Y E A S T S

A News Letter for Persons Interested in Yeast

May, 1956 Volume V, Number 1

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The Editor takes pleasure in thanking all those who have contributed to this issue. Without this gratifying support the News Letter cannot fulfill its purpose. The Editors would like to invite others to send in contributions for future issues. It is planned to publish the next issue of the News Letter about December 1, 1956. It would be appreciated if anyone would notify the Editor of additional people in our field who would like to receive the Yeast News Letter.

Cost of operation: Contributions to help finance the News Letter are voluntary. Thanks to more numerous contributions during the last year, there were sufficient funds on hand to publish the spring edition of 1956.

The Editors.

It is with deep regret that the Editor has to announce the unexpected death of Professor A. J. Kluyver on May 14, 1956. Until the last day he was active and in seemingly good health. Friday he still gave his usual class-lecture; Monday morning he was found on his bed, already gone.

We are thankful that Kluyver passed away "in the saddle". He would not have wanted anything else. Yet at 67 his mind was still as keen as ever and we had hoped that he would be active for many more years to come. In addition to his leadership in the field of general microbiology, Kluyver, during his life has been the inspirational force behind the well known monographs on yeast taxonomy originating in the Delft laboratory. Furthermore, he and his students made numerous contributions to yeast physiology. The University of Delft, and Kluyvers many pupils in Holland and abroad, are mourning a great man, not only a scientist of the highest caliber, but above all a friend with a noble character.

I. Low Temperature Research Station, Cambridge, England. Communicated by Dr. J. A. Barnett.

1. Symposium on yeasts.

The British Mycological Society held a Symposium on yeasts in London on 17th March 1956, with the following programme:

M. INGRAM (Low Temperature Research Station, Cambridge)
"Introduction."

F.W. BEECH (Long Ashton, Bristol)
"Some practical problems of yeast identification."

J.A. BARNETT (Low Temperature Research Station, Cambridge)
"Some unsolved problems of yeast taxonomy."

F.T. LAST (Rothamsted, Hertfordshire)
"The distribution of Sporobolomyces and Tilletiopsis."

G.C. AINSWORTH (Exeter University)
"Pathogenic yeasts."

R.R. FOWELL (Distillers Co. Ltd., Epsom)
"The crossing of yeasts with low spore viability."

J. WHITE (Fardon's Vinegar Co. Ltd., Birmingham)
"Osmosensitivity and enzyme activity as functions of environment in mass cultures of yeasts."

M. P. SCARR (Tate & Lyle Ltd., Keston)
"The micro-ecology of osmophilic yeasts."

The Chairman was Dr. Ingram.

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2. Red yeasts from frozen peas.

We have isolated 3 strains of red yeast from heavily contaminated frozen peas. Mulcock (1955: N.Z., J. Sci. Techn. B37, 15) found a strain of Rhodotorula glutinis spoiled frozen peas. Our strains seem more comparable with Sporobolomyces spp; one is similar to Sp. holsaticus.

We would like to know the experience of other workers with these yeasts, using the mirror colony technique. How can one be sure that the mirror colonies have not developed from falling vegetative cells, i.e. not spores?

3. The systematics of yeasts.
By V.I. Kudriavzev. Pp. 427 8 vo.
Moscow: Academy of Sciences, 1954
(Preface dated December 1951)

Professor Kudriavzev has very kindly sent us a copy of his book on yeast systematics. Most of the section headings are given below:

General Part

1. Historical aspects of systematics.

2. On the theory of the natural classification of organisms:

   (i) The bases of the systematic characterization of species;

   (ii) The bases of the characterization of larger systematic groups.

3. The artificiality of the present-day classification of yeasts.

4. The natural (geneological) classification of yeasts.

5. The classification of microbial enzymes in connection with the new concept of their origin and development.

6. The chief methods of laboratory investigation of yeasts used for their systematic identification:

   (i) The study of morphology and life cycle. The determination of spore-forming capacities.

   (ii) The determination of the form of spores: their mode of formation and germination.

   (iii) The determination of the ability of yeasts to assimilate nitrogen-free carbon-containing substances.

   (iv) The determination of the species within a genus and of varieties within a species by mutual relations when cultured together.

Special Part

Genus Saccharomyces.

