field effectiveness is dependent on a regular distribution system. Moreover, more than one capsule yearly is needed. In Niger, we showed that the prevalence of low serum retinol among weaned children aged 2 years was nearly back to presupplementation levels only 3 months after vitamin A capsules were given (39·8% of children before supplementation, and 34·4% after 3 months; unpublished data). Food-based measures are indeed imperative for sustained control of this deficiency. What is unique about vitamin A deficiency is that food solutions exist and are feasible, even in low-income populations. Some 20 years ago, Noel W Solomons[3] concluded that red (unrefined) palm oil, the highest and most bioavailable plant source of provitamin A, did as well as vitamin A supplements. Red palm oil could do the work in most of sub-Saharan Africa, provided that it is not bleached during cooking and an efficient commercial distribution network is established. Our studies in non-producing areas of Burkina Faso showed that people were willing to buy red palm oil and that it was effective in significantly curbing vitamin A deficiency in mothers and children (before-and-after difference in proportion of patients with deficiency: p<0·01 in children and p<0·001 in mothers).[4,5] What is needed is the scaling-up of such relevant food-based interventions to take over from erratic vitamin A capsule distribution.

I declare no competing interests.

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1 The Lancet. Vitamin A distribution in danger. *Lancet* 2018; **391:** 1866.
2 Latham M. The great vitamin A fiasco. *World Nutr* 2010; **1:** 12–45.
3 Solomons NW. Plant sources of vitamin A and human nutrition: red palm oil does the job. *Nutr Rev* 1998; **56:** 309–22.
4 Zagré NM, Delpeuch F, Traissac P, Delisle H. Red palm oil as a source of vitamin A for mothers and children: impact of a pilot project in Burkina Faso. *Pub Health Nutr* 2003; **6:** 733–42.
5 Delisle H. The nutritional value of red palm oil. In: Rival A (ed). Achieving sustainable cultivation of oil palm. Cambridge: Burleigh-Dodds Science Publishing, 2017: 217–31.

Did Cro-Magnon 1 have neurofibromatosis type 2?

In their Correspondence to *The Lancet* (March 31, p1259),[1] Philippe Charlier and colleagues infer that the Cro-Magnon 1 skull (Les Eyzies, France) had neurofibromatosis type 1 (NF1). Their diagnosis was based on a micro-CT scan examination and three-dimensional reconstruction of the skull, which permitted a detailed analysis of the cranial fossil remains, including, in particular, the exact bone aspect of a round polycyclic osteolytic lesion on the right frontal bone (attributed to a progressive bone erosion secondary to a subcutaneous schwannoma) and the aspect and size of the cranial nerve foramina (showing "asymmetry of the size of the internal auditory meatus" secondary to an acoustic schwannoma without additional foramina anomalies).[1]

However, Charlier and colleagues based their diagnosis of NF1 on features belonging to the clinical and radiological phenotype of neurofibromatosis type 2 (NF2): indirect signs of the presence of nodular (subcutaneous) schwannomas and schwannoma of the VIII cranial nerve. They stated that acoustic neurinomas (schwannomas) are more frequent in NF2, but have also been reported in NF1 and that "cases of internal auditory meatus enlargement in NF1 have also been described without any associated acoustic nerve tumour". We think that, in this Cro-Magnon 1 skull, the diagnosis of NF1 is less well defined than Charlier and colleagues attribute it.[1] Unless the word schwannoma was wrongly attributed to a (subcutaneous frontal) neurofibroma[1] (in this respect, to support their NF1 diagnosis, the authors cite a study on bone microstructure [and erosion], similar to that encountered in the Cro-Magnon frontal lesion, in NF1 bone dysplasia),[2] there is apparently no good reason to force this accurate micro-CT reconstruction towards a somewhat mixed neurofibromatosis phenotype presenting with NF2 features, but being labelled as NF1. A more likely diagnosis, according to their retrospective micro-CT findings, could be that of NF2. An alternative diagnosis (hard to demonstrate) could be that of mosaic NF2 (or schwannomatosis) based on the presence of a unilateral (right) subcutaneous schwannoma and an ipsilateral enlarged internal auditory meatus. Previous attempts at rediagnosing NF2 (or schwannomatosis) phenotypes on the basis of clinical and pathological reviews of old portraits and specimens' reports have been made.[3] On the basis of the above considerations, the full facial reconstruction of the Cro-Magnon male individual[1] should not include the additional smaller facial tumours (ie, the cutaneous neurofibromas), which belong to the NF1 phenotype. Previous CT scan reconstructions have shown NF1 phenotypes on the basis of stronger paleoradiological evidence.[4] Conversely, paleopathological diagnoses of NF1 on the basis of skull or post-axial skeletal remains have been attempted in the past,[5] generating less well defined (weaker) NF1 phenotypes and causing (historical) confusion.

We declare no competing interests.

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1 Charlier P, Benmoussa N, Froesch P, Huynh-Charlier I, Balzeau A. Did Cro-Magnon 1 have neurofibromatosis type 1? *Lancet* 2018; **391:** 1259.

