



MILFORD WOLPOFF, RACHEL CASPARI

AN UNPARALLELED PARALLELISM

ABSTRACT: *Neanderthals and Indigenous Aboriginal Australians are twin themes in Jan Jelínek's life work. Jelínek's understanding of these humans is quite different from the treatment accorded them by many other anthropologists who treat each as a model for understanding the other. These segments of humanity have been considered parallel races at various times, because of the similarities perceived in their "primitive" technologies and "primitive" cranial form (invariably meaning brow ridges). But parallelism is understood a different way in paleoanthropology, where it refers to the homoplasies that mark independent development of the same features by different species. This use of parallelism could apply to the description of how the evolution of Neanderthals and Indigenous Aboriginal Australians is related if Neanderthals are a different species. This is because the same sequence of changes took place in Europe and Australasia, at the opposite ends of the earth. But as Jelínek has always emphasized, the interpretation of Neanderthals as a different species is very unlikely; the odds of the required homoplasies cannot be calculated, but their combined probability is quite clearly diminishingly small.*

KEY WORDS: *Neanderthal – Parallel evolution – Species*

Jan Jelínek has views about human diversity and evolution that are strongly influenced by his time spent with Aboriginal Australians. During his stay in Australia he learned about another way to be human, a way as complex and valuable as the European societies with which he was already familiar. He recognized it was this very cultural diversity that made us human, and also that cultural behaviours are not caused by morphology. His experience with Australians helped him see humans as an evolving entity, and to apply that knowledge to the past – especially to Neanderthals. Australians are not pariahs, outcasts of humanity. Their physical differences neither denote inferiority nor status as a parallel species. And for Jelínek, neither does Neanderthal morphology. The comparison between Neanderthals and modern Aboriginal populations is apt, not because of any imagined shared primitiveness, but because of two related parallelisms. Viewed historically, there has been parallel treatment of both groups by anthropologists: both segments of humanity have at various

times been considered parallel races or even species, and for much the same reasons.

What's wrong with the Neanderthal species? Other primates speciate, often quite readily, and the differences between Neanderthals and other (especially living) populations is often characterized as beyond the range of variation expected for a species (Howell 1978, Rak 1993, Stringer, McKie 1996, Tattersall 1995). Buttressing this argument is the claim that Neanderthals have autapomorphies (Howell 1994, Hublin *et al.* 1996, Santa Luca 1978). If excessive variation and the possession of unique features cannot be used to identify a new species, what can?

PARIAHS OF THE PALAEOLITHIC

Neanderthals are certainly *different*, but the issue is whether they are *unique* in a manner that shows them to be



FIGURE 1. Indigenous Aboriginal Australian, after Kraemer (1905). Despite Klaatsch's continued arguments that Australians were humanity's basal stock, directly ancestral to the European Aurignacians, they have served as the model for Neanderthals in the minds of many 20th century scholars, and several Central European palaeoanthropologists including Jan Jelfnek spent time in Australia, learning their customs. Even recently, American professors had their graduate students in palaeoanthropology pick Aboriginal Australians as the obligatory comparative sample for Neanderthal studies. Indigenous Aboriginal Australians are not Neanderthals, Neanderthal ancestors, or Neanderthal descendants; yet, each has been used to interpret the morphology and behaviour of the other.

somewhat more than a racial variation of humankind¹⁾. Neanderthal samples do share a number of characters that are very common. These comprise a *unique combination of features* that are, however, neither universal among the Neanderthals nor unknown in their penecontemporaries. Some of these such as superior pubic ramus shape (long and thin for males) are shared by archaic individuals from other regions²⁾ but are no longer found. Others such as the mandibular foramen form, are unknown in Neanderthal penecontemporaries but occur in the post-

¹⁾ Meaning penecontemporary Late Pleistocene humankind, of course. The races of today are separated from the Neanderthal race by 1200 or more generations and very considerable evolutionary change. Differences between Neanderthals and any living race must exceed normal variation between living races for this reason alone.

²⁾ Unfortunately, pubic ramus anatomy in early post-Neanderthal Europeans is unknown.

Neanderthal Europeans, often at lower frequencies. Others yet such as the variations of the axillary border of the scapula are present in penecontemporaries and also occur in post-Neanderthal Europeans, often at lower frequencies. The fact is that when comparisons are made to sufficiently large samples of both penecontemporary people from other regions and post-Neanderthal Europeans, few if any *real European Neanderthal autapomorphies* can be shown.

