



NLM

GRU 2014

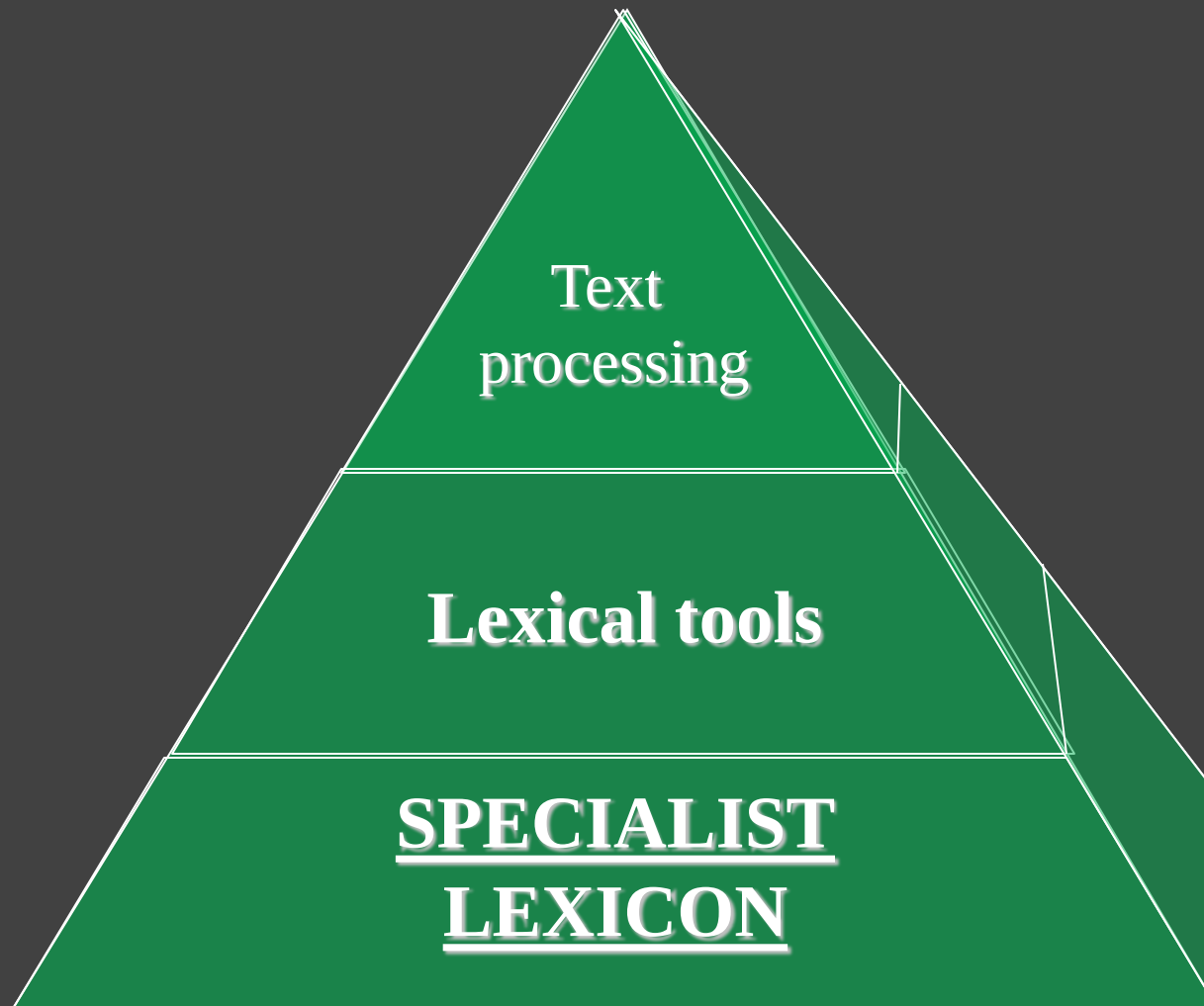
July 21, 2014



Allen Browne
Chris Lu

The SPECIALIST Lexicon and Lexical Tools

July 21, 2014

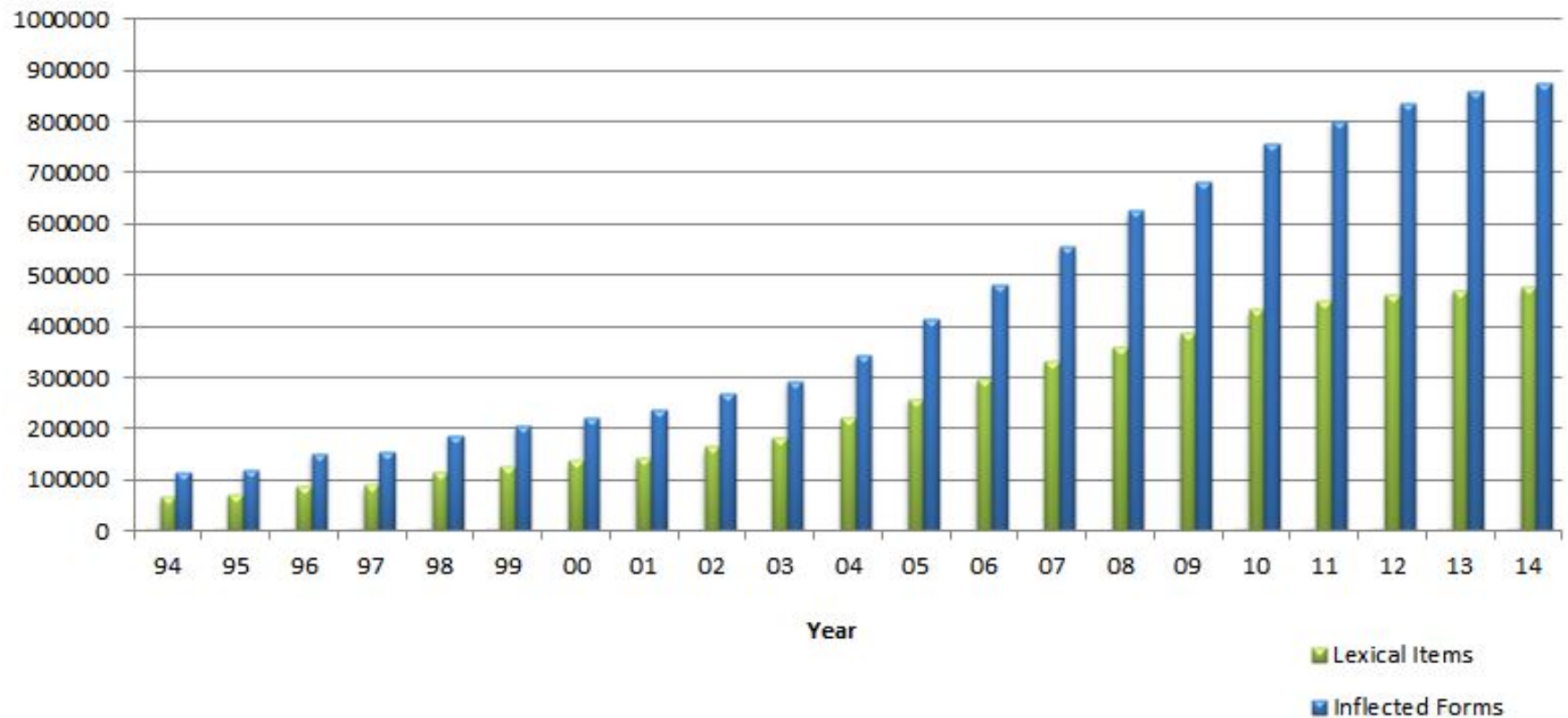


The SPECIALIST lexicon

- A syntactic lexicon
- Biomedical and general English
