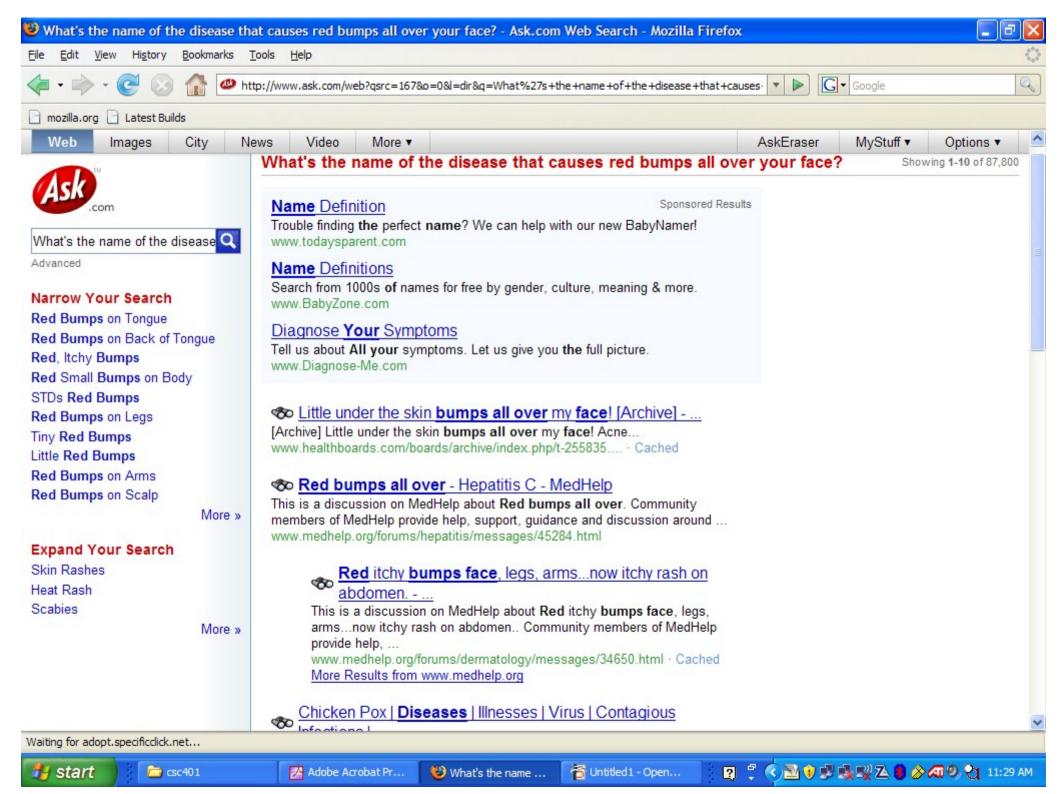
Information Retrieval Systems

These include:

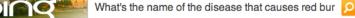
- Web search engines, e.g. Google
- Question-answering systems, e.g. Ask.com
- Pseudo-NL document retrieval, e.g. Canadian World Encyclopedia, MS Office Assistant
- Legal/Medical professional research services, e.g. Lexis-Nexis
- TREC (Text REtrieval Conference) systems, more recently DUC (Document Understanding Conference) has been good showcase of these



Ask Jeeves—example (1)

You	asked disease that causes red bumps all over	your face
liha	ve found answers to the following questions:	your face
	What disease or condition could be indicated by the sympton	
	swelling or lump	•
	Where can I find the box score & recap	for the
	Major League Team the Cincinnati Reds 2	
(SA)	Where can I find the official Web site of the	• •
	Cincinnati Reds = ?	
653	Where can I find information about diseases and conditions?	•
458	Where can I see an image of the human	
	facial nerves	·
458	Where can I buy Cincinnati Reds merchandise?	•
	Where can I buy tickets to an upcoming	
	Cincinnati Reds 🗀 home game?	

What's the disease that causes red bumps all over your face?



Show all ○ Only from Canada

ALL RESULTS ALL RESULTS

L RESULTS 1-10 of 446,000 results · Advanced

SEARCH HISTORY

Now you can go back further with search history. Learn More.

What's the name of the disease that...

See all

Clear all | Turn off

Red, Itchy Bumps In Various Areas of Body - Dermatology ...

Over the past 2 months these red bumps have appeared in clumps on almost every ... What's the best HIV Test? Mar 04 by Jose Gonzalez ... Only your physician can provide specific ...

www.medhelp.org/posts/Dermatology/Red-Itchy-Bumps-In-Various-Areas-of-Body/show/244042 · Cached page

Bumps Upper Lip - Wellsphere

... disease can this have caused it Re:can gum disease cause white bumps ... cracks in the corners of my mouth and also red bumps ... Care - brown pigment and loss of pimeant of face I all ...

stanford.wellsphere.com/wellmix360/bumps-upper-lip · Cached page

Sore red pimple like bumps on vagina - Dermatology ...