1. S. globosus.
2. S. ribis Ludwig, 1917.
3. S. paradoxus
4. S. casei Harrison, 1927.
5. S. lactis
6. S. vini Meyen, 1838
   a. S. vini var. cartilaginosus nov. var. Kudriavzev.
   b. S. vini var. cerevisiae nov. var. Kudriavzev.
7. S. cartilaginosus
8. S. cerevisiae
9. S. coreanus Saito, 1909.
10. S. uvarum
    a. S. uvarum var. carlsbergensis nov. var. Kudriavzev.
    b. S. uvarum var. melibiosus nov. var. Kudriavzev.
11. S. carlsbergensis
12. S. chevalieri
13. S. oviformis
    S. oviformis v. cheresiensis nov. var. Kudriavzev.
14. S. bayanus
15. S. chodati Steiner, 1924.
16. S. heterogenicus
17. S. aceris-sacchari
18. S. prostoserdovi sp. nov. Kudriavzev.

Genus Issatchenkia nov. gen. Kudriavzev.

I. orientalis nov. sp. Kudriavzev.

Genus Zygosaccharomyces

1. Z. bailii
   a. Z. bailii var. galactosus nov. var. Kudriavzev.
   b. Z. bailii var. galactomaltosus nov. var. Kudriavzev.
2. Z. mongolicus
3. Z. lactis
4. Z. nadsonii
5. Z. thermotolerans Philippov, 1932
6. Z. eupagicus (i.e. eupagycus)
7. Z. fermentati. Naganishi, 1928.
8. Z. florentinus.
9. Z. rautensteinii sp. nov. Kudriavzev.

Genus Fabospora nov. gen. Kudriavzev. (Bean-shaped spores)

1. F. macedoniensis (Diddens & Lodder) Kudriavzev, nov. com. (syn. Sacch. macedoniensis, S. fragrans, S. muciparus)

2. F. fragilis (Jörgensen) Kudriavzev nov. comb. (syn. Sacch. fragilis, Sacch. lactis, Sacch. cavernicula, C. pseudotropicalis)

Genus Zygofabospora nov. gen. Kudriavzev.

1. Z. marxiana (Hansen) Kudriavzev nov. comb. (syn. Sacch. marxianus, Zygosacch. marxianus, Zygosacch. ashbyi)

2. Z. krasilnikovi nov. sp. Kudriavzev.

Genus Pichia.

1. P. alcoholophila
2. P. membranaefaciens.

Genus Zygopichia

1. Z. chevalieri
2. Z. farinosa.

Genus Hansenula

1. H. kluyveri (Bedf.) Kudriavzev, nov. comb. (syn. P. kluyveri Bedford 1942).
2. H. suavolens.
3. H. anomala
4. H. wichmanni Zikes, 1906
5. H. belgica
6. H. lambica
7. H. fermentans. Verona & Valleg, 1933.

Genus Zygowillia (Klöcker) Kudriavzev.

1. Z. pastori (Guill.) Kudriavzev, nov. comb. (syn. Zygosacch. pastori)
2. Z. chodati (Mrak et al.) Kudriavzev, nov. comb. (syn. P. chodatii v. fermentans)
3. Z. pini (Holst) Kudriavzev, nov. comb. (syn. Zygosacch. pini.)

Genus Williopsis

W. saturnus

Genus Zygowilliopsis nov. gen. Kudriavzev.
(syn. Zygohansenula)

Z. californicus (Lodder) Kudriavzev, nov. comb. (syn. Zygoh. californica).

Genus Debaryomyces

1. D. disporus
2. D. globosus

3. D. rosei Kudriavzev, nov. comb.
(syn. Torulaspora rosei, Zygosacch. globiformis f. typica)
4. D. dekkeri
5. D. delbrückii (Lindner) Kudriavzev, nov. comb.
(syn. Torulaspora delbrückii)
6. D. mandshuricus
7. D. kursanovi. nov. spec. Kudriavzev.
8. D. vini
9. D. mucosus
10. D. tyrocola
11. D. hansenii (Zopf) Kudriavzev, nov. comb.
(syn. Sacch. hansenii, D. tyrocola var. hansenii)
12. D. konokotinae nov. sp. Kudriavzev.
13. D. klöckeri
14. D. guilliermondii.