- Over 476,000 records

Lexicon Growth

SPECIALIST LEXICON Growth

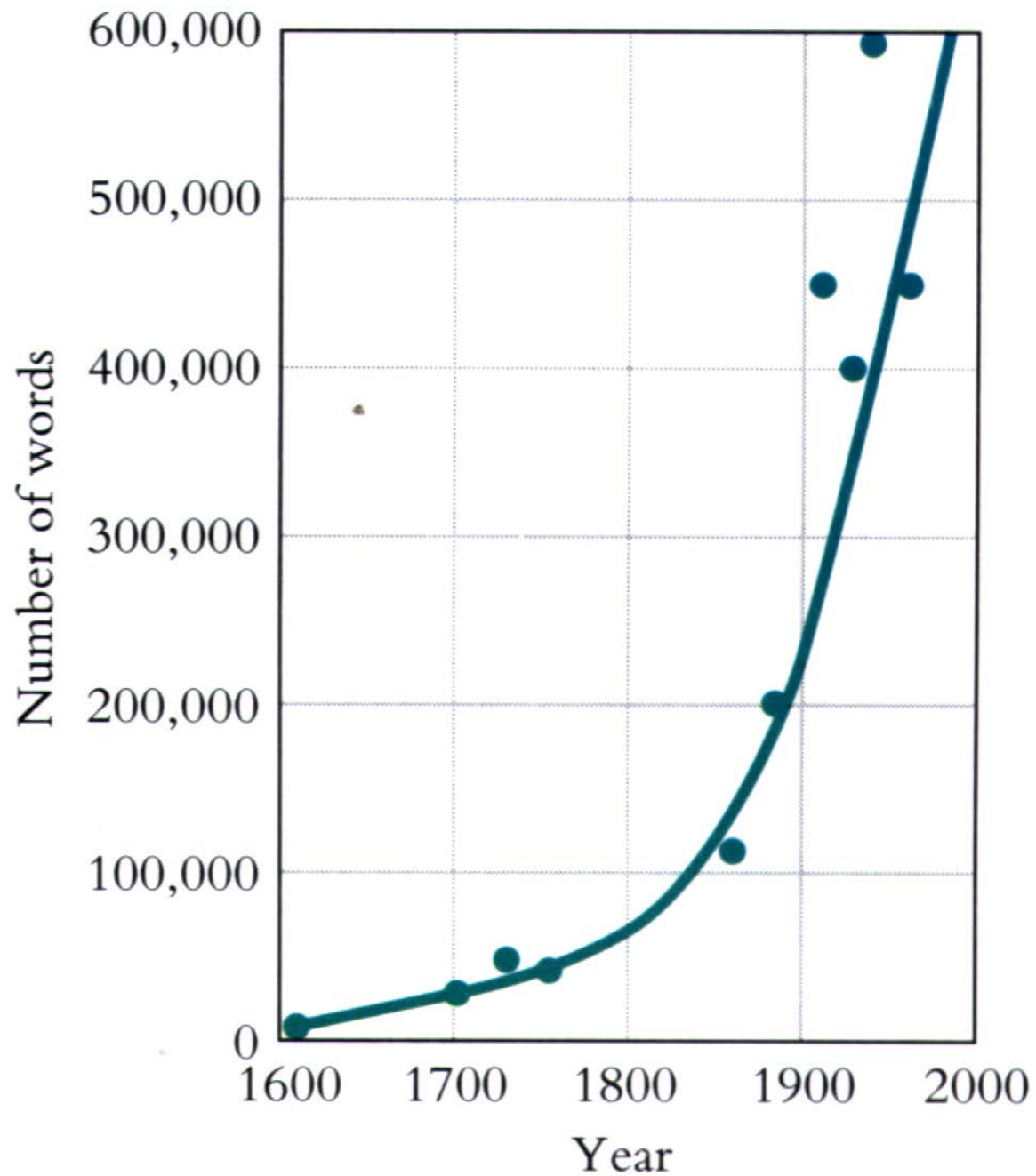


village
square the circle
square
square
fair and square root

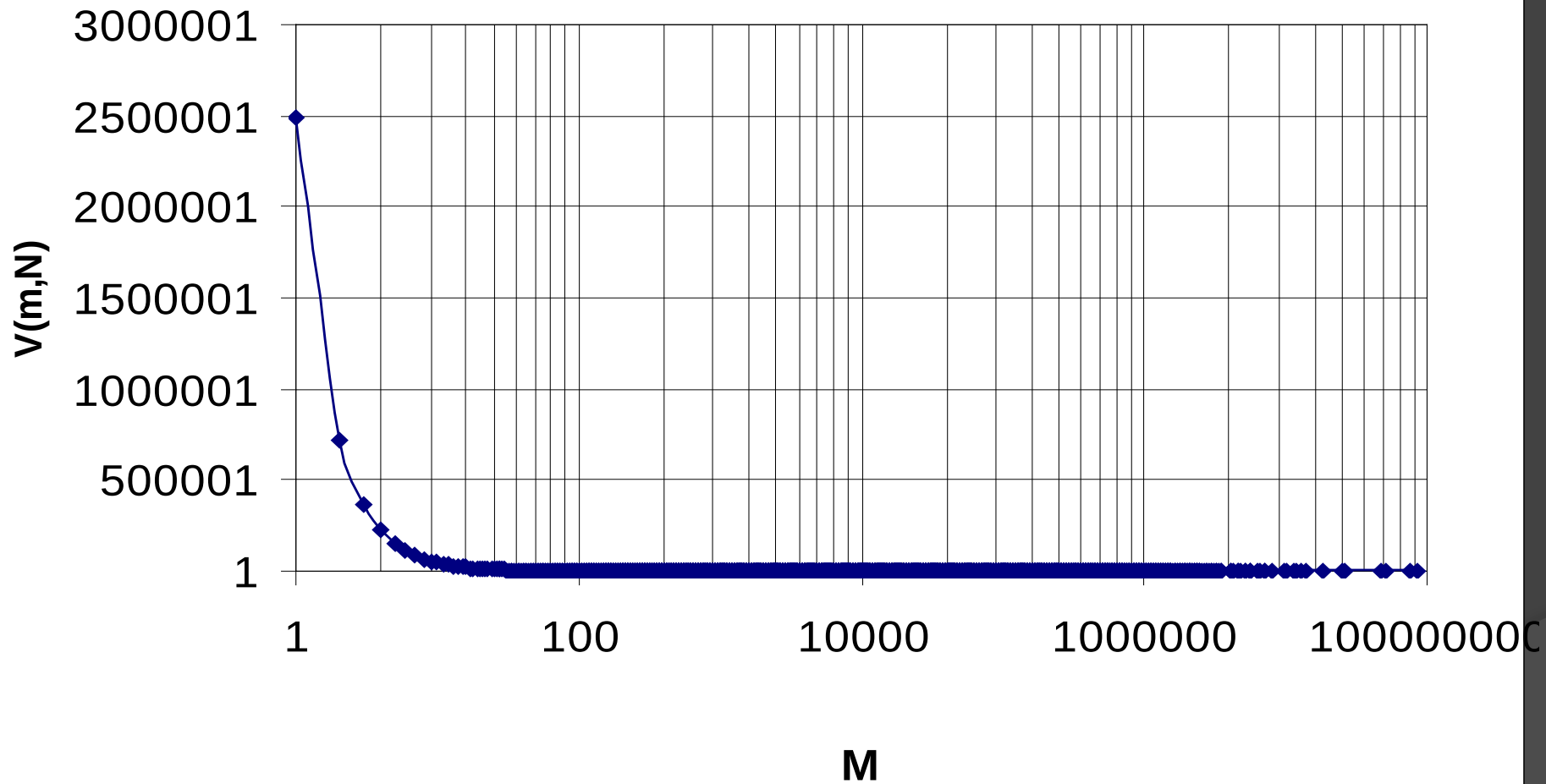
George A.
Miller

The Science
of Words

