cord believed to be by elective increase of presynaptic inhibition mechanisms. It therefore acts specifically against the decrease of the inhibitory mechanisms released by strychnine and blocks the transfer of the increased impulses between spinal segments. Diazepam thus limits the need for prolonged general anaesthesia with controlled breathing to the really severe cases.

Pharmacological textbooks (Laurence, 1966; Goodman and Gilman, 1970) seem universal in their condemnation of strychnine as a therapeutic drug. There is no justification for the presence of any strychnine-containing compound in therapeutic usage, and we urgently suggest that immediate withdrawal be enforced.

We are grateful to Dr. Alex P. Mowat and Dr. S. A. Mason for permission to submit this report for publication, to the nursing

staffs of the casualty department and the intensive care unit for their help, and to Mrs. Pamela Golding for secretarial assistance.

References

- Brett, E. M. (1970). *Developmental Medicine and Child Neurology*, 12, 655.
 Goodman, L. S., and Gilman, A. (editors) (1970). *Pharmacological Basis of Therapeutics*, 4th Ed. London, Macmillan.
 Hawkins, G. F. (1962). *British Medical Journal*, 2, 26.
 Heidrich, H., and Ibe, K. (1969). *Archiv. für Toxikologie*, 24, p. 188.
 Laurence, D. R. (1966). *Clinical Pharmacology*, 3rd Ed. London, Churchill.
 Martindale's *Extra Pharmacopoeia*, 1967, ed. R. G. Todd, 25th edn. London, Pharmaceutical Press.
 Southby, R. (1965). *Medical Journal of Australia*, 1, 533.
 Statham, C. (1956). *British Medical Journal*, 2, 1101.
 Thienes, C. H., and Haley, T. J. (1964). *Clinical Toxicology*, 4th ed. London, Kimpton.

Case of Poisoning from Red Whelk

C. FLEMING

British Medical Journal, 1971, 3, 520-521

Paralytic shellfish poisoning is rare in the United Kingdom, the most recent outbreak being that in 1968 in north-east England (McCollum *et al.*, 1968), when 78 cases were reported, the cause being common mussels which had concentrated the toxin produced by *Gonyaulax tamarensis*, a dinoflagellate. A case of poisoning by *Neptunea antiqua* was suspected in 1969 (Wood, 1970), but the issue was confused at that time owing to the prevalence of toxin in mussels consequent on an efflorescence of *G. tamarensis*.

A unique case of poisoning by tetramine, a toxin produced in the salivary glands of *N. antiqua*, the red whelk, occurred in Fife in the summer of 1970.

Case History

A young adult man was admitted to hospital at 7 p.m. suffering from a curare-like poisoning. At lunch time he had eaten red whelks which had been boiled and removed from the shells. One hour later blurred vision and diplopia had developed, followed by tingling of the hands and feet and twitching of the calf muscles. Coarse muscular twitching and weakness of the limbs developed into paralysis and collapse. Three and a half hours after the meal he had a violent attack of vomiting lasting about half an hour, followed by acute proctalgia lasting about five minutes but without defecation or diarrhoea. Further vomiting occurred in the ambulance bringing him to hospital. The patient also complained of vague lower abdominal pain. After his admission the symptoms became less severe and improvement was rapid, the patient being fully recovered and mobile in 24 hours. Examination of the abdomen and nervous system showed nothing abnormal. He was discharged after 48 hours' observation, no further symptoms having developed.

A shell was identified at the Gatty Marine Laboratory, St. Andrews, as one of the whelk family, *N. antiqua*, which secretes the toxin tetramine in its salivary glands (Halstead, 1965). Several other members of the whelk family also secrete tetramine.

Comment

N. antiqua is a non-littoral species, ranging from the shallows to depths of up to 100 fathoms (183 m), and is not normally seen by persons collecting shellfish on the shore. Its size, how-

ever, might make it attractive if found, as a shell can yield up to about 80 g of edible meat.

There is very little information available on tetramine poisoning in man after the consumption of whelks related to *N. antiqua*. The only toxicity data available are for mice, which indicate a seasonal variation ranging from 240 mouse units in September to a maximum of 430 mouse units in July. The toxin appears to be confined to the salivary ducts of the organism, and it is possible that removal of the ducts before consumption would eliminate the risk of poisoning (Fänge, 1960).

