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This interview transcript has been edited by BW for clarity and concision. It has been approved by the interviewee.

Bernard Wood (BW) and Yoel Rak (YR)

BW: Thank you for joining us for this oral history interview. Please, could you begin by giving us your name, and the name and location of the institution where you work, or worked if you are retired?

YR: My name is Yoel Rak and I'm still working at the Tel Aviv University Medical School, formerly the Sackler Medical School. I am still teaching anatomy and human evolution: I like to teach.

BW: Could you give us a sense of your family background? Were there any academics in your family? Were you the first in your family to go to college?

YR: My parents, who were born in Poland, were refugees and they didn't have the chance to study anything, so I'm the first one in my family to go to university. I was born in Germany in a refugee camp in 1946, and we moved to Israel when I was two.

BW: Are you an only child?

YR: No, I have two younger brothers.

BW: Are they 'academic'?

YR: No. My family back in Poland, through several generations, were curtain merchants. My brothers carry on that tradition, and they're doing very well!

BW: So why are you not a successful curtain merchant? When did you decide curtains weren't for you?

YR: Ever since I was a child, I was interested in natural history. I collected butterflies and some fossils, sea fossils and the like: I had lots of collections. When I was 12 I started the Israeli Society of Tropical Fish! My teachers at elementary school were very helpful. We even had a natural history magazine we printed out on a drum from a stencil!

BW: Where did you go to high school?

YR: I went to a boarding school that was originally intended for orphans from the Holocaust, but when I attended it was already for Israelis. It was a fantastic school, and I'm very grateful for that opportunity. The biology teacher recognized my interest in natural history, and every Saturday morning we would go out to the countryside, where he would teach us and we would collect this and that. In 1961, I read in the newspaper that a Japanese expedition had found evidence of a 'caveman', so I ran away from school and hitchhiked to Amud Cave. I saw my first Neanderthal *and* my first Japanese person, Professor Suzuki, on the same day!

BW: What did you study as an undergraduate?

YR: I studied in the prehistory department at the Hebrew University in Jerusalem with Ofer Bar-Yosef and Eitan Chernov, who helped me combine prehistory with anatomy. It was a four-year course, but I spent three years in the anatomy department in Tel Aviv; I drove from Jerusalem three times a week! At the end of my studies in 1972, I went with Ofer Bar-Yosef and Naama Goren-Inbar to Africa, and we visited Mary Leakey at Olduvai Gorge. Richard and Meave Leakey were there with their children.

BW: What did you do next?

YR: I did a Masters' degree in anatomy for a year, then because I was in the reserves I fought for almost nine months in the Arab-Israeli war in 1973. It was obvious I would need to leave Israel to continue my studies, and Glynn Isaac suggested that I should go to Berkeley to study with Clark Howell, so I wrote to Berkeley. Sherry Washburn and Desmond Clark were also there, and I was so scared. In my heart I was hoping not to be accepted!

BW: Did you know anything about the US?

YR: Yes. By now I was married, and my wife was originally from the US, so we went to visit.

BW: What was it like at Berkeley, and were there other graduate students?

YR: I went there in 1975. It was the heyday of paleoanthropology in Berkeley. The hominin fossils from the Omo in Ethiopia were there. The other students, who included Noel Boas and Russ Ciochon, were enthusiastic and intense.

BW: What was it like being Clark Howell's student?

YR: I'll give you an example. Soon after I got to Berkeley, maybe in the first week, I was shown a reconstruction of a hominin skull from the Omo. The 'mastoid' looked to me like the greater trochanter of a bovid, but the manuscript and the photograph had already been sent to the AJPA [*American Journal of Physical Anthropology*]. I didn't know what to do, so I asked my American father-in-law what I should do. So, on his advice, I went to Clark Howell and said "Listen, I'm sure I'm wrong, but I think part of this reconstruction is wrong. There is no mastoid, it's a greater trochanter." Clark Howell said "Show me" and we went to the safe, and took out the reconstruction. I explained that the bone is solid, there were no air cells, it's not a mastoid. He said "You are right," then he picked up the telephone, called the editor of the AJPA, and asked for the manuscript to be returned.

BW: Wow!

YR: That is the sort of guy Clark Howell was. After that incident, realizing I knew some anatomy, Clark asked me if I would like to describe a calotte (the two parietals and the occipital) of a juvenile *Paranthropus boisei*. I said, "Sure." And that was how my career started.

BW: So how did you get from this task to your eventual thesis?