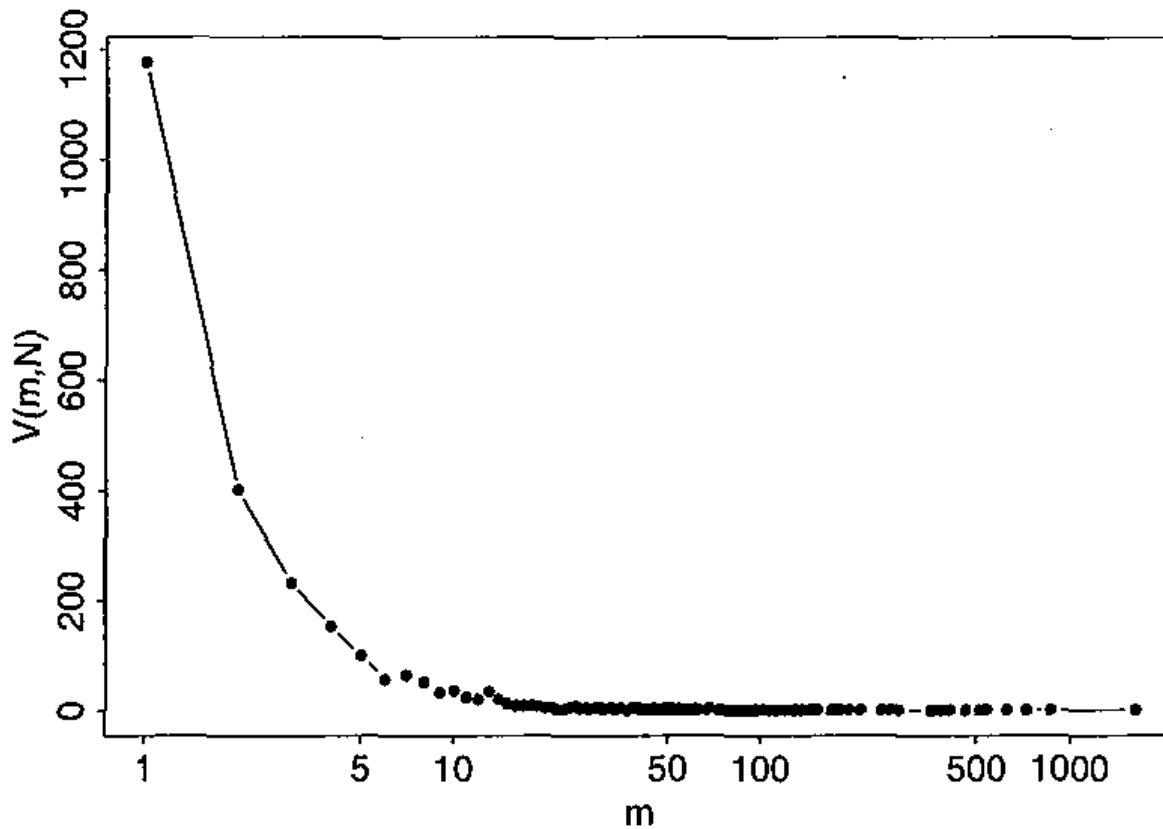
1991



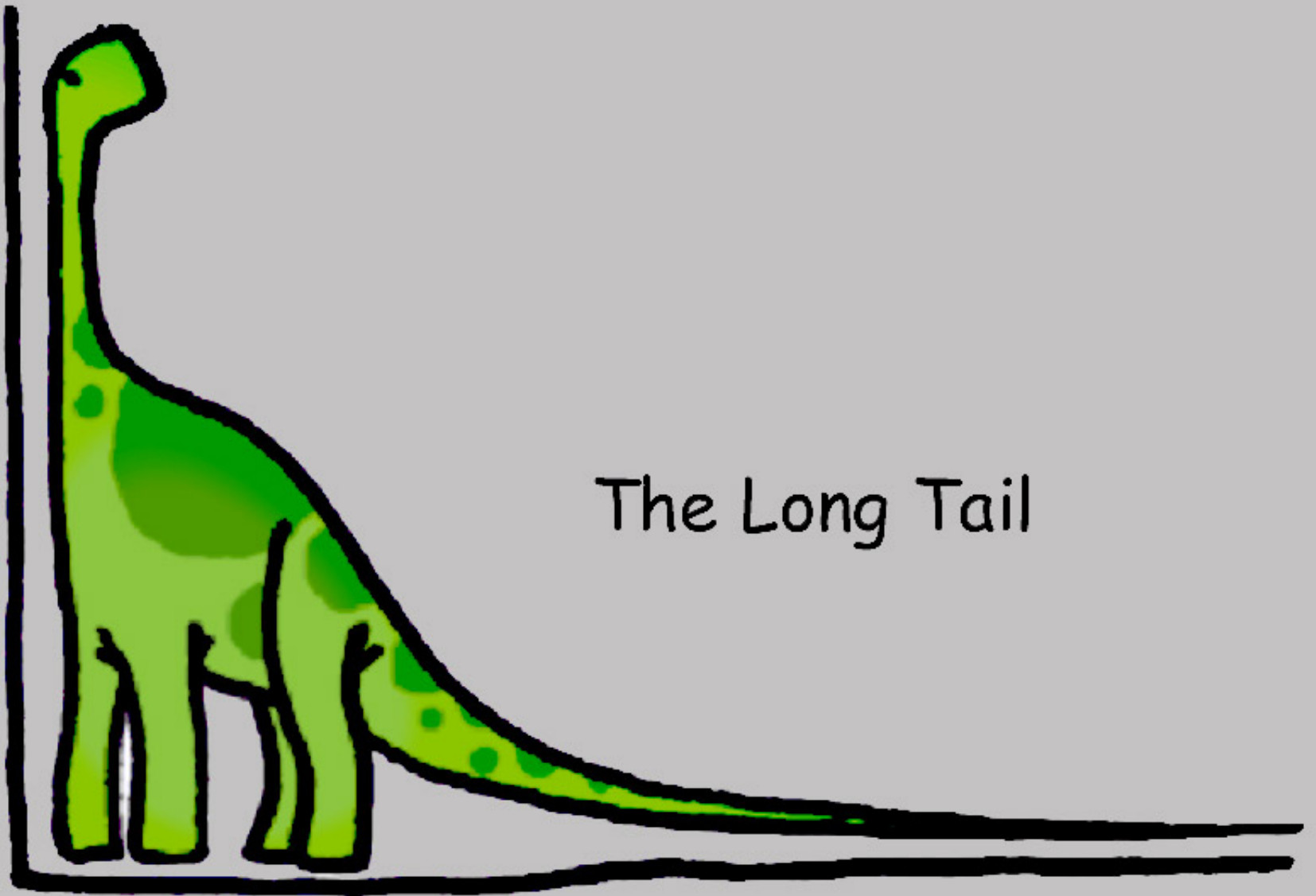
Frequency Spectrum of Medline 2006



Frequency Spectrum: Alice in Wonderland



Number of Words ->



Word Frequency ->

The SPECIALIST LEXICON

- ⦿ Morphology
 - Inflection
