

BOSE RESEARCH INSTITUTE

ANNUAL REPORT
and
ACCOUNTS

For the Year 1938-39

Scan: Bl-Lib-Gm

ANNUAL REPORT

The Director begs to present the annual report of the working of the Bose Institute for the session 1938-39.

1. The Governing Body as constituted on 1st April, 1938, consisted of the following members:—

1. Dr. Rabindra Nath Tagore,
2. Lady Abala Bose,
3. Sir Nilratan Sircar, M.A., M.D., LL.D., etc.,
4. Mr. J. N. Basu, M.L.A.,
5. Prof. Birbal Sahni, Sc.D., F.R.S., Lucknow,
6. Mr. S. C. Mukherji, I.C.S. (retd.),
7. Mr. B. M. Sen, M.A. (Cantab.), M.Sc. (Cal.), I.E.S.,
Principal Presidency College,
8. Mr. S. K. Mandal, Solicitor,
9. Mr. S. M. Bose, M.A., LL.B., Member, Public
Service Commission, Bengal; Secretary, Bose
Institute,
10. Prof. N. C. Nag, M.A., F.I.C., Asst. Director, Bose
Institute,
11. Mr. A. N. Mitter, Superintendent, Bose Institute,
12. Dr. D. M. Bose, M.A., Ph.D., F.N.I., Director, Bose
Institute.

Five meetings of the Governing Body were held on 15th July, 3rd September, 13th December, 1938, 6th March and 22nd March, 1939.

2. *Sir J. C. Bose Memorial Lecture.*—A scheme for the delivery of an annual Sir J. C. Bose Memorial Lecture on the 30th of November, the birth day of the founder and the foundation day of the Bose Institute has been accepted by the Governing Body. Dr. Rabindra Nath Tagore accepted the invitation to deliver the first Memorial Lecture. As he was unable to be present at the meeting, his address was read by Mr. Ramananda Chatterjee. Sir Nilratan Sircar who presided over the meeting delivered an address reviewing the life and work of

SCam: B1. Lib. Gm

Sir J. C. Bose. Both the addresses have been printed and circulated.

3. *Staff*.—During the year under review the following new appointments have been made.

Department of Plant Physiology and Genetics.—

Dr. B. K. Kar, M.Sc., Ph.D. (Leipzig), formerly Research Assistant to Prof. Parija of Cuttack; Assistant Physiologist and Microscopist, Cotton Research Laboratory, Lyallpur; Fellow, Deutsche Akademie, Munich.

Dr. P. J. Gregory, M.A., Ph.D. (Lond.), F.R.M.S., F.L.S., formerly Research Fellow, Madras University.

Dr. J. K. Chowdhury, M.Sc., Ph.D. (Birmingham).

Department of Chemistry.—

Dr. N. B. Das, Ph.D., formerly Lady Tata Memorial Fellow; recently working as a member of the scientific staff of Prof. Euler, Nobel Laureate, Stockholm.

Department of Physics.—

Dr. N. K. Saha, M.Sc., Ph.D. (Heidelberg), P.R. Student, Calcutta University.

Mr. S. D. Chatterjee, M.Sc., formerly Palit Research Scholar, Calcutta University.

Mr. M. S. Sinha, M.Sc., formerly Palit Research Scholar, Calcutta University.

Mr. B. B. Ghosh, M.Sc. (Cal.).

Mr. A. C. Deb, M.Sc. (Cal.).

Mr. Sasanka Sekher Sarkar, M.Sc., of the department of Anthropology has been awarded a Humboldt Scholarship, and is at present working in the laboratory of Prof. Eugen Fischer in Berlin on some problems of racial biology.

Mrs. Biva Majumdar, M.A., an honorary research worker in the Department of Physics, has been awarded a Premchand Roychand Research Studentship in Physics.

Dr. Radhesh Chandra Ghose's tenure of scholarship expired on June 30th, 1938.

4. *Research activities.*—

During last year, many fresh lines of investigations have been introduced, involving the construction and installation of many new apparatus and the study of new experimental techniques. Results based on these new lines of work will be forthcoming during the succeeding years. Here an account is given of the investigations that are being carried out in the different department of the Institute, and in Appendix I is given abstract of papers which have been published during the last year or are ready for publication. At the anniversary meeting held on November 30th, 1938, the programme of work to be carried out in the Institute was presented.

I. *Department of Plant Physiology and Genetics.*—

The study of plant hormones and their influence on the growth and tropic movement in plants have been commenced since July 1938. Investigations have been completed on the polarity of hormone transport and also on the effect of high concentration of auxin on the growth and geotropism of *Triticum coleoptiles*. The effect of Auxin treatment in inducing root development in cuttings of different plants and trees is being investigated.

The influence of auxin concentration on the longitudinal growth of specimens of *Vallisneria spiralis* grown in balanced nutritive solutions has been investigated. Investigations on the variation of root pressure and respiration in specimens of *Helianthus* under different conditions of growth and of light and temperature have been commenced. In this connection, the suitability of different techniques employed for plant tissue cultures in nutrient media is being investigated. Amongst the problems to be investigated with such isolated plant tissues are the measurement of root pressure in excised root tips and the influence of hormones on the geotropism of root tips.

The investigation of catalese activity of the seed of *Cajanus* and of *Jute* has been completed. Morphological and other

Gm

variations observed in *Mimosa Spegazzini* grown in the open and in a glass house is being studied.

With a view to the study of the various problems concerning the Phasic development of Tropical plants, a scheme of work has been started to investigate the problem on the following lines:

- A. Temperature effect (Vernalization).
- B. Photo-periodic effect.
- C. Growth Hormones.

Preliminary investigations on the effect of vernalization have been made with Rice, Wheat, Barley, Oat and Gram. In every case pure line strains were used.

