

## INDIVIDUAL STUDY

### *Experience and knowledge in general practice*

B. JAMES, M.B., B.S., M.R.C.G.P.

Marlow, Bucks

Three major agencies operate in the education of a general practitioner, pregraduate education, postgraduate education and experience in general practice itself. Since knowledge of medicine is a doctor's main stock in trade, it is important to discover what knowledge is required to perform his task efficiently and how his knowledge varies during his career in practice. The latter could best be discovered by setting long and detailed written and oral examinations. However, it would be difficult to obtain the co-operation of enough practitioners to make it worth while, so recourse must be made to theory. This creates uncertainty.

#### *Medical knowledge*

It is reasonable first to ask what we mean by medical knowledge. There is considerable variety in its nature and it is necessary to have some understanding of it. Aristotle stated that all knowledge can be stated in the form A is B, and despite the complexity in the nature of grammar which Chomsky (1968) has demonstrated all statements can be modified until they adopt this form. The unit of knowledge in the brain has been given a name (the mnemon) and probably involves a change in conduction at a synapse. Its precise nature remains uncertain. We can suppose that the statement A is B means at a cellular level that a connection is made so that when the group of cells whose activity represents the idea A is stimulated, the group of cells representing the idea B is stimulated in turn by a conducted impulse. We can also suppose that all logical thought is of the form, if A is B and B is C, then A is C.

By this means we can suppose that knowledge builds itself into long chains, but that furthermore these chains intersect to make networks. Where chains intersect, we can suppose the statement to have special significance and indeed the brain appears to attach a particular pleasure principle to closing a ring in a network. This may explain the pleasure gained from solving chess problems or crossword puzzles, often called the 'aha' situation. The intersections have another property, namely that they are readily remembered, so that we can see the advantage to the brain obtained by attaching pleasure to the discovery of particularly valuable information and to its preferential retention.

Regarding knowledge generally as having the nature of a reticulum, we can appreciate that the degree to which the reticulum is developed varies considerably from one branch of knowledge to another. French irregular verbs have little reticulum and have to be rote learned. Algebra, at the other extreme, is a network where the branches of the tree are axioms and the nodes are theorems. We can state, hopefully perhaps, that most branches of knowledge are at an imperfect state but all aspire to the nature of an algebra. Further support for the network hypothesis comes from the use of mnemonics or rhyme to supply an artificial network structure where a natural one does not exist. One objection is that if knowledge is like this, what about knowledge about knowledge or even knowledge about knowledge about knowledge? However, since they will all be networks the problems raised by recursivity are negligible.

Thus much medical knowledge is rote learning, for example, the rash of measles whose appearance, if forgotten, cannot be deduced from first principles. There are also fairly substantial parts of the subject which are worked out logically and form a network. Nevertheless there appears a certain scholastic bias which prevents the formulation of simplifying generalizations such as the relation between infection and pyrexia.

#### *The importance of repetition*

When the student qualifies, he possesses a considerable amount of knowledge of a very heterogeneous character all of which will have an approximately exponential decay. This will be affected by the degree to which the knowledge has a structure and to the amount of reinforcement it receives from practical experience and postgraduate education. In general, learning is proportional to the logarithm of the number of repetitions so that in the absence of any other

factor one can expect that the knowledge a practitioner has of a particular case is approximately proportional to the log of the number of times he has seen it.

General practice involves many tasks besides diagnosis; however, the quality of the diagnosis determines the quality of the treatment that is subsequently given. Furthermore, although the process of diagnosis may involve logical deduction it is predominantly a process of pattern recognition and therefore a function of the amount of knowledge possessed by the diagnostician.

