OPUNTIA

296

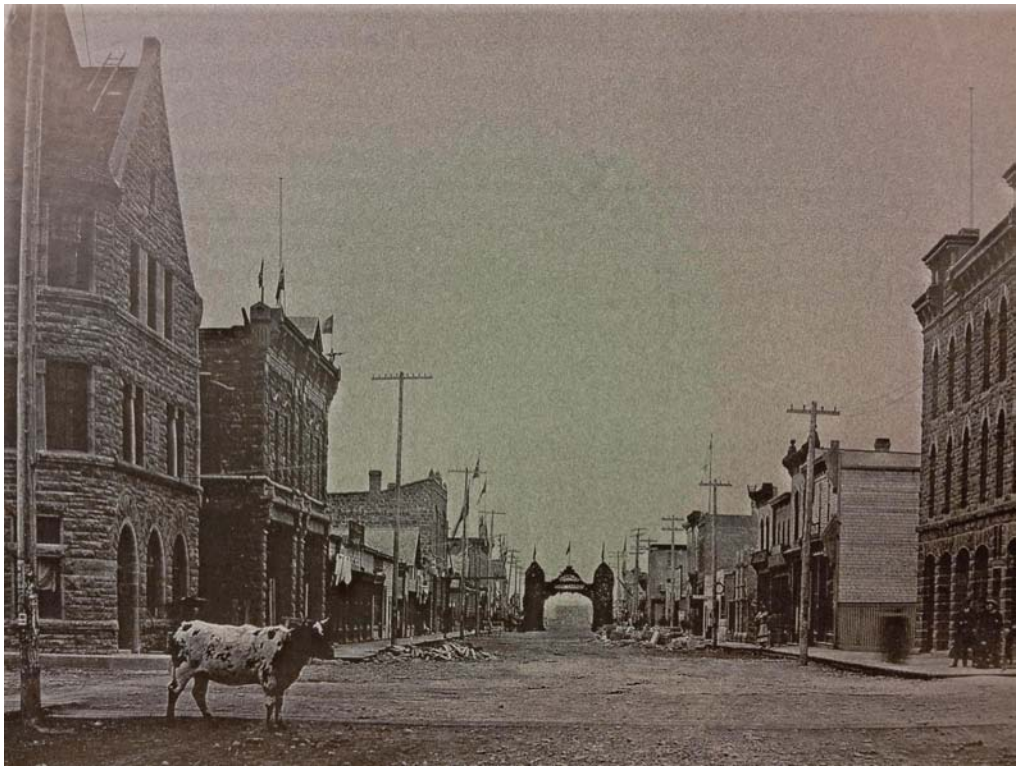
Middle January 2015

Opuntia is published by Dale Speirs, Calgary, Alberta. My e-mail address is: opuntia57@hotmail.com
When sending me an emailed letter of comment, please include your name and town in the message.

AROUND COWTOWN
photos by Dale Speirs

Most shopping mall art is blah, but this flock of Canada geese is quite nice. Seen at the Sunridge Mall in northeast Calgary.

This was a difficult shot since the pub is directly across the street from the courthouse. Look closely in the upper right corner and you can see the court sign and a parked police pickup of some constable no doubt testifying in a case.



A better view of the Alberta Hotel Building, taken from where the steer was standing.

Above is one of my favourite historical photos of Calgary, taken in 1889 when it was still a village. The view is looking east along 8 Avenue from 1 Street SW in the very heart of the city. The arch was for the visit of some royal prince or other, and was dismantled after he left. It was at the eastern entrance of the village.

I found the exact same spot on 2014-12-21 and re-photographed it. The steer seems to have wandered away but a few of the buildings remain. At extreme right in both photos is the Alberta Hotel Building, which for the past several decades has been occupied by boutiques and trendy restaurants. A balcony was added in more modern times to serve as a patio for the restaurant. The far end of the avenue is blocked by the shiny glass of the Municipal Building. The eastern boundary of the city is now about 20 km beyond it.