The effect to be observed was whether there is any variation in the time of flowering or ear emergence as measured from the date of sowing, in the treated as compared to the untreated specimens.

The results so far obtained have been indecisive both in Rice treated to cold vernalization, and in Wheat and Barley treated to cold and warm vernalization; earliness of emergence has been observed in the case of cold-treated seeds of Oat and Gram.

These experiments are being repeated in greater detail, and the effects of additional photo-periodic and hormone treatment on vernalized and non-vernalized seeds are being investigated.

Studies in the physiology of the ripening of tropical fruits is being undertaken.

The effect of oxygen concentration on the respiratory activity of the storage organs of a number of plants is being investigated. In this connection an Air Current Commutator apparatus is being constructed in the Institute Workshop.

Dr. H. K. Nandi, Research Fellow in Cytogenetics, left the Institute in February 1938 on being appointed Economic Botanist to the Assam Government and no successor was appointed till January 1939. The new Fellow Dr. Gregory has initiated investigations along the following lines:—

1. Cytological study of economic plants which have not yet been worked out, like Lichi, Indian Almond, Neem, etc.

GML

2. Cytogenetic study of different varieties of crop plants, like Bengal Gram, Mango and Indigo.
3. Study of the effect of Colchicine on plant chromosomes and the possibilities of inducing artificial mutation in plants by this treatment.

II. In the department of Biochemistry and Agricultural Chemistry the following new type of investigations has been commenced:—

- (i) the synthesis of proteins in plant tissues,
- (ii) the formation of and loss of organic acids and metabolism of these acids in plant tissues, and the role which these reactions play in the life of the plant.

In this connection a Tissue Respiration apparatus is being constructed in the Institute Workshop.

The chemical investigation of the active principles of Indian medicinal plants is being continued. Two proteolytic enzymes have been isolated from the leaves of *C. Infortunatum*, and their individuality has been established and their anthelmintic properties investigated.

An alkaloid present in the leaves of the Indian medicinal plant *S. Melonga* has been detected and its constitution is being studied.

An investigation has been completed on the speed of absorption of Oxygen in different kinds of Turpentine, when used alone and in the presence of different chemicals which act as anti-oxygens and also when exposed to light or kept in darkness. The anti-oxygenic or pyro-oxygenic action of various dye-stuffs on Turpentine is being investigated.

The following work has been carried out at the experimental research station at Falta:—

In continuation of the investigations reported last year on the effect of individual and mixed manures on rice cultivation, the chemical analysis of the paddy grown on such manured soils is being investigated. Also the chemical composition

Gm

of the silt deposited by river-water on rice fields has been determined.

Field trials have been undertaken during the last few years to find out whether the following kinds of plants of economic importance can be grown in the alluvial soil round about Calcutta:—

- (i) Wheat and pulses from different localities,
- (ii) Bamni tree cotton brought from Comilla,
- (iii) Strawberries from runners brought from Darjeeling and Dehra Dun, and also grown from seeds imported from Germany.

Promising results have already been obtained, but further investigations spread over longer periods are necessary. Physiological feeding experiments on albino rats with different pure and mixed diets are being continued.

Chemical and mechanical analysis of soils from the different localities round about Falta, and also from different parts of Bengal is being carried out with a view (i) to correlate the paddy yield on some of these soils with their composition and (ii) to determine the geographical distribution of different types of soil in Bengal. Further the microbiology of some of these soils is being investigated.

The growth of fresh water fishes in ponds at Falta as dependent upon the nature of pond water and the presence of algæ and protozoic life is being investigated.

III. In the Department of Physics, the following lines of investigations are being carried out:—

A. *Study of nuclear disintegration and artificial radio-activity.*—The particles used for the production of nuclear disintegration are—

- (i) neutrons generated in tubes containing 65 mg. of Radium mixed with Beryllium ;
- (ii) α -particles from Polonium. For the preparation of Polonium we are purchasing spent Radon tubes from America and separating out by chemical methods Polonium from the parent Radiolead ;

Gm

- (iii) the source of neutron at our disposal not being sufficiently intense, arrangements are being made to build up a medium high voltage discharge apparatus which is expected to be a fairly powerful source of neutrons.

Amongst the problems which are being investigated at present are the determination of neutron resonance levels in Vanadium, chemical isolation of radioactive isotopes of Cobalt, etc. The recently discovered fission of Uranium nucleus by absorption of slow neutrons is also being studied. For satisfactory progress in such investigations, the strength of the neutron source has to be considerably increased.

The α -particle disintegration of Flourine and other elements are being studied. The energy spectra of the negative and positive electrons and γ -radiation emitted by the end products of such nuclear disintegration are being studied by Wilson Cloud Chamber and by other methods.

B. *Cosmic ray investigations.*—The photography of cosmic ray tracks in Wilson Cloud Chamber has been commenced. Photographs of penetrating and shower producing radiations have been obtained. A counter controlled Wilson Chamber, which is specially suited for the photography of cosmic ray showers has been constructed. After it has been tested in Calcutta, it will be taken to Darjeeling, and the intensity and frequency of such showers at different altitudes will be investigated. A similar line of investigation on the altitude distribution of neutrons in cosmic ray is being undertaken.

The photographic plate method of investigating the nuclear disintegration of some atomic nuclei has already led to certain definite results which will soon be published. The nature of the component of the cosmic radiation responsible for such nuclear disintegration is being investigated by placing suitably treated photographic plates at the altitudes of Calcutta, Darjeeling and Sandakphu.

The thanks of the Governing Body are due to Mr. Larkin, Deputy Commissioner, and to Mr. N. K. Nag, District Engineer,

Gm

Darjeeling District, for providing facilities for the storage of treated photographic in the Dak Bungalow at Sandakphu.