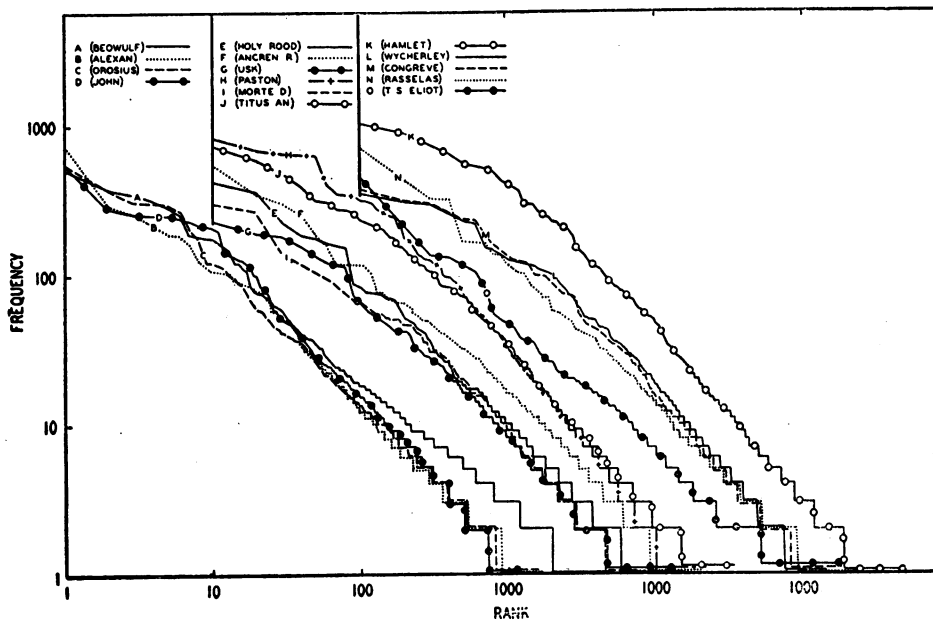


Figure 1. Beowulf to T. S. Eliot. Rank-frequency distributions of the words of fifteen English writers from early Old English to the present day. Copyright: Addison Wesley Press, Inc.

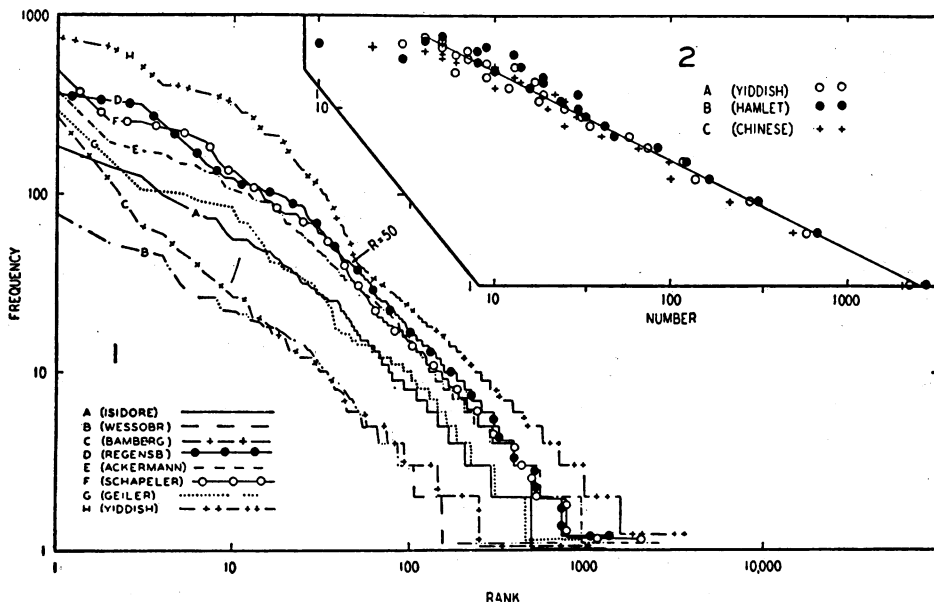


Figure 2. Comparative curves. (1) Rank-frequency distributions of the words of seven Old High German or Middle High German authors, and of Yiddish; (2) the number-frequency relationship of Yiddish, Hamlet, and Chinese. Copyright: Addison Wesley Press, Inc.

It follows that a doctor's knowledge is an adaptation to his work and the amount of this knowledge is closely related to the spectrum of disease that he encounters, being greatest for common complaints and least for rarities.

