VI. THE PROTEIN PROFUSION

Proteins are well recognized for structural and enzymatic properties, but they have another important function: they're the "words" nature employs to communicate information between and within living organisms.

Protein is a sequence of the 20 biological amino acids, which are the "alphabet" in the protein "language."

THE ENGLISH ALPHABET

A	**H**	**O**	**V**
B	**I**	**P**	**W**
C	**J**	**Q**	**X**
D	**K**	**R**	**Y**
E	**L**	**S**	**Z**
F	**M**	**T**	
G	**N**	**U**	

THE PROTEIN ALPHABET

[A]-Alanine	**[K]-Lysine**	**[S]-Serine**
[C]-Cysteine	**[L]-Leucine**	**[T]-Threonine**
[D]-Aspartic acid	**[M]-Methionine**	**[V]-Valine**
[E]-Glutamic acid	**[N]-Asparagine**	**[W]-Tryptophan**
[F]-Phenylalanine	**[P]-Proline**	**[Y]-Tyrosine**
[G]-Glycine	**[Q]-Glutamine**	**[1]-Isoleucine**
[H]-Histidine	**[R]-Arginine**	

Given a protein with a chain length of 100 amino acids, there are $20^{100}=10^{130}$ possible sequences[1] in which those twenty aminos can be linked. By comparison Webster's New World Dictionary, with an alphabet of 26 letters, has only $1.42x10^5$ (142,000) words. The human genome only codes for 100,000 proteins,[2] although the immune system maintains a "library" that can discriminate about a billion foreign proteins.[3]

Thus, only a tiny fraction of those possible 10^{130} protein "words" are expressed in nature so the tree of life is made of amino acid sequences, and the empty space around the tree represents the myriad sequences that were never used.

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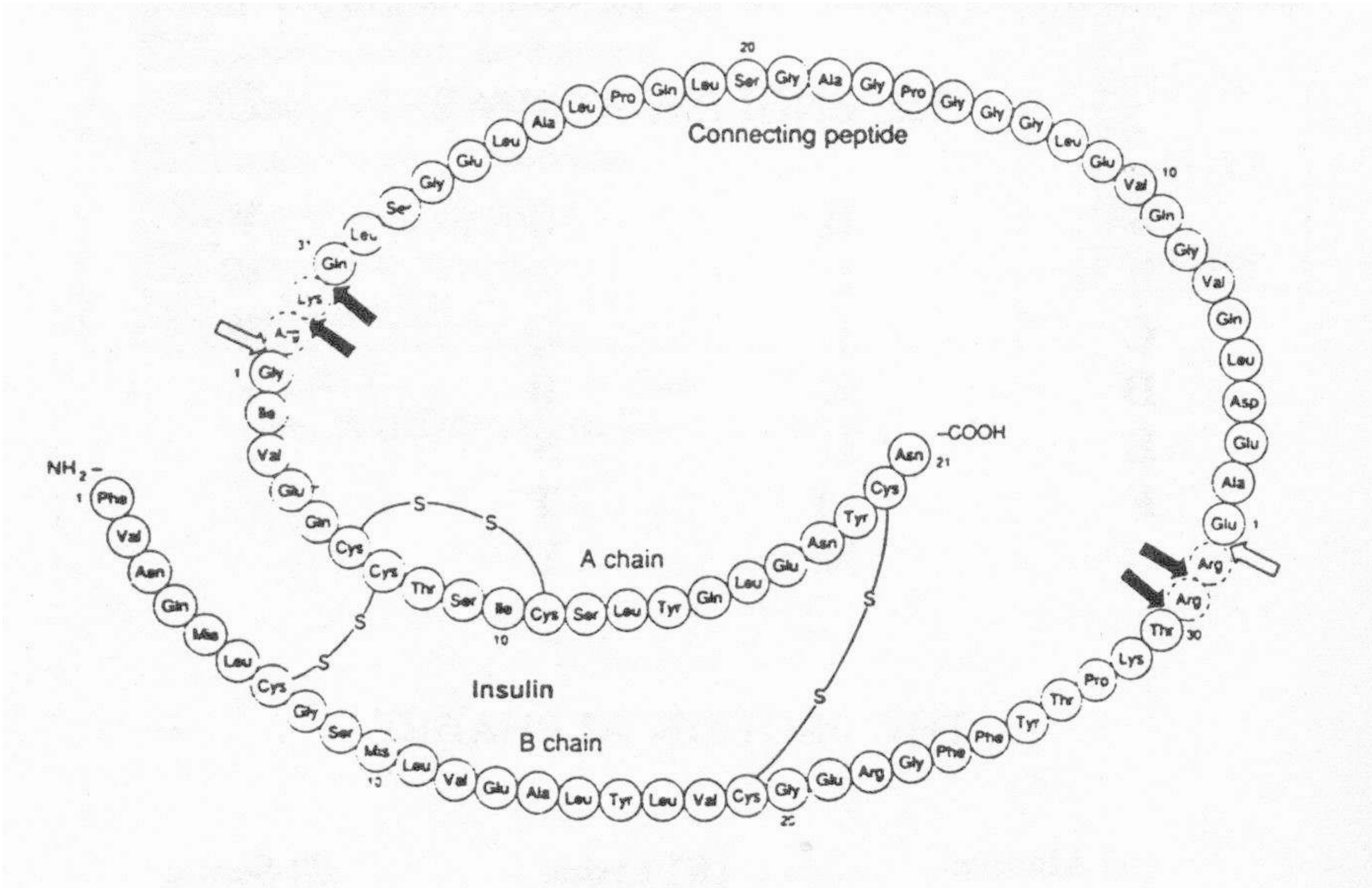
[1]See note 76. de Duve. p 253.