Genus Schwanniomyces

S. occidentalis

Genus Metschnikowiella (Metschnikoff) Genkel, 1913.
(syn. Mononospora, Metschnikowia Kamensky 1899, Monosporella).

1. M. bicuspidata (Metzshnikoff) Kudriavzev, nov. comb.
(syn. Monospora bicuspidata, Monosporella bicuspidata)

2. M. unicuspidata (Keilin) Kudriavzev, nov. comb.
(syn. Monosporella unicuspidata)

Genus Coccidiascus

Genus Nadsoniomyces Kudriavzev, 1932.

Genus Endoblastomyces Odinzova, 1947.

Genus Schizosaccharomyces

1. S. pombe
2. S. acidodevoratus Chalenko, 1941
(syn. S. liquefaciens, S. pombe rasse liquefaciens Dekker, 1931, S. mosquensis Shcherbakov & Popova, 1934).

Genus Octosporomyces Kudriavzev, nov. gen.
(syn. Schizosaccharomyces).

1. O. octosporus (Beijerinck) Kudriavzev, nov. comb.
(syn. Schizossach. octosporus)

2. O. japonicus (Yukawa) Kudriavzev, nov. comb.
(syn. Schizosacch. japonicus, Schizosacch. versatilis).

Genus Saccharomycodes

1. S. ludwigii
2. S. vini (Kroemer & Heinrich) Kudriavzev, nov. comb. (syn. S. ludwigii var. vini).
3. S. behrensianus.

Genus Saenkia nov. gen. Kudriavzev.

1. S. biápora (Castelli) Kudriavzev, nov. comb. (syn. Saccharomycodes bisporus)

Genus Hanseniaspora

1. H. apiculata (Reess) Zikes, 1911
   (syn. Sacch. apiculatus, Hansenia apiculata, Pseudosacch. apiculatus, Kl. apiculata, Kloeckeraspora apiculata, etc.)

2. H. antillarum (Klöcker) Kudriavzev, nov. comb.
   (syn. Pseudosacch. antillarum, Kl. antillarum, Pseudosacch. willi, Kl. willi, etc.)

3. H. javanica (Klöcker) Kudriavzev, nov. comb.
   (syn. Pseudosacch. javanicus, Kl. javanica, Pseudosacch. malaianus, Kl. malaiana (Kl.) Janke, 1923, 1929. etc.)

Genus Nadsonia

N. fulvescens

Note: extra details are given above in certain cases only, assuming access to Lodder & Kreger-van Rij (1952).

4. Chinese fermentation micro-organisms.

We have obtained a photocopy of 1941 Bulletin No. 126 of the National Bureau of Industrial Research, a list of the Fermentation Micro-organisms Isolated, Identified and Cultured in the National Bureau of Industrial Research, Chungking.

II. Soil Bureau Experiment Station, Department of Scientific and Industrial Research, Eastern Hutt Road, Lower Hutt, New Zealand. Communicated by Dr. Margaret di Menna.

A survey of yeasts in tussock grassland soils in New Zealand has been completed and is being prepared for publication. Three locations were chosen for study, all at an altitude of 2,500-3,000 feet and under vegetational cover dominated by Festuca novae-zelandiae, but several hundred miles apart and with widely differing soils. The list of species

isolated was essentially similar for the three locations but the dominant species was different in each case, Cryptococcus diffluens at one place, Cryptococcus albidus at a second, and Cryptococcus terreus at the third. Numbers were of the order of 5,000 to 20,000 per gram of soil.

These results were reached by plating out soil dilutions on glucose-peptone-yeast extract agar, pH 4. To check their validity surveys are also being made of yeasts in a forest soil, now under pasture, using a number of different methods and media for the primary isolations. The principal yeast species in this soil are Cr. albidus, Cr. terreus, Candida curvata, and what appears to be a new, non-fermenting species of Candida. So far it seems that the glucose-peptone medium is the best, in spite of the way in which it encourages mold growth. A number of soil extract agars have been used. One gave results comparable with the glucose-peptone medium, another lowered the yeast count without apparently affecting any particular species, and a third gave an extremely depressed count, suppressing growth of all species but C. curvata.

As samples come to hand from the Soil Bureau field workers, yeasts from various peats are being investigated. These are proving highly interesting. The results so far suggest that the lowland intrazonal peats support yeasts which are physiologically similar to those of mineral soils, non-fermenting, mucilaginous, nitrate-assimilating species, whilst the alpine and sub-antarctic zonal peats contain a large proportion of fermenting species.