C. One of our Fellows Dr. A. K. Dutta was guest-worker for one year in Prof. Debye's laboratory in Berlin, during which period he undertook certain theoretical and experimental investigations on the dispersion and absorption of ultra-sonic waves in different liquids. After his return to Calcutta in February 1938, he has been busy in building up the rather elaborate apparatus necessary for such investigations. The whole apparatus has been partly assembled and partly constructed in the Institute Workshop under the supervision of Dr. J. P. Sircar. In the original apparatus used at Berlin, a Zeiss Spectrograph worth about Rs.7,000 was used. With the lenses and prisms imported from Germany and costing about Rs.400 a spectrograph has been constructed which gives as good results as the more costly one used in Germany.

The experimental investigations on the dispersion of ultra-sonic waves in liquids have been commenced, and certain theoretical investigation on the absorption of ultra-sonic radiation in liquids has been completed.

D. The other lines of physical investigation which have been taken up are the specific heat and electrical conductivity measurements on certain rare earth fluorides at low temperatures, with a view to the determination of the electronic energy levels in such crystals. Further the study of fluorescence and phosphorescence of crystals and solutions, specially those containing rare earth ions, is being undertaken.

E. In theoretical physics investigations have been carried out on (i) relativistic statistical mechanics and the study of matter at high temperatures and pressures, (ii) on the stability of degenerate electron gas ; (iii) further, certain investigations on the theory of conduction and absorption in stellar material has been carried out.

Parallel with the experimental investigation in nuclear physics, theoretical calculations of the binding energies of the nucleus is being undertaken on the model of Yukawa.

GmL

IV. In the department of Zoology the following work has been undertaken :—

1. The investigation on the reproductive organs of a species of Ants (*Diacamma vagans*) is being continued this year.
2. Observations have been started on the breeding habits of different kinds of indigenous fishes such as *Kai* (*Anabas* sp.), *Techoko* (*Panchax panchax*) and Shrimps.
3. The observations of the factors determining the polymorphism in Red-ants (*Ecophylla smaragdina*, Fabr.) by administering different food to the larvæ is being continued.
4. Observations are also being continued on the egg-laying habits of certain species of spiders before mating to see if partheno-genesis or reproduction without fertilization occurs in them, as maintained by several investigators.
5. Some minor observations were made on artificial nest formation by Red-ants (*Ecophylla smaragdina* Fabr.) and the migrating habits of a species of caterpillar.

5. *Seminar and Symposium.*—A physics seminar in co-operation with the Physics and Applied Mathematics Department of the University College of Science has been started since July 1938. Up till now 20 meetings have been held, and many interesting and fruitful discussions have taken place. It is proposed to hold a four days' Symposium during the Easter week on the properties of the Mesotron as revealed by Cosmic ray investigations. It is expected that interested workers from other University centres will take part in it.

6. *Guest-Worker.*—The Sir J. C. Bose Research Fellow of the Calcutta University in Biophysics, Dr. B. K. Bagchi, has elected to work in the Bose Institute. His line of investigation is in human Electro-encephalography, i.e. the recording of

electrical potentials from intact human brains, under various psychological and physiological conditions—this being the first project of its kind in India. The building of a sound-proof air-conditioned room and the construction of a suitable low frequency and high amplification recording apparatus have been commenced.

7. *Publications.*—To facilitate the rapidity of publication and distribution, the Governing Body have decided to print the Transactions of the Bose Institute locally in the Baptist Mission Press. A special type was indented by the Press for this purpose, and this has caused a few months' delay in starting the printing. The printing of the Volume XII of the Transactions has been almost completed.

The Governing Body have taken over from Messrs. Longmans Green & Co. the unsold volumes of the Transactions, of which they were the printers and publishers.

8. *Library.*—During the year 74 books and 97 bound volumes of Journals have been added to the library. The list of journals subscribed and received in exchange is given in Appendix II. It is proposed to increase the number of Institutions to whom the Transactions of the Bose Institute will be sent free. It is expected that the number of journals received in exchange will be thereby increased.

Mr. Jatindranath Sen Gupta, Librarian, has been on leave without pay since November 1938. Mr. Sasi Bhusan Khan is officiating as Librarian in his place.

9. *Workshop.*—Since June 1938, Mr. Nishi Kanta Baul, Workshop Superintendent, has been on sick leave. Dr. Jyotiprakash Sircar has been placed in charge of the Workshop. During the year under review owing to the increase in the number of workers and to the introduction of new lines of research, the demand on the workshop has been extremely severe. The aim of the Institute from the beginning has been to manufacture as far as possible all the apparatus required for investigations, in the Institute workshop. The number of mechanics has been increased and further increase in the staff

Bm

is desirable, and will be made when suitable persons are available. The workshop has to record the loss of Putiram Das, a very skilled tinsmith who had been associated with the work of the Founder Director for nearly forty years.

10. *Audited Accounts.*—The audited income and expenditure account of the Institute is given in the following pages. The Institute has received the usual annual grant of Rs.53,000 from the Government of India.