ALWAYS check with **your** personal ... i noticed **red bumps** after shaving one day and it didnt really bother me **cause** i get that sumtimes ... and **all** that; i've had **red bumps all over** the

www.medhelp.org/posts/Dermatology/Sore-**red**-pimple-like-**bumps**-on-vagina/ show/6855 · Cached page

How to Get Rid of Razor Bumps - howtogetridofstuff.com

Be Gentle on **Your Face**. The reaction to razor **bumps** that many men ... Il scrape yourself or shave **your** hair unevenly **causing** those **red** razor **bumps**. ... for razor burn, > just rub **all over** ...

www.howtogetridofstuff.com/health/how-to-get-rid-of-razor-bumps · Cached page

Chicken Pox | Diseases | Illnesses | Virus | Contagious ...

Chicken pox is a human disease, so how did it get its name? Well, the disease causes the skin to break out in red bumps ... sucks because pimple-like bumps grow all over your face ...

www.kidzworld.com/article/4854-chicken-pox-101 · Cached page

Under Skin Bumps | LIVESTRONG.COM

Razor bumps can cause a red rash and make your skill feel chafed.d up with a face full of red, irritated bumps instead of a close ... What's Your Goal for the Weekend?? Alright ...

www.livestrong.com/under-skin-bumps · Cached page

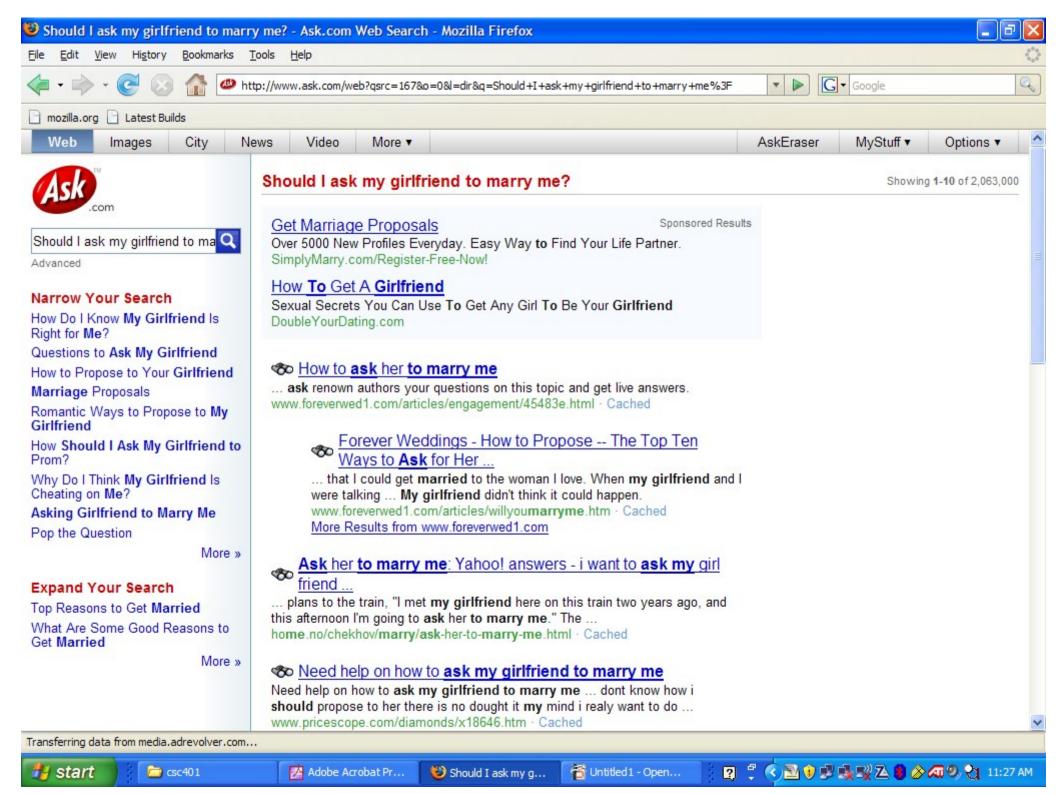
Vaginal Bumps and Lumps

i have had a small under the skin **red bump** ... Okay, mine are **all** scabbed **cause** i scratched these **bumps**. ... it is and it is better to know **what's** going on with **your** ... womenshealth.about.com/b/2006/04/06/vaginal-bumps-and-lumps.htm · Cached page

Neck pain - Wrong Diagnosis.com

Face/Neck/Chest pain for over 3 yrs after ... Itchy red bumps all over body ... related to your Neck pain Take Survey View Results. Causes of Neck pain listed in Disease Database:

www.wrongdiagnosis.com/sym/neck_pain.htm · Cached page



Now you can go back further with search history. Learn More.

Should I ask my girlfriend to marry...

What's the name of the disease that ...

See all

Clear all | Turn off

place....MORE...

www.chacha.com/guestion/how-do-should-i-ask-my-girlfriend-to-marry-me

Should I ask my girlfriend to marry me? - Yahoo ...