III. South African Council for Scientific and Industrial Research, National Chemical Research Laboratory, P. O. Box 395, Pretoria. Communicated by Dr. J. P. van der Walt.

The following new species of yeast have been isolated recently.

Saccharomyces transvaalensis nov. spec.

This large-celled species is characterized by the fermentation of only glucose and galactose. It does not assimilate saccharose, maltose or lactose. It forms a primitive pseudomycelium and 1-2 round to somewhat oval spores per ascus. A detailed description of this organism will appear in a forthcoming issue of Antonie van Leeuwenhoek.

Saccharomyces capensis nov. spec.

This large-celled species is characterized by the fermentation of glucose, saccharose and raffinose 1/3. It does not assimilate galactose or maltose. It forms no pseudomycelium and produces 1-4 round spores per ascus. A detailed description is appearing in a forthcoming issue of Antonie van Leeuwenhoek.

Saccharomyces pretoriensis nov. spec.

This small-celled species ferments glucose, galactose, saccharose, maltose and raffinose 1/3. It does not assimilate lactose. Morphologically

it is quite distinct from other species with the same biochemical properties in that it forms protuberances during sporulation as does Sacch. rosei and Sacch. fermentati. 1-4 round spores are formed per ascus. A detailed description is appearing in a forthcoming issue of the Journal for General Microbiology.

Pichia vanriji nov. spec.

This species is non-fermentative and assimilates glucose, galactose, saccharose, maltose, but not lactose. It is characterized by the early formation of a creeping pellicle and forms 1-4 round spores per ascus. A full description will be appearing in a forthcoming issue of the Journal for General Microbiology.

Studies are in progress on an entirely new and hitherto undescribed, primitive yeast group. This group is characterized by the formation of asci containing more than 8 spores. Further salient features are the vegetative reproduction by budding the pronounced fermentative dissilimation and inability to assimilate nitrate. A detailed description of these organisms and their phylogenetic significance in relation to the existing genera of the Endomycetaceae will be found in a forthcoming issue of Antonie van Leeuwenhoek.

IV. Institut für Garungsgewerbe. Mikrobiologische Abteilung. Seestrasse 13. Berlin N 65. (West). Communicated by Professor Siegfried Windisch.

a) Numerous strains of Trichosporon, isolated in part from food stuffs and in part from humans and domestic animals, were tested with respect to the differences which exist between Trichosporon cutaneum and Tr. infestans. In addition, they were tested with regard to the morphogenesis of the genus. This material was presented at a meeting of the Deutschen Gesellschaft für Hygiene und Mikrobiologie in Bad Kissingen on March 27, 1955 (cf. S. Windisch, Zentralblatt für Bakteriologie II 108, 688, 1955 and Die Brauerei (Berlin) 9, Nr. 78/79, 571, 1955).

b) The biology of the film forming yeasts has been studied for an extenxive period in this laboratory. At the present time, further investigations are underway on the formation of pellicles. Part of the work deals with the morphogenesis of the pellicles and part of it with the physiological conditions for pellicle formation. Very probably, the pellicle formation is not always a result of the needs for oxygen for a particular yeast. Investigations with Candida mycoderma, Pichia membranaefaciens and Candida krusei have shown that the formation and utilization of organic acids, such as citric and acetic acids, are perhaps very useful for the determination of many kinds of yeasts. This and certain bad results in the use of wort acidified with tartaric acid in brewery plant control led to the next topic:

c) Behavior of yeasts in the presence of organic acids, in particular citric, acetic and tartaric acid. Part of the results were reported during the European Brewery Convention in Baden-Baden on May 23, 1955 (cf. Proceedings European Brewery Convention 5, 69, 1955). The investigations are continued.

d) Studies during the last several years on the occurrence of yeasts in the intestinal tract of people with certain diseases led to a more exact knowledge of the frequency and speciation of yeasts in diseases of various organs (cf. S. Windisch and F. Staib, Zentralblatt für Bakteriologie I Orig. 164, 493, 1955). The work is continued.

V. Instituto de Higiene. Laboratorio de Micologia. Montevideo, Uruguay. Communicated by Dr. Ricardo C. Artagaveytia-Allende.

