BOSE RESEARCH INSTITUTE

ANNUAL REPORT
and
ACCOUNTS

For the Year 1941-42

REPORT OF THE GOVERNING BODY 1941-42

The Director presented the following annual report on the working of the Bose Institute for the year 1941-42.

1. *Governing Body*—The Governing Body sustained a serious loss by the passing away of Dr. Rabindra Nath Tagore who was a member of the Governing Body since September, 1919.

Mr. K. C. Neogy, M.L.A. was elected a member of the Governing Body on 5th September, 1941.

2. *Obituary*—The Governing Body recorded its deep regret on the passing away of Seth Jamunalal Bajaj a friend and well-wisher of the Bose Iinstitute. He gave a handsome donation for the erection of the Baccharaj Laboratory, Mayapuri, Darjeeling, which is named after his father.

3. *Meetings of the Governing Body*—Six meetings were held during the year, in four of which the agenda included matters arising out of correspondence with the Government of India regarding their proposals on the future constitution of the Bose Institute. Uptill now no final agreement has been reached, pending which the Central Government are continuing their grant from year to year.

Until a definite financial arrangement is reached which will guarantee an adequate graded scale of pay to research fellows and scholars, a certain number of the workers will always try to improve their financial positions by seeking more remunerative appointments elsewhere.

4. *Sir J. C. Bose Memorial Lecture*—The fourth lecture of this series was delivered by Dr. J. C. Ghosh, D.Sc., Director, Indian Institute of Science, Bangalore, on the 30th of November, 1941. The subject of his discourse was 'Science and Modern Life'; it has been printed as a booklet and distributed.

5. *Staff*—Dr. N. B. Das, Research Fellow in Biochemistry, resigned his Fellowship in April, 1941 to take up the post of Assistant Research Officer, Imperial Veterinary Institute, Mukteswar. Dr. J. K. Choudhury, Research Fellow in Botany resigned his Fellowship in September, 1941 to take up the post of Lecturer in Botany in the Bethune College, Calcutta.

Mr. Ram Parshad, M.Sc., Research Scholar in Physics left in October, 1941 to take up a research appointment in the Irrigation Research Institute, Lahore.

Dr. K. T. Jacob, M.A., PH.D. (Lond.) was appointed Research Fellow in Cytogenetics from August, 1941.

Mr. A. T. Das, M.Sc., was appointed Sir J. C. Bose Research Scholar in

Dr. B. K. Bagchi, M.A., PH.D., Sir J. C. Bose Research Fellow of the Calcutta University, was granted study leave to proceed to the U. S. A. from April to December, 1941. Owing to the outbreak of war in the Pacific Dr. Bagchi did not return. The Calcutta University has appointed Dr. Basudev Banerjee, PH.D. (Munich) Research Fellow in his place. Dr. Banerjee is working in the Bose Institute.

Dr. H. K. Banerjee received the degree of doctor of Science of the Dacca University during the year.

Honorary Research Workers. Dr. R. L. Sen Gupta, M.SC., PH.D. (Lond.) Professor of Physics, Presidency College, Calcutta.

Dr. N. K. Saha, M.SC., PH.D. (Heidelberg) Professor of Physics, Scottish Churches College, Calcutta.

Dr. J. K. Choudhury, M.SC., PH.D. (Birmingham) Lecturer in Botany, Bethune College, Calcutta.

Miss Parukutti, M.SC., Professor of Botany, Lady Brabourne College, Calcutta.

Mr. Harbans Lall, M.SC., Lecturer in Physics, Dayanand Anglo-Vedic College, Lahore.

6. *War Measures*—It is a matter of gratification that there has not been any loss in the strength of the mistri and menial staff due to the panic caused by the outbreak of war in Malay and Burma.

The construction of a large glass house commenced in November, was not completed; the panes of plate glass have been stored in a safe place, the roof covered with corruguated iron sheets, and the sides blocked with wooden planks. This large space is now being used as godown for the storage of wooden furniture from the lecture hall. All large glass windows have been removed, and the openings covered with wooden planks. Air raid shelters have been provided for the staff of the Institute in some rooms on the ground floor. Other rooms on the ground floor with bricked up doors and windows are being utilised for the storage of books and apparatus and chemicals. Some valuable books and apparatus have been sent to Mayapuri, Darjeeling.

Schemes for the transference of a part of the Institute to a suitable place outside Calcutta are being examined by a Sub-Committee of the Governing Body. Several likely places were visited by a senior officer of the Institute. Uptill now no scheme has been finally accepted.

The front hall of the Institute has been placed at the disposal of the A.R.P. authorities for shelter purpose. Slit trenches have been dug in the lawn of the Institute.

7. *Co-operation with other Scientific Institutions*—The grant from the Board of Scientific and Industrial Research is being continued. The Agri-biochemist of the Department of Sericulture Bengal has been provided with

Investigations for finding suitable vegetative methods of propagation of chincona plants are being conducted in collaboration with the Government Chincona Plantation, Mungpoo.

** Research Activities.*

Plant Physiology—In the last report it was stated that from investigations carried on in the previous year with leaflets of *Desmodium gyrans* it was concluded that the energy of the pulsatory activity of the mobile leaflets was supplied by the dissimilation of sugar either synthesised in the leaflet under light action, or supplied as glucose from the solution in which the stem of the leaflet dips. This year the investigation was directed towards finding out at which stage in the process of dissimilation is the energy released for the maintenance of the pulsatory activity. Preliminary invesitgations show that it is during the stage of phosphorylation of the glucose molecule that the energy is released. Further it is probable that the phosphorylation is due to the splitting up of molecules of adenyl phosphate which is found to occur in a large number of animal and vegetable tissues. If this is established, then the mechanism of release of energy for contraction will be found to be similar in animal muscular fibres and in the pulvinus of Desmodium leaflet.

An attempt is being made to work out a physical model of the coupled reactions which takes in the cells of Desmodium pulvinus; this will lead to an explanation of the periodicity in the contractile activity of the pulvinus.

Plant Hormones—Investigations have been carried out on the transport of root forming hormones in *Impatiens* as controlled by external application of auxins. A Photo Kymograph method of detecting such hormone concentrations, using the curvature of coleoptile, has been worked out. Different methods of extracting hormones from plants are being investigated.

Chincona—Promising results have been obtained in growing adventitious roots on gootes and cuttings of chincona trees by treatment with auxins. This year the experiments are being repeated on a large scale at Mungpoo to find out whether the method can be utilised for vegetative propogation of chincona plants. A successful method of vegetative propogation will be of value in rapidly extending chincona plantations.