SCAM: B1. Lib. Gm

BOSE

Income and Expenditure Account

INCOME.	RS.	A. P.	RS.	A. P.	RS.	A. P.
A. Income on Government Grant Account—						
Grant from Government of India—						
For Research Work ..			50,000	0 0		
For Publication Expenses			3,000	0 0		
					53,000	0 0
B. Income on Trust Fund Account—						
Interest	50,150	8 0				
Add Interest accrued to end of year	12,749	15 8				
	62,900	7 8				
Less Interest paid on Govt. Papers to date of purchase ..	166	4 0				
	62,734	3 8				
Less Interest accrued last year	12,502	1 0				
			50,232	2 8		
Dividend (Gross) ..	.....		1,500	0 0		
Refund of Income Tax ..	.....		1,567	15 2		
House Rent	1,275	0 0				
Add outstanding this year	58	1 0				
	1,333	1 0				
Less outstanding last year	150	0 0				
			1,183	1 0		
Ground Rent	1,560	0 0				
Add outstanding this year	390	0 0				
	1,950	0 0				
Less outstanding last year	390	0 0				
			1,560	0 0		
Miscellaneous Receipts ..	.....		230	15 6		
					56,274	2 4
Building Repairs Fund transferred .. ..	.....		.....		3,500	0 0
TOTAL ..	.....		.....		1,12,774	2 4

D. M. BOSE,
Director.

A. N. MITTER,
Superintendent.

INSTITUTE.

for the Year ended 31st March, 1939.

EXPENDITURE.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.
A. Expenditure on Government									
<i>Grant Account—</i>									
Scholarships and Allowances (Director's and Staff's) ..	....			54,063	14	0			
Wages of Mistries and Servants ..	....			5,122	0	9			
Provident Fund Contribution ..	....			2,262	4	0			
Staff Retirement Bonus Fund ..	....			2,000	0	0			
Laboratory Expenses ..	....			10,662	10	6			
Purchases of Apparatus ..	....			4,846	7	6			
Purchases of Books ..	....			2,597	14	0			
Purchases of Furniture ..	....			912	5	3			
General Expenses (including Printing, Stationery, Electric, Telephone, Staff's Tiffin, etc.) ..	....			3,913	10	3			
Travelling and Conveyance ..	....			1,115	4	0			
Rents, Rates and Taxes ..	....			479	8	9			
Repairs to Buildings, etc. ..	....			5,002	5	9			
Publication Expenses ..	....			3,000	0	0			
				95,978	4	9			
<i>Less Deficit recouped from Trust Fund ..</i>	....			42,978	4	9			
							53,000	0	0
B. Expenditure on Trust Fund									
<i>Account—</i>									
Scholarship ..	....			1,500	0	0			
Bank Charges, Renewal Fees, etc. ..	....			221	2	4			
Municipal Taxes ..	....			323	11	6			
Income Tax Deduction ..	....			220	1	0			
Depreciation ..	....			21,782	10	9			
Deficit on Govt. Grant a/c as above ..	42,978	4	9						
<i>Less Capital Expenditure ..</i>	8,356	10	9						
				34,621	10	0			
							58,669	3	7
Balance carried to Balance Sheet ..	....			....			1,104	14	9
TOTAL ..	....			....			1,12,774	2	4

Examined and found correct.

Central Bank Buildings, }
 100, Clive Street, }
 Calcutta. }
The 20th April, 1939. }

P. K. GHOSH & Co.,
Incorporated Accountants (Lond.),
Registered Accountants,
Auditors.

BOSE

Balance Sheet as at 31st

LIABILITIES.			RS. A. P.	RS. A. P.
<i>Liability for Unpaid Salaries—</i>				
As per last Balance Sheet	..	..	154 13 6	
Add for this year	..	..	420 0 0	
				574 13 6
<i>Security Deposit from Tenant</i>	..	..	....	80 0 0
<i>Provision for Contingent Liabilities</i>	..	..	....	4,257 0 0
<i>Staff Retirement Bonus Fund—</i>				
As per last Balance Sheet	..	..	4,500 0 0	
Addition this year	..	..	2,000 0 0	
				6,500 0 0
<i>Investment Fluctuation Fund</i>	..	..	....	1,29,104 5 7
<i>Physical and Biological Dept. Capital a/c</i>	..	..	....	10,000 0 0
<i>Donations</i>	..	..		11,03,165 12 5
<i>Amount accumulated for Trust Fund—</i>				
During 21 years (1917-38)	..	..	4,66,230 5 6	
Add Balance of Income and Expenditure				
Account for 1938-39	..	..	1,104 14 9	
				4,67,335 4 3

TOTAL 17,21,017 3 9

D. M. BOSE,
Director.

A. N. MITTER,
Superintendent

INSTITUTE.

March, 1939.

ASSETS	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.
<i>Fixed Assets—</i>									
(As per statement annexed)									
<i>Land—</i>									
At Calcutta ..	1,65,613	0	0						
At Darjeeling ..	16,000	0	0						
				1,81,613	0	0			
<i>Buildings—</i>									
At Calcutta ..	2,32,862	0	0						
At Darjeeling ..	21,441	0	0						
At Falta ..	36,731	0	0						
				2,91,034	0	0			
<i>Furniture and Fixtures</i> ..	.....			8,871	0	0			
<i>Apparatus</i> ..	.....			27,253	0	0			
<i>Books</i> ..	.....			9,880	0	0			
							5,18,651	0	0
<i>Investments—</i>									
Rs.12,09,200 $3\frac{1}{2}\%$ G.P. Notes ..	.....			9,44,574	6	4			
„ 1,35,100 4% Govt. Loans ..	.....			1,27,585	1	0			
„ 70,000 $4\frac{1}{2}\%$ Govt. Loans ..	.....			66,450	12	6			
„ 10,000 5% Govt. Loans ..	.....			9,787	8	5			
„ 20,000 $7\frac{1}{2}\%$ Preference shares ..	.....			20,000	0	0			
							11,68,397	12	3
<i>Interest accrued on Investment</i> ..	.....			.....			12,749	15	8
<i>House and Ground Rents Outstanding</i> ..	.....			.....			448	1	0
<i>Security Deposit</i> ..	.....			.....			50	0	0
<i>Advance to Scholar</i> ..	.....			.....			500	0	0
<i>Cash—</i>									
<i>Trust Fund Account at Bank</i> ..	.....			18,407	7	4			
<i>Establishment Account in hand and at Bank</i> ..	.....			1,812	15	6			
							20,220	6	10
TOTAL..	.....			.....			17,21,017	3	9

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 Investments with the Bankers' lodgement certificates.