[2]Kaufman SA. *Scientific American.* Scientific American, Inc. New York. ISSN 0036-8733. Aug 1991 p 79.

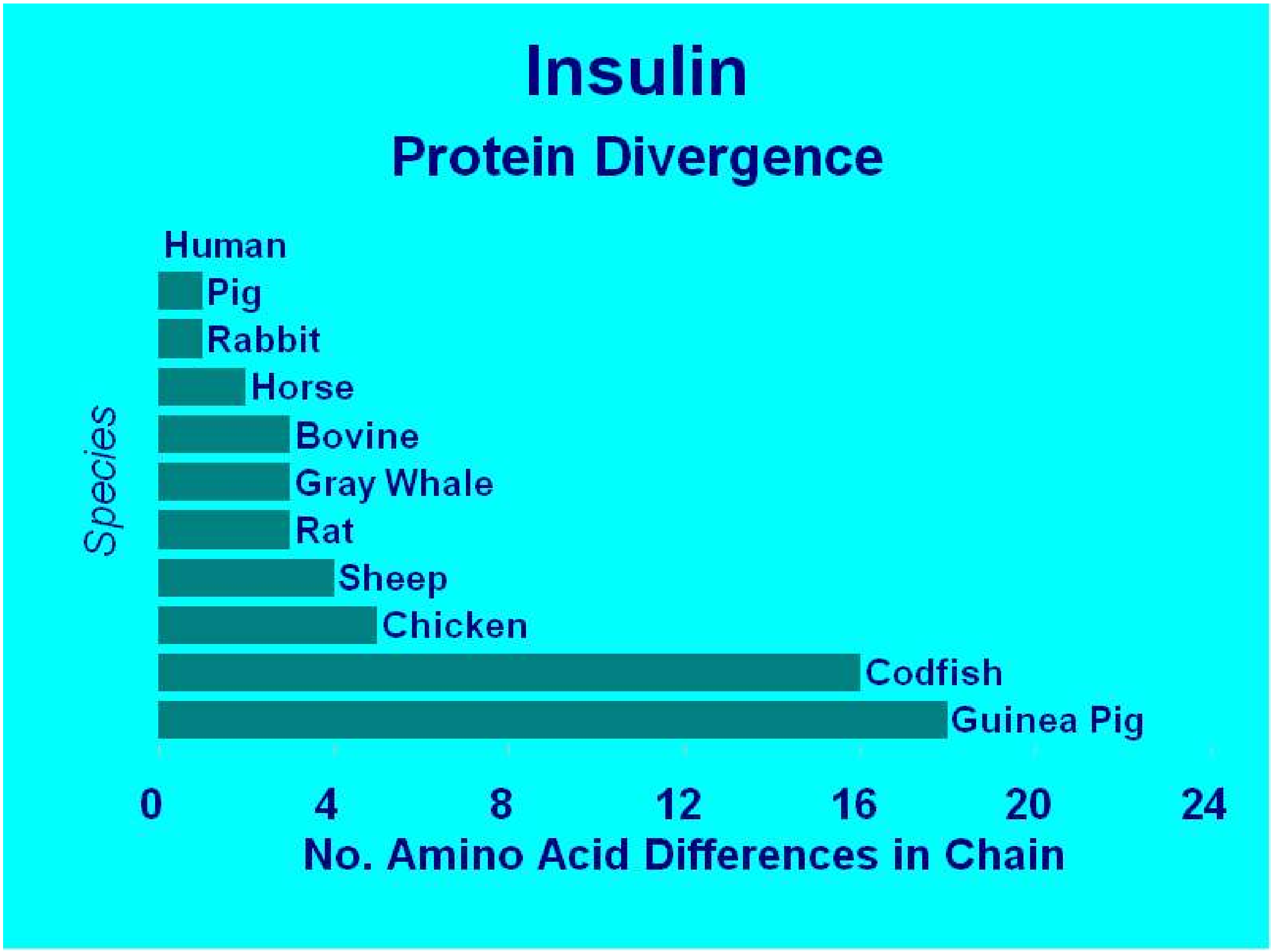
[3]See note 98. Ganong. p 487.