Should I ask my girlfriend to marry me? ... Should I ask her to marry me? When would be the appropriate time to do so?

answers.vahoo.com/question/index?gid=20100310081546AAn1UXi · Cached page

How Do I Ask My Girlfriend to Marry Me?

How Do I Ask My Girlfriend to Marry Me ? So you have a lasting relationship and it's time to "pop the question" and ask your girlfriend to marry you - but how do you go ... www.selfhelparticles.net/ask-girlfriend-to-marry-me · Cached page

Asking my girlfriend to marry me? - Yahoo! Answers

Asking my girlfriend to marry me? ... the sweets in your pocket, and ask the waiter to put the "marry me ... more amazing and memorable me thinks. Maybe you should

answers.yahoo.com/question/index?qid=20080621164718AA50hJV · Cached page

a romantic way to ask my girlfriend to marry me ...

Relationship question: a romantic way to ask my girlfriend to marry me? Hi, There are many ways to ... to make the experience memorial and keep in mind where ever you ask her should ...

www.justanswer.com/questions/cl2o-a-romantic-way-to-ask-my-girlfriend-to-marryme · Cached page

girlfriend - Need a girlfriend?, Should I move in with ...

Where should I ask my girlfriend to marry me? Popular Hunches hunch.com/browse-topics/search/?query=girlfriend · Cached page

WikiAnswers - How do you get your girlfriend to marry ...

Will your girlfriend marry you? How do you get my girlfriend to marry me? How do you get married to your girlfriend? Should ... want to marry your girlfriend? When should you ask ...

wiki.answers.com/Q/How_do_you_get_your_girlfriend_to_marry_you · Cached page

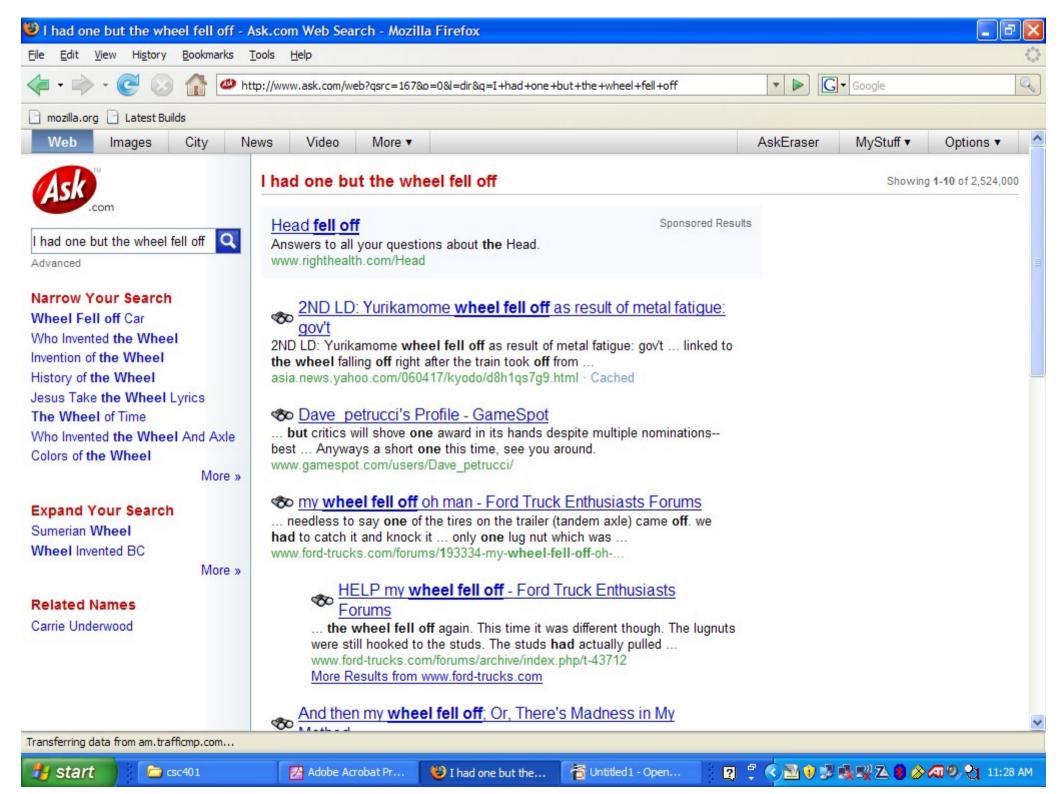
Yahoo! Canada Answers - Should i marry my pregnant EX ...

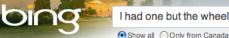
Ask. What would you ... My EX Girlfriend Texted me today telling ... she is having my baby. I'm not sure i love her and she loves me but i don't know if I'm ready for marriage. Should i marry ...

ca.answers.yahoo.com/question/index?qid=20100217155709AAw9upa · Cached page

How do i propose to my girlfriend? - Answers.Ask.com

... http://www.100questionsbeforemarriage.com/blog/how-do-i-ask-my-girlfriend-tomarry-me/ ... I want to propose to my girlfriend..Where should I do it? inswers ask com/Eashion and Beauty/Jewelry/how do i propose to my





I had one but the wheel fell off



ALL RESULTS **ALL RESULTS**

1-10 of 16,600,000 results · Advanced

SEARCH HISTORY

Now you can go back further with search history. Learn More.