Central Bank Buildings,)
 100, Clive Street,)
 Calcutta.)
 The 20th April, 1939.)

P. K. GHOSH & Co.,
 Incorporated Accountants (Lond.),
 Registered Accountants,
 Auditors.

Scan: B1.Lib.Gum

BOSE INSTITUTE.

Re: Balance Sheet as at 31st March, 1939.

STATEMENT showing how the values of the FIXED ASSETS have been arrived at.

	Revaluation price at 31-3-31 and subsequent additions to 31-3-38 at cost.	Additions in 1938-39.	Sold in 1938-39 (Deducted at cost.)	Total Gross Value at 31-3-39.	Depreciation to 31-3-38.	Less depreciation to 31-3-38 on assets sold in 1938-39.	Add depreciation for 1938-39.	Total depreciation to 31-3-39.	Net balance at 31-3-39.
Land at Calcutta	1,70,000 0 0	....	4,387 0 0	1,65,613 0 0	....	....	....	....	1,65,613 0 0
Land at Darjeeling	16,000 0 0	....	....	16,000 0 0	....	....	....	....	16,000 0 0
Buildings at Calcutta ..	2,92,595 15 8	....	9,023 15 8	2,83,572 0 0	44,531 15 8	910 15 8	(2½%) 7,089 0 0	50,710 0 0	2,32,862 0 0
Buildings at Darjeeling ..	27,566 0 0	....	....	27,566 0 0	5,298 0 0	....	(3%) 827 0 0	6,125 0 0	21,441 0 0
Buildings at Falta	49,992 0 0	....	....	49,992 0 0	11,261 0 0	....	(4%) 2,000 0 0	13,261 0 0	36,731 0 0
Furniture and Fixtures ..	16,488 12 9	912 5 3	....	17,401 2 0	7,659 12 9	....	(5%) 870 5 3	8,530 2 0	8,871 0 0
Apparatus (excluding those made in Institute) ..	62,131 7 3	4,846 7 6	....	66,977 14 9	31,352 7 3	....	(12½%) 8,372 7 6	39,724 14 9	27,253 0 0
Books (excluding those published by Institute)	18,393 10 9	2,597 14 0	....	20,991 8 9	8,487 10 9	....	(12½%) 2,623 14 0	11,111 8 9	9,880 0 0
TOTAL ..	6,53,167 14 5	8,356 10 9	13,410 15 8	6,48,113 9 6	1,08,590 14 5	910 15 8	21,782 10 9	1,29,462 9 6	5,18,651 0 0

P. K. GHOSH & CO.

20-4-39.

Scanned by: B1. Lib. Gm

The Annual Meeting of the Governing Body, Bose Research Institute, was held on Saturday, the 29th April, 1939, at the Bose Institute at 6-30 P.M.

Present :

Sir Nilratan Sircar (in the chair),
Lady Abala Bose,
Mr. J. N. Basu,
Mr. B. M. Sen,
Mr. S. M. Bose,
Prof. N. C. Nag,
Mr. A. N. Mitter,
Dr. D. M. Bose.

Mr. A. N. Mitter presented the audited accounts for the year 1938-39. Resolved that the audited accounts be passed.

Gm

APPENDIX I.

ABSTRACT OF PAPERS.

A. Department of Plant Physiology.

1. On the variation in the longitudinal growth of leaves of *Vallisneria spiralis* in nutrient solutions, to which different concentrations of β -indole acetic acid were added. By B. K. Palit.

The rate of growth of *Vallisneria spiralis* in standard nutrient solutions containing the following concentrations of β -indole acetic 10^{-12} , 10^{-9} and 10^{-6} was investigated by a quadruplex oscillating recorder. For each concentration two sets of records were taken, one in August and the other in December, each extending over twelve days. The results obtained were as follows:

- (i) The total growth is smaller in December than in August.
- (ii) Compared to the total growth in the standard nutrient solution, the growth is greater in a solution containing a concentration of 10^{-9} of the Auxin, and smaller in solutions with Auxin concentrations of 10^{-12} and 10^{-6} respectively.
- (iii) The time of maximum growth is shifted towards the beginning with increasing Auxin concentration. For the growth in the standard and 10^{-12} Auxin solutions one growth maximum is observed. With Auxin concentrations of 10^{-9} and 10^{-6} two periods of growth maxima are observed.

2. Investigation on the Catalase Activity of Jute seed, both clitorious and capsularis. By A. Guha Thakurta and B. K. Dutta.

The investigation was undertaken to find out whether the catalase activity is an indicator of vitality, age, or moisture content of the seed.

Within 7 months of the time of harvest, when the germination was almost cent per cent, the catalase activity was found appreciably to follow the moisture content of the seed. After that period when the percentage of germination declined rapidly, the catalase activity was found to be related to the vitality of the seed. Some catalase, however, remained when germination was absolutely nil; this residual catalase was not completely destroyed when the seeds were kept in a water bath for 5 hours at a temperature of 100°C .

3. Investigation of the Catalase Activity of the seed of *Cajanus* at different stages—Pre-resting, Resting, Post-resting. By A. Thakurta and B. Dutta.

The catalase activity in the pre-resting stage slowly decreased as the seed advanced in maturity up to a certain limit after which it remained, more or less, unchanged. The catalase content remained the same during the resting

Scan: Bl. Lib. Gm

period and even after that till the post-resting seed absorbed water. The catalase activity increased progressively when the water content of the post-resting seed was gradually increased.