Jute—The influence of the pH value of nutrient solutions on the growth of jute plants and in the production of the 'dieback' effect in jute leaves has been investigated. It is found that while there is a range of pH values for optimum rate of growth of jute, it has no effect on the dieback effect. It is shown that the presence of an excess of (NO_3) nitrogen in the translocated sap is probably responsible for this effect.

The effect of different manures on yield and growth of jute has been carried out at Falta on randomised plots. Treatment of soil with cowdung has

been found to be highly significant. Almost equally effective is a mixture of calcium phosphate, ammonium sulphate and potassium chloride.

Cytogenetics of cotton—A detailed study of the nucleolar chromosomes in eight types of asiatic cotton has been made. Further it has been shown that the chromosomes of all types could be classified in seven groups each, depending on their lengths and morphology. Such a preliminary study is of importance when choosing parents for hybridisation work.

A study has been made of the nuclear changes in the lint primordial cells of *Gossypium arboreum* var. typicum (KI).

Vernalisation—Detailed investigations have been made on three Pusa varieties of wheat, of the effect of presowing treatment of seedlings to warmth, cold, and photo periodic exposures. A tentative conclusion is drawn that vernalisation completes only a part of the presowing developmental period and the later vegetative stage is independent of it. Similar investigations have been started with rice.

Mango—Studies have been continued on the processes involved during the ripening of the typical Indian fruit mango. The effect of ethylêne gas in producing changes in the fruit at different stages of its growth has been studied. Similarly the rate of evolution of volatile products and of respiration at all these stages of the mango fruit has been studied.

A study has been made of the changes which take place in the senescent stage of the mango. The enzymes which are responsible for these changes and the successive degradation products have been studied.

With a view to studying the mechanism of carbohydrate breakdown in Desmodium gyrans, different methods of preparing Glucose-l-phosphate has been tried. A new and which is also a quick method has been worked out by which this ester can be isolated in a very pure condition from sweet potato. Atttempts are being made to prepare other intermediaries and carriers which will be of use in the study of biological oxidation and reduction processes.

Physics—Cosmic Ray investigations—A new method has been worked out for determining the mass of the mesotron, by the examination of photographic plates exposed at high altitudes to cosmic radiation. It has also been established that the star like tracks found in such exposed plates are due to mesotrons produced in a multiple shower by interaction of a component of the cosmic ray with a nuclear particle, the proton or the neutron. The primary component responsible is chiefly neutron (also possibly proton) and also photon. These results provide experimental support to a recent theory that high energy protons incident on the top of the earth's atmosphere are responsible for the multiplicity of the cosmic ray effects observed inside the atmosphere.

Very successful photographs have been obtained of penetrating cosmic ray showers with an automatic counter controlled Wilson chamber. The

The nature of the latent images formed in silver halide grains in a photographic emulsion exposed to ionising rays has been investigated.

The ratio of excitation of the two radioactive isomers of Br^{80} as function of the incident neutron energy has been investigated.

Theoretical investigations have been carried out on the elastic scattering of mesotron in a Coulomb field, on the collision between mestron and electron. The interaction between the electron and the radiation field has been studied, and so also the theory of particles with spin one half with special reference to Compton effect.

Ultra sonics—A number of investigations have been made on the variation with concentration of the velocity of supersonic waves in electrolytic solutions. A class of electrolytes has been discovered in which the variation of velocity with concentration behaves anomalously. It is surmised that there is a relation between the compressibilities of these electrolytes and their viscosities.

A theoretical investigation has been undertaken to deduce an expression for the viscosity of a liquid in terms of the cohesive force between the liquid molecules and on other molecular constants.

An investigation has been undertaken to study the anisotropy of certain class of substances in the liquid state from a study of their X-ray diffraction patterns.

Construction of the following apparatus is nearing completion.

(*i*) An apparatus for the generation of neutron by the low voltage collision between deuterons impinging on a target covered with a compound of heavy hydrogen.

(*ii*) a high frequency galvanometer with a photographic registration arrangement. This galvanometer along with a linear high gain valve circuit will be used to study the processes of nuclear disintegration and mesotron shower production by cosmic rays at high altitudes.

(*iii*) a powerful generator for ultra sonic waves.

Anthropology—A number of investigations have been undertaken on the blood group studies of Indian aboriginal tribes; a study has been made on the classification of Nasal Elevation Index.

The investigations on twins is being continued; records of 71 twins have been collected. The usual course of lectures and demonstration are given twice a year to D.P.H. students of the All-India Institute of Hygiene and Public Health.

Zoology—Investigations are being continued on the parthenogenetic reproduction in red ants and of the factors environmental or otherwise, on which the polymorphism and sex differentiation in the larvæ depends. The

influence of temperature and of the vitamin content of the food-stuffs consumed by them are being specially studied. Cytological investigations on the larvæ and the pupæ of the worker ants are being undertaken.

A systematic study is being made of the antmimicking spiders of Bengal. The study of the egg laying habits of Kai, Khalisa and other fishes of allied character in experimental tanks is being continued.

Publications—Vol. XIV of the Transactions of the Bose Institute has been completed and issued, Volume XV is being printed.

Library—The number of books and journals received during the year has been much restricted. The following new journals are being received in exchange.

(*i*) Proceedings of the National Academy of Sciences, U.S.A.
(*ii*) Proceeding of the National Institute of Sciences, India.
(*iii*) Proceedings of the Indian Academy of Science Sec. B., Bangalore.
(*iv*) Constributions from the Boyce Thompson Institute.

Audited Account—The audited income and expenditure account of the Institute is given in the following pages. The Institute has received a grant of Rs. 50,000 from the Government of India for the year 1941-42.

GML

BOSE

Balance Sheet as at

LIABILITIES	Rs. A. P.	Rs. A. P.	Rs. A. P.
Sir J. C. Bose Research Scholarship Trust Fund—			
Capital Account	....	....	50,000 0 0
Interest in deposit as per last Account	562 11 9		
Interest received this year ..	1,750 0 0	2,312 11 9	
Less Scholarship paid this year	....	470 0 0	1,842 11 9
Staff Retirement Bonus Fund—			
As per last Balance Sheet ..	....	3,000 0 0	
Addition this year	....	1,000 0 0	4,000 0 0
Investment Fluctuation Fund—			
As per last Balance Sheet ..	....	....	1,29,104 5 7
Provision for Contingent & Outstanding Liabilities—	....	....	4,257 0 0
Physical and Biological Dept. Capital Account—			
As per last Balance Sheet ..	....	1,132 6 9	
Less transferred to Income and Expenditure Account to meet part of deficit ..	....	1,132 6 9	
Provident Fund Deposit in part—	....	....	25,835 8 10
Donations—			
As per last Balance Sheet ..	....	....	11,03,165 12 5
Accumulated Trust Fund—			
As per last Account ..	....	4,67,335 4 3	
Less part of deficit for the year		3,506 10 10	4,63,828 9 5
TOTAL ..	....	....	17,82,034 0 0

D. M. BOSE

INSTITUTE

31st March, 1942.