Yet, the burden of proof that Neanderthals are human, *Homo sapiens*, is greater than showing they lack autapomorphies. This is because apart from the real unique combination of features that Neanderthals have, other, shall we say, more imaginary uniquenesses have become "common knowledge" and are perhaps even better known than actual Neanderthal anatomy.

Recent publications have produced a set of disjointed interpretations about what European Neanderthals represent morphologically and what they were capable of behaviourally. Trying to piece together all that has been recently written ... results in a picture resembling postmodernist art, where a series of incongruous, completely unrelated images are combined together in the same scene producing a phantasmagoria. ... the study of European Neanderthals has reached a state in palaeoanthropology where the [functions of the] fossils themselves [as evidence for human evolution] have been supplanted by speculations about them.

(Frayer 1993: 9)

For instance, in a recent popular book:

Although larger than ours, the Neanderthal brain was differently organized. *Homo sapiens* has a more vertical forehead – mark of a greatly expanded cerebral cortex, the frontal lobes, literally the thinking part of the brain. Neanderthal brains are especially expanded to the rear – whatever that might imply; but their foreheads slope as did those of their ancestors, and it seems unlikely that they would ever have developed the cleverness that was suddenly to blossom within our own species beginning roughly 30,000 years ago. ... Neanderthals ... did not have the fully modern form of larynx and so were incapable of the full range of speech of the modern Tower of Babel. ... Neanderthal tools are the same wherever they are found – and whenever they were made ... In the sense that they were virtually invariant, showing all the signs of simple slavish copying for millennia, they were indeed "stupid".

(Eldredge 1995: 85)

Assertions like these are particularly disquieting because they are contrary to the research conclusions of scientists who study Neanderthals. It is quite clear that the form of Neanderthal brain endocasts is indistinguishable from modern humans (Kochetkova 1978, Holloway 1985), and their hyoid anatomy³⁾ indicates a larynx position that is the same as ours (Arensburg *et al.* 1990). Actually, the

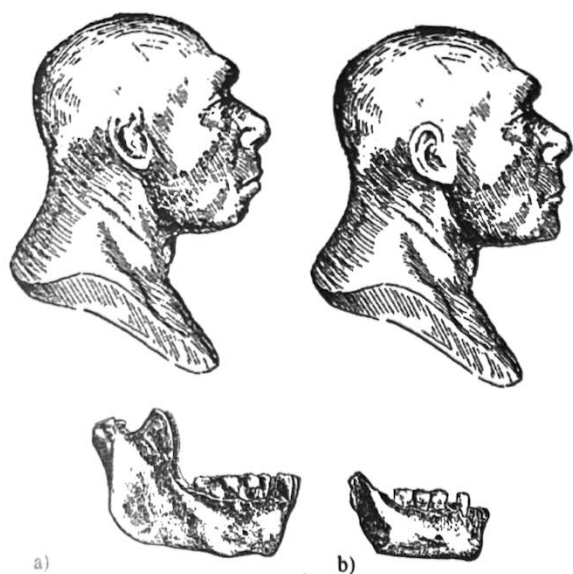


FIGURE 2. The J.H. McGregor restoration of La Chapelle (left, after Andrews 1945) in the original and with a chin (right). Krapina J (a) and Vindija 231 (b) (after Mikič, 1981) show just this variation among Neanderthal chins. The perception of intelligence and character for these two is quite different.

differences said to mark such important behavioural capacities are very minor and occur in features that are continuous and variable across modern humanity. Moreover, for most of these features there is no known physiological relationship between the morphology and the behaviour it supposedly affects. Alleged links between minor morphological variations and behavioural capacities are particularly unfortunate because of their circularity: behavioural inferences are made about morphology, usually without substantiation and beyond any logic (e.g., low brows denote low intelligence; small semicircular ear canals demonstrate trading rather than technical innovation).⁴⁾ The inferences become "fact" and the morphological features are then taken as "markers", and become "evidence" of backwardness and reduced mental capacity. Where have we seen this line of reasoning before?

We think these inferences are disturbing because they are identical to those used to dehumanize other human races

³⁾ Two Neanderthal hyoids are known, from Kebara (Israel) and Gabezo Gordo (Spain). Because this bone is held in a sling of muscles and ligaments, its form reflects the forces acting on it and these forces are position-dependent. The position of the hyoid varies remarkably during talking and swallowing but the anatomical identity of these bones with modern human ones, and the dramatic differences between human hyoids and those of other mammalian species, from chimpanzees to pigs, supports the notion that Neanderthal throats were used to make human-like speech sounds.