Pro-insulin is a protein, a long spiral sequence of amino acids[4] linked together.   After synthesis in the pancreas, it is cleaved to active insulin (shown below the arrows):



[4]See note 2. *Harper's 1990.* p 533.

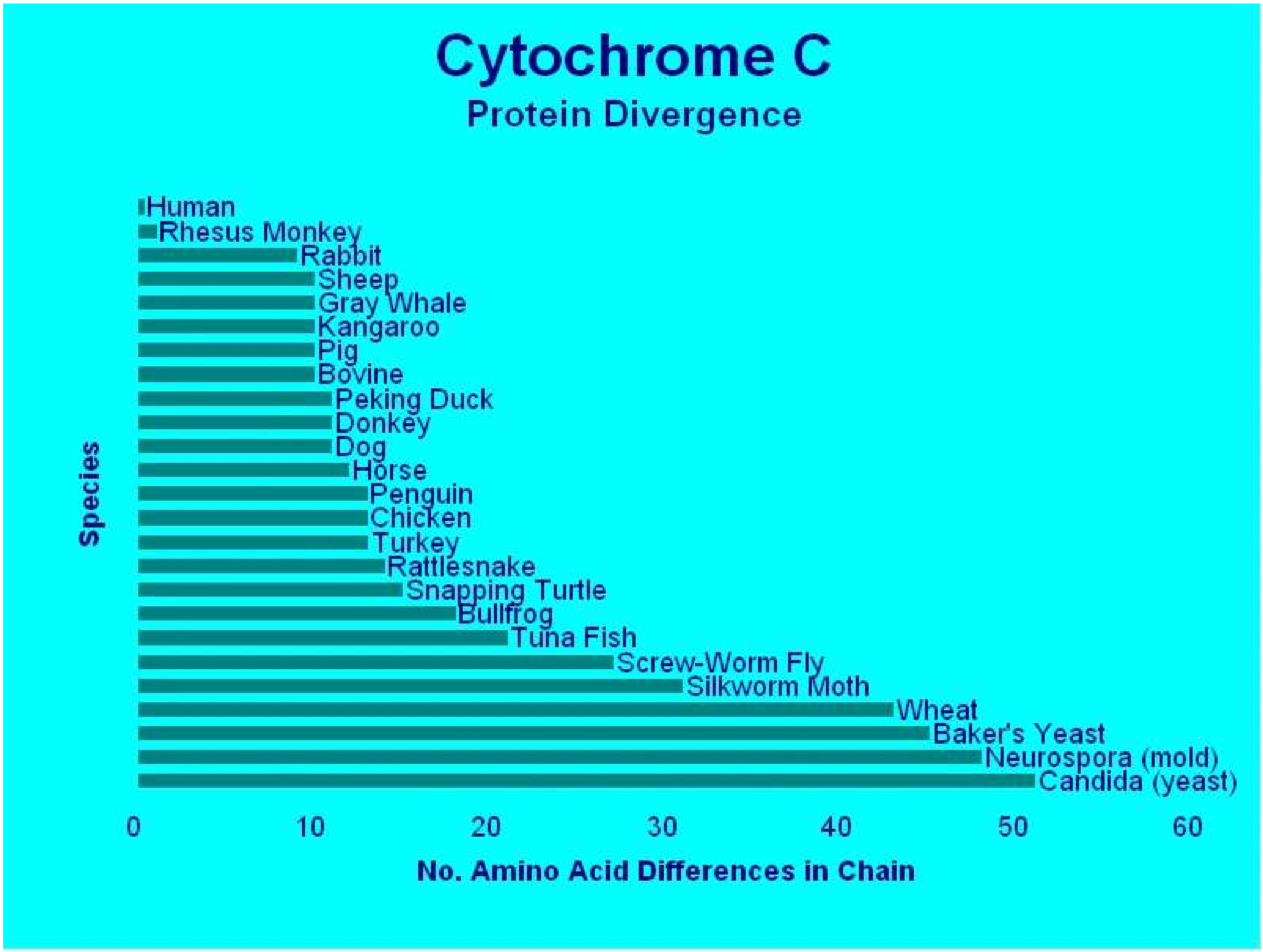
This sequence has variations from species to species:[5]