Up until the early 1980s, the philistines on City Council rubber-stamped any demolitions of historic buildings for replacement by glass towers and concrete boxes. An outcry developed, as a result of which several blocks of 8 Avenue SW downtown had preservation orders put on the few remaining sandstone buildings. The rest of the mall is lined with skyscrapers.

In OPUNTIA #295, I showed you what the Olympic Plaza looked like at night on New Year's Eve.

Here is what it looked like a fortnight later on a weekday afternoon.

THE TROUBLE WITH THE BERINGIA DOGMA
by Dale Speirs

The standard gospel of archaeologists that humans did not cross into North America until the Bering Straits dried up has always been laughable to the aboriginal tribes of Alaska and Nunavut. The Aleut regularly cross the short distance by boat in summer and by walking across the ice in winter. Recent discoveries show that human colonization down the coasts of the Americas was done via watercraft, not walking across Beringia [5]. Other studies show that after the Ice Age ended, western Canada was not colonized by people moving down from northern refugia but by people moving north, following the melting ice from way down south [6].

The idea of Berginia also assumes that humans cannot survive in glaciated terrain, but this is a false premise as well. Humans at least criss-crossed the ice without too much worry. In a northwestern British Columbia glacier, the body of an ancient aboriginal tribesman was found frozen in the ice [4]. It was carbon-dated at 550 years ago, making it the oldest preserved body in North America. The man was about 175 cm tall, aged in his late teens to early 20s, well-groomed, and in good physical condition. He was wearing a brimmed hat and a gopher-skin cape, and was carrying a walking stick and a supply of smoked salmon. He had iron tools. It is not unreasonable to posit that humans 10,000 years before him were also equipped against nature, save for the occasional hunter like him falling into a crevice.

Moreover, recent studies show the native peoples of the Americas did not develop from a single group but had multiple origins in Asia. In fact, many American tribes are genetically closer to Chinese and Polynesians than Siberians [3]. Eastern Siberian tribes lack certain DNA groups that Amerinds have, but which Mongolian/Manchurian/southeast Siberians have [9]. Linguistic studies show that the pre-European distribution of aboriginal languages in North America is best explained by Pleistocene geography, not the post-melt distribution of tribes [10]. The Grand Banks of Newfoundland were habitable land, and many tribes moving north as the glaciers melted came from land now submerged, not, as commonly supposed, the current distribution of land.

What The Ice Did Next.

Continental glaciation may bury vast tracts of land under kilometres of ice but it also exposes large areas of the continental shelves. What are now submerged straits once were deep valleys, and while migrating humans may have been frozen out of the core of the continent they may not have even noticed as they worked their way down the coastline. New evidence suggests that while some humans were migrating down the slopes of the Rockies, others were sailing down the coast of western North America in small boats at a faster rate.

The coastal areas were not only broader, but had some remarkable features. Gigantic springs flowed as fresh water underneath the ice sheets found its way through the bedrock and erupted on the slopes of the continental margin [2].

Sea-floor sampling and digital terrain imaging shows drowned terrestrial landscapes off the coast of British Columbia. In situ tree stumps and stone tools were recovered from 53 m depth off Haida Qwaii (formerly Queen Charlotte Islands). Drawing a new coastline for the glacial era shows the coastal islands of British Columbia were part of contiguous land, and the Bering Strait was not only dry land 12,5000 years ago but the land extended out to the Aleutian Islands. Notwithstanding the ability to cross a flooded Bering Straits today, ancient humans could also have walked across a vast plain extending from Siberia to southern Alaska and traveled down the coastline unimpeded by continental glaciation [8].

Zoologists and geologists have been bringing up samples from the now drowned shorelines which show the flora and fauna of that vanished world was quite adequate to support humans. A study published in early 2003 remarks that: "*The first intertidal species [of mollusc] to colonize the Queen Charlotte Islands archipelago along the northeastern Pacific margin of Canada after the last glacial maximum was Macoma nasuta at 13,210 + or - 80 14C years before present. Prior to this time, molluscs were likely excluded where grounded ice extended from the 2 km thick Cordilleran ice sheet on mainland British Columbia. ... Fossil assemblages of intertidal molluscs are used to map ancient shorelines and indicate which species were available as a subsistence resource for early peoples ... When early peoples might have been migrating along the littoral zone, the molluscan productivity of the outer coast was much higher than it is at present.*" [1].

