same time Tr bends back to feed into the low pressure area. The bending back may be indicated by the high pressure wedges directed to west or south. The eastward displacement and bending back of Tr together, *under the influence of a low pressure area*, are sufficient to dynamically explain the disappearance of the temperature inversion over a locality.

Figure below is a vertical structure before the onset of a nor'wester. The receding Tr is shown by the dotted line (at the time of nor wester).

Fresh Cold Air at the rear of a Northern Low Pressure Area of a Western Disturbance



Though the favourable conditions like fresh Tm at lower levels and fresh Tc at higher levels are present over a locality in Bengal, due to temperature inversion, and lack of marked orography, thunderstorms cannot occur unless the velocity gradient at the rear of the 'cold front' is large. But the effect of the 'cold front' by itself is on an average small in Bengal. The additional cause of

vertical convection is provided by afternoon heating or insolation. For vertical convection due to strong surface heating, there must be inequality, *i.e.*, the isopycnics must not be horizontal.[6] The distribution of rivers and land apparently provide the necessary contrast in surface heating. The rivers may play a part in postponing the time occurrence of the nor'wester.

In the nor'westers there is an absence of aneasily recognisable time sequence. Most of the nor'westers occur in the afternoons, *i.e.*, are dependent on the afternoon heating or insolation. The main causes are due to insufficient wind velocity gradient at the 'cold front' due to lack of mountains and other marked orographic features and due to the temperature inversion. The temperature inversion can only break up if the low pressure area is marked. The low pressure areas of the western disturbances are not quite marked over Bengal. Insolation deepens the low pressure area. Hence the tendency to wipe out the inversion over a locality would be possible in the afternoons. The large river systems tend to disturb the even movement of the nor'westers.

The temperature inversion allows sufficient energy to accumulate until the explosive condition is reached, and may be responsible for the severity of the thunderstorms.

With an extended chart, it must be possible to trace all the air masses considered above.

But with a limited chart some helpful criteria can be given. The upper winds in and around the Bay of Bengal and the weather there should be watched. An infeed of bent back Tr to a secondary low pressure over C.P. or Orissa area[4] moving ENE wards towards Bengal was found to pre-indicate the occurrence of nor'westers. The in feed of Tr to the low pressure area could be deduced if the winds at latitudes south of about 17° N like Port Blair veered and become SE and the winds at stations to the north of the latitudes and almost to the west of Bengal were S.W. The winds in lower Burma and Tenassarim may also be used as for Port Blair. Here again, the time between the winds at Port Blair becoming S.E. and winds along North Madras and Orissa becoming S.W. and the onset of nor'westers can be decided after statistics have been collected over a long period. 36 hours may just be the outside limit.

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SOCIETY FOR THE STUDY OF THE HISTORY OF SCIENCE

THE need of forming a national society in India for the promotion of studies in the history of sciences in this part of the world was explained by Dr. Alexander Wolsky of UNESCO at a meeting of some delegates to the Science Congress at Allahabad on 3rd January 1949.

Dr. Wolsky explained the role which the UNESCO would play in his scheme of forming a National Committee or a Society in India. He said that the role of the UNESCO would be an indirect or passive one.

Dr. Wolsky thought that India with such a glorious past in the history of science was a bit neglected and there should be more active research in this direction. The rest of the world should know far more about the scientific achievements of this country and it was really something which should attract attention all over the world.

Dr. Wolsky pointed out that a Society formed for the purpose of study of history of sciences in this part of the world would find it easier to ask for financial support from the International Union as he was confident it would be forthcoming.

After a short discussion of Dr. Wolsky's proposal, the Science Congress formed a committee with Prof. Banerjee as convener and with powers to co-opt, to formulate a scheme in this connection.

1851 EXHIBITION SCHOLARSHIP

ONE Science Research Scholarship will be awarded this year by the Royal Commissioners for the London Exhibition of 1851 to students from Indian universities or institutions having post-graduate departments of Science The scholarship, which is of the value of £ 350 per annum and tenable for a period of two years, is intended to enable the selected student, who has already completed a full university course and whose record gives evidence of capacity for original scientific investigation, to devote himself to post-graduate research in some branch of pure or applied Science at any institution abroad approved by the Commissioners.

Subjects of the Dominion of India below the age of 26 on May 1, 1949 will be eligible for this Scholarship. Applications from students whether residing in India or abroad have to be recommended by the authorities of a university or an institution and are to be made to Provincial Governments and local administrations through the universities and institutions concerned who would forward them so as to reach the Secretary, Ministry of Education, Government of India, not later than March 10, 1949.