I had one but the wheel fell off

Should I ask my girlfriend to marry...

What's the name of the disease that...

See all

Clear all | Turn off

The Wheelbarrow song - Wikipedia, the free encyclopedia

I had a wheelbarrow, the wheel fell off I had a ... pitch near the corner flag, the wheel fell off and he spoke to both County fans and a terrace chant was born, sang from

en.wikipedia.org/wiki/The Wheelbarrow song Cached page

London Slang - I

I had one but the wheels fell off - a bizarre sarcastic reply that you give when you don't understand what the other person is saying (usually technical). e.g. www.londonslang.com/db/i · Cached page

Trailer Wheel Almost Fell Off - Close Call [Archive ...

[Archive] Trailer Wheel Almost Fell Off - Close Call Trailers ... One lug bolt was sheered off. Another was nearly gone. Another had a missing lug nut. www.mastercraft.com/teamtalk/archive/index.php/t-5109.html · Cached page

New land rover in the family.. [Archive] - Land Rover ...

My dad just bought a "new" 1967 88 with a soft top. Just about wrecked it on the way home when he got off the freeway and his left rear wheel almost fell off. had one stud

forum.landrovernet.com/archive/index.php/t-74377.html · Cached page

The Wheel Fell Off « Mellotone 70 Up Blog

For reasons I've never understood, the song Notts County fans sing most often begins, "I had a wheelbarrow, the wheel fell off." Or is it wheels?

mellotone70up.wordpress.com/2010/02/19/...-the-wheel-fell-off · Cached page

I fell off the ferris wheel and now I am paralyzed and ...

I had just shaved. I smelled like musk. I exuded ... or reciprocate, or give me some, I fell off the ferris wheel and now I am ... Things that no one told you...until now,

www.everything2.com/title/I+feII+off+the+ferris+wheeI+and+now+I+am+paralyzed+and +bitter · Cached page

Renault gets race ban for wheel loss - F1 | ITV Sport ...

... from the pit stop position without one of the retaining devices for the wheel ... lot of vibration and it felt like I had a puncture, but then a few corners later the wheel flew

www.itv-f1.com/news_article.aspx?id=46489 · Cached page

Safety fears raised after plane wheel falls off - ABC ...

... one of the nose wheels fell off a ... fell off a plane at Melbourne Airport on Saturday. The plane was preparing for take-off when a ground engineer noticed one of the wheels had ...

www.abc.net.au/news/stories/2009/07/27/2637051.htm · Cached page

Wheelsure - Wheel-loss operator loses O-licence for 3 ...

The stud threads were virtually undamaged, indicating that the wheelnuts had unwound gradually until the wheels fell off. Only one wheel

MORE ON THIS PAGE

The chant

There are many different stories about where the song started. Some believe it was when a groundsman was on the pitch at half time with a wheelbarrow. As he cut the corner of the pitch near the corner flag, the wheel fell off and he spoke to both County fans and a terrace chant was born, sang ...

Go to the page

Microsoft Word - Dissertation - Final Draft - B.doc (PDF File)

They actively courted **Diefenbaker**, who then saw an opportunity to expand Canadian economic and political interests in the region. The personal relationships that **Diefenbaker** was able to establish with some of these leaders would be instrumental in developing trade and other linkages.

library2.usask.ca/theses/available/etd-08032009-175549/...

Spyware

Get Enterprise-Wide Protection with Microsoft® Forefront. Try it Free. Microsoft.com/Forefront

Wax

We've Got Your Style! Hairstyling Videos & Step-by-step instructions www.garnier.ca/yourstyle

Cheating Spouse

Love'em but Don't Trust'em? Do you want to know for sure? www.TattletalesInvestigations.com

Who is Lookup

Global **Who** is Lookup for domain names and their owners www.who.is

Sponsored Results

Microsoft Word - 17 - gouzenko outline (PDF File)

Dief knew, but did not fire him) Pearson and Diefenbaker - blackmail March 1966 Liberals raise the "Monseigneur case" in House of Commons: Refers to GERDA MUNSINGER (Prostitute? German spy? www.lackenbauer.ca/Hist103/Outlines/9-2_COLDout.pdf

The Nexus of Assholery: Moral Puritans of the Hateful Left

May 9, 2008 ... Conservative Pierre Sevigny, one of John **Diefenbaker's** ministers, ... Now, Lulu's provided us with an absolute **embarrassment** of riches in Pierre Sevigny sleeping with an East **German Spy** is pretty juicy stuff – but ...

nexusofassholery.blogspot.com/2008/05/moral-puritans-of...