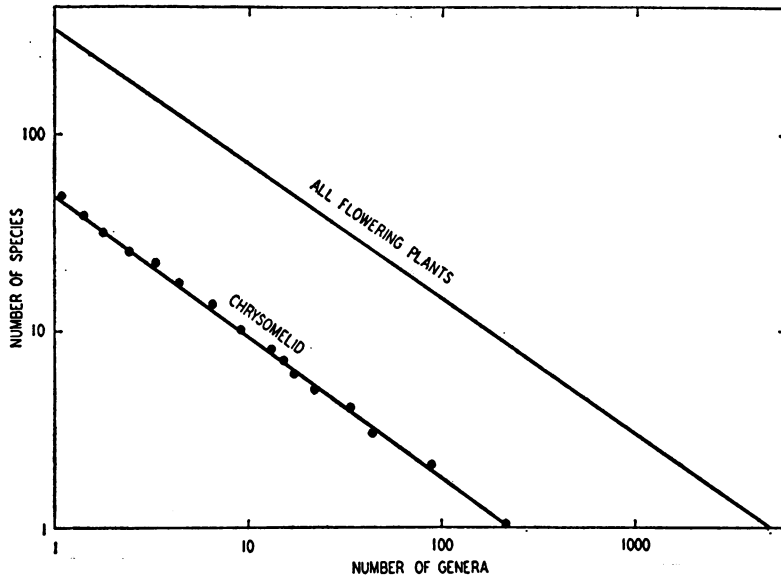


Figure 3. The number of different genera of like number of different species for all flowering plants and for Chrysomelid beetles (from the J. C. Wills data, after reversing the co-ordinates). Copyright: Addison Wesley Press, Inc.

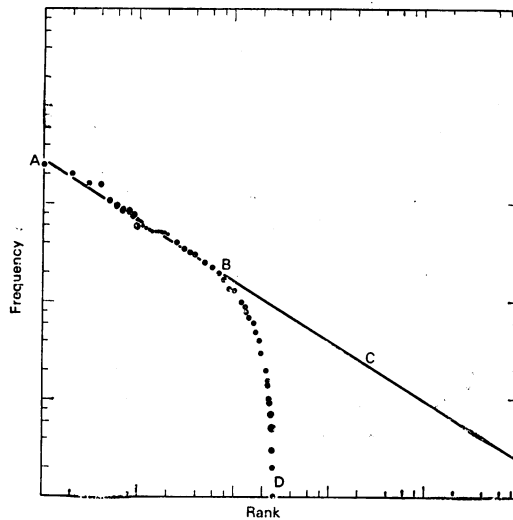


Figure 4.

*Zipf's Law*

If we consider as a theoretical population a large random list of positive integers which are to be described in terms of their factors, it will be seen that all the numbers are divisible by one, about half are divisible by two, about one third divisible by three and so on. If the number of numbers is  $N$ , then the product of the factor by the number of numbers it factorizes is always near to  $N$ . This is known as Zipf's Law,<sup>1 4</sup> but it is found to apply to a surprisingly large number of cases notably in human communication (figures 1, 2, 3, 5, 6). Thus the rank frequency curve of the words in Shakespeare or Confucius obeys Zipf's Law. The factors of the integers may be