 - Derivation
- ⦿ Orthography
 - Spelling variants
- ⦿ Syntax
 - Complementation for verbs, nouns, and adjectives

Morphology

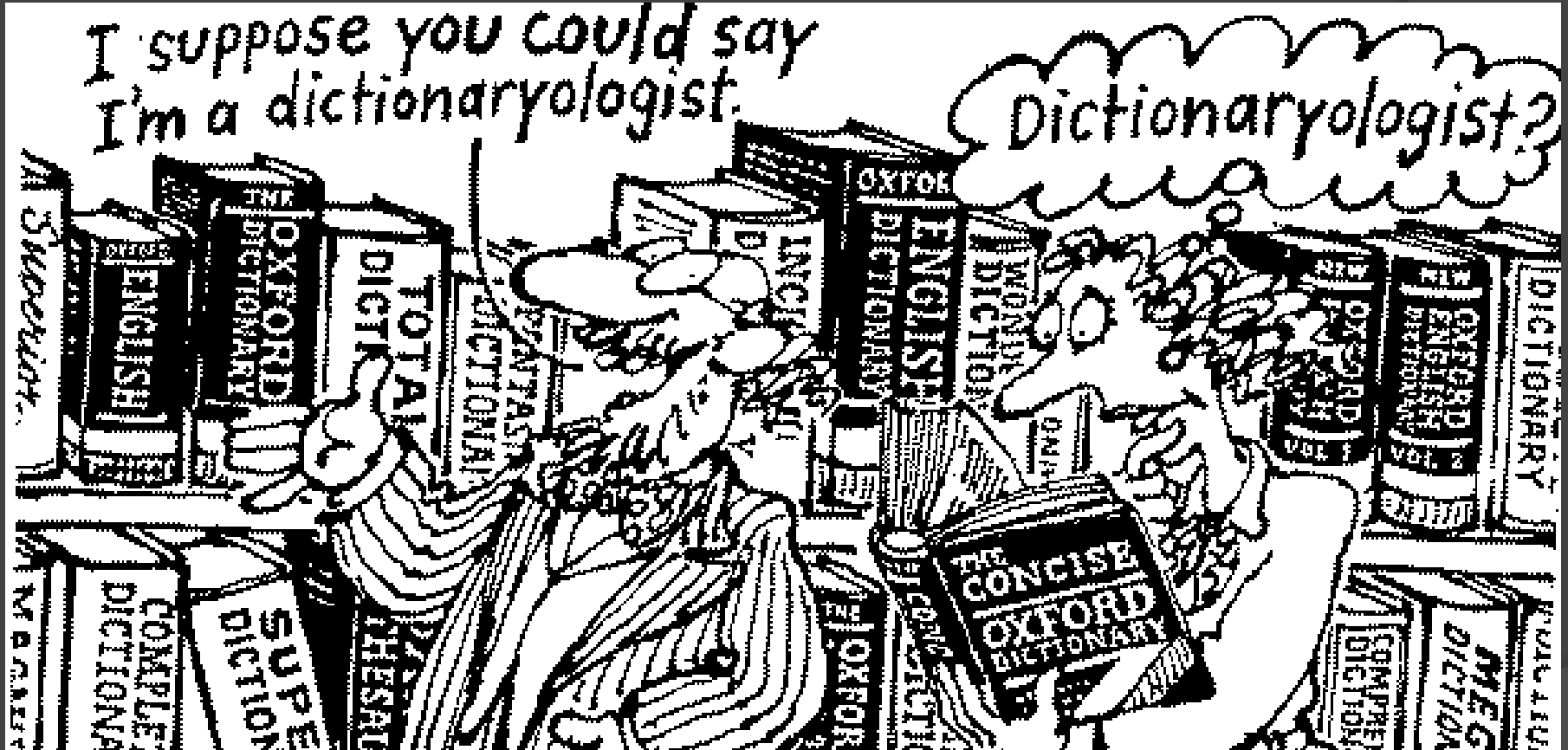
⦿ Inflectional

- nucleus, nuclei
- cauterize, cauterizes, cauterized, cauterizing
- red, redder reddest