Famous Foreign Masons

John **Diefenbaker** ... Eighteenth-century songwriters in search of easy rhymes fell in love with his name, feminized with an "e" to make it agree with "machine." Try doing that with "Schmidt," the name of the drunken **German** carpenter who turned Guillotin's blueprints into a reality. ... Alchemist, cabalist, and **spy**, the members tripod.com/Edward Weigert/famous foreign masons...

Tories dismiss 'wild' allegations of secret Bernier meeting

OTTAWA – The Liberal opposition suggested Wednesday that Canada's **spy** agency met with the Prime Minister's Office in early May to discuss the "conduct" of former Foreign Affairs minister Maxime Bernier. ... It is that way because of Conservative governments, people like John **Diefenbaker** and Brian Mulronev, who led on the...

www.nationalpost.com/news/canada/story.html?id=547066

CBC News Indepth: Canadian Government

3. The Gerda Munsinger scandal: The guilty parties were already out of office by the time the Canadian public learned that some Progressive Conservative cabinet ministers had been consorting with an East **German** playgirl who may have been a KGB **spy**.

www.cbc.ca/news/background/cdngovernment/scandals.html · Cached

Citizen Fink

Related Searches

Diefenbaker John Prime Minister

John **Diefenbaker** Biography

John Diefenbaker Life

Lake Diefenbaker

Cabin Rentals at Lake Diefenbaker

Prime Ministers of Canada

Avro Arrow

Diefenbunker

Elbow Harbor Saskatchewan

Trudeau

Lester Pearson

John Diefenbaker

ALL RESULTS

SEARCH HISTORY

Who was the German spy who...

What animals are unique to Canada?

I had one but the wheel

Should I ask my girlfriend to marry...

What's the name of the disease that...

See all

Clear all | Turn off

● Show all Only from Canada

ALL RESULTS

1-10 of 298 results · Advanced

April - John F. Kennedy Presidential Library & Museum

The East German press service said the move was in reprisal ... glee and thumped their desks when Prime Minister Diefenbaker ... U.S. captain gets 20 years on spy charges. (pg. 12)

www.jfklibrary.org/Historical+Resources/Archives/Reference+Desk/New+York+Times +Chronology/... · Cached page

Cold War Times - August 2008 - Vol. 8, Issue 3

... Museum continues to work with the Diefenbaker Museum in Ottawa, Canada, the Atomic Bunker in Harnekop, Germany, and the International Spy ... Simon - The Cold

www.coldwar.org/text_files/ColdwartimesNov2009.pdf · Cached page

Harry S. Truman - Wikipedia, the free encyclopedia

On November 11, 1918 his artillery unit fired some of the last shots of World War I into German positions. The war was a transformative experience that brought out Truman's ...

en.wikipedia.org/wiki/Harry_S._Truman · Cached page

Pay Articles from June 1960 Part 6 - Site Map - The ...

DIEFENBAKER GETS ASSURANCE BY U.S.; Eisenhower Pledges Backing ... SOVIET SPY DEVICE WAS FOUND IN 1959; Planted in U.S ... Sight-Seeing Company Regains Permit -- New German Ship ...

spiderbites.nytimes.com/pay 1960/articles 1960 06 00005.html

shwi.alternatehistorv.com

Sorge, alleged Soviet spy and former German diplomat. -It is seemingly a season for invasions; on August 9, 1945, the invasion of. Italy begins.

shwi.alternatehistory.com/For%20All%20Time.txt · Cached page

Pay Articles from November 1958 Part 6 - Site Map ...

German Fined for Remarks; Plan Offered by Britain; Soviet Complains to U.N. On Budget ... COURT INTRUDER THREATENS SOBLE; Convicted Spy, a Witness in Perjury Trial, Accosted ...

spiderbites.nvtimes.com/pay 1958/articles 1958 11 00005.html

Dear Readers

If a Canadian spy could not believe it, then how much ... in the U.S. campaign against Prime Minister Diefenbaker ... D.Q. Coster, "Behind the German Lines," Readers Digest 37 ...

www.peace.ca/questionsofushostility.htm · Cached page

My Autobiography .. From Jimmy to Jim

I was terribly embarrassed. It cost me a pound, but it was ... German bombers came over the first night and their very ... He was arrested as a spy in the Spanish-American War ...

www.permeable.com/genealogy/jimmy.html · Cached page

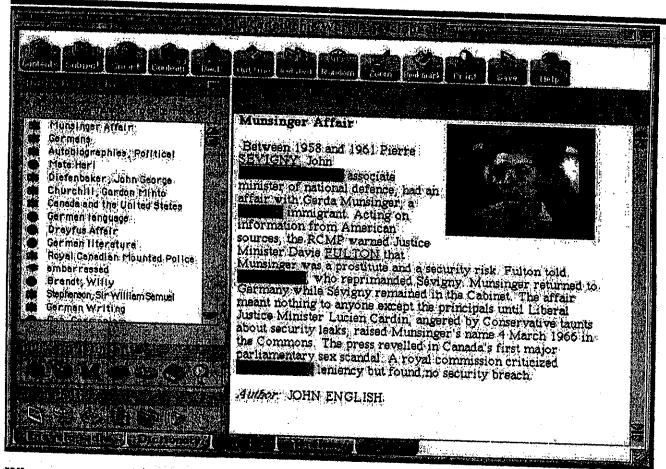
For All Time - The Postwar World (parts 35-79)

MORE ON THIS PAGE

The Kremlin accused President Kennedy vesterday of espousing a doctrine that the United States must stand ready to undertake a preventive nuclear attack on the Soviet Union. An authoritative article in Pravda contended that the President's advocacy of a policy of "nuclear initiative" had become apparent in an interview with him published last week.