⁴⁾ For instance as in the Eldredge quote above (1995), and in Hublin *et al.* (1996) where an inner ear anatomy once thought to show some australopithecines were arboreal quadrupeds was found in Neanderthals and reinterpreted to show that they were incapable of inventing the things that they used.

more than a century ago. For example, Paul Broca (1861) thought that there was a reciprocal relationship between the front and back of the brain; expansion of one occurred at the expense of the other. Since he (as others of his time) believed the "higher mental functions" were housed in the front and emotion housed in the rear, his classification of human races into "*races frontales*" such as the whites, and "*races occipitales*" such as the blacks, had not only behavioural implications, but could be (and were) used to identify which variations were superior and which were inferior. No surprises were forthcoming (Gould 1981: 98-100).

There would be no doubt, in Broca's mind, about what the low forehead and expanded posterior that Eldredge describes for Neanderthals would imply for a human race. A century after Broca there might seem to be little progress in how human cranial form is interpreted, despite overwhelming evidence that there is no link of any sort between anatomical features such as brow ridges and sloping foreheads, and behaviors or behavioural capacities. Fortunately, we need not rely on cranial form to interpret Neanderthal behavioural capacities.

Much of the perception that Neanderthals were stupid comes not from their brains, which after all were quite large, but from their chins (see above). Interpreting a "weak" chin also harks back to the bad old days of phrenology, when "character" was thought to be reflected in chins and ears, as well as in foreheads. As Gregory (1929) put it, "one's own family, of course, was fairly true to type but sin played havoc with the features of other races." In one account of a pseudoscientific explanation for how the expression of the chin can be linked to behaviour (cited in DuBrul and Sicher 1954: 5) "it has been rightly said that the chin is essential to the beauty of the human countenance and therefore in a choice of mates, those deficient in this direction would be losers in life's race". Broca's very demonstration of a cortical speech-center in the human brain (1865) lead to a search for its manifestation in external anatomy. Where better than in the chin, where one might expect to find the influence of the tongue? Discovery of the chinless Neanderthal mandible from La Nauvette only fueled these speculations. The lack of a chin is therefore considered dehumanizing, and even though we know the mechanical explanation of the chin (Daegling 1993), there is a subtle, deep seated suspicion that it was not called the "*mental eminence*" for nothing. In fact a relationship between chins and mental capacity exists as long as chins are markers of modernity and all that that represents. Ironically, while Neanderthals are widely characterized as chinless, and this is considered one of the important features that makes them sub-human, the characterization is incorrect. Some Neanderthals had well-developed chins (*Figure 2*) and within Neanderthals, the frequency of prominent chins increases over time.

The phrenology of the last century is now considered pseudoscience, widely recognized as invalid and its use to dehumanize racial groups is a prime example of scientific



FIGURE 3. This figure, from figures 29 and 31 (reversed) in Stringer and McKie (1996), compares females Jebel Irhoud 1 (left) with Tabun 1 as these authors oriented them. They are out of the Frankfurt plane. The authors believe Jebel Irhoud 1 is a direct ancestor of modern humans, while Tabun 1 is an extinct Neanderthal woman of a different species. The facing view of Jebel Irhoud 1 (upper left) is tilted forward out of the Frankfurt plane which creates a higher forehead. The lateral view of Tabun 1 (lower right) is also out of the Frankfurt plane, tilted backward so the forehead is lower and the face is more prognathic. In its correct, comparable orientation, in the Frankfurt plane (Figure 4), the obscured similarities of the specimens are revealed.

racism (Gould 1981). It is no longer fashionable to use features of different races as indicators of their behavioural inferiority and the methodologies used to link morphology and behaviour have long been abandoned as typological and unscientific. Or have they? Certainly they are no longer applied to the *living* races; however, parallel treatment can be found even in recent literature concerning Neanderthals. They are now "the other" used to define ourselves as superior human creatures. This parallel has been clear for some time. For instance, as M. and C. Quennell (1945) put it in a popular book from the middle of the century:

His large head, with the thick frontal bones, must have been very good for butting a brother Neanderthal, but it was no use against the stone wall of advancing civilization, and like the Tasmanian and Bushman, the Red Indian and Australian of nowadays, he fades out of the picture and his place is taken by a cleverer people.