⦿ Derivational

- laryngeal -- larynx
- transport -- transportation

Derivational Morphology



Dictionary+ology+ist

Derivational Morphology



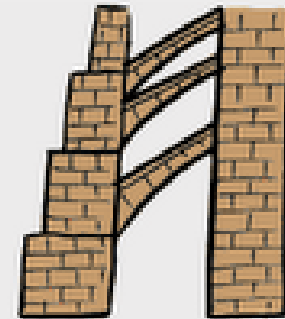
WAITER



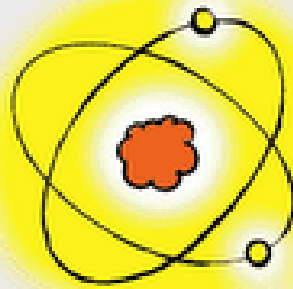
WAITRESS



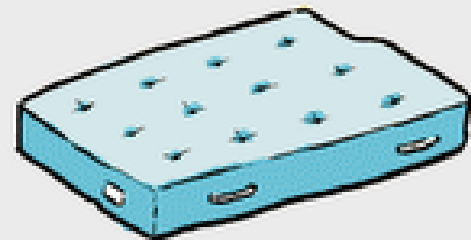
BUTTER



BUTTRESS



MATTER



MATTRESS

© 2006 Stivess

Orthography

Spelling Variation

- ⦿ align -- aline
- ⦿ Grave's disease -- Graves's disease -- Graves' disease
- ⦿ anesthetize -- anesthetise
- ⦿ Esophagus -- oesophagus
- ⦿ foetus – fetus
- ⦿ centre -- center

Orthography

HAGAR THE HORRIBLE CHRIS BROWNE



Syntax -- Verb Complements

- ① intran

- I'll treat.

- ② tran=np

- He treated the patient.

- ③ ditran=np,pphr(with,np)

- She treated the patient with the drug.

Syntax -- Verb Complements

```
{base=treat
entry=E0061964
    cat=verb
    variants=reg
    intran
    tran=np
    tran=pphr(with,np)
    tran=pphr(of,np)
    ditran=np,pphr(to,np)
    ditran=np,pphr(with,np)
    ditran=np,pphr(for,np)
    cplxtran=np,advbl
    nominalization=treatment|noun|E0061968
}
```

Syntax -- Verb Particle Constructions

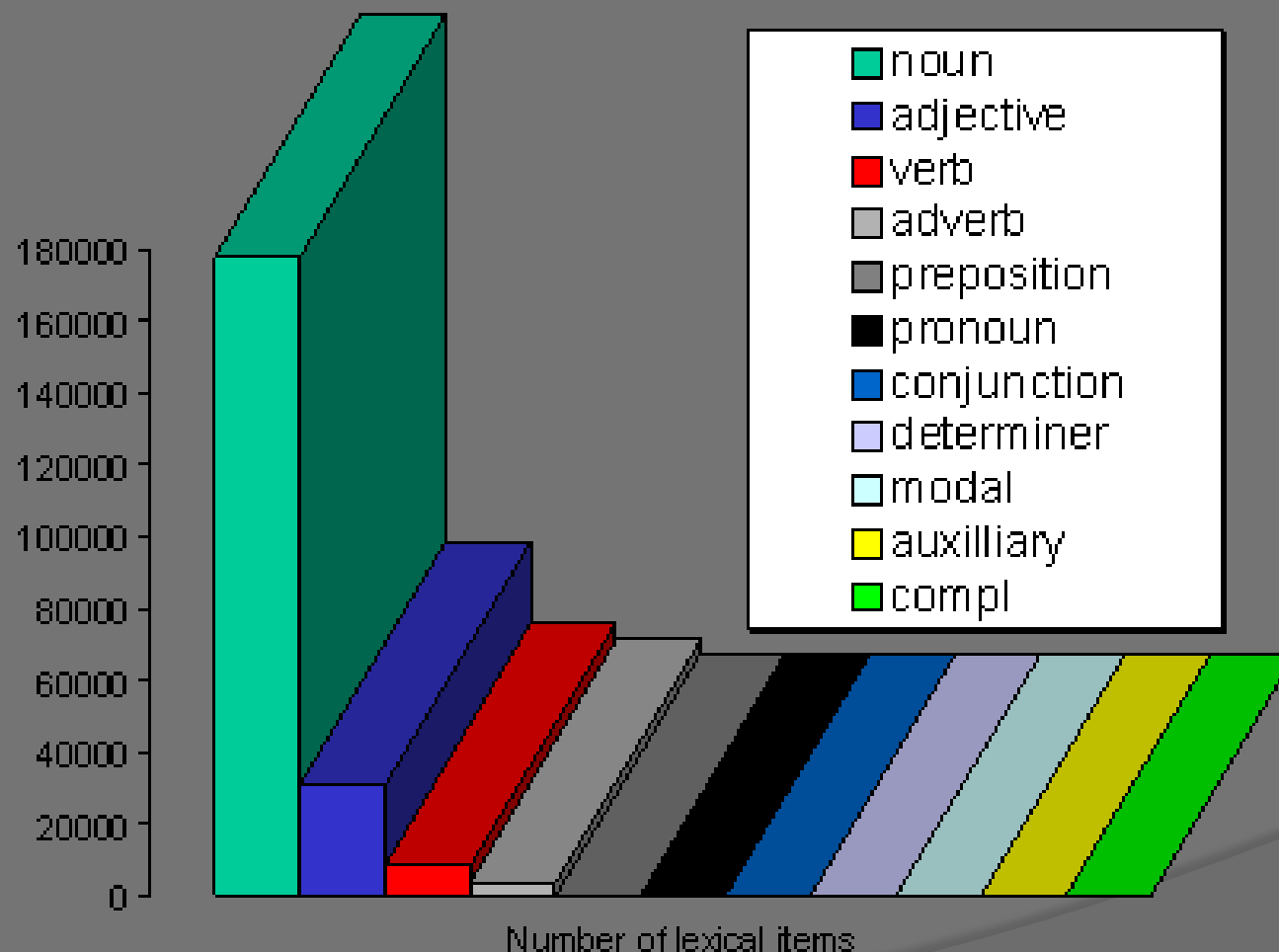


© King Features Syndicate.

clean up
scrub down
look up

```
{base=clean  
  entry=E0017272  
  cat=verb  
  variants=reg  
  intran  
  intran;part(up)  
  tran=np  
  tran=np;part(up)  
  nominalization=clean|noun|E0017273  
  nominalization=cleanup|noun|E0319808}
```