4. Polarity of Hormone Transport in the coleoptile of Triticum. By A. Thakurta and B. Dutta.

Deseeded coleoptile stump of which the tip was removed by one centimeter by double decapitation, became insensitive to geotropic stimulus. When a coleoptile tip was attached to either of the ends, apical or basal, geotropic curvature occurred at the apical region. From this it was concluded that growth substance had been transported both in basipetal and in acropetal directions.

5. Effect of High Concentration Auxin on the Growth and Geotropism of the coleoptile of Triticum. By A. Thakurta and B. Dutta.

It has been found that (i) apical application of 1% β -indole acetic acid increased the growth of the coleoptile stump but annulled the geotropic movement, (ii) whereas basal application retarded growth but did not affect geotropism.

(i) In the case of apical application the observed effects can be interpreted on the assumption that the application of an Auxin at any point on a coleoptile leads to a concentration of hormone in the locality. The residual hormone in the coleoptile is quickly transported towards the tip attracted by the Auxin, where it is immediately utilized in producing growth. The movement of hormone being very rapid, unequal lateral distribution due to geotropic stimulus is hampered in a horizontally placed stump.

(ii) In the case of basal application the transport of the residual hormone is towards the base; it is withdrawn from the growing region and consequently growth is retarded. The growing zone being distant from the point of application of Auxin, the transport of hormone does not occur so speedily as in the case of apical application and therefore, the unequal lateral distribution is not much hampered in a horizontally placed stump and so a geotropic curvature occurs. This conclusion has been corroborated by the experiment with short-length stump in which the geotropism is annulled by basal application of Auxin.

B. *Department of Biochemistry and Agricultural Chemistry.*

6. On the absorption of Oxygen by Turpentine and the use of anti-oxygens. By K. N. Bose.

In order to determine the exact amount of oxygen absorbed by turpentine, an apparatus has been devised which measures the volume of oxygen directly. Two different qualities of turpentine, viz., from Indian and American species of Pines have been investigated and their speed of oxygen absorption when used alone and when used with different chemicals which act as anti-oxygens have been measured. The respective mode of action of these chemicals have

Gm

been compared. The speed of oxygen absorption when Turpentine is kept exposed to light and when kept in the dark has also been measured.

7. Proteolytic Enzymes of the leaves of *Clerodendron Infortunatum*. By H. N. Banerjee.

A cold aqueous extract of *C. Infortunatum* leaves contain at least two proteolytic enzymes: (a) A proteinase which liquefies gelatin and hydrolyzes gelatin, casein, egg-albumin and dissolves fibrin, at pH_6 . (b) A peptidase which attacks Witte-peptone and Rochepeptone at pH_8 .

By a very simple process involving fractional absorption and elution the enzymes have been separated and concentrated.

By absorption at pH_6 on kaolin and elution at $pH_{4.7}$ with KH_2PO_4 a preparation of the proteinase almost free from peptidase was obtained; and by adsorption at $pH_{7.2}$ on gelatinous tricalcium phosphate and elution at $pH_{9.2}$ with K_2HPO_4 , a preparation of peptidase almost free from proteinase was obtained. The separate identities of proteinase and peptidase are also clearly established firstly by the great difference in stability between the two and secondly by the fact that at the pH at which the proteinase exerts its optimum activity on gelatin the peptidase does not attack peptones and *vice versa*.

The proteinase requires a minimum concentration of 2.1% gelatin for maximum rate of activity at $40^\circ C$. The data reveal no constant value for the Michaelis constant, K_m . The substrate concentration at which half the maximum reaction velocity is reached corresponds to 0.75% gelatin. The course of reaction at the early stages follow the Schutz-Arrhenius rule.

The critical inactivation temperature is $55^\circ C$. at pH_6 .

The protease is spontaneously inactivated on standing at $25^\circ C$. with toluene, the process following the course of a unimolecular reaction, the activity being halved in about 20 hours.

8. Some field trials with sweet scented *Oryza sativa*. By N. C. Nag and A. K. Pain.

Brimful Paddy generally cultivated and much prized in Sikkim has been cultivated at Falta with very promising results, both as regards yield and quality of the rice. Soils on which Brimful rice is cultivated in the higher altitudes have been analyzed. Although results of mechanical analysis investigations show wide differences from that obtained with the lower level Falta soil, there is greater similarity in their available constituents. Analyses of the rice show higher percentage of protein and mineral constituents in Brimful rice cultivated at Falta as compared to those of Baktulsi obtained from local markets. Sweet scented rice command higher price and therefore likely to be more profitable.

9. Chemical and Mechanical Analysis of some paddy soils of 24-Perganas. By N. C. Nag and A. K. Pain.

Analyses of soils from Falta, Nurpur (Hughly Point), Diamond Harbour, and Port Canning have been carried out. These places are geographically

similarly situated near flowing rivers. Mechanical analysis results bring out this similarity quite prominently in their silt and clay contents. The yield of paddy in some of these soils have been examined and found to be also very nearly the same.

In continuation of the above subject, analyses have been carried out on soils from more inland places such as Harindanga, Shirakole, Baruipur, Mograhat and Dakshin Barasat. These soils show lower percentages of silt and clay deposits and are not so rich as paddy producing areas. But their composition is more suitable for other kinds of produce such as vegetables and fruits.

10. Examination of certain barren spots in the Falta Farm. By N. C. Nag and A. K. Pain.

At Falta there appear certain spots which are barren and plants die or do not grow at all in those spots. They are most often acid in character, the pH being 4 or even lower. It has been observed that bacterial growth is least in these soils. Mushrooms have, however, been noticed to grow on these spots. The upper crust of the soils have been analyzed and have been found to contain much soluble mineral salts. Experiments have been carried out to improve the fertility of these areas; some promising results have been obtained. Lime treatment seems to improve the vegetable growing power of the soil along with the raising of the pH value of the soil.