Go to the page

Canadian Encyclopedia—example (1)



Who was the German spy who embarrassed Diefenbaker?

Canadian Encyclopedia—example (2)

	ne sancolai, a word encyclopedia	
Coments Subject Smare Boolean Buch		Š
Tomo in treaming or or endor.		
Animal Issues Yeterinary Medicine Fur Trapping Animal Breeding Disease, Animal Newfoundland Act: Document Animal	The close relationship between human and has persisted since prehistoric times but societies for the protection of have been in existence for only about 125 years in the Western world.	
Natural Regions Animal Agriculture animal Wild Animals I Have Known	Development of Rights During the Victorian era, the antivivisection movement	
Arctic Animals Animals in Winter Globe Theatre Humane Societies	developed to oppose science's use of in biomedical research. The battle between vivisectionists and antivivisectionists resulted in the UK's Cruelty to Act (1876). This legislation heralded a clear victory for the antivivisection movement and imposed upon Britain's	
	medical scientists a system of licensing, inspection and bureaucratic practices. The need for the act has been debated ever since and in 1986 was strengthen and replaced by the (Scientific Procedures) Act.	
	After WWII, biomedical research escalated tremendously. New drugs, treatments and techniques were	

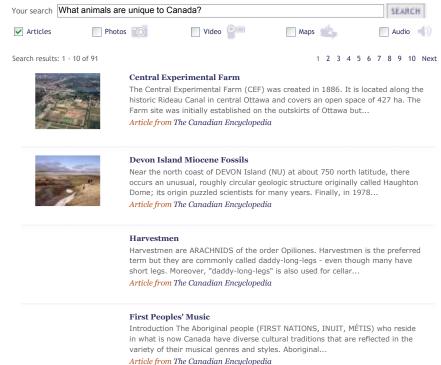
What animals are unique to Canada?



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SEARCH THE CANADIAN ENCYCLOPEDIA









Theatre Design to 1950
Canada's earliest theatre buildings are known only through written accounts and other archival sources. The first is thought to have been the New Grand Theatre, erected in 1789 for the British military garrison in Halifax. It...

Article from The Canadian Encyclopedia



Native People: Subarctic

The area of Subarctic cultures lies largely within the 5 million km 2 zone of northern or boreal coniferous forest that extends from the arctic tundra to the mountains, plains or deciduous forest in the south and across North...

Article from The Canadian Encyclopedia



Native People: Northwest Coast

The Canadian portion of the Northwest Coast is a region of extremes in topography, from wide beaches to deep fjords and snowcapped mountains. Temperatures are moderate, the January mean above freezing and July less than $18^{\circ}\dots$

Article from The Canadian Encyclopedia



Yellowknife (NWT)

Yellowknife, NWT. Yellowknife is the capital of the NORTHWEST TERRITORIES and the territory's only city. It sits on the ancient rock of the Canadian SHIELD, on the north shore of GREAT SLAVE LAKE. Due to its northerly location... Article from The Canadian Encyclopedia

Work

At different times in different cultures, work has been considered a divine







Canada?

ALL RESULTS

SEARCH HISTORY

Now you can go back further with search history.

What animals are unique to Canada?

I had one but the wheel fell off

Should I ask my girlfriend to marry...

What's the name of the disease that...

See all

Clear all | Turn off

Show all Only from Canada

show all Only from Canada

ALL RESULTS

1-10 of 19,700,000 results · Advanced

Q

RoRoArt - Unique Sock Animals

Over the years, other **Animal** patterns appeared, but the ... Up here in **Canada**, in the 20's, 30's & 40's, we did not ... The tradition of the Sock Monkey was that they were a **unique** ...

www.roroart.com/history.htm · Cached page

Unique Facts about Canada: New France

Unique Facts about Canada: New France ... animals | vocabulary | health | science | math | history ... was the ancestor of future Prime Minister of Canada ... www.sheppardsoftware.com/canadaweb/factfile/Unique-facts-Canada3.htm · Cached

Jobs Working with Animals in Canada

Animal Jobs Canada. Our unique, informative and inspiring Working with Animals Ebook Guides contain everything you need to know ... www.animal-job.co.uk/animal-jobs-canada.html · Cached page

Unique Facts about Canada: Basic Geography

Unique Facts about Canada: Basic Geography ... animals | vocabulary | health | science | math | history ... lies in Arctic regions, however, and thus Canada has ... www.sheppardsoftware.com/canadaweb/factfile/Unique-facts-Canada1.htm · Cached page

WikiAnswers - What are two unique traditions of Canada

This question has not been answered yet.

wiki.answers.com/Q/What_are_two_unique_traditions_of_Canada · Cached page

Canadianisms - Unique Canadian things - Eh!