Jeffreys (1867) stated that in the second half of the nineteenth century whelks, including the red whelk or almond (*N. antiqua*), were regarded as a delicacy by the lower working classes in London but did not mention any known noxious effects at that time. Boulenger and Boulenger estimated the value of whelk fisheries in England at £25,000 per annum in 1914. The whelks were used principally as bait and occupied only a very secondary position as food. Related species, *N. arthritica* and *N. intersculpta*, have been reported as producing numerous intoxications in Japan (Asano and Ito, 1960).

Intoxication results when the glands of whole shellfish are ingested either raw or cooked or from cans. The clinical characteristics of whelk poisoning may be nausea, vomiting, anorexia, weakness, fatigue, faintness, dizziness, photophobia, impaired visual accommodation, and dryness of the mouth. Frequently gastrointestinal motility is disturbed, producing either diarrhoea or constipation, and paralytic ileus is not uncommon. In the present case it is interesting that actual paralysis occurred, presumably a quantitative effect.

Tetramine (teramethylammonium hydroxide) produces typical curare-like effects in mammals and frogs. The vascular system shows a fall of blood pressure, with a slowing of the heart by peripheral vagus stimulation and peripheral vasomotor depression. Respiration is temporarily paralysed by intravenous injections of tetramine owing to a curare-like effect on the phrenic nerves. Some workers believe that the respiratory action is entirely central, with the primary stimulation followed by depression of the medullary centres (Sollmann, 1949). Excretion of tetramine is very rapid in mammals, which may account for the transient symptoms of food poisoning in mild cases.

Whelk poisoning is said to be a public health problem in Hokkaido, Japan, where numerous intoxications have occurred, but the details of these outbreaks are not known (Asano, 1952; Kanna and Hirai, 1956).

The common whelk (*Buccinum undatum*), which can grow to 6 in (15 cm) in length, is still eaten in some areas. This species is non-toxic unless, possibly, after feeding on mussels contaminated by *G. tamarensis*. The periwinkle (*Littorina littorea*) is another non-toxic species eaten in many parts of the United Kingdom. A recent survey in the Forth showed no exogenous toxin in samples taken at a time when high levels were recorded in mussels (Department of Agriculture and Fisheries (Scotland), 1969, 1970).

Confusion may arise as a result of local nomenclature. *B. undatum* is known as the whelk, buckie, and mutlog; *N. antiqua* is known as the red whelk, almond, buckie, mutlog (Manx), barnagh (Irish), and spindle shell; and *L. littorea* is known as the winkle, periwinkle, buckie (Scots), and wilk (Scots), the latter derived direct from M. E. Wilke.

There is not as yet a problem in the United Kingdom, but with the growth in popularity of aqualung diving there is an increased possibility that divers hunting for edible shellfish and crustacea may collect *N. antiqua*. There is also a very remote possibility that developments in the fishing industry might lead to an attempt to harvest this gastropod on a commercial scale because of the quantity of edible meat obtainable. I am informed that the red whelk is eaten in some areas as it forms a small proportion of catches of edible whelk. So long as the organism is small there would appear to be little danger of serious toxic effects because of the obvious quantitative effect of the toxin. In the case described above, however, the shellfish consumed were all large, the shells being 5-6 in (13-15 cm) long, and the quantitative effect appears to have been responsible for the transient paralysis, which was a feature not described in the literature.

I have to thank Dr. A. H. Lauder for the case history, Professor M. S. Laverack for providing biological information about *N. antiqua*, and Dr. G. S. Riddell for his advice and permission to report the case.

References

- Asano, M. (1952). Quoted by Halstead (1965).
 Asano, M., and Ito, M. (1960). *Annals of the New York Academy of Sciences*, 90, 674.
 Boulenger, G. A., and Boulenger, C. L. (1914). *Animal Life by the Sea-shore*. Department of Agriculture and Fisheries (Scotland) (1969, 1970). Bioassays of PSP Toxin in Shellfish.
 Fänge, R. (1960). *Annals of the New York Academy of Sciences*, 90, 689.
 Halstead, B. W. (1965). *Poisonous and Venomous Marine Animals*, vol. 1, p. 665. Washington, U.S. Government Printing Office.
 Jeffreys, J. W. (1867). *British Conchology*.
 Kanna, K., and Hirai, M., (1956). Quoted by Halstead (1965).
 McCollum, J. P. K., Pearson, R. C. M., Ingham, H. R., Wood, P. C., and Dewar, H. R. (1968). *Lancet*, 2, 767.
 Sollmann, T. (1949). Quoted by Halstead (1965).
 Wood, P. C. (1970). Ministry of Agriculture and Fisheries. Personal communication.