Categories – Parts of Speech



Lexicon Unit Records

{**base**=Kaposi's sarcoma
spelling_variant=Kaposi sarcoma
entry=E0003576

cat=noun
variants=uncount
variants=reg
variants=glreg

}

{**base**=chronic
entry=E0016869

cat=adj
variants=inv
position=attrib(1)
position=pred
stative

}

{**base**=aspirate
entry=E0010803

cat=verb
variants=reg
tran=np
nominalization=aspiration|noun|E0010804

}

{**base**=in
entry=E0033870

cat=prep

}

Orthographic vs. Lexicographic Word:

Why, for instance, if a two-word boy scout feels chilly on his one-word campground, does he pull up a two-word camp chair in front of his one-word campfire? Anyone who seeks a strictly logical answer to such questions is chasing will-o'-the-wisps (chargeable in telegrams as a single word, because of the hyphens) in a semantic bog.

Louis Salomon, Semantics and Common Sense, Holt Rinehart and Winston, 1966.

UTF-8

```
{base=resume  
spelling_variant=résumé  
spelling_variant=resumé  
entry=E0053099  
      cat=noun  
      variants=reg  
}
```

```
{base=role  
spelling_variant=rôle  
entry=E0053757  
      cat=noun  
      variants=reg  
}
```

```
{base=deja vu  
spelling_variant=deja-vu  
spelling_variant=déjà vu  
entry=E0021340  
      cat=noun  
      variants=uncount  
}
```

```
{base=cafe  
spelling_variant=café  
entry=E0420690  
      cat=noun  
      variants=reg  
}
```

Noun Variants

```
{base=Kaposi's sarcoma  
spelling_variant=Kaposi sarcoma  
entry=E0003576  
  cat=noun  
  variants=uncount  
  variants=reg  
  variants=glreg  
}
```

- ⦿ Kaposi's sarcoma
- ⦿ Kaposi's sarcomas
- ⦿ Kaposi's sarcomata
- ⦿ Kaposi sarcoma
- ⦿ Kaposi sarcomas
- ⦿ Kaposi sarcomata

Regular Nouns

The plural suffix is s.

y becomes *ie* following a consonant before *s*.

e is inserted before *s* if the base ends in *s*, *z*, *x*, *ch*, or *s*

Leach – Leaches

Stomach – Stomachs ← irregular

Greco-latin Regular nouns

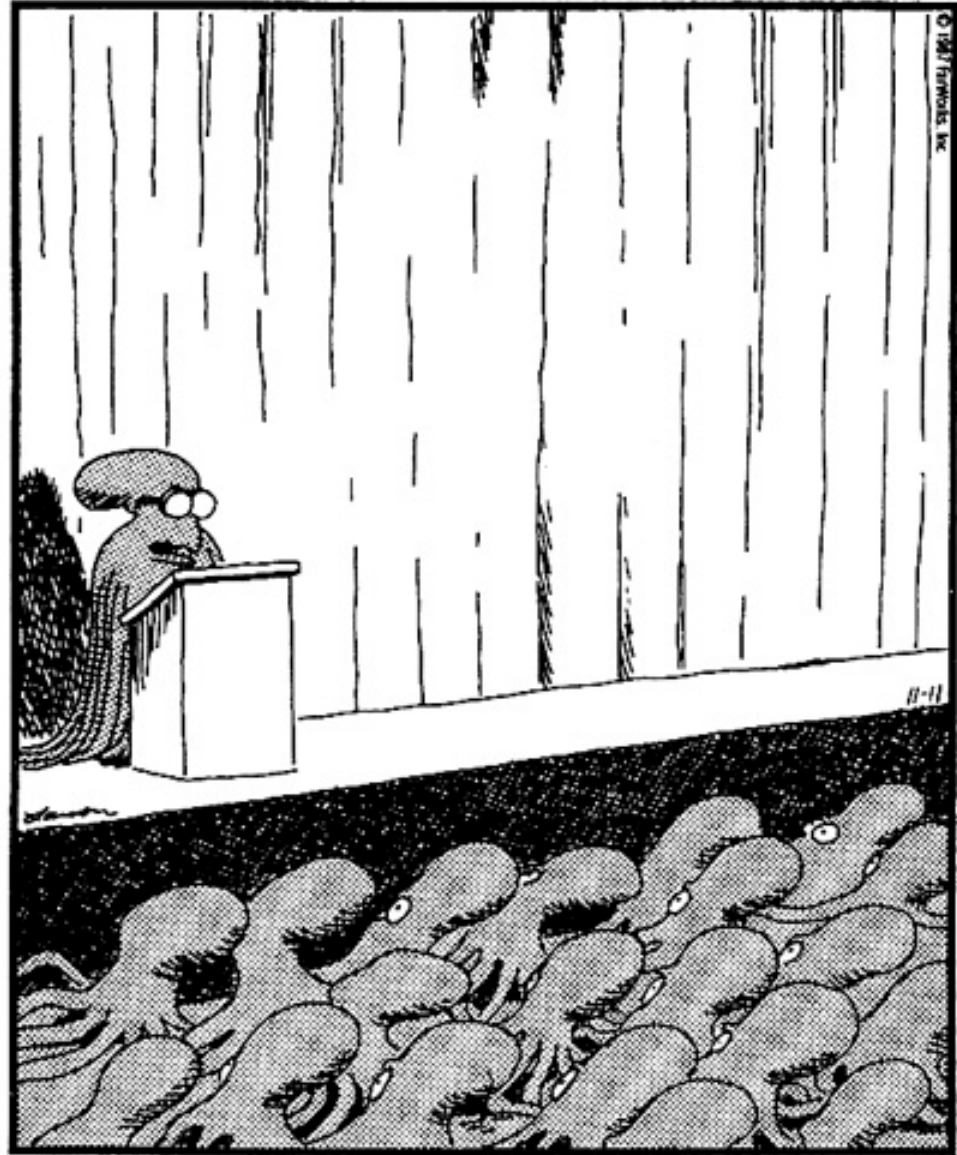
singular ends with:	plural ends with:	Examples
-us	-i	focus/foci
-ma	-mata	trauma/traumata
-a	-ae	larva/larvae
-um	-a	ilium/ilia
-on	-a	taxon/taxa
-sis	-ses	analysis/analyses
-is	-ides	cystis/cystides
-men	-mina	foramen/foramina
-ex	-ices	index/indices
-x	-ces	matrix/matrices

Octopuses

```
{base=octopus  
entry=E0204527  
  cat=noun  
  variants=reg  
  variants=greg  
}
```

THE FAR SIDE

By GARY LARSON



"Fellow octopi, or octopuses ... octopi? ... Dang,
it's hard to start a speech with this crowd."

