fibres in the ulnar nerve from patients with Werdnig-Hoffmann disease but no evidence of demyelination with teased fibre preparations. They suggested that the slow motor nerve conduction may be due to arrested myelination brought about by the fetal onset of the disease.

The finding of slow conduction in the severe but not in the other forms of spinal muscular atrophy suggests that the severe infantile form of spinal muscular atrophy as a group are different from the other forms of the disease and this might support the views of those workers who believe that different genes are involved (Hausmanowa-Petrusewicz, 1970; Fried and Emery, 1971; Pearn, Carter, and Wilson, 1973). However, the difference may be explained by the early onset in the severe form with secondary effect on myelination.

The presence of slow motor nerve conduction in Werdnig-Hoffmann disease makes it difficult to distinguish it from severe peripheral neuropathy (Karch and Ulrich, 1975). Recording of sensory action potential may not help either as it has been reported as being absent in Werdnig-Hoffmann disease (Raimbault and Laget, 1972), though our own preliminary studies have failed to confirm this (Schwartz and Moosa, 1976). Difficulties of interpretation may also be encountered in the muscle histology, especially in the very early stages of the disease. The EMG appears to be the only sure way of diagnosis with the finding of the characteristic repetitive discharges described by Buchthal and Olsen (1970). These have not been described in other neurogenic conditions.

Summary

The ulnar and posterior tibial conduction velocities were measured in 29 children with spinal muscular atrophy, 14 of whom had the severe form of the disease. The ulnar nerve velocity was slow in 12 of the 14 severely affected infants, but normal or fast in 11 of 14 children less severely affected. The corresponding results for the posterior tibial nerve were slow velocities in 11 of 12 infants in the severe group and normal or fast in all 11 infants less severely affected. The difficulty in distinguishing infantile spinal muscular atrophy from peripheral neuropathy is emphasized.

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Failure to thrive and death in early infancy associated with raised urinary homovanillic and vanillylmandelic acids

'It is not always possible to find why certain infants fail to thrive. Such instances are regarded as due to some congenital weakness of constitution, a concept which is still far from satisfactory' (Holt and McIntosh, 1933). An enigmatic case of failure to thrive in an infant is here reported.

Case report

A 2½-month-old White boy was brought to the Mayo Clinic for evaluation of failure to thrive. The infant was born at term to a 35-year-old White woman (gravida IV, para 3) whose other 3 children are alive and well. Pregnancy was complicated by polyhydramnios, noted after the fourth month of gestation. Also, at the seventh

month of pregnancy the mother had an episode of pneumonia that resolved with erythromycin. Labour and delivery were uncomplicated. Birthweight was 2700 g, head circumference 35 cm. The baby was fed with standard formula (Enfamil, 60–90 ml every 3 hours).

At 1 month, however, there was no weight gain, and the formula was switched to a soya protein isolate preparation (Isomil). The infant vomited about once every 2 days and seemed to have constant nasal congestion and some mucoid discharge from the nose.

When examined at the Mayo Clinic at the age of 2½ months (Fig.) he was found to be a 2600 g, emaciated infant with a length of 48.3 cm and head circumference of 36.7 cm (all below the 3rd centile). Blood pressure by flush method was 75 mmHg. A white mucoid

FIG.—Facial appearance, showing abnormal vertical eye movements.

discharge from the nose and a 2/6 systolic ejection murmur were noted. The liver and spleen were palpated 2 cm below the costal margin. A smooth kidney was palpable in the left flank and a 2 × 2 cm angioma of the left thigh was noticed. The infant had opisthotonic posturing on occasion.

Hb was 11.3 g/dl, haematocrit 30.7%, platelets 352 000/mm³ (352 × 10⁹/l), leucocytes 5900/mm³ (5.9 × 10⁹/l) with 34% neutrophils, 48% lymphocytes, 13.5% monocytes, and 4.5% eosinophils. Urine was microscopically clear, s.g. 1.012, and pH 7. Arterial blood gases were normal, pH 7.42. Creatinine was 0.45 mg/100 ml (40 µmol/l). Serum Na, K, Ca, and Mg normal. Glucose was 88 mg/100 ml (4.9 mmol/l), SGOT 26 units/l, and SGPT 20 units/l. Serology for the following was negative: *Toxoplasma*, rubella, cytomegalovirus, herpesvirus, and syphilis. A tuberculin skin test was negative. Serum thyroxine 11.4 µg/100 ml (898 nmol/l); stool fat (72-hour collection) within normal limits. Sweat Na, immunoglobulins, and serum proteins were normal, as was chromosome analysis (46, XY).