We are primarily working on yeasts of medical interest. A study was completed recently of cultures of Cryptococcus, some of which were of pathogenic origin and others of non-pathogenic origin. The purpose of the study was a comparison of the two groups of cultures and to determine their identity or non-identity. We have also done some yeast work during a recent trip to Mexico, Venezuela and Ecuador, particularly in laboratories of the first two countries.

VI. Carlsberg Laboratorium. Physiological Department. Copenhagen, Denmark. Communicated by Dr. Catherine Thorne-Roberts.

On the 19th of May, Professor Ojvind Winge celebrated his 70th birthday and on June 1st he will retire as head of the Physiological Department of the Carlsberg Laboratorium, a post he has filled for the last 23 years. Professor Winge will not, however, give up his scientific investigations entirely. A laboratory and office are to be placed at his disposal in an adjoining building, and he will continue to direct the hop and barley breeding work at "Nordgaarden", the experimental farm of the Carlsberg Breweries. He will also still be in contact with the yeast investigations expected to be carried out in the future. Professor Winge's successor is to be Dr. Heinz Holter, at present head of the Cytochemical Department at the Carlsberg Laboratorium. Dr. Holter will continue his work on localization of enzymes in amoebal cells and at the same time will commence investigations on yeasts. I will remain at Carlsberg and assist Dr. Holter in the latter undertaking.

VII. Instituto "Jaime Ferran" de Microbiologia, Madrid, Spain.

Dr. Carlos Ramirez Gomez recently sent the Editor a number of his papers dealing with yeast ecology and in which a number of new species are described belonging to the genera Pichia, Saccharomyces, Endomycopsis and Debaryomyces. The papers are in Spanish and were published in Microbiologia Española (6, 405, 1953; 7, 107, 1954; 7, 110, 1954; 8, 225, 1955; 8, 137, 1955).

VIII. University of Illinois, Department of Bacteriology. Urbana, Illinois. Communicated by Dr. F. M. Clark.

The utilization of inositol by Schizosaccharomyces pombe

Dr. Henry Yarbrough and F. M. Clark have completed work on the utilization of inositol by Schizosaccharomyces pombe. Inositol appears

to be an essential metabolite for this yeast and when added in excess of the growth requirements is not catabolized by this yeast. It disappears from the medium at a rate commensurate with the growth rate of the yeast. Compounds of inositol which are unavailable to the yeast cell are liberated into the medium after active growth of yeast has stopped (48-72 hours). When this supernatant free from yeast cells is hydrolyzed this form of inositol again becomes available. Much of the inositol within the yeast cell is bound to the lipid fraction. The work indicates that these compounds are probably phospho-lipids. The cell residue after exhaustive extraction with fat solvents still contains 16-20% of the original content of inositol. This remaining inositol is insoluble in all solvents used and is not liberated from the cell residue by treatment with proteolytic enzymes or fractionation for nucleoprotein. It was suggested by Smith (J. Gen. Microbiology 5:772 (1951)) that in Saccharomyces carlsbergensis phytin-like compounds were present. Using the technic suggested by Smith we were unable to demonstrate any phytin-like compounds in Schizosaccharomyces pombe. Cells undergoing autolysis liberated free inositol whereas heat-killed cells did not. This seemed to be an indication that the inositol in these cells was in bound form and not stored as free inositol.

Two other problems are under investigation in the department at present. Mr. Deufel is working on pigment formation in the Genus Rhodotorula. The other problem involves the synthesis of inositol by Saccharomyces carlsbergensis.

THE OXIDATIVE METABOLISM OF GLUCOSE BY RHODOTORULA GRACILIS

John Hyland Litchfield and Z. John Ordal
Department of Food Technology
University of Illinois, 1956

(Abstract of a thesis by J. H. Litchfield)

The objectives of this investigation were as follows: 1. to obtain information on the pathways of the aerobic metabolism of glucose by Rhodotorula gracilis, NRRL Y-1091; 2. to demonstrate the oxidative assimilation of various metabolic intermediates; and 3. to determine the efficiency of glucose utilization by this organism under conditions of controlled temperature, pH, and aeration rate. A study was also carried out on the endogenous respiration of this organism.