All rights reserved.

THE FAR SIDE © 1987 FARWORKS, INC.

Uncount Nouns

(abstract or mass)

```
{base=smallpox  
entry=E0056359  
  cat=noun  
  variants=uncount  
}
```

```
{base=potassium  
entry=E0049387  
  cat=noun  
  variants=uncount  
}
```

- ⦿ * a smallpox
- ⦿ * two smallpoxes
- ⦿ much smallpox
- ⦿ * a potassium
- ⦿ * two potassiums
- ⦿ much potassium

* This form does not occur

Countability

● Mail

* A mail

much mail

* many mails

● E-Mail

An e-mail

much e-mail

many e-mails

* This form does not occur

Uncount Nouns

Singulars



Spaghetti



Broccolo



Jacuzzi

Farley
4/1/2

Fixed Plural Nouns

```
{base=police  
entry=E0048616  
  cat=noun  
  variants=plur  
}
```

```
{base=scissors  
entry=E0054633  
  cat=noun  
  variants=plur  
}
```

Irregular Nouns

```
{base=corpus  
entry=E0019113  
  cat=noun  
  variants=irreg|corpora|  
  variants=reg  
}
```

```
{base=larynx  
entry=E0036919  
  cat=noun  
  variants=irreg|larynges|  
  variants=reg  
}
```

Regular Verbs

- ⦿ The third person present tense suffix is *s*.
 - *y* becomes *ie* following a consonant before *s*.
 - *e* is inserted between *z*, *x*, *ch*, or *sh* and *s*.
- ⦿ The past tense suffix is *ed*.
 - *y* becomes *ie* following a consonant before *ed*.
 - Final *e* is deleted before *ed*.
- The past participle is the same as the past tense.
- The present participle suffix is *ing*.
 - *y* becomes *ie* following a consonant before *ing*.
 - Final *e* is deleted before *ing*
unless preceded by *e*, *y* or *o*.

Regular Verbs

- ⦿ dismiss: dismisses, dismissed, dismissing
- ⦿ agree: agrees; agreed; agreeing
- ⦿ dry: dries, dried, drying

Regular Doubling Verbs

- ⦿ End in a CVC pattern
- ⦿ Double the final consonant before *ed* and *ing*.
- ⦿ Are otherwise regular
- ⦿ variants=regd

control: controls, controlled, controlling

Irregular Verbs



Bite: bite, bites, bit, bitten

Irregular Verbs

{base=bite

entry=E0013219

cat=verb

variants=irreg|bite|bites|bit|bitten|biting|

intran

tran=np

cplxtran=np,advbl

}

Ancillary Data Bases

- ◎ Synonymy
 - sm.db
- ◎ Derivation
 - dm.db, dm.rules
- ◎ Inflection
 - im.rules
- ◎ Neoclassical compounds
 - nc.db



Derivational Facts and Rules

dm.facts

treatment|noun|treat|verb

prohibition|noun|prohibitive|adj

cell lineage|noun|cell line|noun

photochemotherapeutic|adj|photochemotherapy|noun

pharmacotherapeutic|adj|pharmacotherapy|noun

Derivational Facts and Rules

dm.rules

**# e.g. alienation|alienate
ation\$|noun|ate|verb
ration|rate; station|state;**

Inflectional Facts and Rules

im.rules

Noun rules (gldreg)

us\$|noun|singular|i\$|noun|plural

antus|anti;

ma\$|noun|singular|mata\$|noun|plural

a\$|noun|singular|ae\$|noun|plural

um\$|noun|singular|a\$|noun|plural

on\$|noun|singular|a\$|noun|plural

sis\$|noun|singular|ses\$|noun|plural

is\$|noun|singular|ides\$|noun|plural

men\$|noun|singular|mina\$|noun|plural

ex\$|noun|singular|ices\$|noun|plural

x\$|noun|singular|ces\$|noun|plural

Neoclassical compounds

nc.db

abdomin(o)|abdomen|root

ab|away from|prefix

acanth(o)|prickle|root

acar(o)|mite|root

acetabul(o)|acetabulum|root

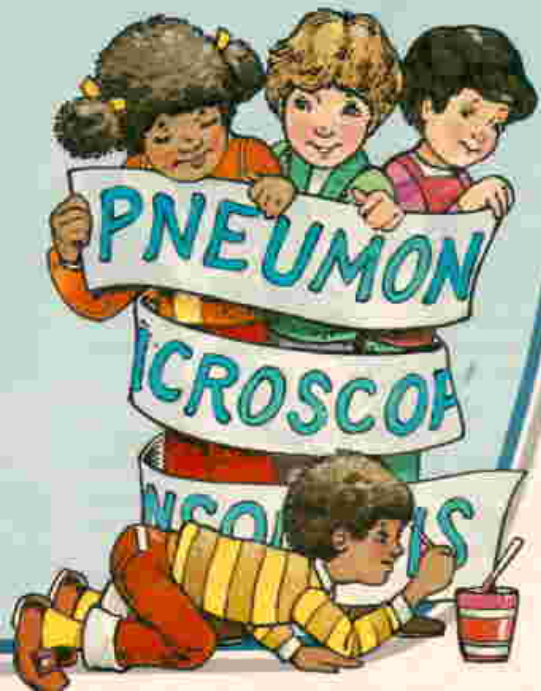
ad|towards|prefix

agogue|inducing|terminal

albumin(o)|albumin|root

sis|condition|terminal

stomy|surgical opening|terminal



PNEUMONULTRAMICROSCOPICS ILICOVOLCANOCONIOSIS

pneu.mo.no.ul.tra.mi.cro.scop.ic.sil.i.co.vol.ca.no.co.ni.o.sis
 \n(y)u:-m*(-.)no--.*l-tr*-mi--kr*-'ska:p-ik-'sil-i-(.)ko--(.)v\
 n [NL, fr. Gk pneumo-n + ISV ultramicroscopic + NL
 silicon +]a:l-'ka--no--.ko--ne--'o--s*s ISV volcano + Gk
 konis dust : **a pneumoconiosis caused by the inhalation of
 very fine silicate or quartz dust**

-- Merriam Webster's 3rd International Dictionary, page 1747.