Certainly Neanderthals were different from us, but how different were they from their contemporaries, our putative "modern human" ancestors? There is a perception that Neanderthals differ more from penecontemporary populations than living races differ from each other, and this contributes to the interpretation that they are on a distinct lineage. But the source of this perception is unclear, as systematic comparisons are yet to be made. Actually we

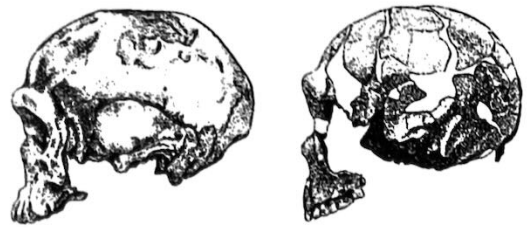


FIGURE 4. Jebel Irhoud 1 (left) and Tabun, modified from Stringer and McKie (1996, figures 29, 31) by placing them both in the Frankfurt plane. Just this small change shows the similarities in shape to be quite evident.

think many factors apart from the anatomy of the bones themselves contribute to this perception. For instance consider the published comparison of two women, Tabun (a putative Neanderthal whose line went extinct) and Jebel Irhoud 1 (a putative ancestor of early modern humans) presented in a recent book (Figure 3). The differences that meet the eye, and convince the mind, are more a consequence of non-standard orientations of the specimens than of the anatomies compared, and this is made evident when standard orientations of the same figures are shown (Figure 4).

Neanderthals are not only continually portrayed incorrectly, the errors seem mostly to maximize features that make them seem "primitive".

Yet in the Levant where so-called modern humans and Neanderthals are found at neighbouring penecontemporary sites, they cannot always even be easily distinguished and it is difficult to consider the continuous variation between them as demarcating different species (Figure 6). In fact archaeological data reveal little, if any difference between their behaviours (Bar-Yosef 1992, Marks 1993). The Levant evidence raises the question of whether Neanderthal populations are unique, or any more than racially distinct, anywhere.

ARE NEANDERTHALS UNIQUE?

Examination of the real Neanderthal features – the features far more common in the Neanderthal sample than in other populations, reveals a somewhat different picture. Frayer's work (1993, and below) and the research of Churchill, Mann, Smith, and others show that common Neanderthal features decrease gradually after the Neanderthals cease to be a distinct anatomical or cultural entity. In some cases, features differ more dramatically between the post-Neanderthal and later European populations than between the Neanderthals and post-Neanderthals. While the classic comparison of La Chapelle with a modern Frenchman emphasizes Neanderthal differences, some of the

Features in the Unique¹ Neandertal Character Set, and their Distribution in Later Europeans²

	European Neandertals	Earliest post-Neandertals	Living Europeans ³
Projection of nasal root in front of orbits	29 mm	22 mm	20 mm
Puffy maxilla and associated midfacial prognathism	✓	absent	absent
Midfacial projection	✓✓✓	✓✓	absent
Mastoid projection below juxtamastoid process	small (6.8 mm)	small (6.0 mm)	large (>9 mm)
Mastoid tubercle	35%	20%	absent
Suprainiac fossa	normal	occasional	occasional
Large frontal <i>and</i> large maxillary sinuses	✓	✓	✓
Large occipitomastoid crest	normal	rare	absent
Lambdoidal flattening and bun	normal	often present	rare ³
Circular cranial shape, as seen from the rear	✓	absent	rare
Double-arched supraorbital torus	✓	absent	absent
Horizontal-oval mandibular foramen	53%	18%	1%
Retromolar space	common (>75%)	occasional	rare
Large numbers of perikymata	✓	?	✓
Relatively large limb joint surfaces	✓	✓	absent
Dorsal scapular groove	65%	17%	1%
Long pubic ramus	✓	?	absent
Proximal femoral flange	✓	✓	absent

¹ These are very common in Neandertals and rare in other Pleistocene populations - not actual autapomorphies

² After D. Frayer, J. Szilvássy and colleagues, F. Smith, A. Mann, and research by the authors.

³ It has been argued that certain European populations, especially Iron-Age samples from the extreme northwest, especially resemble Neandertals. Resemblances certainly occur, but these comparisons involve only gross lateral profile shape and are insufficient to establish any special relationships.

immediate successors of the Neanderthal populations such as Mladeč 5 and 6 share detailed resemblances to Neandertals (Figure 5). Most Neanderthal features do not disappear suddenly, which makes theories of complete replacement or genetic swamping very problematic.