ASSETS.	Rs. A. P.	Rs. A. P.	Rs. A. P.
Fixed Assets— (as per statement annexed)			
Land—			
At Calcutta	1,65,613 0 0		
At Darjeeling	16,000 0 0	1,81,613 0 0	
Buildings—			
At Calcutta	2,21,534 0 0		
At Darjeeling	19,236 0 0		
At Falta	31,731 0 0	2,72,501 0 0	
Furniture and Fixtures ..	....	8,262 0 0	
Apparatus	....	13,327 0 0	
Books and Journals	....	6,355 0 0	4,82,058 0 0
Investments—			
Rs. 12,09,200 3½% G. P. Notes of which 8,800/- with A.G.B. (Account Urmilla Devi Benevolent Fund)	....	9,44,574 6 4	
„ 1,35,100 4% Govt. Loans	....	1,27,585 1 0	
„ 70,000 4½% Govt. Loans	....	66,450 12 6	
„ 10,000 5% Govt. Loans	....	9,787 8 5	
„ 20,000 7½% Preference shares	....	20,000 0 0	11,68,397 12 3
Interest Accrued on Investments	....	....	12,749 15 8
Sir J. C. Bose Research Scholarship Trust Fund—			
Rs. 50,000 3½% G. P. Notes	....	....	50,000 0 0
Ground Rent Outstanding ..	....	....	600 0 0
Security Deposits	....	....	75 0 0
Suspense (wrong debit in Bank Pass Book)	....	....	250 0 0
Scientific and Industrial Research Scholarship Outstanding—			
As per last Balance Sheet ..	....	200 0 0	
Less realised this year ..	....	100 0 0	100 0 0
Advance to Scholar (for Foreign Education)—			
As per last Balance Sheet ..	....	475 0 0	
Less recovered this year ..	....	300 0 0	175 0 0
Cash—			
Trust Fund Account at Bank (of which Rs. 25,835-8-10 is on account of Provident Fund Deposit)	....	66,563 1 5	
Establishment Account in hand and at Bank	....	1,065 2 8	67,628 4 1
TOTAL ..	....	....	17,82,034 0 0

We have examined the above Balance Sheet of the Bose Institute and beg to report that the same is correctly stated according to the best of our information and the explanations given to us and as shown by the books of account of the Institute. We have also verified the

Income and Expenditure Account

Income	Rs.	A.	P.	Rs.	A.	P.	Rs.	A.	P.
Income on Government Grant Account—									
Grant from Government of India—									
For Research Work ..	....			50,000	0	0			
Board of S. & I. R's Contribution for research done for them less Rs. 100/- received on account of 1940-41 ..	....			3,200	0	0	53,200	0	0
Income on Trust Fund Account—									
Interest (General) ..	53,126	0	0						
Less Sir J. C. Bose Scholarship Fund Rs. 1,750/- and Urmilla Devi Benevolent Fund Rs. 308/-	2,058	0	0	51,068	0	0			
Interest (Sir J. C. Bose Scholarship Fund) in part	....			470	0	0			
Interest (Urmilla Devi Benevolent Fund)	....			308	0	0			
Dividend (for Birla Scholarship) ..	....			1,500	0	0			
House Rent	....			300	0	0			
Ground Rent	1,650	0	0						
Add outstanding this year	600	0	0						
	2,250	0	0						
Less outstanding last year	450	0	0	1,800	0	0			
Miscellaneous Receipts ..	....			374	15	6	55,820	15	6
Amount transferred from Physical and Biological Capital Account	....			1,132	6	9			
Balance Deficit for the year transferred to Balance Sheet	....			3.506	10	10	4,639	1	7
Total ..	....			....			1,13,660	1	1

D. M. Bose,
Director.

INSTITUTE

for the year ended 31st March, 1942.

EXPENDITURE.	Rs. A. P.	Rs. A. P.	Rs. A. P.
Expenditure on Government Grant Account—			
Scholarships and Allowances (Director's and Staff's) ..	....	53,025 9 9	
Board of S. & I. R. Scholarship	....	1,200 0 0	
Wages of Mistries and Servants	....	7,076 10 9	
Provident Fund Contribution (less last year's liability) ..	....	2,532 6 0	
Staff Retirement Bonus Fund	....	1,000 0 0	
Laboratory Expenses ..	9,405 10 3		
Less transfer to Trust Fund Account for Urmilla Devi Benevolent Fund Biological Research & Birla Research Expenses	608 0 0	8,797 10 3	
Board of S. & I. R. Research Expenses	....	2,000 0 0	
Purchases of Apparatus ..	....	4,086 7 0	
Purchases of Books and Journals	....	1,385 14 6	
Purchases of Furniture ..	....	60 0 0	
General Expenses (including Printing, Stationery, Electric, Telephone, Staff's Tiffin, etc.)	....	3,901 9 3	
Bonus & Gratuity	....	160 0 0	
Sir J. C. Bose Memorial Lecture	....	440 2 9	
Travelling and Conveyance ..	....	1,361 7 3	
Rents, Rates and Taxes ..	....	782 6 9	
Repairs to Buildings ..	....	7,819 7 0	
A. R. P. constructions ..	....	713 10 6	
		96,343 5 9	
Less Deficit recouped from Trust Fund	....	43,143 5 9	53,200 0 0
Expenditure on Trust Fund Account—			
Birla Scholarship	....	1,200 0 0	
Birla Research Expenses ..	....	300 0 0	
Sir J. C. Bose Scholarship ..	....	470 0 0	
Urmilla Devi Benevolent Fund Biological Research Expenses	....	308 0 0	
Bank Charges, Renewal Fees, Miscellaneous, etc. ..	....	139 7 4	
Income Tax Deduction ..	....	932 4 0	
Depreciation	....	19,499 5 6	
Deficit on Government Grant Account as above	43,143 5 9		
Less Capital Expenditure	5,532 5 6	37,611 0 3	60,460 1 1
TOTAL ..	....	....	1,13,660 1 1

Examined and found correct.

BOSE INSTITUTE

Re: Balance Sheet as at 31st March, 1942.