Experiments with inhibitors showed that glucose oxidation by resting cells was not inhibited appreciably by 0.02 M. fluoride, but was inhibited by 0.001 M. iodoacetate. Cells grown in the presence of 0.02 M. fluoride were undiminished in their ability to oxidize glucose. Arsenite (0.001 M.) significantly inhibited both glucose and pyruvate oxidation.

A cell free extract was prepared which oxidized glucose and gluconate in the presence of adenosine triphosphate and magnesium ions, glucose-6-phosphate and ribose-5-phosphate in the presence of triphosphopyridine nucleotide, and fructose-6-phosphate in the absence of any added coenzyme. Fructose 1,6, diphosphate was oxidized very slowly. Chromatographic analysis showed that 6-phosphogluconate and pentose phosphate were

products of glucose-6-phosphate oxidation by this extract. These observations were confirmed by an analysis of vacuum dried cells for the various phosphorylated intermediates.

Malonate (0.04 M.) significantly inhibited the oxidation of acetate, pyruvate, α-ketoglutarate, and the simultaneous oxidation of oxaloacetate and acetate by resting cells, while succinate oxidation was inhibited by 0.02 M. malonate. The oxidation of acetate, pyruvate, and malate by resting cells was inhibited by 0.002 M fluoroacetate. Citrate was detected as a product of the oxidation of these acids in the presence of fluoroacetate, and as a product of the simultaneous oxidation of oxaloacetate and acetate in the presence of malonate. L-glutamate, L-alanine, and L-aspartate were also oxidized by resting cells. A cell free extract oxidized citrate, iso-citrate, and all the dicarboxylic acids of the tricarboxylic acid cycle.

From these results it was concluded that the hexose monophosphate pathway was an important initial mechanism of glucose oxidation and that the tricarboxylic acid cycle was the most important pathway of terminal respiration utilized by this organism.

Resting cells oxidatively assimilated glucose and the various acids related to the tricarboxylic acid cycle rather than oxidizing them to completion. The addition of 2,4, dinitrophenol stimulated the oxidation of these compounds but complete oxidation was not obtained.

The efficiency of glucose utilization in Wickerham's yeast nitrogen base medium with glucose as the sole source of carbon was found to be 49.7 per cent at pH 5.5 and 32°C. The metabolic activity of cells grown on a minimal synthetic medium was similar to that of cells grown on an enriched medium although the endogenous respiration of the former cells was greater.

Another graduate student, W. H. Lee, has been growing Rhodotorula gracilis in continuous culture in a medium containing Dextrose and urea with a small amount of yeast extract. The organism grows well with an efficiency of sugar utilization of 50-55%.

IX. United States Department of Agriculture. Northern Utilization Research Branch. Peoria, Illinois. Communicated by Dr. L. J. Wickerham.

On April 12, Dr. Jacomina Lodder completed three months of study related to taxonomy of yeasts. Her ready grasp of our concepts and procedures, and her clear, analytical consideration of problems bearing on the genetics of yeasts furthered our researches in a marked degree. April 6 was "Lodder Day" with zymologists from five states participating. A round table discussion on problems of interest to taxonomists was the first event of the afternoon. The remainder was spent in informal discussions, and in observing demonstrations of hybridization procedures, of the influence of agglutination on zygote formation in a new species of yeast, and of taxonomic procedures. In the evening, Dr. Lodder showed films and colored slides of Holland. All of the persons in the Culture Unit will remember Mia's very pleasant ways.

Recently two papers on the hybridization of Saccharomyces lactis, Saccharomyces fragilis, and related species were published in the JOURNAL OF BACTERIOLOGY. One means of separating hybrids from the parent cultures is by selecting white parents that yield pigmented hybrids. Because the difference in color is striking, the following cultures and procedures are suggested for classroom experiments:

Saccharomyces lactis NRRL Y-1140 is a heterothallic haploid strain and Zygosaccharomyces ashbyi NRRL Y-1598 is a homothallic, predominantly haploid strain. Approximately equal volumes of cells from slant cultures are mixed in the center of a slant by a loop, then the mixture is spread over the surface of the slant. The mixture is serially transferred at weekly intervals. The third or fourth serial transfer, when streaked on plates, will yield red colonies of hybrids and white colonies of the parents. The red pigment is pulcherrimin. The medium used is YM agar (3 grams each of yeast extract and malt extract, 5 grams of peptone, 10 grams of glucose, and 20 grams of agar per liter of distilled water. The pH is not adjusted.) The temperature of incubation is 25°C.