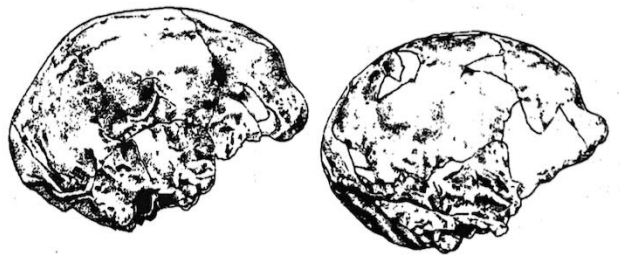


FIGURE 5. European continuity is clear in comparisons such as this, between Mladeč 5 (left) and Spy 2, in this drawing by Karen Harvey. Ironically, Mladeč 5 is more "Neandertal-like" than Spy 2 in its expression of minimal mastoid projection, and lambdoidal flattening and bunning.

SPECIES AND THE PATTERN OF VARIABILITY

One of the most important contributions of the phylogenetic approach to palaeontology is that past species cannot be identified by differences alone. There are many reasons for this, perhaps most importantly because the units of comparison for past and living species cannot be described in acceptably corresponding ways. But the most important reason comes from how species are defined.

According to the evolutionary species concept developed by Wiley, species are genealogical entities, each delimited by a beginning and an end. An evolutionary species is:

"... a single lineage of ancestral-descendant populations which maintains its identity from other such lineages and which has its own evolutionary tendencies and historical fate. ... By lineage I mean one or a series of demes that share a common history of descent not shared by other demes ..."

(1981: 25)

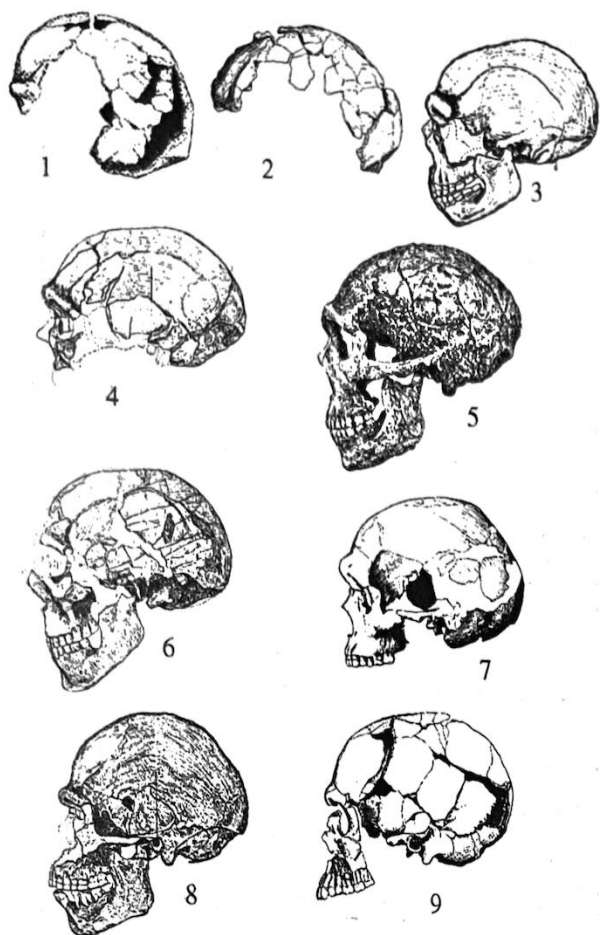


FIGURE 6. Lateral views of Levantine crania: 1 Qafzeh 3, 2 Qafzeh 5, 3 Tabun, 4 Skhul 9, 5 Amud, 6 Skhul 4, 7 Qafzeh 6, 8 Skhul 5 and 9 Qafzeh 9 (from Larsen, Matter, Gebo 1991, McCown, Keith 1939, Vandermeersch 1981). Only Tabun and Amud are traditionally considered Neandertals, but differences in anatomy within the sample are gradual and not large.

Being able to isolate unique regional features (or combinations of features) for long periods of time is not enough for species identification; there must also be unique evolutionary tendencies, and no evidence of genic exchange that would show a history of descent within a species to be shared by members of other species. A palaeoanthropologist may look for a demonstration of some significant differences in evolutionary tendencies, the *direction of change* in a European deme as it is viewed over time, if Neanderthals are a distinct species at its end. When truly dramatic anatomical differences are lacking, it is the *direction* of anatomical change that becomes the key issue in recognizing species. However, if evolutionary tendencies in an apparent evolutionary species are the same as the tendencies in penecontemporary demes and if there is evidence of mixture between them, we may conclude that the identification of two contemporary evolutionary species is incorrect. While a formal phylogenetic analysis is invalid within a species, and we would not want to assume our oppositum's conclusions by assuming separate

species were present and conducting such an analysis, one basic precept of the cladistic approach must prevail. We must accept the explanation that minimizes unlikely events.