Statement showing how the values of the Fixed Assets have been arrived at.

	Revaluation price at 31-3-31 after adjustment of additions and sales to 31-3-41 at cost.	Additions (Capital Expenditure) in 1941-42	Total Gross Value at 31-3-42	Depreciation to 31-3-41	Depreciation for 1941-42 and rates thereof	Total Depreciation to 31-3-42	Net Balance at 31-3-42 (as shown in annexed Balance Sheet)
	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.
..	1,65,613 0 0	Nil.	1,65,613 0 0	Nil.	Nil.	Nil.	1,65,613 0 0
..	16,000 0 0	Nil.	16,000 0 0	Nil.	Nil.	Nil.	16,000 0 0
..	2,89,620 4 0	Nil.	2,89,620 4 0	62,294 4 0	5,792 0 0 (2%)	68,086 4 0	2,21,534 0 0
ling	27,566 0 0	Nil.	27,566 0 0	7,641 0 0	689 0 0 (2½%)	8,330 0 0	19,236 0 0
..	49,992 0 0	Nil.	49,992 0 0	16,761 0 0	1,500 0 0 (3%)	18,261 0 0	31,731 0 0
ures nade ..	19,650 11 9	60 0 0	19,710 11 9	10,463 11 9	985 0 0 (5%)	11,448 11 9	8,262 0 0
ling the ..	75,290 12 0	4,086 7 0	79,377 3 0	58,112 12 0	7,937 7 0 (10%)	66,050 3 0	13,327 0 0
nals ub- ute)	24,570 0 0	1,385 14 6	25,955 14 6	17,005 0 0	2,595 14 6 (10%)	19,600 14 6	6,355 0 0
..	6,68,302 11 9	5,532 5 6	6,73,835 1 3	1,72,277 11 9	19,499 5 6	1,91,777 1 3	4,82,058 0 0

GML

The Annual Meeting of Governing Body of the Bose Research Institute was held on Thursday the 21st July 1942 at the Bose Institute at 6 P.M.

Present—

Mr. K. C. Neogy, M.L.A. (in the chair)
Lady Abala Bose
Mr. S. M. Bose
Mr. B. M. Sen
Prof. N. C. Nag
Mr. A. N. Mitter
Dr. D. M. Bose

Mr. A. N. Mitter presented the audited accounts for the year 1941-42.
Resolved that the audited accounts be passed.

Appendix I

ABSTRACT OF PAPERS AND REPORTS

A. *Plant Physiology and Genetics.*

1. On the mechanism of contraction of the pulvinus of leaflets of *Desmodium gyrans.*

Previous investigations have shown that the pulsatory activity of the leaflets of *Desmodium* gyrans is maintained by the dissimilation of the sugar stored in the leaflet, which has been either photosynthesised in the leaflet or imbibed from a solution of glucose in which the stem of the leaflet is dipped. Under the latter condition the leaflet is found to continue its pulsation for a long time even in complete darkness. The best results are obtained when the leaflet stem is dipped in a glucose solution and is also exposed to daylight. This shows that sugar cannot completely replace the substances which are produced in the leaflet of Desmodium under the action of light.

Investigations are being carried out to find at which stage in the dissimilation of sugar is the energy supplied to maintain the contractile activity of the pulvinus. We have followed the analogy of the mechnism of contraction of muscular fibres in animal tissues. In many animal and plant tissues the first step in the dissimilation of glycogen or of sugar is the phosphorylation of the glucose molecule by the action of adenyl phosphate leading to the production of glucose-l-phosphate and adenylic acid. At a later stage of the process the reaction product phosphopyruvate decomposes to pyruvic acid with the reformation of adenyl phosphate. In animal tissues it is supposed that the energy of contraction of the myosine elements of the muscle fibre is supplied by the decomposition of adenyl phosphate.

Glucose-l-phosphate has been prepared in the biochemical laboratory by Dr. H. K. Banerjee and its efficacy has been tested by Mr. B. K. Palit, who finds that in a nutrient solution in which root tips of different plants can grow, the glucose in the solution can be replaced successfully by the glucose-l-phosphate. Desmodium gyrans leaflets whose stems dipped in dilute glucose are found to maintain their activity in the dark. Some experiments were carried out in which the leaflets were dipped in solutions of glucose-l-phosphate, but the pulsatory activity of the leaflets was not maintained. If these negative results are verified by similar experiments carried out during the rainy season when the Desmodium is in its most vigorous condition, then the conclusion can be drawn that the contractile activity of the leaflet is maintained by the process of phosphorylation presumably in the presence of adenyl phosphate. The sap expressed from Desmodium leaflets is being tested

Plant Hormones and Auxin treatment.

2. *Velocity of longitudinal transport and transverse translocation of the root forming hormone in Impatiens by the attraction of high concentration auxin.* By A. GUHA THAKURTA & B. K. DUTT (ready for publication).

In the present investigation the velocity of root forming hormone has been determined from the distance of the treated region of the stem from the leafy top and the average time of root formation at different regions, apical, central and basal. The mean velocity of root forming hormone by the attraction of high concentration auxin (1% indole acetic acid) has been found to be 2·0 mm. per hour.

The transverse translocation of hormone has been shown by the split stem method. When the stem of *Impatiens* is split in two halves and one half is completely defoliated and treated with high concentration auxin, roots form at the treated region indicating that root forming hormone has been translocated from the leafy half and the hormone in doing so has crossed the stem at some region below the end of the split. When both the halves are treated with auxin, roots form at the leafy half only, showing that all the hormone has concentrated at the treated region of the leafy half, and that the auxin treatment in the leafy half has in that way blocked the translocation of hormone to the defoliated half.

An additional investigation was performed on the effect of sugars and vitamin B_1 on root formation under treatment with auxin. When the completely defoliated stem of Impatiens having constant supply of glucose, sucrose and vitamin B_1 through the decapitated top, is treated with high concentration auxin no root formation occurs at the treated region. This shows that whatever influence the carbohydrate and vitamin may have on root formation they are ineffective in the absence of root forming hormone naturally present in the plant.

3. *Detection of hormone concentration in plants induced by the action of high concentration auxin by the coleoptile curvature method.* By B. K. DUTT & A. GUHA THAKURTA (investigation continued).

A specially designed Photo-Kymograph has been constructed for automatically recording the curvature of coleoptiles, induced by unilateral application of agar block containing plant hormone. In previous communications it has been deduced that high concentration auxin attracts the internal hormone of the plant from other regions to the treated region. In the present investigation experiments have been undertaken to observe by direct measurement how the hormone concentration of the untreated regions is changed in treated plant.