The coastal sites have since been submerged by rising oceans as the ice sheets melted, leaving little evidence for archaeologists. From the maximum height of the Ice Ages to our present day, the melting ice sheets and glaciers released 52,000,000 cubic kilometres of water. The sea level rose 15 metres at about 19,200 to 18,700 years ago [7]. So much water was locked up during the

Pleistocene that large areas of today's seabed were then exposed land. As the Ice Ages ended, the melting water flooded areas such as the Grand Banks of Newfoundland, the English Channel/North Sea, the Arabian Gulf, and the Black Sea. There were several stages to the melting, and after the big melt, additional floods of water came down from time to time as various highlands, mountains, and high-latitude areas slowly warmed up.

Are There Any Alternative Histories?

Suppose that glaciation was much heavier during the Pleistocene than in our timeline, and more, importantly, lasted longer. Central Alaska was not left ice-free, and sea levels remained lower. With vast land areas exposed in the northern Pacific, a nomadic culture spreads from mainland central Asia and established itself in what is today an ocean. Likewise for the Arabian Gulf and Black Sea, the flooding of which gave rise to the flood myths in our timeline.

Beringia cannot be taken in isolation. 5,000 to 8,000 years ago, as the ice sheets melted, civilizations arose in the Mediterranean and Middle East areas. They moved north as the land shed its burden. If the melt were delayed, and a strong connection was maintained between the Americas and central Asia, then the oriental peoples would be in possession of a genuine Middle Kingdom, one that stretched from China to the Columbia River.

Add an extra couple of millennia to the last ice age, and let the Chinese spread across two continents. When the waters rise again after a delayed melt, the Chinese civilization is sophisticated enough to maintain seaborne trade contacts and communication with their American cousins. It is unlikely there could be a single empire covering the two continents because the ability to hold large areas together depends on fast communications and the ability to quickly shift armies around to where they are needed. Nonetheless, while the political entities might be fragmented, the Chinese warlords on both sides of the Pacific Ocean would still have much in common culturally.

When the Europeans arrive from the other side of the Americas, they cannot wedge themselves in. They are not dealing with primitive aboriginal tribes but with an advanced society that can give as good as it gets. The Chinese push back. Depending on the aggressiveness of the warlords, they may not go past the Rocky Mountains. But if they breed as much as they did in our timeline, the warlords may decide to open up lebensraum all the way out to the Mississippi River. The continent is then split north-south, not necessarily between two single entities, but rather between a loose group of Chinese warlords and a cluster of European colonies.

With, say, a dozen Chinese warlords east of the Rockies, and a half-dozen European colonies washing up against the Mississippi River, there would be constant political intrigue and petty warfare. This is what gave Europeans an advantage in our timeline in technology, as war speeds up technological evolution. The Chinese never sink back into sloth as they did in our timeline, and the Europeans can never rest.

We have always been at war with Eastasia.

References.

1] Hetherington, R., and R.G.B. Reid (2003) Malacological insights into the marine ecology and changing climate of the late Pleistocene-early Holocene Queen Charlotte Islands archipelago, western Canada, and implications for early peoples. CANADIAN JOURNAL OF ZOOLOGY 81:626-661

2] Faure, H., et al (2002) The coastal oasis: Ice Age springs on emerged continental shelves. GLOBAL AND PLANETARY CHANGE 33:47-56

3] Brace, C.L., et al (2001) Old World sources of the first New World human inhabitants: A comparative craniofacial view. PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES USA 98:10017-10022

4] Munro, M. (2000-12-26) The thaw of history. NATIONAL POST, page A15

5] Dixon, E.J. (2001) Human colonization of the Americas: timing, technology, and process. QUATERNARY SCIENCE REVIEWS 20:277-299