The Protein of a tobacco mosaic virus, Dahlemense strain

acetylseryltyrosylserylisoleucylthreonylserylprolylserylglutami
nylphenylalanylvalylphenylalanylleucylserylserylvalyltryptoph
ylalanylasparylprolylsoleucylglutamylleucylleucylasparaginy
lvalylcysteinythreonylserylserylleucylglycylasparaginyglutami
nylphenylalanylglutaminythreonylglutaminyglutaminyalanyla
rginythreonythreonylglutaminyvalylglutaminyglutaminyphe
nylalanylserylglutaminyvalyltryptophyllsylprolylphenylalanyl
prolylglutaminyserylthreonylvalylarginylphenylalanylprolylgly
cylaspartylvalyltyrosylsystylvalyltyrosylarginyltyrosylasparaginy
lalanylvalylleucylaspartylprolylleucylisoleucylthreonylalanylleu
cylleucylglycylthryonylphenylalanylasparylthreonylarginylasp
araginylarginylisoleucylisoleucylglutamylvalylglutamylasparag
inylglutaminyglutaminyserylprolylthreonylthreonylalanylgluta
mylthreonylleucylaspartylalanylthreonylarginylarginylvalylasp
artylaspartylalanylthreonylvalylalanylisoleucylarginylserylalan
ylasparaginylisoleucylasparaginylleucylvalylasparaginyglutam
ylleucylvalylarginylglycylthreonyllycylleucyltyrosylasparaginy
lglutaminyasparaginythreonylphenylalanylglutamylserylmeth
ionylserylglycylleucylvalyltryptophylthreonylserylalanylprolylal
anylserine

Synonyms

sm.db

alar|adj|wing|noun

amygdaline|adj|tonsil|noun

articular|adj|joint|noun

bulbar|adj|medulla oblongata|noun

fununcular|adj|boil|noun

genicular|adj|knee|noun

hepatocellular|adj|liver cells|noun

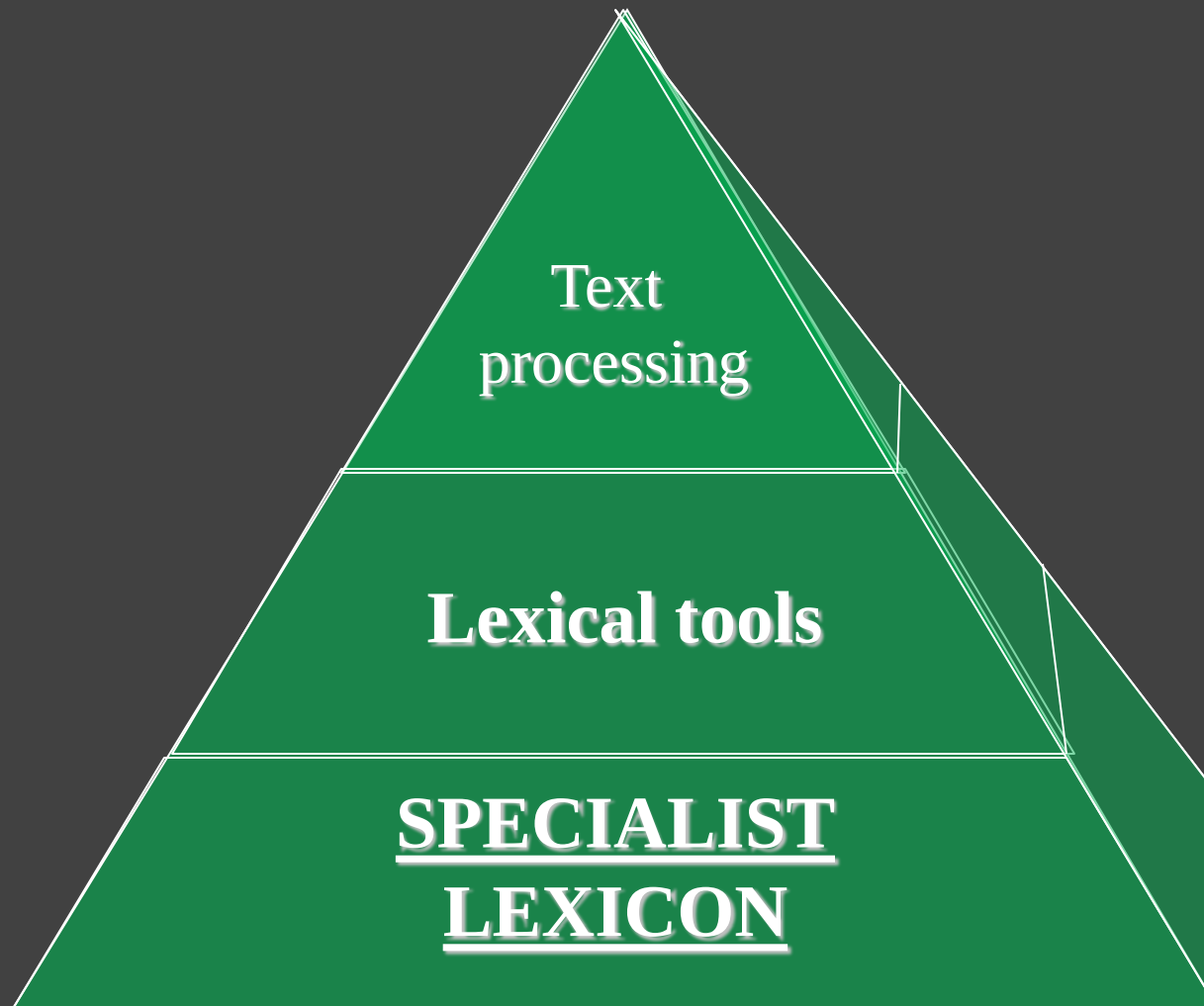
lazar|adj|leprosy|noun

lenticular|adj|crystalline lens|noun

ypsiliiform|adj|upsiloid|adj

wolfram|noun|tungsten|noun

double vision|noun|diplopia|noun



Lexical Tools

- ◎ Wordind -- breaks strings into words
 - Produces the Metathesaurus word indexes (MRXW)
- ◎ LVG -- performs various lexical transformations
- ◎ NORM -- a selection of LVG transformations,
 - Used for Metathesaurus indexing
 - Produces the Metathesaurus Normalized word and string indexes (MRXNW & MRXNS)
 - Used to access those indexes

Normalization

- Hodgkin Disease
- HODGKINS DISEASE
- Hodgkin's Disease
- Disease, Hodgkin's
- HODGKIN'S DISEASE
- Hodgkin's disease
- Hodgkins Disease
- Hodgkin's disease NOS
- Hodgkin's disease, NOS
- Disease, Hodgkins
- Diseases, Hodgkins
- Hodgkins Diseases
- Hodgkins disease
- hodgkin's disease
- Disease;Hodgkins
- Disease, Hodgkin
- disease hodgkin

The Lexical Systems Group

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- ⦿ Chris Lu: lu@nlm.nih.gov