YR: My work on "baby Zinj" as we called it, resulted in my 'love affair' with *Australopithecus boisei*, now *Paranthropus boisei*. Originally, I thought I would focus my thesis on the face of the 'robust' australopiths, so the original title was "The Face of the Robust Australopithecines," but Tim White had come to Berkeley and he became my co-advisor, and he suggested I expanded the thesis to include *Australopithecus africanus* and *Australopithecus afarensis*, so the eventual title was *The Australopithecine Face*.

BW: The 'book of the thesis' (see below) could only have been written by somebody who knows and understands a lot of anatomy and functional morphology. Are the excellent illustrations in the book yours?

YR: They were done by an artist friend of Clark Howell's, Judy Ogden. She was not only a fantastic artist, but she was willing to listen to me (which is an achievement!). She was very patient (I made what seemed like hundreds of adjustments!) and she followed my advice.

BW: My copy of *The Australopithecine Face* is really battered, which reflects how useful it is. What also impressed me is that, unless I am mistaken, there weren't many numbers in the book. Your arguments were almost exclusively qualitative.

YR: I remember that I was working at what was then the Transvaal Museum when Elisabeth Vrba was there. I was studying the fossils in that old brick safe. Liz Vrba told somebody else

who was visiting "This Israeli is looking at the skull all day long and doesn't write anything." Liz and I became good friends, and I told her "Yeah, that's what I'm doing. I'm looking and trying to see, instead of trying to measure!"

BW: I understand. You know more morphology in your little finger than I do, but the problem is there are very few folk as good as you. It has always struck me that you need to look at fossils again and again. They are trying to talk to you. They have a message for us. How did you go about knowing what that message was?

YR: Someone else who was like me is the late Charlie Lockwood. We would draw the fossils, because drawing forces you to pay attention to the anatomy. I would look for hours and hours, trying to appraise the topography and the structures, and eventually I would come came up with ideas. And I know I am revealing my age with what I'm going to say, but the youngsters today come with their microscribe and start measuring. They are measuring without understanding what they're measuring. I know I sound like an old man, but it's what I don't like.

BW: Clark and Tim were your PhD Co-Advisors. Who was the examiner of the PhD?

YR: The anatomist in Berkeley, who was Professor Srebnik.

BW: Who connected you with Academic Press to get it published? They did a very fine job.

YR: Tim White. After my dissertation was finished and I was already in Israel, Clark Howell, sweet Clark Howell, called me and told me that my dissertation is very nice. I was very thankful for it. And Tim White liked it as well, which is not a easy thing! Tim called a man called Woodcock at Academic Press, and apparently told him "Listen, you have to publish this book." Woodcock was also a very good friend of Clark Howell's!

BW: You were married. How did you 'make ends meet' in Berkeley?

YR: Well, again it was Clark Howell. He gave me a job as a research assistant, putting me in charge of casting. This was casting the old way, not using CT scans. In the old way, you paid a lot of attention to the anatomy. For example, we used paint to emphasize any distinctive morphology, such as the overlapping parieto-temporal suture in *Paranthropus boisei*. I was paid a modest sum of money, but we had married student housing that was very cheap; we managed. Every month when I got my salary, I bought a book, because by the end of the month I didn't have the money to do so!

BW: You were awarded your PhD in 1981, but when Clark called to tell you it was final, you were already back in Israel?

YR: Yes, we left Berkeley in 1980. I was very fortunate that my teachers in Israel had told me that if I did well at my PhD there would be a job for me back in Israel in Tel Aviv. That was very reassuring.

BW: You were a Lecturer at what was then the Sackler Medical School in Tel Aviv?

YR: Yes, I was a lecturer. As I told you, I like to teach, and I like to teach anatomy. I also taught a popular course in the medical school about the fossil evidence for human evolution.

BW: Let's talk about your research.

YR: Well, before I went to Berkeley, I was excavating in Hayonim Cave and I had been excavating in 'Ubeidiya for six years, so I had field experience. There are no hominins at 'Ubeidiya, but at Hayonim we were excavating a Natufian graveyard, and it was a very important incentive for me to continue in this field.

BW: You liked being in the field, you liked excavating, you liked finding things, and you had this love of anatomy and anatomy teaching. What was next in your research career?

YR: Again, this is thanks to Clark Howell. When I went back to Israel he told me that excavations should be resumed at Kebara, where excavations had been halted since the 1960s. And he told me, "Don't worry, we'll get you money." Excavations were resumed with Bernard Vandermeersch, Ofer Bar-Yosef, and Baruch Arensburg, and in 1983 we found the Neanderthal associated skeleton. Unfortunately for me there was no face, and everybody was grabbing another piece of the skeleton, so I was left with the pelvis!