SERENDIPITY AND EVOLUTION

Here's the rub. If Neanderthals are a separate species, the direction of their evolution (for instance their larger brains and more distinct chins) is not only toward modernity, but is the same as the evolutionary trajectory of human evolution in other regions, such as Asia, Africa, and Australasia. How can we be so sure Neanderthals are a separate species when this interpretation requires that significant elements in European Neanderthal evolution can be found in other regions. These include the following:

1. expansion of brain size
2. reduction in the cranial superstructures (central and lateral supraorbital, and nuchal tori) and cranial bone thickness
3. expansion of the occipital plane at the expense of the nuchal (muscle-bearing) plane
4. expansion of the superciliary aspect of the supraorbital torus
5. anterior dental reduction
6. nasal breadth reduction
7. appearance of a true mental eminence with a mental trigone.

Examining the most obvious case, expanding brain size, European crania increase quite clearly from the Middle Pleistocene to the Neanderthal condition, and comparing the earlier Neanderthal sites such as Ehringsdorf and Krapina to the later ones reveals an increase within the Neanderthals as well. The brain size increase continues to modern Europeans⁵⁾. But this pattern of increase is not just a European phenomenon. As far away from Neanderthals as one can get, there is an increase in Australasian brain sizes, from the Kabuh formation Indonesians through Ngandong and to living Native Indigenous Aboriginal Australians. Just as in Europe, the difference between the latest of the "archaic" samples and the modern one is quite small. Since the living Australians are *Homo sapiens*, the brain size increase in Europe up to the Neanderthals would have to be a parallelism if Neanderthals are a different species.

One similar evolutionary trend in two species could just be luck. But more? Consider the fact that as cranial size expands, the nuchal plane of the occiput shortens in both of these regions (and others). But because the upper

⁵⁾ Contrary to the "generally understood" knowledge that brain size decreases after Neandertals - this comes from comparing without taking sex into account. Most Neandertal crania are male but the comparisons are made with modern samples of more equal sex distribution. Comparisons by sex reveals a different pattern.

European Brain Volumes¹

	Female average	Male average
Middle Pleistocene	1134 (n=6)	1305 (n=2)
Würm Neandertal	1286 (n=4)	1575 (n=7)
Modern Aboriginal European ²	1307 (n=35)	1555 (n=35)

¹ in cubic centimeters, from Wolpoff (1996)

² represented by the a sample of the Farringdon Street crania, London (Hooke 1926)

Australasian Brain Volumes¹

	Female average	Male average
Indonesian Kabuh	875 (n=5)	1032 (n=2)
Indonesian Ngandong	1093 (n=2) ²	1177 (n=4)
Modern Aboriginal Australian	1119 (n=22)	1239 (n=51)

¹ in cubic centimeters, from Holloway (1980), Weidenreich (1943), Duckworth (1904), Klekamp *et al.* (1987) and Wolpoff (1996)

² Ngawi is smaller than any of these females. While her capacity is as yet unknown, it would lower the female average and thereby accentuate the dimorphism.

European Occipitals

	Nuchal plane length (mm)	Occipital index
Middle Pleistocene	54.3 (n=3)	114.2 (n=3)
Western European Würm Neandertal	44.7 (n=3)	135.8 (n=3)

Australasian Occipitals

	Nuchal plane length (mm)	Occipital index
Indonesian Kabuh	51.7 (n=3)	98.6 (n=3)
Indonesian Ngandong	48.5 (n=6)	124.7 (n=6)

European Supraorbital Dimensions at the Center of the Orbit

	Vertical height (mm)	Projection from internal surface (mm)
Middle Pleistocene	14.7 (n=7)	26.9 (n=3)
Western European Würm Neandertal	13.4 (n=11)	23.3 (n=10)

Australasian Supraorbital Dimensions at the Center of the Orbit

	Vertical height (mm)	Projection from internal surface (mm)
Indonesian Kabuh	15.9 (n=3)	27.4 (n=5)
Indonesian Ngandong	12.8 (n=7)	26.0 (n=7)

portion of the occiput increases along with brain size expansion, the occipital index (upper occiput/lower occiput, or 100*lambda-inion/inion-opisthion) increases (point 3, above). Here too, evolutionary trends in the two regions mirror each other, even though just as in the cranial capacity example the details differ. Late Pleistocene Indonesians, for instance, have larger nuchal planes and lower occipital indices than Late Pleistocene Europeans.