2 Kühnisch J, Seto J, Lange C, et al. Multiscale, converging defects of macro-porosity, microstructure and matrix mineralization impact long bone fragility in NF1. *PLoS One* 2014; **9:** e86115.
3 Ruggieri M, Praticò AD, Caltabiano R, Polizzi A. Rediagnosing one of Smith's patients (John McCann) with "neuromas tumours" (1849). *Neurol Sci* 2017; **38:** 493–99.
4 Panzer S, Wittig H, Zesch S, et al. Evidence of neurofibromatosis type 1 in a multi-morbid Inca child mummy: a paleoradiological investigation using computed tomography. *PLoS One* 2017; **12:** e0175000.
5 Ruggieri M, Praticò AD, Caltabiano R, Polizzi A. Early history of the different forms of neurofibromatosis from ancient Egypt to the British Empire and beyond: first descriptions, medical curiosities, misconceptions, landmarks, and the persons behind the syndromes. *Am J Med Genet A* 2018; **176:** 515–50.

Authors' reply

We read with interest the letter by Martino Ruggieri and colleagues about our retrospective diagnosis of the Cro-Magnon 1 skull.[1] We are pleased that the diagnosis of neurofibromatosis is not in question but rather its subclassification and clinical presentation.

First, the ambiguity of any retrospective diagnosis on old skeletal elements is because researchers are forced to base their conclusions on traces only (the negative of pathological processes having since disappeared).[2] Additionally, the absence of preserved DNA in this individual prevented any genetic verification of the diagnosis.

Second, the case cited by Ruggieri and colleagues is that of an Inca mummy of a child from the 17th century, with perfectly preserved organic tissues, allowing a diagnosis of multiple neurofibromas present in soft tissues;[3] it cannot reasonably serve as a comparison case with the dry skull of a fossil man.

Third, our diagnostic proposal was mainly based on comparison with cases in anatomical reference collections, and we stress that neurofibromatosis type 1 remains the preferred diagnosis for Cro-Magnon 1. In this type of disease, the patient's skin is covered with tumours of dermal origin (neurofibromas) that progressively grow and erode the bone in depth. In the case of Cro-Magnon 1, these lesions are at the level of the right frontal bone, the root of the nose, the left brow bone, the maxillary bone, and so on. It is true that the acoustic neuroma (or schwannoma of the nervis vestibularis) is one of the major signs of neurofibromatosis type 2 (it is generally bilateral, or unilateral but associated with brain tumours such as meningioma, glioma, schwannoma, posterior subcapsular lenticular opacities and so on, which is obviously not the case in Cro-Magnon 1). Therefore, unilateral erosion of the internal auditory canal is absolutely not pathognomonic of neurofibromatosis 2 disease. It has to be said that further micro-CT scan analyses will take place to detect any sphenoid wing dysplasia on Cro-Magnon 1, despite severe postmortem damages—an anomaly particularly related to neurofibromatosis type 1.[4]

Lastly, we insist on the fact that skin lesions in neurofibromatosis type 2 are very minor, and would not have left lesions as severe as those diagnosed on the face of this patient nearly 28 000 years old.[5]

We declare no competing interests.

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1 Charlier P, Benmoussa N, Froesch P, Huynh-Charlier I, Balzeau A. Did Cro-Magnon 1 have neurofibromatosis type 1? *Lancet* 2018; **391:** 1259.
2 Charlier P, Froesch P, Balzeau A, Huynh-Charlier I. 3-dimensional brain surface reconstruction from dried skull: interest for retrospective diagnosis in forensic anthropology. *Am J Forensic Med Pathol* 2014; **35:** 283–84.
3 Panzer S, Wittig H, Zesch S, et al. Evidence of neurofibromatosis type 1 in a multi-morbid Inca child mummy: a paleoradiological investigation using computed tomography. *PLoS ONE* 2017; **12:** e0175000.
4 Arrington DK, Danehy AR, Peleggi A, Proctor MR, Irons MB, Ullrich NJ. Calvarial defects and skeletal dysplasia in patients with neurofibromatosis type 1. *J Neurosurg Pediatr* 2013; **11:** 410–16.
5 Plana-Pia A, Bielsa-Marsol I, Carrato-Monino C. Diagnostic and prognostic relevance of the cutaneous manifestations of neurofibromatosis type 2. *Actas Dermosifiliogr* 2017; **108:** 630–36.

Subject of *The Vaccine Race* offers perspective on errors


JVisentin/istock

I am the "Flawed hero" described by Mark Honigsbaum in his review of *The Vaccine Race* by Meredith Wadman (May 13, 2017, p1874),[1] who he writes is now "enjoying a rehabilitation".

Now rehabilitated, the many inaccuracies repeated by Honigsbaum require clarification.[2] Wadman did not share the text of her book with me before publication, and I was not contacted by a fact checker—circumstances that undermine Honigsbaum's opinion that the book was "impeccably researched".[1]

Honigsbaum gratuitously labels me "a flawed hero", the subject of a "Greek tragedy" who has "fallen from grace." Honigsbaum does not clearly explain the basis for his pejorative assertions. He omits my several hundred prizes, awards, honorary lectures, and so on, because he pronounced me "flawed."

The title to self-duplicating biological systems like my WI-38 cell strain has not been legally established even to this day. My lawsuit settlement against the National Institutes of Health did not give the WI-38 title to anyone.[2–4] The Bayh-Dole act specifically allows compensation for scientists who make discoveries using federal funds (I never received compensation for my discoveries). However, billions of dollars were—and still are—made by the world's human virus vaccine manufacturers who continue using the WI-38 cell strain