anæmia and obstructive jaundice (pancreatic carcinoma) the concentration of pigment was at the lowest limit of optical measurement.

It would appear, therefore, that choleglobin production from oxyhæmoglobin does not take place in the normal erythrocyte, and this and subsequent changes to form biliverdin can only ensue after disruption of the corpuscle.

C. GARDIKAS
J. E. KENCH
J. F. WILKINSON

Department of Hæmatology,
University of Manchester,
and
Manchester Royal Infirmary.
Jan. 17.

¹ Lemberg, R., Legge, J. W., and Lockwood, W. H., *Biochem. J.*, **35**, 339 (1941).

² Lemberg, R., and Legge, J. W., *Aust. J. Exp. Biol. and Med. Sci.*, **20**, 65 (1942).

Origin of Noble Sugar-Canes (*Saccharum officinarum* L.)

THE cultivated sugar-canes belong to two main groups: (1) the thin and hardy types of north Indian canes botanically classified under *Saccharum Barberi* Jesw. and *Saccharum sinense* Roxb.; and (2) the thick or noble types, *Saccharum officinarum*. The origin of these noble canes is still obscure, and Barber¹ and Jesweit² were of opinion that it was in the mountainous islands of the Malayan Archipelago, New Guinea and Polynesia. It is considered that these types of cane were introduced into India only very recently and are referred to as 'the introduced canes', while the north Indian canes are held to be indigenous to India and any mention of sugar-cane in India in early historical records or mythological legends is believed to refer only to north Indian canes.

Cytogenetical studies³, supported by morphological evidence, have indicated that the north Indian canes are complex polyploid hybrids derived from the extensive natural hybridization of *S. officinarum* with *S. spontaneum* L., a related wild species which has a geographical distribution extending from the slopes of the Himalayas down to the tropical plains of Sumatra and Java. Therefore, it was concluded that the north Indian canes are of a later origin than the noble canes and that the thick canes must have been in cultivation in India earlier than the 'indigenous' or north Indian canes.

Studies are now in progress to identify the fundamental species composition of the noble cane, *S. officinarum*, which is considered to be an octoploid ($2n = 80$) with a basic number $x = 10$ characteristic of Andropogonæ⁴. In interspecific and intergeneric hybrids with *S. officinarum* it is found that the haploid complement ($n = 40$) of *S. officinarum* pairs auto-syndetically to the exclusion of pairing between parental chromosomes. This was to be expected owing to the polyploid composition of the haploid complement itself. When, however, the chromosome complement of *S. officinarum* was reduced to the diploid and haploid number by successive back-crossing with the *Sclerostachya fusca* A. Camus, a wild species of a related genus, the homology between parental chromosomes began to manifest itself. Thus, with the diploid number, although ten bivalents of *S. officinarum* were commonly noticed, a certain

number of multivalents resulting from the pairing of parental chromosomes were also noticed. In the haploid state it was clearly noticed that five chromosomes of *S. officinarum* invariably paired with five of the other parental species, thereby showing homology between them.

One of the types of the noble class of canes, namely, *Vellai* ($2n = 80$), was crossed with *Sclerostachya* ($2n = 30$) and the hybrid was successively back-crossed with the same wild species. The accompanying table gives in the main the analysis of chromosome associations at metaphase I of meiosis in the derived hybrids.

ASSOCIATION OF CHROMOSOMES AT METAPHASE I

	2n (number)	No. in the species complements of hybrids		Pairing at metaphase I
		<i>S. offi- cinarum</i> (O)	<i>Scleros- tachya</i> <i>fusca</i> (S)	
Parents:				
<i>S. officinarum</i> (Vellai)	80			40 ^{II}
<i>Scl. fusca</i>	30			15 ^{II}
Hybrids:				
F_1 hybrid	55	40	15	20 ^{II} (O) + 5 ^{II} (S) + 5 ^I (S)
$F_1 \times Scl. fusca$ (back-cross I)	70	40	30	20 ^{II} (O) + 15 ^{II} (S)
$B.C. I \times Scl. fusca$ (back-cross II)	50	20	30	$\left\{ \begin{array}{l} 10^{II}(O) + 15^{II}(S) \\ 5^{III}(O + S) + \\ 15^{II}(O + S) + \\ 5^{II}(O) \end{array} \right.$
$B.C. II \times Scl. fusca$ (back-cross III)	40	10	30	$\left\{ \begin{array}{l} 2^{IV}(O + S) + \\ 2^{III}(O + S) + \\ 5^{III}(O + S) + \\ 10^{II}(S) + 5^{I}(O) \end{array} \right.$

The basic number of ten chromosomes is now seen to be really constituted of two different sets of $x = 5$ chromosomes each, one set of which is common to both *Sclerostachya* and noble cane. A detailed account will be published elsewhere. The identification of these fundamental complements now remains to be investigated through a series of interspecific and intergeneric crosses by the utilization of the back-cross hybrids with the reduced complement of *S. officinarum*.

It is interesting to note that *Sclerostachya fusca* was originally included in the genus *Saccharum*⁵, and later was separated as a different genus. This species is found widely distributed in India from Kashmir to Bengal and Assam and also in the Western Ghats. It is clear from the above studies that *S. officinarum* and *Sclerostachya* have had a common ancestry through an unidentified basic species with $x = 5$ chromosomes. This would lend further support to the view that *S. officinarum* has been in existence in India from very early times and that it played a part in the evolution of the north Indian or indigenous canes.

N. PARTHASARATHY

Indian Agricultural Research Institute,
New Delhi.
Nov. 13.

¹ Barber, C. A., *Int. Sug. J., Lond.*, **22**, 249 (1920).

² Jesweit, J., *Proc. Int. Soc. Sug. Tech.*, IIIrd Congress, Soerabaya, 44 (1930).

³ Parthasarathy, N., *J. Ind. Bot. Soc.*, M.O.P. Commemoration Vol., 133 (1946).

⁴ Bremer, G., *Genetica*, **7**, 293 (1925).

⁵ Roxburgh, W., "Flora Indica" (1874).