It has been found that when the top of avena coleoptile, treated basally

avena test plant, the curvature induced in considerably less than when the tip of the untreated coleoptile is similarly applied on the test plant. Definite result has also been obtained by the agar extraction process.

4. *Hormone extraction from plants.* (*ibid.*).

Extraction of hormone from various plants by ether and other extraction methods has been undertaken, to observe its effect on growth and root formation in plants.

Hormones were extracted by the ether extraction method from *Impatiens* leaves and mango leaves and flowers. When the lanoline mixtures of these extracts were applied on the stem of *Impatiens* acceleration of growth was observed. The experiment is being continued.

5. *Investigation on the vegetative propagation of Cinchona.* (*ibid.*).

Experiments were conducted at Mungpoo to discover a suitable method of vegetative propogation of *chincona ledgeriana.* Attempt was made at the end of June last year to find out whether such propogation is possible from gootes and cuttings treated with different concentrations of auxins and Vitamin B_1. It has been found that 2% Indole acetic acid induces vigorous root formation in the gootes of young plants. In some of the older plants there have been root formatoin by treatment with 2% Indole acetic acid. During the present year the experiments are being repeated once in early spring and again in late summer. Indole acetic acid and indole butyric acid in lanoline paste and aqueous solution will be used.

Further the effect of previous and subsequent applications of Vitamins B_1 and C, of amino acids and of dilute potassium permanganate solutions will be investigated.

6. *Physiological responses induced on plants by the action of light and darkness.* (*ibid.*)

It has been observed by some workers that capping the upper part of the tomato plant with black cloth induces physiological responses such as epinasty of leaves, swelling, inhibition of growth, initiation of adventitious roots and disturbance of apical dominance correlations. Experiments have been undertaken to investigate into the causes of such physiological responses.

Cytogeneties of Cotton.

7. *Preliminary observations on the chromosome morphology in Asiatic cottons with special reference to their phylogeny and inter-relationships.* By K. T. Jacob (*Trans. Bose Res. Inst.* Vol. XIV).

A detailed critical study of the nucleolar chromosomes was made in the

1. *Gossypium stocksii Mast.*
2. „ *arboreum* L. var. *typicum* forma *indica* H. & G. (Nadam)
3. „ „ „ *neglectum* „*bengalensis* H & G (roseum)
4. „ „ „ *cernuum* H & G (cernum from Garo Hills)
5. „ *herbaceum* „ *africanum* H & G.
6. „ „ „ *frutescens* Delile (Uppam, 2919)
7. „ „ „ *typicum* H & G (Russian, 2282)

Evidences from the somatic complements suggest that the Asiatic cottons are secondary allotetraploids with the constitution 4b—2.

Among the *arboreums, typicum* represents an early type, *neglectum* a later and *cernuum* a still later type in the evolution of the species. In the *herbaceum* types, *typicum* appears to be more highly evolved than *frutescens.*

8. *Studies in Cotton IV. Morphology of the somatic chromosome in eight types of Asiatic cottons.* By K. T. Jacob (Trans. Bose Res. Inst. Vol. XV).

A detailed study of the chromosome character of the previous seven types of asiatic cotton and of *Gossypoum arboreum* var. typicum (KI) has been given. The chromosomes of all the types could be classified into seven groups each, depending on their lengths and morphology.

The importance of such a study in choosing parents for hybridisation work is discussed.

9. *Nuclear changes in the lint primordial cells of Gossypoum arboreum* var. *typicum (KI).* By K. T. Jacob (Science and Culture, 7, 512, 1942).

The lint primordial cells before protrusion were found to be binucleate, this condition having arisen by the suppression of the cross-walls in the previous mitosis.

The two nuclei fuse just before protrusion, in other words the fusion of the two nuclei is an essential pre-requisite for the development of the lint hairs.

These nuclei are clear and homogenous and not abnormal and darkly stained as reported by previous investigators.

The increased size of the nuclei of the lint primordial cells at the time of protrusion is due to the fact that they are 'tetraploid' nuclei and not due to the absorptoin of water by the nuclei, as reported by previous workers.

B. *Bio and Agricultural Chemistry.*

10. *Studies on the influence of pH on the growth and on the production of 'die back effect' in Jute (Corchorus capsularis).* By B. K. Palit, (Trans. Bose Res. Inst., Vol. XV).

Previous investigation on the appearance of 'dieback effect' in Jute led

sand may have some influence on the appearance of this effect. Present investigation was undertaken to test the point and also to determine the value of pH for optimum growth.

Culture solutions with four different pH values were used. Optimum growth was found for pH 5.6 to 7.6. The 'die back' effect was found to occur with all the culture solutions used. Estimate of the carbohydrate and nitrogen content in healthy and affected leaves were made. In healthy leaves the percentage of starch is low, of soluble sugar high with very low (NO_3) nitrogen. While in affected leaves the starch value is high in comparison to the soluble sugar present, and an appreciable amount of (NO_3) nitrogen is found. It is inferred that the 'dieback' effect is due to excessive translocation of (NO_3) nitrogen from the soil to the leaves due to local accumulation of (NO_3) in the soil. Further investigations are being continued.

11. *Manurial Experiment on the Jute Plant* (*Corchorus capsularis*). By J. K. Choudhury (ready for publication).

A manurial experiment on jute plants (D. 154) was conducted at Falta. Data obtained for both yield and growth in height of the plants treated with cowdung were found to be highly significant. Almost equally effective was found a mixture of calcium phosphate, ammonium sulphate and potassium chloride. The effects of a mixture of ammonium sulphate and potassium chloride was less favourable, and those of calcium phosphate in combination with either ammonium sulphate or potassium chloride was detrimental.

In general there exists a relationship between the height of jute plants and their yield. The plants continued to grow in height up to the tenth week from the date of sowing, and the rate of growth was more pronounced between the fifth and the seventh week.

12. *Vernalisation of Indian crops I. Investigations on some varieties of Indian Wheat.* By B. K. Kar (ready for publication).

Investigations were commenced in 1938 chiefly with I.P. 165 variety of Pusa wheat and later supplemented by investigations on two other varieties I.P. 4 and I.P. 52.

Certain conclusions have now been reached on the effect on ear emergence produced by treatment of seedlings to (*i*) cold treatment (*ii*) to light treatment of different periods and a combination of cold or warmth and light treatment. The results obtained are discussed in light of the evolutionary history of wheat naturalised in India.

13. *Effect of vernalisation on Paddy.* By B. K. Kar (not complete).