11. Investigations on the possibility of growing different varieties of Strawberries at Falta. By N. C. Nag.

The following varieties of strawberries are being grown in Falta:

- (i) strawberry plants brought from Darjeeling during November, 1936;
- (ii) a German variety grown from seeds in Darjeeling in 1938 and then brought to Falta;
- (iii) plants brought from Dehra Dun in June 1938.

(i) and (iii) are propagated by runners, while (ii) die out every year.

To acclimatize the plants it is found necessary to protect them from excessive sunshine and rain. The plants are becoming more vigorous every year and the yield of fruits both in size and numbers appear to be increasing. The effect of phosphate fertilizers in increasing the yield is being investigated.

12. Chemical examination of rice grown under individual and mixed manures. By A. K. Pain.

In a previous paper the yield of rice and the composition of rice plants grown in differently manured soils was reported. In the present paper the chemical examination of the rice grown is reported.

Gm

C. Department of Physics.

13. Origin of colour in paramagnetic ions in solutions. By D. M. Bose and P. C. Mukherji. *Philosophical Magazine*, Vol. XXVI, 757, (1938).

A new theory of the origin of colour in paramagnetic ions in solutions is developed and compared with the available absorption data for these solutions, excluding those containing rare earth ions. A satisfactory agreement with the experimental data has been found.

14. On the absorption of supersonic waves in liquids. By A. K. Dutta and B. B. Ghose.

In a previous paper published in the Transactions, Vol. XII, a formula has been derived by one of us which enables one to calculate the dispersion of supersonic waves in liquids. The conclusion was drawn that the dispersion should occur in the region of 10^8 to 10^9 frequencies per second. In the present paper an expression has been obtained for the absorption in such liquids, based upon the results obtained in the previous paper. It is shown that by assuming the value of the frequency of maximum dispersion in the liquids as obtained in the previous paper, the experimental values of absorption can be easily explained.

Anomalous absorption observed in certain liquids require further investigation.

15. Electric conduction due to 4f electrons in some trivalent rare earth compounds. By K. P. Ghosh and B. B. Ghosh. *Ind. Jour. Phys.*, Vol. XIII, 259, (1938).

The conductivity of fluorides of La, Ce, Pd and Nd in the form of fine crystals has been measured by compressing them to form solid rings placed between two coaxial cylindrical electrodes. Taking lanthanum fluoride as standard and subtracting its conductivity from those of the other fluorides, the conductivity due to the 4f electrons in the Ce^{+++} , Pd^{+++} and Nd^{+++} ions have been determined. Using a formula similar to that proposed by Wilson for semi-conductors, it is found that ΔW as calculated from the measurements agrees approximately with the overall width of the multiplet structure of the free ions of these elements, as obtained from magnetic and spectroscopic data.

16. The theory of Molecular dissociation and the fundamental mechanisms in the Upper Atmosphere. R. C. Majumdar. *Ind. Jour. Phys.*, Vol. 12, p. 75, 1938.

A theoretical formula is worked out to estimate the degree of molecular dissociation in the upper atmosphere under the action of the ultraviolet light of the sun. It is found that the oxygen molecules are completely dissociated at a height of about 167 km., that is much above the E-region of the ionosphere, provided we assume a temperature of $300^\circ K$ and a molecular weight corresponding to the average mass of nitrogen molecules. The results are discussed

GML

in reference to the constituents of the Ionosphere as well as the mechanism of the fundamental processes in the latter.

17. Relativistic Statistical Mechanics and the study of matter at high temperatures and pressures. By R. C. Majumdar.

A general theory of relativistic statistical mechanics is worked out and the explicit equation of state for matter is obtained. Expressions for the other physical quantities such as Energy, Pressure, Entropy, etc., which are of frequent use are tabulated in a convenient form for application. The criterion for degeneracy and nondegeneracy in the relativistic mechanics is also discussed in detail. Further a general dissociation formula in the relativistic case is worked out for an assembly of different types of particles in equilibrium. Application of the theorem is then made to obtain the equation of state for an assembly where the formation and annihilation of pairs of electrons and positrons are taking place in statistical equilibrium. All these results are then applied to investigate the equilibrium configuration of massive spheres. Their identifications with actual stars are also discussed.

18. On the stability of degenerate electron gas. By R. C. Majumdar.

It has been shown in the present paper that there will be always finite ranges of pressure, temperature and density within which we can talk of a free degenerate electron gas. The lower and upper limits of the range are determined from the formations of atoms and neutrons respectively. The equilibrium configurations for these limiting spheres are calculated and the results obtained are discussed in reference to the theories of Planets and White Dwarfs.

19. A general theory of conduction in stellar atmosphere. By Mrs. Bibha Majumdar.

In this paper a general mathematical theory has been developed from the principles of the quantum Kinetic Theory of Gases to investigate the physical properties of an ionized gas, consisting of free electrons and neutral or ionized atoms subject to external electric and magnetic fields. The application of pure classical methods, as is well known, leads to the serious difficulty of solving an integral which is divergent. This difficulty has been overcome in the theory which is developed here. The theory is then successfully applied to study the phenomena of conduction in stellar matter, particularly in stellar atmospheres, which has been the subject of many interesting discussions during the last few years in connection with the origin and limitation of sun's general magnetic field.