An XYY Individual of Average Height

J. KAHN, T. COATES, JOYCE M. MAXWELL,
D. E. MUTTON, FRED A. S. REED

British Medical Journal, 1971, 3, 521

We report the case of an XYY individual of average height. He was diagnosed during a cytogenetic survey of 175 factory apprentices.

Case Report

The patient was born on 12 March 1954. In 1965 he and his brother (now aged 18) and two sisters (now aged 20 and 17) were adopted by a paternal aunt. He received a secondary modern education and left school at 15. For the first year his employment record was poor. On 28 July 1969 he was employed as a labourer, being dismissed in August. On 8 September he was employed as a labourer by a different firm, again being dismissed four days later. On 25 September he started as a labourer with a third firm, being dismissed on 10 October. On 13 October a fourth firm employed him as a labourer; he was dismissed in November. He was then again employed as a labourer, being dismissed on 26 June 1970. On 29 June he took up his current apprenticeship at a large paper mill and so far has not been dismissed (August 1971).

In October 1970 he was committed to a juvenile court for theft of milk and butter; he pleaded guilty and was fined £5. At the time of his offence he was earning an average weekly wage of £11 and was residing with his adoptive parents, to whom he paid £3 a week for his keep. One of the sisters of the factory's medical centre visited the family and found the home pleasant and well kept.

The boy's medical history was unremarkable. His father was born in 1919 and his mother in 1918. His height and weight were measured during two clinical examinations made by T.C. in 1970—1 July, 5 ft 6½ in, 9 st 7¼ lb (169 cm, 60 kg); 9 November, 5 ft 7¼ in, 9 st 7¼ lb (172 cm, 60.7 kg). He was a healthy-looking teenager. A tattoo was present on the skin of the right forearm, and a para-umbilical herniorrhaphy scar was noted. Apart from a blood pressure of 120/80 mm Hg all systems were normal. Measurements of bone age were done by the method of Tanner, Whitehouse, and Healy (1962), and the x-ray film of the hand and wrist was kindly rated by Mr. Whitehouse. Bone age of 15.6 years was within normal range compared with the chronological age of 16.7 years.

Cytogenetic Data.—Blood samples were collected from factory apprentices to serve as controls in a current survey of Borstal boys. After collection the samples were pooled and given a random code number. The XYY diagnosis was made on 10 cells. The random number was decoded and a second sample was obtained. Analysis of 10 cells from the new sample confirmed the previous XYY diagnosis. In both samples the Y chromosomes were easily identifiable as the longest elements in the G/Y group. Diagnosis was also confirmed with the aid of fluorescence microscopy. The size of the fluorescing bodies in interphase nuclei again suggested somewhat larger than average Y chromosomes.

Comment

This patient is of special interest because of his average height and unremarkable clinical history. It was not possible to assess his height in relation to the heights of his parents, and the possibility of undetected mosaicism cannot be excluded.

At this stage of our survey we have insufficient information on our sample of apprentices to evaluate the significance of the patient's minor offence and poor initial record of employment. This case illustrates that in order to obtain a better estimate of the frequency of XYY individuals it is necessary to study a cross-section of all heights of any given population.

Dr. Freda S. Reed is in receipt of a grant from the Mental Health Research Fund.

Reference

- Tanner, J. M., Whitehouse, R. H., and Healy, N. J. R., (1962). A new system for estimating skeletal maturity from the hand and wrist with standards derived from a study of 2,600 healthy British children. Part I and II. Paris, Centre Internationale de l'Enfant.

Institute of Psychiatry, London S.E.5

J. KAHN, PH.D., Lecturer in Cytogenetics
 JOYCE M. MAXWELL, Junior Technical Officer
 FRED A. S. REED, M.B., D.P.M., Research Assistant

Reede International Ltd., Larkfield, Kent

T. COATES, M.B., D.I.H., Senior Medical Officer

Guy's Hospital Medical School, London S.E.1

D. E. MUTTON, B.Sc., Department of Paediatric Research