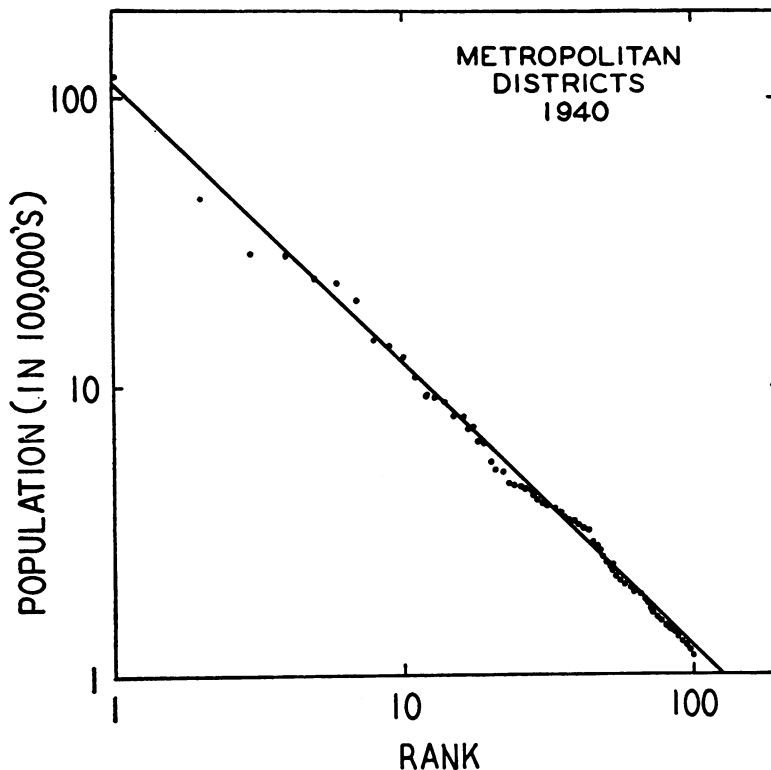


Figure 5. Metropolitan districts. One hundred largest in the U.S.A. in 1940, ranked in the order of decreasing population size. Copyright: Addison Wesley Press, Inc.

regarded as the words that describe them and the names of the diagnoses may be regarded as the words that describe the patients, we might therefore be excused for expecting that the rank frequency curve for disease in general will obey Zipf's Law also.

The statistics which are available (General Register Office, 1958) apply only to general practice. Arranged in order of frequency and plotted (figure 4) it will be seen that Zipf's Law is obeyed down to about rank 130 where the gradient becomes more steep.

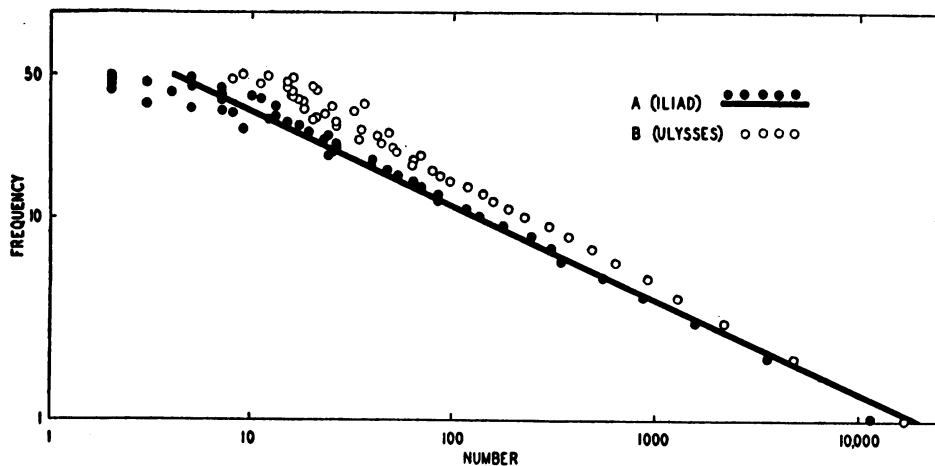


Figure 6. The number-frequency relationship of words. (A) Homer's *Iliad*; (B) James Joyce's *Ulysses*. Copyright: Addison Wesley Press, Inc.

TABLE I

G.R.O. PUBLICATION No. 14. VOL. I. TABLE 9. IN ORDER OF FREQUENCY, CONSULTING RATES PER 1,000 POPULATION ALL AGES, BOTH SEXES