6] Driver, J.C. (1998) Human adaptation at the Pleistocene/Holocene boundary in western Canada 11,000 to 9,000 BP. QUATERNARY INTERNATIONAL 49:141-150

7] Lambeck, K., Y. Yokoyama, P. Johnston, and A. Purcell (2000) Global ice volumes at the Last Glacial Maximum and early Lateglacial. EARTH AND PLANETARY SCIENCE LETTERS 181:513-527

8] Fedje, D.W., and H. Josenhans (2000) Drowned forests and archaeology on the continental shelf of British Columbia. GEOLOGY 28:99-102

9] Neel, J.V., R.J. Biggar, and R.I. Sukernik (1994) Virologic and genetic studies relate Amerind origins to the indigenous people of the Mongolia/Manchuria/southeastern Siberia region. PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES USA 91:10737-10741

10] Rogers, R.A., L.D. Martin, and T.D. Nicklas (1990) Ice Age geography and the distribution of native North American languages. JOURNAL OF BIOGEOGRAPHY 17:131-143

DISCWORLD: PART 7. NEW WORLD BEING BORN
by Dale Speirs

As I have mentioned before, one thing I like about the Discworld series is that it is not some stagnant fantasy land where kings play games with thrones and nothing evolves. Pratchett introduces major technological changes in a number of novels and explores their ramifications. Some of these novels involve Moist von Lipwig, who is bidden by the Patrician to do various jobs such as reviving the post office, but others are separate stories.

MOVING PICTURES (1990) is the earliest of these. A small god, set free by the death of its last acolyte, inspires Ankh-Morpork alchemists to not only invent octo-cellulose but an application for it, strips of pictures that when run through a projector show moving people. The alchemists decide to set up in a remote area called Holy Wood, where they can make these moving pictures in good weather and sunshine, since Ankh-Morpork tends to be gloomy and rainy.

The effect on Discworld is the same as it was on our spherical planet. People are attracted to the magic of moving pictures, which takes them away from their troubles and gives them vicarious experiences. There are many drawn to Holy Wood to become stars. (As George Carlin remarked, "*It's all about Dig Me!*") The problem is that the magic of moving pictures has also thinned the walls of reality and the Things from the Dungeon Dimensions lurking on the threshold are pressing hard to get through. Over at the Unseen University, a forgotten machine has triggered an alarm about a rift in reality, and the wizards are wondering what to do. Holy Wood, as it turned out, was once before a city in ancient times when it was destroyed by the last incursion from the Dungeon Dimensions.

The funniest sub-plot, and one that had this farm boy laughing out loud, is when a Holy Wood producer decides he wants the spectacle of a thousand elephants in one of his movies but doesn't realize what he is asking for. The sub-plot is told in segments through the novel about how the Klatchian livestock dealer Azhural gets the biggest (in more ways than one) single order his business has ever received. First he has to find that many elephants, then figure out how to drive them across the continent to Holy Wood. His assistant M'Bu, a bright lad who likes a real challenge, works with him to herd 1,000 pachyderms through jungle and mountain passes. Having been on many cattle drives when I was a teenager (see OPUNTIA #60.5), this subplot is probably funnier to me than city slickers, but even so Pratchett tells an hilarious story.

The spread of movie theatres, the advent of celebrity cults, and the magic of Holy Wood finally allow the Things to break through, creating all sorts of trouble and destroying Holy Wood in the process. As the characters raise themselves out of the rubble and the novel winds down to a close, the last loose thread is tied. Azhural finally arrives at the gates of the city with 1,000 elephants.

THE TRUTH (2000) begins with another disruptive technology. Dwarfs in Ankh-Morpork have imported moving type and presses to compete against engravers. William de Worde, a public scribe, has been selling a hand-inscribed newsletter to a dozen clients outside Ankh-Morpork who want news of what is going on there. His engraved-copy letter becomes a typeset newspaper, and he suddenly finds himself a publisher rather than a scribe. He has distribution channels to worry about and hiring people to get news to fill the paper. Half the readers of the newspaper want to get their names in the paper and the other half want to keep their names out of it.