[5]Dayhoff MO, and Eck RV. *Atlas of Protein Sequence and Structure*. National Biomedical Research Foundation. Silver Spring, MD. 1968. Library of Congress No. 65-29342.

Before human insulin became available, diabetics who developed antibodies to beef insulin were commonly switched to pork insulin, closer to the structure of human insulin, and less likely to be detected as a foreign protein by the immune system.[6]

As another example of protein divergence, here is cytochrome C, an electron transfer enzyme in the mitochondria of plant and animals cells.[7] Clearly the sequence diverges in proportion to the evolutionary distance from humans:



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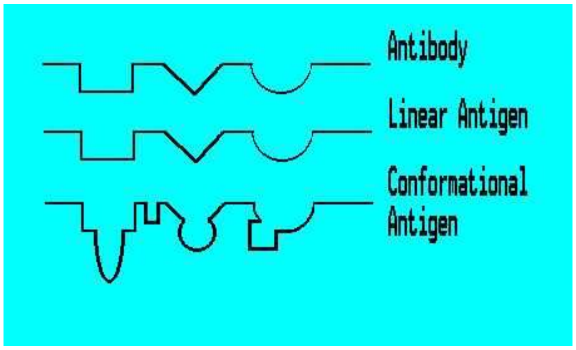
[6]Hyde RM, and Patnode RA. *Immunology*. John Wiley & Sons. New York, 1987. p 28. ISBN 0-471-82925-0.

[7]See note 133. Dayhoff. p 301.

Protein is identified by its amino acid sequence; the sequence is reflected by the antibodies that the immune system forms against it. Proteins need only be about 36 amino acids long to be strong antigens.[8] In this graphic abbreviation, the lines represent sequences of amino acids folded into geometric shapes.



Ordinarily, about 98% of dietary proteins are digested and absorbed as harmless amino acids.[9] However, fragments of whole protein may be absorbed by pinocytosis, a sort of "swallowing" by intestinal lining cells.[10] Once in the circulation the protein fragments can provoke the formation of antibodies.

For the sake of analogy, let us invent the amino acids [I], [O], and [U]. Suppose then that the immune system encounters this protein fragment:

[I]-[A]-[M]-[N]-[O]-[T]-[Y]-[O]-[U]

This is a message that the immune system seeks diligently since such information is usually associated with a microbiological invader. It will generate antibodies and the question is whether the antibodies will cross-react against the body's own protein fragment:

[I[-[A]-[M]-[Y]-[O]-[U]

A browse through a computer sequence analysis database[11] shows that animal proteins have few amino acid sequences in common with plant proteins while they are similar to each other. Myoglobins, collagens, immunoglobulins, hemoglobins, and their genes from various animal species resemble those from humans. Many of these proteins are not even present in plant species.

T=thymine	G=guanine
C=cytosine	A=adenine

These four nucleic acid bases are the business end of DNA.[12] Three bases in sequence form a "codon" which specifies one amino acid. Hence, a long sequence of bases specifies a protein about a third the length of its gene.

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[8]See note 134. Hyde and Patnode. p 25.

[9]Guyton AC. *Textbook of Medical Physiology*. WB Saunders.Philadelphia, 1971. p 769. ISBN 0-7216-4392-2.

[10]*ibid.* p 771.

[11]Genetics Computer Group. *Sequence Analysis Software Package v6.0*. Madison, 1989.

[12]See note 76 deDuve. pp 251-59.