To find out the metabolic changes brought about by various vernalisation processes, two varieties of Aus paddy (Kataktara & Dharial from Dacca) were vernalised in cold treatment and then supplemented with different photo-

periods and sown in four replications for each treatment in randomised blocks. Random selection of the whole plants (leaving the roots) were made every week from the earliest stage to the flowring stage. Mr. A. T. Das is undertaking an analysis of the materials collected for their nitrogen, carbohydrate, phosphoric acid and calcium contents.

14. *Studies in the Physiology of some Indian Fruits III. Effect of ethylene gas on the different stages of Mangifera indica.* By B. K. KAR and H. K. BANERJEE (to be published in the Trans. Bose Res. Inst., Vol. XV).

The results obtained from these investigations confirm the previous results obtained with *Psidium* guayava. Young immature mango fruits do not show an enhanced reaction as in the case of mature fruits, where the respiration rate is appreciably increased with increase in carbohydrate content. The increased rate of respiration may also be due to the attainment of the climacteric phase at this stage which is possibly further enhanced by the ethylene reaction. This aspect of the problem is investigated in the paper IV of this series.

15. *Studies in the Physiology of some Indian Fruits IV. Evolution of volatile products and the rate of respiration during the different stages of Mangifera indica.* By B. K. KAR and H. K. BANERJEE (to be published in Trans. Bose Res. Inst. Vol. XV).

The previous investigations on the metabolism of fruits have shown that the various reactions are dependent on the physiological phases of the outgoing material. In this investigation therefore, the consequent evolution of gaseous products from the earliest to the ripening stages of the fresh fruit has been estimated. It was found that in a current of free air drawn from the fruit chamber, the rate of evolution of total volatile product, as estimated here, was negligible in the early and enlarging stages of the fruit. The rate increased in the mature stage of the fruit and was continued during the ripening stage. In the post-ripening stage the evolution of volatile product was appreciably increased. When compared to the corresponding respiration rate, it was seen that climacteric rise in respiration rate was not accompanied by by increase in volatile product but rather preceeded it. The increased output of total volatile product was shown in the post-climateric and ripening stage which increased in volume further in the senescent stage.

16. *Senescence Zymasis in Mango.* By H. K. BANERJEE (ready for publication).

Zymasis and cell oxidations are linked processes. During the senescent stage in the mango, especially under condition of its storage, rapid catabolic changes occur which are responsible for the degradative decomposition of its substrate.

Anærobic glycolysis, directed by the zymase complex is responsible for most of the reactions involved. The essential feature of the process is that

ethyl alcohol with possibly its precursor acetaldehyde accumulates. In the mango the rate of zymasis after a slow initial period of varying extent becomes increasingly accelerated as the fruit advances in ripening. The extent of zymasis has been evaluated as the alcohol number.

The Alcohol Enzyme, 1. A cell free preparation of Alcohol dehydrogenase has been made from *Magnifera indica* and the activity of the enzyme was measured anærobically by the Thunberg tube technique and manometrically with the Warburg manometers.

The enzyme oxidises ethyl alcohol in the following systems:

Ethyl Alcohol—Alcohol Dehydrogenase—CoenzymeI—Coenzyme dehydrogenase—Methylene blue—oxygen.

The effect of variation in the concentration of these components, the specificity of substrate, and the effect of fixatives have been investigated.

The product of oxidation has been proved to be acetaldehyde.

The enzyme is inhibited by $CuSO_4$ and Iodoacetate. The intact pulp oxidises both EtOH and acetaldehyde, but the cell free preparation is without any action on acetaldehyde.

Reduced glutathione and also KCN, Na_2S, and thioglycollic acid activate the enzymic dehydrogenation of EtOH.

The activation is due to the binding of heavy metals, since when these are removed as completely as possible (dialysis), the effect of reduced glutathione and KCN are less than usual and inhibition caused by $CuSO_4$ is counteracted by addition of reduced GSH or KCN.

17. *Mechanism of carbohydrate breakdown in Desmodium.* By H. K. Banerjee (not completed).

In collaboration with the Department of Plant Physiology the path of carbohydrate breakdown in the Desmodium is being investigated. The phosphorylating system responsible for such reaction is being followed.

As a preliminary Glucose-1-phosphate, an important intermediary in carbohydrate breakdown has been synthesised in vitro by an enzyme isolated from fresh potato on soluble starch prepared in the laboratory. The physiological action of this important ester has been tested on the movement of the isolated Desmodium shoot and also on plant tissues grown in culture medium.

A new and quick process has been developed by which this ester can be isolated in a very pure condition from the sweet potato.

Attempts are being made to prepare some other intermediaries and carriers in the chemical laboratory for future investigations.

C. *Department of Physics.*

17. *On the elastic scattering of meson by a Coulomb field Part I.* By R.

The scattering of meson by a Coulomb field has been calculated for different values of its spin. The contribution to the scattering due to the finite size of the nucleus and the screening of the nucleus by the atomic electrons are also estimated. It is found that the spin of the meson contributes considerably to the scattering at large angles for even moderate incident energy and at small angles for relatively high energy of the meson. The significance of these results in the theory of multiple scattering of meson will be discussed in the second part of the paper.

18. *On the collision between meson and electron.* By S. Gupta and R. C. MAJUMDAR, (sent to Proc. Nat. Inst. of Sciences of India for publication).

The cross-sections for the meson-electron collision for different values of spin of meson are investigated from the quantum electro-dynamics. In the first article the Hamiltonian containing the interaction of meson with the electromagnetic field is given and in the second article the matrix elements of the interaction between meson and electron for different polarisations of meson are calculated. The cross-sections are evaluated in the third article whereas in the fourth one the bearing of these results on the spin of the meson is discussed.

19. *The theory of particles of spin half and the Compton effect.* By R. C. MAJUMDAR (A note has been sent to Science and Culture and the full paper to the Indian Journal of Physics).

It has been recently shown by Bhabha and Basu that the scattering of photon by an electron when calculated from the "hole theory" of Dirac does not lead to Klein-Nishina formula for the Compton effect. They find that when the energy of the incident photon is comparable with or larger than the rest energy of the electron the total scattering cross-section becomes considerably larger than the Klein-Nishina formula. It is pointed out in this note that the deviation which has been obtained by Bhabha and Basu is due to the method of procedure adopted by them in treating the problem. It is shown that by following the method of quantum electrodynamics if we replace the wave function of Dirac which is a "c" number by an operator which is a "q" number and subject them to the commutation relations compatable with the Pauli's exclusion principle, we obtain the Klein-Nishina formula also in the hole theory of Dirac.