Meanwhile, there is the usual plot against the Patrician by the royalists, this time using character assassination. The patrician himself is not too pleased with the newspaper but allows it as a necessary evil. These are the times we live in. The novel wraps up with apparent disaster but likely recovery for the newspaper.

GOING POSTAL (2004) introduces Moist von Lipwig, a criminal who is given a choice by the Patrician between the noose or revitalizing the postal system, which has degenerated to an abysmal condition, much like the USPS or Royal Mail. Lipwig, guarded by a golem to make certain he doesn't return to his old ways, finds a decrepit building with two decrepit caretakers. One of them, Stanley, is an obsessive pinhead, the slang term for those who collect sewing pins. Pratchett is obviously having fun here with philatelists, and goes into detail about pinhead culture.

As in our world, the phrase "public service" hasn't been heard in decades, and technological change such as semaphore telegraphs have superseded the Post Office's original purpose. The executives who run the clacker system, as the

telegraphs are known, have a monopoly and want to keep it that way despite poor quality service of the clackers as they run the systems down to maximize their profits. Moist finds out that others before him, in the recent past, were assigned the duty of revitalizing the Post Office and ended up dead by unknown hands.

Exploring the GPO building, Moist finds remnants of the past. There are huge piles of letters that have reached critical mass and come alive, constantly whispering their messages. Moist finds a sorting machine with gears the designer manufactured so that their value of pi was 3.000 even, triggering the machine to work multidimensionally due to the distortion in space. It not only sorted the letters the posties fed into it, it sorted letters written fifty years into the future.

Moist puts the golem to work cleaning up the Post Office. Golems work 24/7 without sleeping, which makes them perfect for sorting letters. Gradually a semblance of a postal system is built up against many odds and tribulations. Slowly the Post Office speeds up to pace. Postage stamps are printed, lettercarriers hired (golems are especially good at that job), and routes established to other cities.

The clackers men see a threat to their business and begin actively sabotaging the Post Office, such as burning down the GPO building. But sabotage works both ways, and the two systems compete in deadly earnest. Not just figuratively, either. There is a very clever method of sabotaging clacker towers by sending a certain type of message through, the semaphore equivalent of a computer virus. The clacker towers rock back and forth when a message comes through with the occasional word that raises the semaphores on one side and lowers them on the other simultaneously. Spaced out in time, this rocking is not serious and nothing to worry about. With a malicious message though, certain words can be repeated so that the tower keeps swaying to the point it reaches its resonant frequency and snaps.

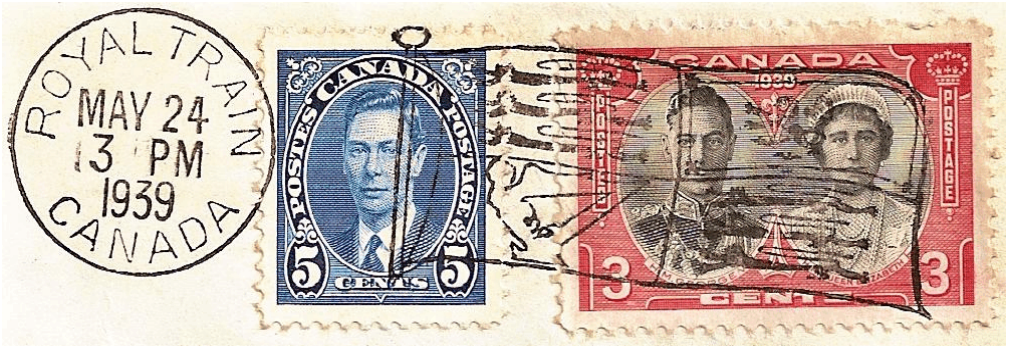
But in the end, the Post Office survives, and so do the clackers, albeit under new management. The clacker executives get theirs yet, and are run in for fraud, embezzlement, and all the usual standard practices of high finance.