The second European trend noted above is the reduction of cranial superstructures. This, too, is part of the evolutionary pattern in Australasia and other regions. For instance, note the reduction of the height of the supraorbital

torus at the center of the orbit, and the reduction of the projection of the torus anterior to the endocranial surface, in the same position.

These changes are the same in direction but dissimilar in detail. In combination they are not connected by any single overall cause, whether it is brain size increase, body size increase, gracilization, or whatever. The chances of parallel changes like these serendipitously occurring in different genetically isolated lineages are not even minimal. The genic exchanges that normally occur within a species are not just a better explanation for how they became widespread and common, they are the only explanation.

CONCLUSIONS

F. C. Howell referred (1994) to Weidenreich's polycentric network as requiring "unparalleled parallelism," but nothing could be farther from the truth (Wolpoff, Caspari 1997) and in fact it is Howell's scheme, and other theories like that of regionally distinct contemporary evolving human species, that must be described this way. Nowhere are more homoplasies created than in the interpretation that there is a separate Neanderthal species. The parallel evolutionary trends that this interpretation requires can only be explained in the most unacceptable and unsatisfactory manner (c.f. Brace 1996), and this no doubt is why such an interpretation remains controversial.

Jan Jelínek has argued for the essential humanity of these ancient Europeans throughout his career, arguments that strongly influenced us and many of our colleagues. The themes we have presented are interwoven throughout his life work: the lack of real Neanderthal uniqueness, the significance of Neanderthal ancestry found in the clear presence of Neanderthal features in post-Neanderthal Europeans, and the importance of understanding other peoples, specifically Australians who are neither ancestors nor analogues for Palaeolithic Europeans and yet have so many lessons to teach us.