Viral and bacterial cultures of the nasopharynx, urine, stool, and CSF were noncontributory. Serum and urinary amino acid, and serum ammonia values were normal. X-rays of the skull, chest, and skeletal system and an intravenous pyelogram were normal. EMI scan (computerized transaxial tomogram) of the head showed no evidence of a space-occupying lesion or cerebral atrophy. EEG was normal. Histamine skin test, normal. Bone marrow aspiration showed no abnormal cells.

Hospital course. Several modifications of diet using medium-chain triglycerides and gavage feeding, although providing adequate caloric intake, failed to produce weight gain or change in head size during 8 weeks' observation.

The infant had a pulse rate of 120–150 throughout his hospital stay. On one occasion opsoelonus was seen; we therefore measured urinary homovanillic acid (HVA) and vanillylmandelic acid (VMA) (Table).

He had never been fed banana or vanilla products. Because we suspected the presence of an occult neuroblastoma, we did an abdominal laparotomy. Despite careful exploration of the abdominal cavity, we found no tumour.

His hospital stay was complicated by right upper lobe pneumonia that resolved when antibiotics were administered. He was sent home and died there at the age of 4½ months (weight 2460 g). Complete necropsy

TABLE
Urinary HVA and VMA values (µg/mg creatinine)

	Specimen					Normal
	1	2	3	4	5	
HVA	24.4	26.5	31	23.8	23.3	1.4–15
VMA	65	44.3	45	34.3	43.8	1.2–35

did not show any tumour in the abdomen, chest, neck, adrenal glands, or central nervous system. On microscopical examination, the brain, lung, thyroid, liver, adrenal glands, and intestinal tract were normal. Post-mortem blood culture yielded pneumococci.

Discussion

The investigation of failure to thrive in infancy includes a search for organic, environmental, and emotional causes (Illingworth, 1963; Luzzatti, 1964). Hannaway (1970) studied 100 infants with 'failure to thrive': 51% were found to have non-organic causes such as feeding problems, environmental deprivation, constitutional dwarfism, and rumination; 49% proved to have organic causes, urinary tract infection and central nervous system, gastrointestinal, cardiovascular, endocrine diseases, and in the case of one patient familial dysautonomia.

Our patient had severe growth retardation with no identifiable cause. On five occasions urinary HVA and VMA were raised. The urinary values of catecholamine metabolites of healthy children are well established (Voorhess, 1967; Gitlow *et al.*, 1968; Hakulinen, 1971). Transient increased urinary catecholamine metabolite excretions have been observed in children in four conditions (Hakulinen, 1971): after surgical procedures; congenital heart disease with heart failure; acute bronchial asthma; and after exchange transfusion. The finding of persistently raised catecholamine metabolites in our patient prompted us to look for a neural crest tumour. However, the clinical, surgical, and necropsy findings did not disclose such a neoplasm *in situ*.

Familial dysautonomia is the only non-neoplastic disorder in which peripheral catecholamine metabolism is disturbed, the urinary VMA value is less than normal, and the HVA concentration is raised (Gitlow *et al.*, 1965; Moskowitz and Wurtman, 1975). In our patient this possibility was ruled out by the normal histamine skin test.

Our patient had either increased synthesis or excessive destruction of catecholamines, but the relation of this biochemical abnormality and the failure to thrive is unclear. We are unaware of a comparable case. Should a similar case be encountered, detailed balance studies would be of interest.

Summary

A case of failure to thrive in an infant with persistently raised urinary levels of homovanillic and vanillylmandelic acids is described. No neural crest tumour was discovered at surgical exploration or at necropsy. The relation of this biochemical abnormality and failure to thrive is unclear.

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Childhood actinomycosis

Report of 3 recent cases

The diagnosis of actinomycosis in 3 children presenting during an 18-month period at one hospital is uncommon, and raises the possibility that the reported incidence (*British Medical Journal*, 1973) of this disease in childhood does not reflect its true occurrence. These cases were diagnosed by prompt microscopy of fresh pus followed by anaerobic and aerobic cultures. The causative organism was described a century ago by Israel, and its frequent appearance with other organisms, as occurred in Cases 1 and 2, was reported by Glahn (1954).

Actinomyces israeli is classified in an intermediate position between the bacteria and fungi, and is included in the order actinomycetales with the mycobacteria, *Nocardia* and *Streptomyces*. It is commonly found as a commensal in the mouth and pharynx and its pathogenicity is probably related to dental caries and the coexistence of anaerobic streptococci. It spreads by direct invasion into tissues but not via lymphatic vessels. Blood-borne infection has been described.