1. Bronchitis	261.1	84. Other diseases of respiratory system	15.9
2. Arthritis and rheumatism except rheumatic fever	204.3	85. Cough	15.8
3. Psychoneurotic disorders	165.8	86. Psychoses	15.7
4. Acute nasopharyngitis (common cold)	163.3	87. Bronchitis with emphysema	15.6
5. Influenza	112.9	88. Haemorrhoids	15.6
6. Bronchitis, not specified	97.3	89. Refractive errors	15.2
7. Acute tonsillitis	89.9	90. Appendicitis	14.1
8. Hypertension excluding heart disease	86.7	91. Debility and undue fatigue	14.0
9. Anxiety reaction omitting somatic symptoms	75.3	92. Burns	13.4
10. Other chronic bronchitis	60.1	93. Abortion	13.4
11. Acute bronchitis	59.9	94. Other diseases of buccal cavity and oesophagus	13.4
12. Otitis media excluding mastoiditis	58.8	95. Herpes zoster	13.4
13. Other specified and general symptoms	56.0	96. Pruritis and related conditions	13.4
14. Other muscular rheumatism	55.7	97. Hay fever	13.3
15. Disorders of function of stomach	53.4	98. Hypertrophy of tonsils and adenoids	13.3
16. Disorders of menstruation	53.3	99. Otitis externa	13.1
17. Acute pharyngitis	53.3	100. Hyperplasia of prostate	13.1
18. Asthma	52.5	101. Hypertensive heart disease	12.8
19. Menopausal symptoms	51.7	102. Ulcer of stomach	12.5
20. Sprains and strains of joints and muscles	51.4	103. Pyrexia of unknown origin	12.2
21. Boil and carbuncle	50.8	104. Migraine	12.0
22. Gastro-enteritis and colitis (excluding ulcerative)	47.3	105. Whooping cough	12.0
23. Other myocardial degeneration	43.9	106. Chronic rheumatic heart disease	11.9
24. Acute upper respiratory infections	41.6	107. Dermatophytosis	11.9
25. Osteoarthritis and allied conditions	40.7	108. Lymphadenitis—unqualified	11.9
26. Vascular lesions affecting CNS	39.8	109. Chickenpox	11.9
27. Varicose veins of legs	38.3	110. Disturbance of sleep	11.9
28. Contusion and crushing with intact skin	38.2	111. Other injuries and reactions	11.7
29. Pneumonia	38.1	112. Other diseases of male genital organs	11.7
30. Fractures	36.8	113. Other forms of neuralgia and neuritis	11.5
31. Rheumatoid arthritis	36.2	114. Infectious warts	11.2
32. Heart disease involving coronary arteries	35.6	115. Sciatica	11.2
33. Gastritis and duodenitis	34.7	116. Other infective and parasitic diseases	11.0
34. Ulcer of duodenum	34.5	117. Cholecystitis without calculi	10.4
35. Laceration and open wound	34.0	118. Other diseases and conditions of eye	10.3
36. Eczema	34.0	119. Head injury (excluding skull fracture)	10.0
37. Other diseases of female genital organs	33.8	120. Other diseases of ear and mastoid process	9.9
38. Senility without mention of psychosis	33.3	121. Phlebitis and thrombophlebitis	9.9
39. Complications of pregnancy	32.0	122. Other cerebral paralysis	9.7
40. Obesity, not of endocrine origin	31.8	123. Pyelonephritis, pyelitis and pyelocystitis	9.7
41. Dermatitis	30.6	124. Headache	9.5
42. Wax in ear	29.7	125. Mumps	9.4
43. Unspecified psychoneurosis	28.6	126. Vertigo	9.2
44. 'Multiple' bronchitis	28.2	127. Other allergic disorders	9.0
45. Acute laryngitis and tracheitis	27.9	128. Hordeolum (stye)	9.0
46. Pernicious anaemia	27.8	129. Lung, bronchus and trachea (neoplasms of)	8.4
47. Other diseases of skin and cellular tissue	27.6	130. Myxoedema and cretinism	8.4
48. Diabetes mellitus	27.2	131. Psoriasis and similar disorders	8.3
49. Cellulitis of finger and toe	26.3	132. Breast—neoplasms	8.2
50. Cystitis	25.7	133. Bronchiectasis	8.1
51. Congestive heart failure	25.6	134. Other diseases of arteries	8.0
52. Injury—unspecified	25.4	135. Chronic ulcer of skin	7.9
53. Diseases of teeth and supporting structures	24.7	136. Prostate—neoplasms	7.8
54. Measles	24.3	137. Multiple sclerosis	7.6
55. Other cellulitis, abscess and acute lymphadenitis	23.8	138. Left ventricular failure	7.6
56. Conjunctivitis and ophthalmia	23.7	139. Depression	7.6
57. Angina pectoris omitting coronary disease	23.5	140. Paralysis agitans	7.4
58. Rheumatism, unspecified	23.4	141. Infectious hepatitis	7.4
59. Psychoneurosis with somatic symptoms	23.3	142. Diseases of hair and hair follicles	7.4
60. Urticaria	23.2	143. Pleurisy	7.2
61. Lumbago	23.2	144. Other urinary diseases	7.1
62. Synovitis, bursitis and tenosynovitis	23.0	145. Neurotic-depressive reaction	7.0
63. General arteriosclerosis	22.9	146. Pain in limb	6.8
64. Functional disease of heart	22.1	147. Peptic ulcer, not otherwise specified	6.8
65. Tuberculosis of respiratory system	21.4	148. Other diseases of heart	6.7
66. Hernia of abdominal cavity	21.2	149. Pain in chest	6.7
67. Iron deficiency anaemias	19.8	150. Other neoplasms	6.6
68. Arthritis, unspecified	19.8	151. Pain in back	6.6
69. Uterovaginal prolapse	19.5	152. Thyrotoxicosis with or without goitre	6.5
70. Asthenic reaction	19.2	153. Rubella	6.5
71. Chronic pharyngitis and nasopharyngitis	19.1	154. Hysterical reaction	6.5
72. Anaemia—unspecified	18.7	155. Certain diseases of early infancy	6.5
73. Impetigo	18.7	156. Stomach	6.3
74. Superficial injury	18.7	157. Other inflammatory diseases of eye	6.2
75. Displacement of intervertebral disc	18.6	158. Diarrhoea, age two years and over	6.0
76. Other diseases of digestive system	18.3	159. Congenital malformations	5.9
77. Other diseases of the bones, joints and muscles	18.3	160. Chilblains	5.9
78. Epilepsy	18.0	161. Blepharitis	5.8
79. Complications of the puerperium	18.5	162. Dysentery, all forms	5.8
80. Chronic sinusitis	17.6	163. Uterine fibromyoma	5.7
81. Constipation	17.1	164. Orchitis and epididymitis	5.5
82. Abdominal pain	16.8	165. Cholelithiasis	5.3
83. Diseases of sweat and sebaceous glands	16.1	166. Acute heart failure, undefined	5.3
		167. Diseases of breast	4.9
		168. Acute sinusitis	4.9

