20%). Alexander and Player (1965) have also stated that the southern race, *simum,* has sparse body hair white the northern has no hairs, only follicles. Groves (1975) suggests that the northern may be longer-legged and shorter-bodied than the southern, but this is not based on any data.

A BRIEF PALAEONTOLOGICAL HISTORY AND COMPARATIVE ANATOMICAL STUDY OF THE RECENT RHINOS OF AFRICA

Summary of presentation by Claude Guerin
(Universite Claude Bernard ——Lyon)

Information on this subject has been published by Guerin (1980).

The black rhino (*Diceros bicornis)*

The lineage begins in the upper part of the middle Miocene, about 12 million years ago, with
Paradiceros mukirii known from Fort Ternan (Kenya) and Beni Mellal (Morocco). The genus *Diceros* appears later in the upper Miocene and is known at that time in Spain, Greece and Turkey with *D. pachygnathus,* In Turkey with *D. neumayri,* and in Tunisia and Italy with *D. douariensis.* The first of these three very large Miocene species may be the ancestor of the white rhino, *Ceratotherium.*

The species *D. bicornis* appears during the Pliocene about 4 to 5 million years ago, and is known in more than 20 sites of Pliocene up to middle Pleistocene age, especially Hadar (Afar) in Ethiopia, Omo (Mursi, Usno and Shungura formations) in Ethiopia, East Turkana in Kenya, Laetolil and Olduvai In TanzanIa. More sites of upper Pleistocene and Holocene age are recorded. However, the material is always rare and the fossil form has not yet received any precise taxonomic status. Anatomical differences between the fossil and extant forms are minimal. Thus the fossil form warrants no more than a subspecific status.

I have studied about 60 adult skulls and more than 30 postcranial skeletons of *D. bicornis,* most of these being of Groves' (1967) medium-sized East African forms: subspecies *ladoensis, michaeli* and *brucii.* It is not easy to distinguish between these subspecies, whereas *minor* appears to be smaller-skulled and *bicornis* exceptionally large-skulled. I have not been able to study *chobiensis* and *longipes.* Statistical analyses show that, from the data I collected, *D. bicornis* is homogeneous, with rather normal variability (see Guerin, 1980). The various subspecies appear to constitute a complicated cline.

The white rhino *(Ceratotherium simum)*

The lineage of the white rhino Is much more recent than that of the black. The genus

Ceratotherium appears during the Pliocene with *C. praecox,* a species defined in 1972 by Hooijer and Patterson with material from Kanopol and Ekora in East Africa. The same year Hooijer described abundant material of the same species from Langebaanweg In South Africa. I have studied the material from Chemeron formation (Lake Baringo) and a good deal of material from Hadar (Ethiopia) and from Laetolil (Tanzania). The species is now known in 11 localities of East and South Africa.

The recent species *C. simum* appears about 3 million years ago. it is classically held that there are two fossil subspecies, C.s. *germanoafricanum* from East Africa and *C.s. mauritanicum* from North Africa. I have studied material of *germanoafricanum* from Afar, East Turkana, Olduvai, Omo, Rawi and sever minor locations, and *mauritanicum* material from Ternifine (0.8 million years), Ain Hanech (1.5 mIllion years) and other minor localities. The postcranial material shows clear differences between the fossil and the recent subspecies.

For the two recent forms, *simum* and *cottoni,* I have been able to find only about 30 skulls and 12 postcranials, and many were without specified origin. In fact, only 16 skulls and 8 postcranial skeletons were certainly from *cottoni,* and 8 skulls with 2 postcranial skeletons from *simum.* Hence the results are little more than an indication of differences. On average, *simum* has a skull slightly larger than that of cottoni, with a lower and broader skull roof, and a differently-shaped occipital surface (confirming observations of Groves, 1975). Comparison of fossil forms with the complete sample of recent species shows that the skull of *C. praecox* Is shorter, broader and lower, while the skull of *C.s. germanoafricanum* seems like that of a gigantic white rhino with comparatively narrower occipital surfaces, broader cheek teeth and correspondingly narrower palate widths. A comparison of limb elements again shows *germanofricanum to* be like a giant white rhino, while *mauritanicum* has similar (or exaggerated) proportions to *C. praecox,* being dissimilar to recent white rhinos and *germanoafricanum.*

Since the two Pleistocene subspecies seem to be very different to each other and from the recent ones, *germanoafricanum* probably deserves full species rank and may be the ancestor of the two recent forms; *mauritanicum,* which has no descendants, seems closer to their common ancestor, *C. praecox,* and probably also deserves species rank. The two recent subspecies are clearly distinct from each other and seem to be In the course of a speciation process. More postcranial material, particularly from southern Africa, Is required to help verify this.

BIOCHEMICAL INVESTIGATIONS OF RHINO SYSTEMATICS

Summary of presentation by Matthew George
(Howard University)

A comparative study was undertaken of genetic differences between individual northern and southern white rhinos, and a black rhino. This study was based on comparisons of mitochondrial DNA (mtDNA), which is a useful means of Investigating closely related species since 1.) the molecule Is maternally Inherited, thus complications arising from paternal contributions and recombination events (which affect nuclear DNA) are avoided; 2.) the molecule evolves very rapidly (5-10 times faster than nuclear DNA) so that if differences exist between races they are more likely to be detected than through other methods.

After purification of mtDNA molecules extracted from liver and spleen tissue of the three animals, these were subjected to digestion by 21 different restriction enzymes (which cut the mtDNA at specific sequences of nucleotide units). The cleaved fragments were separated electrophoretically. With most of the restriction enzymes, the migration patterns of mtDNA of the black rhino were different to those of the two white rhinos, while comparison of the two white rhinos showed 13 patterns to be identical and the remaining 8 different.

Analysis of these data indicate that the white rhinos differ by 4% In their nucleotide sequence and they both differ by 7% from the black rhino, If rhinoceros mtDNA changes at a rate of 2% per million years as has been shown in primate mtDNA, the divergence time between the white rhinos is 2 million years, and between either of the white rhinos and the black