Some things that are really cool and **unique** in or about **Canada**: Canadian Food like ... Even though it smells like dead sea **animals**, Halifax is considered one of **Canada**'s most beautiful ...

members.shaw.ca/kcic1/canisms.html · Cached page

CANADA BEEF | Beef Safety

This is an important and unique aspect of cattle production in Canada. Live Animal Inspection. Under Canadian law, each animal must undergo ... www.cbef.com/beefsafety.htm · Cached page

CanadaHelps - Browse for a Charity

Find your favourite animal charity here. There are 411 charities related to ... Any denomination, to anyone - a truly flexible and unique gift! » More about Gift ... www.canadahelps.org/searchcategory.aspx?catlD=1 · Cached page

Certified Applied Animal Behaviorist

Our **Unique** Qualifications. Internship Opportunities ... She established a successful behavior practice, **Animal** Behaviour Services, Inc., in Toronto, **Canada** and was on ... certifiedanimalbehaviorist.com/bios/preid.html · Cached page

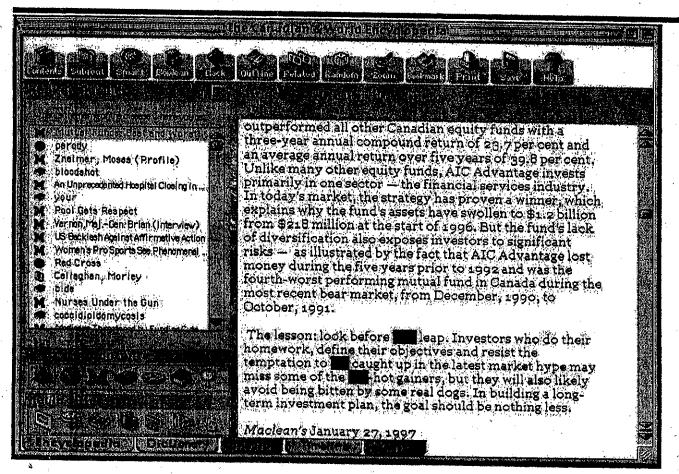
Legislation in Canada Related to Evperimental Animals

MORE ON THIS PAGE

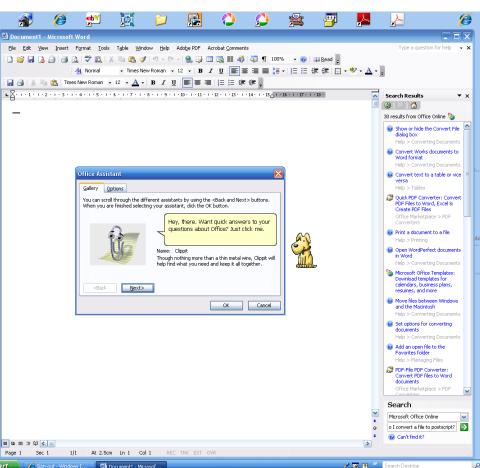
HISTORY OF SOCK MONKEYS A century ago, somewhere in North America, people started making Sock Monkeys! It's impossible to say exactly where or when they began, but Sock Monkeys have been around since the late 1800's! During the Depression, when toys were too expensive and fabric was hard to come by, Sock Monkeys were at the height ...

Go to the page

Canadian Encyclopedia—example (3)



What is the name of the disease where you get red bumps all over your face?



Example TREC Queries

- How often were the peace talks in Ireland delayed or disrupted as a result of acts of violence?
- Who was involved in the Schengen agreement to eliminate border controls in Western Europe and what did they hope to accomplish?
- Is there contemporary interest in the Greek philosophy of stoicism?
- Identify instances of attacks on humans by Africanized (killer) bees.

Terminology

Document — one of book, article, paragraph,

etc.

Collection \longrightarrow corpus (of documents)

Term \longrightarrow word type

Stop word \longrightarrow function word (generally)

Queries

- Specification of subset of documents in a collection.
- Historically, conceived of as either very structured logical language (Boolean connectives etc.) or (in research contexts) well-formed NL.
- Now, particularly in web search engines, they're often just streams of syntactically disconnected keywords.
- Usually given by user, but can be *enhanced* by system, e.g.:

Q: shipwreck salvaging (the recovery or attempted recovery of treasure from sunken ships)

- dictionary definition
- thesaurus
- WordNet
- IR systems depend heavily on quality of the query.

Major IR Tasks

- 1. Document Retrieval: Find documents relevant to query (ranked by relevance).
- 2. Question Answering: Find document with answer to question, or find answer itself.
- 3. Information Extraction: Find answers to specific pre-specified questions within selected bulk documents (not actually IR).