It is reasonable to assume that the total task is the line ABC, the sector ABD being dealt with mainly by general practitioners and the sector CBD being mainly dealt with by other practitioners. Since the practitioner's knowledge is proportional to log frequency the Zipf's Law curve becomes the knowledge curve by the replacement of logarithmic units by linear units on the ordinates. It is reasonable therefore to assume that for ranks below 130 the general practitioner's knowledge adaptation is adequate but that for ranks above 130 it falls below this level. It follows therefore that in the absence of other factors postgraduate education would be best directed towards those diseases in the region of rank 130 (*see table*).

In criticism of this interpretation of the results, it should be pointed out that many of the items in the first 130 of the list are not by any means the exclusive province of general practice; this explanation must therefore be regarded as merely a tentative hypothesis.

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#### RATES FOR COLLEGE ACCOMMODATION

Rates for college accommodation, including breakfast, will be charged as follows from 1 January, 1972:

Single room .. .. .	£3 per night
Double room .. .. .	£5 per night
Flatlet (Bed-sitting room for two, bathroom and dressing room) .. .. .	£7 per night, or £40 per week
Self-contained flat (Double bedroom, sitting room, half kitchen and bathroom) .. .. .	£8 per night, or £45 per week

Members are reminded that children under the age of 12 years cannot be admitted, and dogs are not allowed.

Members and associates may, subject to approval, hire the reception rooms for meetings and social functions. The charges for these are:

Long room (will seat 100) .. .. .	£30 for each occasion
Damask room (will seat 50) .. .. .	£20 for each occasion
Common room and terrace .. .. .	£20 for each occasion
Dining room and kitchen .. .. .	£10 for each occasion

A service charge of ten per cent is added to all accounts to cover gratuities to domestic staff.

For the convenience of members, four car-ports, outside 14 Princes Gate, have been rented by the College and may be hired at 50p per 24 hours.

Enquiries should be addressed to **The Royal College of General Practitioners, 14 Princes Gate, Hyde Park, London, SW7 IPU.** (Tel: 01-584-6262). Whenever possible bookings should be made well in advance.