The hybrids may be confirmed biochemically. Saccharomyces lactis assimilates maltose, but not inulin, Zygosaccharomyces ashbyi assimilates inulin, but not maltose, and the hybrids assimilate both carbon sources.

On May 19, Dr. Ojvind Winge celebrated his 70th birthday. A volume consisting primarily of papers concerned with genetics of yeasts was presented to him. Among them was one on the influence of agglutination on zygote formation in Hansenula wingei, a new species of yeast. This species has unique sexual reactions. Some strains produce ascosporic cultures which immediately agglutinate when agar-grown cells of the opposite sexes are mixed. Within three to five hours up to 70 or 80 percent of zygotes may be produced, and at 24 hours the cells are practically all diploid and have ceased to be agglutinated. Other strains of H. wingei produce ascosporic cultures which are not agglutinative, and when freshly isolated opposite sexes are mixed no conjugation or sporulation occurs. After the sexes have been isolated some months and then mixed, a small number of zygotes are formed. When an agglutinating mating type is crossed with a nonagglutinating mating type, the diploid produced has no agglutinating ability. However, some 93 percent of its ascosporic isolates are agglutinative, most of them being of the same sex as the agglutinative parent. The intensity of the reaction varies from strong and immediate, through latent reactions that occur some minutes after the sexes are mixed, to the few which produce no reactions at all. Agglutinative and nonagglutinative haploids, natural diploids, and hybrid diploids and haploids of H. wingei are available from the NURB Collection.

A rather handsome and interesting book on the taxonomy of the sporogenous yeasts recently has been published in Russia. I shall try to have enough of it translated to give a general outline of it in the next News Letter. (See also item I of this issue. Editor.)

X. Southern Illinois University, Biological Research Laboratory. Carbondale, Illinois. Communicated by Dr. Carl C. Lindegren.

Since the last publication of the Yeast News Letter, the following articles have been published or accepted for publication:

(1) Lindegren, C. C. and Lindegren, G. Eight genes controlling the presence or absence of carbohydrate fermentation in Saccharomyces. J. Gen. Microb. (accepted for publication).

(2) Lindegren, C. C. Is the gene a prime mover? Nature 176, 1244-45 (1955).

(3) Shult, E. E. and Lindegren, C. C. Mapping methods in tetrad analysis. I Provisional arrangement and ordering of loci preliminary to map construction by analysis of tetrad distribution. Genetica (accepted for publication).

(4) Lindegren, C. C. and Shult, E. E. Nonrandom assortment of centromeres with implications regarding random assortment of the chromosomes. Experientia (accepted for publication).

(5) Lindegren, C. C. The stability of the gene. Science (accepted for publication).

(6) Williams, M. A., Lindegren, C. C. and Yuasa, A. Cytoplasmic structures in yeasts: An answer. Nature (accepted for publication).

(7) Lindegren, C. C. Mutation and other variations in microorganisms. Special edition of Compt. rend d. Lab. Carlsberg, Ser. Physiol. (accepted for publication).

(8) Lindegren, Carl C. Recombination in bacteria. Science (accepted for publication).

XI. Dr. Louise Mojonnier, Chairman, Department of Home Economics, Illinois Institute of Technology, Chicago 16, reports the publication of the following paper:

"The microbiological assay of the amino acids of 5 genera of yeasts grown under controlled conditions" by M. L. Mojonnier, L. R. Hedrick and T. Porter in the Journal of Nutrition 57, 579-591, Dec. 1955. A summary of this paper appeared in the fall issue 1955 of the Yeast News Letter.

XII. University of Pennsylvania, Department of Physiology, Section on Cytology and Genetics. Philadelphia 4, Pennsylvania. Dr. Edward D. DeLamater has sent in the following news items.

My recent trip to England to speak on "Bacterial Chromosomes and Their Mechanism of Division", as a contributor to the Symposium on

Bacterial Anatomy sponsored by the Society for General Microbiology, which took place April 10-12 at the Royal Institution in London.

On June 6, I am to present an invitation paper at the Purdue Microbiological Institute meetings entitled, "Implications of Sex in Microorganisms".