BW: How did you get involved with fieldwork in Africa?

YR: Well, this was Tim White, and of course my dear friend, Bill Kimbel (see below). During the 1980s there was no field work in Ethiopia because of the war and the famines, but in 1989 the Berkeley people went to Hadar, and they asked me to join them. It was a pleasure.

BW: If you are an anatomist all those fossils from Hadar make it the F.A.O Schwarz of paleoanthropology! How did the association with Bill Kimbel begin?

YR: Again, it was Clark Howell. When I went to Berkeley, according to Bill, Clark called him and said words to the effect "There is this strange Israeli here, and I want him to see the Hadar hominins that are in Cleveland. Can you host him?" And Bill said "Yes." I went there; he hosted me, and we became good friends and close colleagues, mainly because when we looked fossils

we saw their morphology the same way. I remember that he showed me A.L. 333-45, the base of an *A. afarensis* cranium. It was incredible, when I first saw it I thought I was looking at a chimpanzee, except for the location of the foramen magnum. Both of us were screaming at each other about its morphology! Bill was writing his dissertation at the same time as I was writing mine, so we would spend very late nights sitting in his living room discussing and arguing. We were close because we saw many things the same way.

BW: How did your joint work at Amud come about?

YR: I told you the story of my first visit to Amud as a 15 year-old, but it was Bill Kimbel who suggested we put a joint project together to re-excavate the cave. It was a collaboration involving the Institute of Human Origins (IHO), the Hebrew University and Tel Aviv University. There were a lot of unanswered questions. When the Japanese excavated Amud no radiocarbon dates were available, and they thought the fossils were intermediate between Neanderthals and *Homo sapiens*. Leaving aside the science, Amud is a spectacular cave, and in the second season we found an a beautifully-preserved approximately nine month-old baby Neanderthal. We were lucky to be working with Erella Hovers, who is a fantastic field archeologist and geologist. We answered many questions, and generated others.

BW: You and Bill had been working together on *A. afarensis*, and now you were working together on Neanderthals. Were these separate, or complementary, interests?

YR: I had always tried to convince Bill to expand his interests, and when he came to see Amud with Jay Green (of IHO) he was very enthusiastic. He was not there when we found the baby, so I called and he flew across immediately, and we were all trying to clean everything. For Bill, it was something very different from his work at Hadar.

BW: During your research career, when you were making decisions about what to be interested in, what were the major factors? Were you interested in so much that you had to limit what you actually did? Or did you have to work hard to find things you would be interested in?

YR: When I was a graduate student in Berkeley, everybody was eager to add more stages to human evolution. And of course, everyone was hoping discover a new stage. This was a very naive approach. Everything was interpreted within an anagenetic framework. I was less interested in reconstructing lineages, and more interested in the functional interpretation of the face, or the pelvis, or the mandible and things like that. For me, functional analysis was more challenging and much more interesting. I am still fascinated by *Paranthropus boisei*. Why, with its massive mandible and massive face, are the walls of the brain case so thin?

BW: My impression of your research is that as you are looking at the morphology of the fossils you are mentally reconstructing them as living individuals.

YR: That's right. That's what I do.

BW: You have talked a lot about the opportunities that Clark Howell and Tim White gave you. Do you see that still going on? Are senior researchers as generous these days?

YR: As I always tell my students, it's much easier to publish a paper as a student than as a professor! People are much more forgiving to students. You can have differences of opinion, even with close colleagues. For example, I spent many decades thinking that *A. afarensis* was our ancestor, and then I came to the conclusion that it was more likely to be the ancestor of the robust australopiths. Both Bill Kimbel and Don Johanson disagreed, and took their names off that paper. But we were still very good friends. Just because you don't agree, you don't have to kill each other!

BW: Which researchers in the past do you admire?

YR: I admire Wilfrid Le Gros Clark. He was a major figure who wrote seminal books such as *The Antecedents of Man*, *Ape-Men and Men-Apes*, and the *Fossil Evidence for Human Evolution*. Fantastic, fantastic, stuff. Another one was Franz Weidenreich, and of course Clark Howell.

BW: What attracts you to Weidenreich? He was a consummate morphologist.

YR: That is why I so admire him. Because he noticed, he paid attention to, and he detected all those things nobody else was seeing.

BW: Let me ask you a 'desert island' question. If you had to rescue one of your publications, which would it be? What is the publication you are most proud of?

YR: It would have to be *The Australopithecine Face*. It was a fantastic intellectual experience. And I'm still very proud of it. Another would be a much more specialized publication on the ramus of *A. afarensis*.