20. On the radial limitation of the solar magnetic field. By Mrs. Bibha Majumdar.

In this paper the Diamagnetic Theory of the radial limitation of the general magnetic field of the sun is worked out. The Diamagnetism is induced,

Gm

according to this theory, not by the classical method of Schrödinger but by the quantization in the motion of the electrons induced by the magnetic field. A critical survey of the other existing theories for the observed limitation, namely the drift current and dynamo theories is given in the light of the mathematical analysis as developed in the earlier work of the writer. It is shown that according to none of these theories the magnetic field of the sun can be radially limited to the extent as claimed to be observed by Hale in 1913. Similar conclusions seem to follow also from a study of the polarization of non-uniform rotation of the sun in its magnetic field and from the recent investigation on latitude distribution of cosmic ray intensity.

21. Opacity in stellar material. By Mrs. Bibha Majumdar.

A quantum theory of absorption of electro-magnetic radiation by ionized gas is worked out, in which electrons are assumed to take up energy from the electric field of the incident radiation and transform it by collisions with ions to random motion of electrons and ions. It is interesting to note that the opacity coefficient in stellar interior calculated from this theory agrees fairly well with those obtained by Eddington-Milne from Kramer's process of absorption for a free-free-transition.

22. Optical properties of liquid metals. By Mrs. Bibha Majumdar. *Ind. Jour. Phys.*, Vol. 12, p. 233, 1938.

The optical properties of liquid metals are studied from the above general theory and the results are found to agree fairly well with the observations.

23. Studies in nuclear disintegration by cosmic rays using the photographic plate method. By Biva Choudhury.

This paper contains the report of preliminary observations on the effect of cosmic rays in producing nuclear disintegration. Three pairs of Ilford R₂ plates were taken, and half of each plate was dipped in a 0.3 per cent. solution of Samarium Sulphate. Two of the plates were kept in a refrigerator in a room in the Institute laboratory in Calcutta. Two cement concrete floors were above the refrigerator. The other four plates were taken to Darjeeling on May 17th and sent to Sandakphu (elevation 11,500 ft.) and kept in the Dak Bungalow till 30th October 1938. All the plates were then developed. Owing to temporary breakdown of the refrigerator, the plates kept in Calcutta frilled on developing, and no observations could be made on them.

Two of the Sandakphu plates were satisfactorily developed, and they were scanned under a microscope with 900 magnification. About 0.1 cm² of the untreated portion of the film was examined and no star like tracks were observed. Of the treated portion of the film, an area 0.06 cm² was examined, about 30 starlike tracks were found, which evidently represented the disintegration of Samarium nuclei. The result obtained is in agreement with the observations of Taylor. The maximum energy of disintegration of such nuclei

GML

as calculated from the measured lengths of the tracks on the photographic film was found to be about 13 M.ev. The investigation is being continued.

24. Chemical separation of the radioactive isotope of Cobalt. By S. D. Chatterjee.

When cobalt is bombarded by slow neutrons, an activity of long half-life (1 year) is obtained. This radio-element has been chemically isolated. A solution of sodium cobalti-cyanide is irradiated for three months in a paraffin block by slow neutrons from a Ra-Be source. The free radioactive ions, dislodged from the compound according to Szillard-Chalmers reaction, are precipitated by α -nitroso- β -naphthol. The activity of the isolated isotope of cobalt is studied by a thin-walled G-M counter with the usual accessories.

D. Department of Zoology.

25. On the reproductive role of *Diacamma vagans*, Smith. By G. C. Bhattacharya.

The winged females of *Diacamma vagans*, Smith (a kind of stinging ant) have never been seen. Only the winged males and workers are found in their colony. Now the question arises if there is no female how their reproduction takes place and what is the function of the male in the life-history of the species? Several investigators are of opinion that probably the true female form of *D. vagans* has disappeared and is supplanted by a worker, elected, so to speak to the reproductive office and it is known as a gyneacoid worker. It is supposed that the gynaecoid phase is a physiological rather than a morphological one. If this is not a morphological phase it evidently does not admit of the sexual act. But more than one of the workers of a single colony mating with the males of the species has been observed by the writer. By dissecting a number of workers, in most cases, it is found that they possess ovarian tubules and receptaculum seminis and in some cases to be laden with eggs. From these observations and for some other reasons it is concluded that unlike *Oecophylla*, *Solenopsis*, etc., the *Diacamma vagans* has only two classes of members—namely the males and the females, the latter are also the workers.

Scanned by Bl. Lib. Gm

APPENDIX II.

List of Journals Subscribed.

1. Current Science.
2. Nature.
3. Science Progress.
4. Physical Review.
5. Reviews of Modern Physics.
6. Review of Scientific Instruments.
7. Journal of Chemical Physics.
8. Journal of Research of National Bureau of Standard.
9. Annals of Botany.
10. American Journal of Physical Anthropology.
11. Biochemical Journal.
12. Journal of Biological Chemistry.
13. Plant Physiology.
14. Biological Abstracts.
15. Man.
16. Science Abstracts (A).
17. Zeitschrift fur Physik.
18. Naturwissenschaften.
19. Annals of Eugenics.
20. Botanical Gazette.
21. Indian Journal of Medical Research.
22. Hereditas.
23. Cytologia.
24. Genetics.
25. American Journal of Botany.
26. Physikalische Zeitschrift.
27. New Phytologist.
28. Chemical Abstracts.
29. Journal of Heredity.
30. Journal of Neurophysiology.

List of Journals obtained Free or in Exchange.

1. Welsh Journal of Agriculture.
2. Science Reports of Tohoku Imperial University.
3. Proceedings of Royal Society (A).
4. Proceedings of Royal Society (B).
5. Journal of Agricultural Research.
6. Journal of General Physiology.

7. Journal of the Franklin Institute.
8. Transactions of Royal Society of London (A).
9. Transactions of Royal Society of London (B).
10. Science and Culture.
11. Indian Journal of Agricultural Science.
12. Indian Journal of Veterinary Science and Animal Husbandry.