Evaluation

Precision and recall aren't quite good enough — assuming there are 5 relevant documents to a query out of a collection of 100, all of these systems have 50% precision and 50% recall:

Rank	System A	System B	System C
1.	no	yes	yes
2.	no	yes	no
3.	no	yes	yes
4.	no	yes	no
5.	no	yes	yes
6.	yes	no	no
7.	yes	no	yes
	yes	no	no
9.	yes	no	yes
10.	yes	no	no

Cutoff precision

Measure precision down to some cutoff, e.g. first 5 docs

Rank	System A	System B	System C
1.	no	yes	yes
2.	no	yes	no
3.	no	yes	yes
4.	no	yes	no
5.	no	yes	yes
6.	_	-	_
7.	_	-	-
8.	_	-	-
9.	_	-	-
10.	_	_	-
CP	0%	100%	60%

Uninterpolated Average Precision

Measure precision at every relevant document returned:

Rank	System A	System B	System C
1.	no	yes	yes
2.	no	yes	no
3.	no	yes	yes
4.	no	yes	no
5.	no	yes	yes
6.	yes	no	no
7.	yes	no	yes
8.	yes	no	no
9.	yes	no	yes
10.	yes	no	no
UAP	0.354	1.0	0.679
$1 \leftrightarrow 2$			0.579
$9 \leftrightarrow 10$			0.668

(Interpolated) Average Precision

Measure precision at various levels of recall and average.

11-point Average Precision: Use levels 0%, 10%, 20%, ..., 100%.

Rank	System A	System B	System C
1.	no	yes	yes
2.	no	yes	no
3.	no	yes	yes
4.	no	yes	no
5.	no	yes	yes
6.	yes	no	no
7.	yes	no	yes
8.	yes	no	no
9.	yes	no	yes
10.	yes	no	no
11-AP	0.337	1.0	0.708
$1 \leftrightarrow 2$			0.572
$9 \leftrightarrow 10$			0.698

Uninterpolated vs. Interpolated Average Precision

- Interpolated is *more sensitive* to recall: good to use when comparing 2 algorithms or datasets for which recall differs widely
- Uninterpolated is *less sensitive* to recall: good to use when only difference is relevance order, or when you only want to test precision.

... but the best "measure" is still a precision/recall graph.

Relevance Feedback

User judges results of the search; Query is adjusted accordingly.

Approaches:

- user can judge each retrieved document
- "click capture" on web-sites: clicks count as votes for relevance
- system automatically assumes top-ranked documents are relevant (pseudo-relevance feedback)

Objective: move query vector towards relevant ones and away from irrelevant ones:

$$\vec{q}_{i+1} = \vec{q}_i + \frac{\beta}{R} \sum_{j=1}^{R} \vec{r}_j - \frac{\gamma}{S} \sum_{k=1}^{S} \vec{s}_k,$$

where $0 \le \beta, \gamma \le 1, \beta + \gamma = 1$

Inverted Index

This is the basic data structure for document retrieval: given word, return all documents that contain it in:

- title
- abstract or title
- abstract or title plus chosen index terms
- whole text

Vector Space Model for Retrieval

- Each document represented by vector
- Query also represented by vector
- Each dimension of vector corresponds to a nonstop-list term (word/phrase)
 - -0/1: present/absent
 - $-\mathbb{N}$: number of tokens (of term i in document j: tf_{ij})
 - $-\mathbb{R}_0^+$: dampened weight, e.g.

$$= \begin{cases} 1 + \log t f_{ij} & t f_{ij} > 0 \\ 0 & t f_{ij} = 0 \end{cases}$$

- sometimes add "bonus" for being in title/abstract
- Once vectors are determined, can use cosine method etc. to determine similarity to query

tf.idf

Many frequent terms in one document occur frequently in all documents

These shouldn't count for as much as a term that occurs frequently only in one document

weight
$$(i, j) = t f_{ij} \times i df_i$$

where

- $idf_i = \log(\frac{N}{n_i})$ (inverse document frequency)
- N = number of documents
- n_i = number of documents in which term i occurs

Problems

- Size of query (part. with query expansion)
 - can normalise lengths
- Ambiguous words cause spurious matches
 - can add topic-related words
 - but this means we can determine user-intended sense
 - has to be very high accuracy or it hurts rather than helps
- Vectors of terms, regardless of actual value computed, don't capture indirect connections through semantic relatedness
 - what we need are vectors of ideas/concepts

Answer: Latent Semantic Indexing

Which concepts do we use? How do we assign terms to them? We don't know, but we can guess:

- there are far fewer concepts than terms
- terms that co-occur frequently are likely to reify the same concepts
- so we reduce dimensionality of document matrix using co-occurrence
- use singular value decomposition (SVD)

How well does LSI work?

- k too big: won't capture underlying semantic space
- k too small: too much information lost
- No known analytic method for deriving k experiment
- Term matching typically improves by 0–30% precision
- Works better in domains with lots of synonymy and ambiguity
- Works better when recall is high

Disadvantages:

- SVD is computationally expensive only worth it for huge document collections
- inverted index is not feasible