Shown below is a typical print-out comparing a short length of the genes coding for human and bovine lactalbumin (milk protein). The vertical lines show the identity of bases generating the two proteins, which for this short segment is 91.6%. The printout went on for 1460 base pairs (bp) with an *overall* identity of 79.9%.

```
DEFINITION  Human alpha-lactalbumin gene, complete cds.
DEFINITION  Bovine gene for alpha-lactalbumin.

         1560      1570      1580      1590      1600      1610
Humlac TCACACCAGTGGTTATGACACACAAGCCATAGTTGAAAACAATGAAAGCACGGAATATGG
       ||| |||||||||||||||||||||||||||||  |||||||||| ||||| ||||||||
Bovlac TCATACCAGTGGTTATGACACACAAGCCATAGTACAAAACAATGACAGCACAGAATATGG
          1240      1250      1260      1270      1280      1290
```

It's not surprising that cow's milk is associated with a glossary of pediatric illness.[13] If the genes were 100% identical, human and cow milks would be immunologically indistinguishable and these problems would not arise. The trouble lies in *similar* but not *identical* proteins.

A 62.5% identity was found between corn albumin mRNA and Pea albumin mRNA in this 48 bp segment:

```
DEFINITION  Maize albumin b-32 mRNA, complete cds.
DEFINITION  Pea (P.sativum) albumin 2 (PA2) mRNA, complete cds.

           900       910       920       930       940       950
Mzealb TTCACGTCCTCCACGGGGAAGATTTCAGTGAACTTTGGTACTATTTTTTTGTTTGTTTGC
       | |||    | || || ||| ||   |   | |||||||||| ||| |
Peaabn TGCACTATATGCAGGGTGAATATAATAAAAACCTTTGGTACTTTTTAT
     910       920       930       940       950
```

By contrast, the identity for this 60 bp "best fit" segment of human serum albumin mRNA and corn albumin mRNA is about 18.3%, and there were no other matching segments:

```
DEFINITION  Human serum albumin mRNA, complete cds.
DEFINITION  Maize albumin b-32 mRNA, complete cds.

          40        50        60        70        80        90
Humalb CAGCTTGACTTGCAGCAACAAGTTTTTTACCCTCCTCGGCAAAGCAGGTCTCCTTATCGT
                                     |||||||||| |
Mzealb GGTGGAGTTGGCAAGGCCGGCGACACCCACCTCCTCGGCGACAACCCCAGGTGGCTCGG
            360       370       380       390       400       410
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[13] Halpern GM. *Alimentary Allergy*. Journal of Asthma. 1983;20(4):258.

Matching human albumin against pea and sunflower albumins produced *no* identical segments and the computer locked up attempting to find them. It's likely that an exhaustive search would only disclose that animal proteins are similar to each other and plant proteins are similar to each other, but there is little similarity between plant and animal protein sequences other than their common use of the same 20 amino acids.

Therefore, while plant protein may induce allergy (e.g. hayfever from airborne pollen and hives from wheat), the antibodies do not cross-react with body proteins. Antibodies formed against animal protein *do*.

But scientific textbooks continue to stonewall diet and disease. Legitimate references to genetic and microbial causes are made, but in autoimmunity nary a reference can be found to the similarity of human protein and dietary animal protein. Diseases are called "idiopathic" and not diet-related, without performing vegan diet studies first.

A scanty literature suggests that a diet free of animal protein may be therapeutic in antigen-antibody (ag-ab) disease. Lindahl[14] improved asthmatics with a vegan diet. Kjeldsen-Kragh [15] improved both subjective and laboratory findings in rheumatoid arthritis patients using a lacto-vegetarian regime and the benefits in the diet group were still present after a year.

HYPOTHESIS:

"Clonal deletion" ordinarily eliminates clones of white cells that manufacture antibodies against one's own body proteins,[16] but if dietary protein is similar, though not identical, to the body's own protein, this mechanism may fail. Antibodies formed against dietary animal protein then cross-react with body proteins.[17] The result is autoimmune disease.

Autoimmune disease will surely continue as long as more antigen is being ingested daily. However, it seems likely that if the daily intake of animal protein stops, so also does the daily ag-ab shower into the affected tissues. Normal healing processes are then given a chance.

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[14]Lindahl O, Lindwall L, Spångberg A, Öckerman P. *Vegan regimen with reduced medication in the treatment of bronchial asthma*. J Asthma. 985;22(1):45-55. ISSN 0277-0903.

[15]Kjeldsen-Kragh J, Haugen M, Førre Ø, *et al.*
Controlled trial of fasting and one-year vegetarian diet in rheumatoid arthritis.
Lancet 1991;338:899-902

[16]See note 134. Hyde and Patnode. p 64.

[17]Atassi MZ. *Immunochemistry of Proteins*. Plenum Press. New York, 1977. p 391.
ISBN 0-306-36221-X (v.1).