20. *On the second quantisation of Dirac's relativistic wave equation for electron of spin one half and the interaction between the electron and the radiation field.* By R. C. MAJUMDAR (nearly ready for publication).

It is well known that the negative energy states in the Dirac's theory of electron present great difficulties in the formulation of the problem connected

with the high energy of the electron. Doubts have been expressed as regards the correctness of theories in which the negative energy states are involved such as Compton effect, Bremsstrahling, creation and annihilation of electron and positron etc; they are being usually deduced on the assumption that all the negative energy states are empty. In the present paper a systematic quantisation of Dirac's relativistic wave equation is carried out, the holes in Dirac theory appear as positron in this scheme. The energy-momentum-tensor and the current charge density are found out and quantised. The interaction between the electron and the radiation field is investigated and put together into forms which are convenient for discussions of Compton effect, Bremsstrahlung etc. which involve the negative energy states. It is found that the previous results remain unchanged even when we assume that all the negative energy states are completely filled up. The problems of self energy and the polarisation of vacuum are also discussed and worked out and the results are in complete agreement with those obtained by Weisskop, Dirac and Heisenberg.

21. *Passage of ionising particles through photographic emulsion. Relation between Energy, Range and mean grain spacing along tracks of α-particles and protons.* By BIBHA CHOUDHURI (Vol. XV Trans. Bose Res. Institute).

22. *A photographic method of estimating the mass of the mesotron (some corrections).* By D. M. BOSE and BIBHA CHOUDHURI, (sent for publication to Nature).

Some improvements are introduced in the method given in a previous publication in Nature (148, 259, 1941) for estimating the mass of the mesotron.

It is also pointed that the data contained in the series of communications published in Nature, show that multiple mesotron showers are produced in a single act by some component of the cosmic ray viz. neutron (probably also proton). This can be considered as an experimental support of the Carlson and Schein theory that the totality of the cosmic ray processes taking place in the earth's atmosphere is due to the incidence on the top of the atmosphere of a single type of high energy primary particle, the proton.

23. *Nature of the latent images formed in silver halide grains due to the absorption of light quanta and to the passage of ionising particles in photographic emulsions.* By D. M. BOSE (ready for publication).

A comparative study is made of the mechanisms of formation of latent images by the action of light absorption and by the ionising action of fast charged particles. It is shown that similar to the results obtained by Webb and his fellow workers, *viz.*, that some of the silver halide grains require the absorption of several hundred light quanta to make them developable, it is found that silver halide grains are present in the path of fast ionising

particles which require the absorption of energy of collision equivalent to that of several hundred to thousand light quanta.

24. *Wilson chamber photographs of penetrating cosmic ray showers.* By R. L. SEN GUPTA and M. SINHA. (to appear shortly in the Indian Journal of Physics).

A counter controlled Wilson chamber is described which is specially suited for the photography of multiple penetrating showers. Photographs of different types of showers obtained are given.

25. *A note on the kinetic equivalence of bromine atoms in Phosphorous Pentabromide.* By S. D. CHATTERJEE (Journ. Ind. Chem. Soc. Vol. XIX, 1942).

26. *On the ratio of excitation of the two isomers of Bromine as function of the neutron energy.* By N. K. SAHA and S. D. CHATTERJEE (ready for publication).

Using neutrons of different energies from a Ra Be source, the excitation ratio of the two isomers has been quantitatively studied. It is found that the ratio Br^{80} (4.2 hours) : Br^{80} (18 mts) increases with the increase of neutron energy.

27. *Variation in the velocity of supersonic waves in electrolytic solution with concentration.* By A. K. Dutta and B. B. GHOSH.

Results obtained by previous investigators indicate that in electrolytic solutions the velocity of ultra sonic waves increase with concentration. The authors have discovered a class of electrolytic aqueous solutions of KI, KBr, KNO_3 in which initially there is a diminution of the velocity with concentration, after which the velocity rises again. Further it has been found that the initial anomalous behaviour is dependent on the temperture of the electrolytic solution. It is shown that this variation in velocity is due to the initial diminution of the compressibility of the solutions. Their behaviour therefore do not follow the relation between compressibility and concentration deduced by Falkenhagen and Bachem based upon the ionic dissociation theory of Debye and Falkenhagen.

On the otherhand from the data collected by the authors on the temperature variation of viscosity of some electrolytic solutions, it appears that both the viscosity and the compressibility of these electrolytes vary in a similar way with temperature. The investigation is being continued.

28. *Variation of viscocity of a substance with temperature from the fluid to the liquid state.* By A. K. DUTTA (not complete).

An empirical formula has been deduced connecting the viscocity of a liquid as a function of the cohesive force between the liquid molecules and on other molecular constants; some other factors appear in the formula which it has not been possible to interpret theoretically. The empirical formula appear

to represent satisfactorily the temperature variation of viscocity of a number of liquids. An attempt is being made to extend the formula so that it will represent the temperature variation of viscocity of a substance both in the fluid and in the liquid state. It is necessary for this purpose to introduce a term in the expression for the viscocity of a gas dependent upon the mutual cohesive force between the molecules.

29. *Anisotropy in the Liquid state—evidence from X-ray diffraction data.* By S. R. Das (ready for publication).

From the change in the value of δ the Braggs spacing in any liquid with temperature, the value of α the temperature coefficient of linear expansion of the liquid can be determined. For an isotropic liquid this should be one third of the coefficient of cubical expansion γ as determined from thermal data. Data have been collected for a number of liquids of the value of α as obtained from X-ray measurements and of γ. It is found that the value that γ varies between 3 α and α. The dependence of the variation of γ on the molecular anisotropy of the liquid is discussed.

Apparatus under construction.

(*i*) Construction of a neutron generator. By S. R. Das.

The apparatus is nearing completion; it is of the low voltage type in which deuterons accelerated through a voltage of 70 kv. impinge against a target of some heavy hydrogen compound. The discharge tube is made up of two parts; in the upper part a low voltage arc of 2 amps. at 40-60 volt is maintained in a stream of Deuterium gas at about $0{\cdot}5\times10^{-1}$ mm. pressure. The stream of gas is led in to the high vacuum side of the discharge tube (pressure 2×10^{-4} mm.) through a canal in the iron anode about 1 mm. diameter, where the charged ions are accelerated through about 70 kv., and impinge on the target.

The arc is maintained by an oxide coated dull emitting nickel wire cathode which has been prepared in the laboratory, and it is stabilised by means of a longitudinal magnetic field. The percentage of D^+, D_2^+ and D_2 striking against the target is analysed by means of a calibrated magnetic field and a Faraday cylinder. At present the conditions for the maximum production of D^+ is being investigated. Preliminary work is being carried out with H_2. The deuterium will be produced by electrolysis of heavy water, and the unused portion will be rcovered by passing the exhaust gas from the discharge tube through a tube containing heated copper oxide attached to a condensing circuit. Preliminary trials with Hydrogen are almost completed.

