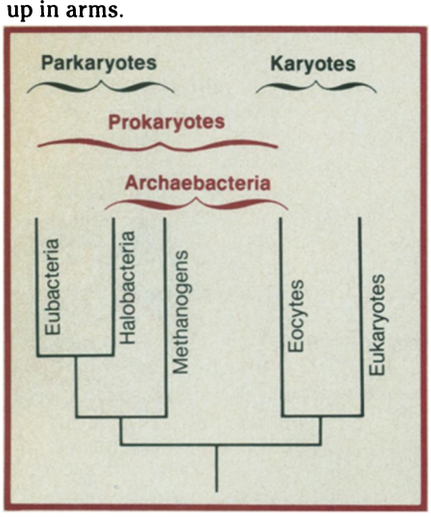
Seekers of Ancestral Cell Debate New Data

A new, computerized method of analyzing bacterial genes is stirring controversy among biologists seeking to characterize the ancestral cell from which all life evolved. The novel program predicts that all living things evolved from a single-celled organism that had a penchant for living in boiling sulfur springs. The prediction conflicts with the popular notion that life began in a tepid primordial soup. More important, it prunes the evolutionary tree in a way that has many biologists up in arms.



Lake's evolutionary tree, with competing classifications shown in red.

James A. Lake, of the Molecular Biology Institute at the University of California at Los Angeles, developed the complex mathematical program in an attempt to correct a long-recognized bias inherent in other methods of testing for evolutionary seniority. His program, like the others, compares the molecular sequences of RNA in bacterial ribosomes — the protein-synthesizing organelles present in all cells — to calculate which cell families have been around the longest. Until now, such calculations have been confounded by the fact that some cell types tend to evolve more quickly than others (SN: 1/31/87, p.74).

"Previous analyses didn't have the kind of sophistication and the statistical power that Lake has introduced," says Allan Wilson, a professor of biochemistry at the University of California at Berkeley. "It looks as though Lake's is the best assessment around at the moment, and I think it's an important advance."

Others, however, are less impressed with Lake's new math, and show no sign of giving up their more traditional views. "We don't know quite what's going on, but there's something fishy in Jim's analysis," says Norman Pace, of Indiana University in Bloomington.

At stake is the survival of a popular classification scheme in which members of the diverse class Archaebacteria are dubbed the progenitors of all modern life. When Lake's program corrects for varying rates of genetic substitutions over millions of years, it takes one branch of the Archaebacteria, the Eocytes, and grafts it to the more rapidly evolving Eukaryotic limb. In doing so it wipes out the venerable Archaebacteria and reorganizes the evolutionary tree right down to its root.

"Using a new, sophisticated mathematics, we have worked out the branching to the very bottom of the tree. And it indicates that the ancestor at the bottom of the tree was very likely an Eocyte, or it had properties like an Eocyte," says Lake, whose analysis appears in the Jan. 14 NATURE.

But archaebacteriologists, upset about Lake's absconding with a portion of their tree, say the new approach is fraught with errors. According to Gary Olsen, a specialist in nucleotide sequence analysis and a colleague of Pace at Indiana University, Lake's algorithm is likely to generate false branching during periods of rapid evolution when "large amounts of background noise can come into play." Moreover, he says, the program appears to be comparing sequences that are not truly related. When Lake's program is applied more conservatively, he says, it confirms, rather than denies, the phylogenetic unity of the Archaebacteria.

"The Archaebacteria do tend to be a strange collection," Olsen concedes. "It includes the Eocytes that like to grow in boiling sulfuric acid, the extreme halophiles that you'd find in the Dead Sea or the Great Salt Lake and the methanogens, which are incredibly oxygen-intolerant." Nevertheless, he says, they share common features — including unique membrane structures and modified RNAs — that justify their taxonomic nobility and hint of their rightful place at the bottom of the tree.

In contrast, Lake says his findings are supported by anatomical evidence linking the sulfurous Eocytes with the more highly evolved Eukaryotes, and he predicts that bacterial fossil records will confirm his taxonomy. His newly proposed classification disposes of the traditional Prokaryotic and Eukaryotic superkingdoms, which he says unfairly granted Eukaryotes evolutionary seniority. They are replaced by two new superkingdoms, the Karyotes and the Parkaryotes (from the Latin *par,* meaning "equal"), with an Eocyte-like cell serving as their ancestral common denominator.

In an editorial accompanying the article, David Penny, of Massey University in Palmerston North, New Zealand, says that Lake's "is perhaps the best approach we have at present for learning the energy source of the last common ancestor. Lake's paper does help to set a higher standard for tree building from DNA sequence data." However, he adds, "The prize is not whose tree is correct, but a better understanding of the last common ancestor of all living organisms and, by implication, elucidation of the origin of life."

With Olsen and others now preparing research manuscripts that will counter Lake's findings, the archaebacteriological debate is sure to evolve. In a rare show of unity, however, and contrary to common lore, both sides agree that the earliest ancestors — whatever the taxonomic breakdown — were probably heat-loving, sulfur-breathing bacteria.

"Rather than thinking about Darwin's warm little pond, it makes sense to think about places where large amounts of energy were available," Lake says. "What better place for an early organism to be than where there is plentiful CO_2 for carbon and plentiful energy available in terms of gaseous hydrogen and sulfur?"

— R. Weiss

So B is for thymus, too?

Are there B lymphocytes alive and well and living in the thymus gland? The answer is yes, say scientists from the University College and Middlesex School of Medicine and Brompton Hospital in London. If so, the production of B lymphocytes in the thymus gland could tweak traditional immunology.

While the thymus gland has long been considered the executive director of T-lymphocyte production, B lymphocytes are thought to come from the bone marrow in humans. But there apparently is a distinct population of B cells produced by the thymus, report Peter G. Isaacson, Andrew J. Norton and Bruce J. Addis in the Dec. 26 LANCET. The scientists looked for the cells after finding a type of B-cell cancer that starts in the thymus. Isaacson said in an interview that tissue-staining techniques show that the B cells in question are active and have a distinct set of antigens on their surface — evidence that they aren't just "passing through" in the blood. He suggests that the cells may act as messengers by presenting antigens to T cells. Thus far, he says, immunologists have reacted to the findings with "a curious silence." □