BW: The description of a book or a paper as being a classic, or seminal, is overused, but *The Australopithecine Face* is exceptional. Is there a book or a paper written by somebody else that you wish you had written?

YR: Phillip Tobias' *The Cranium and Maxillary Dendition of Australopithecus (Zinjanthropus) boisei*, his monograph on the OH 5 cranium. I don't agree with everything in it, but it would be a fantastic dream to be given that cranium and be asked to describe and analyze it.

BW: If you had a fairy godfather, or a fairy godmother, what research question would you ask him? What would you like to know the answer to?

YR: I would like to sort out the taxonomic 'waste basket' called *Homo erectus*. There is no consensus about what to put in the basket, nor about its phylogeny. Do you include OH 9? Or Bodo? It's a big, big mess. In my view, there are more species in human evolution that are side branches than actual modern human ancestors.

BW: That's my prejudice, too! If somebody gave you a ton of money, what research problem would *you* spend it on, or what research would you advise them to spend it on?

YR: I am immediately tempted to say that I'll spend the money on expeditions to find more fossil evidence. But when Michael Ghiselin was asked what he would do with his MacArthur Prize money, he said "I'll buy a new lawn mower." But seriously, I would dedicate some of the money to finite element techniques. I'm too old to start with it now, but I'm amazed about the potential of these techniques to answer questions I was interested in as a graduate student for the anterior pillars and things like this. There are questions that a finite element lab with talented and mechanically inclined people like Callum Ross could answer. The other thing I would do is to go back to all the collections and reexamine the specimens. You will always think about things that are new, and things you didn't have any idea about when you were young and innocent!

BW: What part of your working life did/do you most enjoy, and what part would you have been really pleased to have been rid of?

YR: The discovery of the A.L. 444 skull was a climax in my career! Studying and cooperating with Bill Kimbel and with Don Johanson was a highlight. When I was working on A.L. 444 I was sitting in my lab in Tel Aviv and studying the way I imagined science as a child, sitting and looking at the skull, and calling Bill in the middle of the night and arguing about the TMJ (temporomandibular joint) and things like this. This was a highlight of my career. This is the way I viewed doing science. It was the combination of its discovery in the field, followed by the analysis in the laboratory.

BW: I can appreciate that. Yoel, when you're not working, what do you do?

YR: I like to read the science books, authors like Richard Dawkins and Stephen J. Gould, and other people who explain science, particularly evolution, in a popular way, I enjoy that a lot. I



met Dawkins when he came here to give a lecture. I told him, for heaven's sake, you write faster than I can read!

BW: What about the tropical fish I see behind you?

YR: I had a dog, and when he died I was so heartbroken that I said, listen, the next pet I will have is going to be a guppy. Now I have fish, but when they die I'm sorry about it too!

BW: Yoel, what would you have done if somebody had said you couldn't be a paleoanthropologist?

YR: When Bill and I were sitting in a huddle in the middle of the night watching the insects buzzing around we decided in our next life we will be an entomologist! It's much easier. More seriously, I would love to study bats.

BW: Why?

YR: Because they are so specialized and so fantastic. I was always intrigued by bats. This will be my second life!

BW: Do you think *Paranthropus boisei* is the higher primate equivalent of a bat? It's just weird and strange.

YR: It's so intriguing. I still remember when I figured out the shape of the *Paranthropus boisei* face. I remember I was in the Plums Hotel in Nairobi, and I was drawing it and suddenly I was bending the sheet of paper. And I realized how fantastic it is that a hominid had actually adopted that solution.

BW: Is there anything you would like to talk about that I haven't raised with you?

YR: Well, one of the questions you didn't ask me was did I regret something that I did?

BW: And?

YR: I regret three papers, and ironically they are in *Science* and *Nature*! One is on the Dmanisi skull, the second is on the Neanderthal hyoid, and the third is the tempo and mode in human evolution. Today I would have a completely different view of these things.

BW: Why has your view changed?

YR: I guess as your hair gets whiter, maybe you become wiser? I'm a volunteer teacher now. I do it because, if I may say so, I'm so much smarter and more experienced than I was, and I see things differently, and it's a shame not share those insights with the students! (Much laughter)

BW: That reminds me of the discussion between a son and his father, and the son realizes that his father has become a lot wiser in his old age. Is there anything else that you would like to share with us before we finish?

YR: No. Thank you for the interview.

BW: Yoel, it's been wonderful to see you and I just wish we had spent more time together. Just as you admire Phillip Tobias and Franz Weidenreich as morphologists, there are many of us who admire you for the same thing.

YR: My gosh. Thank you. Thank you.