(ii) High frequency ionisation current recording arrangement. By S. D. Chatterjee.

All the component parts have been constructed by the author in the Institute workshop. Two high frequency galvanometers have been con-

structed; in one a light narrow wire loop moves in the field of an electromagnet, and the other is constructed in accordance with the specifications of Wynn-Williams. Great difficulty has been met with in obtaining sufficient light spot intensity on the photographic film, which depends on the size of the moving mirror and on other optical factors. Another difficulty which had to be overcome was to produce very uniform rate motion of the recording film, which moved at rates varying from 1 to 100 cm., per minute. The recording arrangement will be used with an electrometer tube amplifying arrangement for the measurement of (*i*) the intensity of cosmic ray neutron at different altitudes (*ii*) mesotron showers in a pressure ionisation chamber of small volume and (*iii*) nuclear disintegration by cosmic rays.

(*iii*) A powerful generator of ultra sonic waves is being constructed by B. B. Ghosh under a grant received from the Board of Scientific and Industrial Research. Demountable valve tubes of estimated output 2·5 kv., two oil diffusion pumps of speed 10 litres per second producing end vacuum of the order $6 \cdot 10^{-6}$ mm. have been constructed in the workshop. An arrangement for cutting quartz plates has been set up, and oscillator plates of size 22 mm.×18 mm. have been cut and found to produce very satisfactory ultrasonic oscillations. Besides mica condensers and high frequency choke coils have been constructed.

D. *Department of Anthropology.*

During the year 1941-42 the following papers were published:

30. *Aims and Objects of Eugenic Researches in Bengal.* Bull. Indian Eugenic Soc., I.
31. *Blood Groups in India* Amer. Jr. Phys. Anthr. XXXVII, 1941. (Joint paper with Mrs. E. W. E. Macfarlane).
32. *Further note on the classification of Nasal Elevation Index.* Jr. Ind. Anthr. Inst., II, 1942.
33. *Analysis of Indian Blood group data with special reference to the Oraons.* . Trans. Bose Res. Inst., XV.
34. *Indian Taste Reaction to Phenyl-thio-Carbamide.* Journ. of Heredity. (to be published).

RESEARCHES

Twin investigations are being continued. We have now a total number of 71 twins (including multiple births) on record. Two pairs of twins were brought in January, 1942, for investigations. No field work could be undertaken this year.

Gm

LECTURES

The D. P. H. classes were taken on the following days:—

December 8, 11 and 13, 1941.

E. *Department of Zoology.*

35. *The food and habits of Heteropoda venatoria, Linn.* By G. C. BHATTACHARYYA (Journ. Bom. Nat. Hist. Soc., Vol. XLII, No. 4, 1941).

Spider generally live on the more helpless invertebrates. But instances of their preying upon vertebrates such as fish, frogs, snakes, lizards, etc. are also available. But any instance of spiders preying upon tiny bats has not been known. The author came across such an instance of a spider, *H. venatoria, Linn,* preying on a tiny pipistrelle bat. On further investigations some peculiarities in the habits of this species of spider were observed. Some instances of preying, fighting and cocooning habits of this species have been included in the paper.

36. (*a*) *Parthenogenetic reproduction in Red-ants with reference to the blastogenic* (*genetic*) *or trophogenic* (*environmental*) *causes which determine the development of different classes in them.* By G. C. BHATTACHARYA (ready for publication).

The results of investigations for the determination of the above problem are as follows:—

All through the year the workers of *Œcophylla smaragdina,* Fabr. lay eggs parthenogenetically both in natural and in artificial conditions. These eggs do not present any external characters by which the future class, *e.g.,* males, females or workers to which they will develop could be foretold. Generally workers come out of those eggs. Development and consecutive metamorphoses are much delayed in winter season only. In natural conditions males and queens appear during the summer months from March to May. But in artificial formicaries this does not take place when the ants are fed with fish-bones, shrimps, insects and sugar, etc. In three cases when the artificial nests containing worker-ants were placed in contact with a potted mango plants, males appeared. It has also been observed that only males develop from the unfertilized eggs of the queen.

Before the advent of summer a newly planned experiment was started. A number of flower-buds with stalks, newly sprouted foliage and some branches of plants infested with coccids and aphides were placed in contact with artificial nests, in addition to the usual food containing shrimps and sugar solution. This experiment was continued for more than two months, when in the middle of March a few larvæ of queen appeared in two of those experimental nests.

This shows that workers, males and females may be produced from the parthenogenetic eggs of worker and the anatomical and physiological differentiation of these larvæ is dependent upon the nature of their diet and environment.

The consensus of opinion is that

(*i*) from the parthenogenetic eggs of female only males and from the fertilized eggs workers can develop,

(*ii*) the worker is an atrophied female and parthenogenetically it can lay fertile eggs.

So if it is true that female can produce parthenogenetically males the same must be true that the worker also; and then only the nutritional difference determines whether an egg is to become a male, worker or a highly specialized egg-laying organism, the queen.

(*b*) It is known that true females and workers are produced from the same kind of larvæ of *Apis mellifica* by nutritional differences. The larvæ of these insects fed with royal-jelly are supposed to give rise to queens, Royal jelly was supposed to be rich in vitamin E, but now it is known that it contains vitamin B_1. In normal condition, during the summer months (the time when the males and females appear in Red-ants colony), the larvæ of Red-ants are fed with some secretions of aphides, coccids and newly sprouted twigs or buds of plants. It has been ascertained by suitable tests in the chemical laboratory that these buds, twigs and aphides are rich in vitamin B_1. So nutritional experiment with different concentration of vitamin B_1 (Thiamin) is being started. Attempt is being made for quantitative estimation of vitamin content of aphides and plant leaves. The physiological and anatomical differentiation of the female larvæ may be dependent upon the presence or absence of vitamin B_1 as a factor.

(*c*) Cytological investigations are being continued for the proper interpretation of class differentiation in Red-ants. Some transverse sections from the larvæ and pupæ of worker ant have been prepared and they are being examined.

37. Some progress have been made in systematic studies of the collection of Attid spiders of Bengal (Ant-mimicking group) reported before. Four different species, mimicking the stinging-ant, *Diacamma vagans*, smith, and three different species, mimicking the black ant, *Camponotous compressus* have been identified of which two seem to be new.

Gm