Dr. Abraham Widra, formerly of this department, is now affiliated with the Department of Bacteriology, School of Medicine, University of North Carolina, Chapel Hill, North Carolina, as medical mycologist.

XIII. Sulphite Pulp Manufacturers' Research League, Inc. 1107 East South River Street, Appleton, Wisconsin. Dr. Averill J. Wiley sent in the following news items on December 20, 1955 which was received too late to be included in the fall issue.

The new Hsing-Ying Yeast Plant of the Taiwan Sugar Corporation on Formosa is approaching completion. This new plant to produce Torula type food and feed yeasts from cane molasses in four modified Waldhof type fermentors is designed to produce 40 metric tons (48 U.S. short tons) of dry yeast daily, and as such is to our knowledge much the largest single unit for yeast production yet to be built. Manager of the yeast plant is Mr. H. C. Chien who studied fermentation biochemistry under Professors W. H. Peterson and M. J. Johnson several years ago. Plant Superintendent, T. S. Chen, has been in the United States taking intensive operational instruction at various United States yeast plants the last half of 1955 under auspices of the International Cooperation Administration. The new Formosa plant is now expected to go on stream about March 1, 1956.

XIV. University of California, Department of Food Technology, Davis, California. Reported by Dr. Herman J. Phaff.

1. Dr. E. M. Mrak, Chairman of the Department, left May 3 for 3 months to give a series of lectures on developments in the field of Food Technology at the University of Lausanne in Switzerland. Dr. Mrak, who is accompanied by his family, is planning to return to California by way of Brazil and to spend approximately one month in various places in Brazil to discuss research programs in Food Technology and related fields.

2. Dr. R. Ciferri from Pavia, Italy, has spent the last year studying yeasts in Brazil. He obtained a Fulbright travel grant for one month to visit various institutions in the United States. It was a pleasure to have Dr. Ciferri as a guest in Davis on May 5 and to discuss various aspects of yeast ecology and taxonomy. Dr. Ciferri will go back to Brazil and expects to return to Italy in August.

3. Dr. J. Lodder of Delft, Holland is planning to spend the first week of July on the Davis Campus after completing her work at the

University of Washington with Dr. Roman. She will then return to Holland where she holds a position in the research department of the well-known Yeast and alcohol factory in Delft.

4. A well attended round table discussion group recently met under the chairmanship of Dr. J. L. Etchells during the Annual Meeting of the Society of American Bacteriologists in Houston, Texas. Approximately 18 persons attended. The various participants reported the status of their research projects and related topics dealing with yeast taxonomy, genetics and ecology which resulted in a lively debate and lasted several hours.

5. The following papers were published since the last News Letter appeared:

a) "The Unienzymatic Nature of Yeast Polygalacturonase" by H. J. Phaff and A. L. Demain, Jour. Biol. Chem. 218, 875 (1955).

b) "Yeasts isolated from Drosophila and from their suspected feeding places in southern and central California". by A. M. El-Tabey Shehata, E. M. Mrak and H. J. Phaff, Mycologia 47, 799 (1955). (Three new species of Saccharomyces are described.)

c) "The association of yeasts with certain bark beetles". by M. Shifrine and H. J. Phaff. Mycologia 48, 41 (1956). One new species of Pichia, one of Candida, one of Rhodotorula and two of Torulopsis are described.

6. Dr. R. de Camargo, visiting Rockefeller fellow from Piracicaba, Brazil (Instituto Zimotecnico da Universidade de Sao Paulo) is making a study of the yeasts found in the intestinal tract of Drosophila which occur in large numbers in tomato fields in California during the last part of the season. Also a limited number of yeasts were isolated from spoiled and fermenting tomatoes. A total of 196 yeasts were isolated and it appears that about half the cultures from flies as well as those from the fruit represent a single species - Kloeckeraspora uvarum (Hanseniaspora uvarum). Another common species is a yeast closely related to Pichia fermentans. The other yeasts isolated belong to the genera Kloeckera and Candida.

Camargo's fellowship has been extended for 6 months and he will return to Brazil in the beginning of 1957.

Other work in progress in our laboratory includes a continuation of the growth requirements of the yeast Saccharomycopsis guttulatus by M. Shifrine and a study on the relationship between the genera Hanseniaspora, Kloeckeraspora and Kloeckera by M. W. Miller.

Herman J. Phaff - Editor.