REFERENCES

- ANDREWS R. C., 1945: *Meet Your Ancestors*. Viking, New York.
- ARENSBURG B., SCHEPARTZ L. A., TILLIER A.-M., VANDERMEERSCH B., RAK Y., 1990: A reappraisal of the anatomical basis for speech in Middle Paleolithic hominids. *Amer. J. of Phys. Anthropol.* 83, 2:137-146.
- BAR-YOSEF O., 1992: Middle Paleolithic human adaptations in the Mediterranean Levant. In: T. Akazawa, K. Aoki, and T. Kimura (Eds.): *The Evolution and Dispersal of Modern Humans in Asia*. Pp. 189-215. Hokusen-sha, Tokyo.
- BRACE C. L., 1996: Cro-Magnon and Qafzeh - vive la différence. *Dental Anthropology Newsletter* 10, 3:2-9.
- BROCA P., 1861: Sur le volume et la forme du cerveau suivant les individus et suivant les races. *Bulletin et Mémoires de la Société d'Anthropologie de Paris* 2:139-207, 301-321, 441-446.
- BROCA P., 1865: Sur le siège de la faculté du langage articulé. *Bulletin et Mémoires de la Société d'Anthropologie de Paris* 6:330-357.
- DAEGLING D. J., 1993: Functional morphology of the human chin. *Evol. Anthropol.* 1, 5:170-177.
- DUBRUL E. L., SICHER H., 1954: *The Adaptive Chin*. Thomas, Springfield.
- ELDRIDGE N., 1995: *Dominion*. Henry Holt and Company, New York.
- FRAYER D. W., 1986: Cranial variation at Mladeč and the relationship between Mousterian and Upper Paleolithic hominids. In: V. V. Novotný and A. Mizerová (Eds.): *Fossil Man. New Facts, New Ideas. Papers in Honor of Jan Jelínek's Life Anniversary*. Anthropos (Brno) 23:243-256.
- FRAYER D. W., 1993: Evolution at the European edge: Neanderthal and Upper Paleolithic relationships. *Préhistoire Européenne* 2:9-69.
- GOULD S. J., 1981: *The Mismeasure of Man*. Norton, New York.
- GREGORY W. K., 1929: *Our Face from Fish to Man*. Putnam, New York.
- KRAEMER H., 1905: *Weltall und Menschheit*. Second Edition. Deutsches Verlaghaus Bong & Co., Berlin.
- HOLLOWAY R. L., 1985: The poor brain of *Homo sapiens neanderthalensis*: see what you please. In: E. Delson (Ed.): *Ancestors: The Hard Evidence*. Pp. 319-324. Alan R. Liss, New York.
- HOWELL F. C., 1978: Hominidae. In: V.J. Maglio and H. B. S. Cooke (Eds.): *Evolution of African Mammals*. Pp. 154-248. Harvard University Press, Cambridge.
- HOWELL F. C., 1994: A chronostratigraphic and taxonomic framework of the origins of modern humans. In: M. H. Nitecki and D. V. Nitecki (Eds.): *Origins of Anatomically Modern Humans*. Pp. 253-319. Plenum Press, New York.
- HUBLIN J.-J., SPOOR F., BRAUN M., ZONNEVELD F., CONDEMI S., 1996: A late Neanderthal associated with Upper Paleolithic artefacts. *Nature* 381:224-226.
- JELÍNEK J., 1976: The *Homo sapiens neanderthalensis* and *Homo sapiens sapiens* relationship in Central Europe. *Anthropologie (Brno)* 14:79-81.
- KOCHETKOVA V. I., 1978: *Paleoneurology*. Winston and Sons, Washington, D.C.
- LARSEN C. S., MATTER R. M., GEBO D. L., 1991: *Human Origins. The Fossil Record*. Second Edition. Waveland Press, Prospect Heights.
- MARKS A. E., 1993: The early Upper Paleolithic: the view from the Levant. In: H. Knecht, A. Pike-Tay, and E. White (Eds.): *Before Lascaux: The Complex Record of the Early Upper Paleolithic*. Pp. 5-21. CRC Press, Boca Raton.
- McCOWNT D., KEITHA., 1939: *The Stone Age of Mount Carmel: The Fossil Human Remains from the Levallois-Mousterian*. Volume II. Clarendon Press, Oxford.
- MIKIČ Z., 1981: *Stanja I Problemi Fizičke Anthropologije u Jugoslaviji*. Akadenija Nauka I Umjetnosti Bosne i Hercegovine, Sarajevo.
- QUENNEL M., QUENNEL C. H. B., 1945: *Everyday Life in the Old Stone Age*. Batsford, London.
- RAK Y., 1993: Morphological variation in *Homo neanderthalensis* and *Homo sapiens* in the Levant: a biogeographic model. In: W. H. Kimbel and L. B. Martin (Eds.): *Species, Species Concepts, and Primate Evolution*. Plenum, New York.
- SANTA LUCA A. P., 1978: A re-examination of presumed Neanderthal-like fossils. *J. of Hum. Evol.* 7:619-636.
- STRINGER C. B., GAMBLE C., 1993: *In Search of the Neanderthals*. Thames and Hudson, London.
- STRINGER C. B., MCKIE R., 1996: *African Exodus: the Origins of Modern Humanity*. Jonathan Cape, London.
- SZILVÁSSY J., KRITSCHER H., VLČEK E., 1987: Die Bedeutung röntgenologischer Methoden für anthropologische Untersuchung ur- und frühgeschichtlicher Gräberfelder. *Annals of the Vienna Natural History Museum* 89:313-352.
- TATTERSALL I., 1994a: How does evolution work? *Evol. Anthropol.* 3, 1:2-3.
- TATTERSALL I., 1994b: What does it mean to be human - and why does it matter? *Evol. Anthropol.* 3, 4:114-116.
- TATTERSALL I., 1995: *The Last Neanderthal: the Rise, Success, and Mysterious Extinction of our Closest Human Relatives*. MacMillan, New York.

- VANDERMEERSCH B., 1981: Les hommes fossiles de Qafzeh (Israël). *Cahiers de Paléanthropologie*. Centre National de la Recherche Scientifique, Paris.
- WEIDENREICH F., 1943: The "Neanderthal Man" and the ancestors of "Homo Sapiens". *Amer. Anthropol.* 45, 1:39-48.
- WEIDENREICH F., 1947: Facts and speculations concerning the origin of *Homo sapiens*. *Amer. Anthropol.* 49, 1:187-203.
- WOLPOFF M.H., 1989: The place of the Neanderthals in human evolution. In: E. Trinkaus (Ed.): *The Emergence of Modern Humans. Biocultural Adaptations in the Later Pleistocene*. Pp. 97-141, and combined references for the volume on pp. 232-276. Cambridge University Press, Cambridge.
- WOLPOFF M.H., 1994: What does it mean to be human - and why does it matter? *Evol. Anthropol.* 3, 4:116-117.
- WOLPOFF M.H., 1996: *Human Evolution, 1996 Edition*. McGraw Hill, New York.
- WOLPOFF M.H., CASPARI R., 1997: *Race and Human Evolution*. Simon and Schuster, New York.

Milford Wolpoff, Rachel Caspari
Department of Anthropology
University of Michigan
Ann Arbor, MI 48109-1382
USA