MAKING MONEY (2007) has Moist dragooned into taking over both the Royal Mint and the Royal Bank due to a combination of pressure from the Patrician and the recently defunct Mrs. Lavish who died and trapped him into the job by the terms of her will. The rest of the Lavish family, old money coupon-clippers, are not pleased, especially Cosmo, who has dreams of grandeur. He wants to be the Patrician, as well as putting the bank and mint to good use, to his use.

Moist, having become a central banker, immediately falls to the lure of fiat currency. Why bother with gold and silver when you can print paper currency in any quantity that the sheeple will accept without demur? That the gold in the vault is missing only temporarily shakes the confidence of the public, especially since it was all a plot by assorted Lavishes. The novel basically progresses from one crowd scene to the next mob, but Moist manages to keep his job and his head (not just a figurative expression). The gold standard is replaced by the golem standard, as several hundred new golems arrive in Ankh-Morpork to distract the mobs into one of their old favourites, a race war. The bank and the mint survive, some of the Lavish family get what they deserve, and all ends reasonably well.

RAISING STEAM (2013) is one that I hesitate to review as not up to regular Discworld standards, as this might raise questions about the quality being related to Pratchett's early-onset Alzheimer's disease. The novel deals with the invention of the steam locomotive by Dick Simnel, which attracts the interest of Ankh-Morpork investors. The Patrician wants to keep track (pardon the pun) of this invention, so once again Moist von Lipwig is dragooned into it. He has to negotiate rights of way with landowners and make certain the railway succeeds.

In many of the past Discworld novels, passing reference was made to the dwarfs' homeland being torn by internal disputes between religious fundamentalists and the ordinary folk. This comes to a crisis in this novel with terrorist attacks, destruction of semaphore telegraphs, and a coup d'etat. The Dwarf King was away at the time the violence erupted full-scale, and only the railway can get him back in time to counteract the coup. Moist and his golems are put to the test to get the King back in time. All very Tom Swiftish. Political correctness of a sort then raises its head when the King reveals he is really a she and decides to rule henceforth as a Queen, with other dwarfs also choosing to come out.



If I left anything out that was important to the plot in the more recent novels, it was because their slow and boring progress caused me to skip pages at a time. This is an increasing problem in Pratchett's later novels. I would have said the problem was due to the invention of the word processor, which causes verbal diarrhea in novelists, but one wonders if this was a symptom of pre-clinical Alzheimer's.

It is one thing to add background material and develop back stories of minor characters, even using the dreaded infodumps. In an ideal novel, everything should go to moving the story forward, not just upping the word count.

LAWYERS IN SPACE

In the Criminal Code of Canada (federal felony laws) there is a reference to a Space Station. A Space Station in the Criminal Code? Canada has a 3% share in the International Tin Can, pardon me, the International Space Station. No doubt someone had gone over the ramifications of a crime in space.

Section 7, sub-section 2.3 and 2.31 read as follow:

Despite anything in this Act or any other Act, a Canadian crew member who, during a space flight, commits an act or omission outside Canada that if committed in Canada would constitute an indictable offence is deemed to have committed that act or omission in Canada, if that act or omission is committed
(a) on, or in relation to, a flight element of the Space Station; or
(b) on any means of transportation to or from the Space Station.

Despite anything in this Act or any other Act, a crew member of a Partner State who commits an act or omission outside Canada during a space flight on, or in relation to, a flight element of the Space Station or any means of transportation to and from the Space Station that if committed in Canada would constitute an indictable offence is deemed to have committed that act or omission in Canada, if that act or omission
(a) threatens the life or security of a Canadian crew member; or
(b) is committed on, or in relation to, a flight element provided by Canada or damages a Canadian flight element.

SEEN IN THE LITERATURE

Pushie, M.J., et al (2014) **Evidence for biogenic copper (hemocyanin) in the Middle Cambrian arthropod *Marrella* from the Burgess Shale.** PALAIOS 29:512-524

Authors' abstract: "*To test whether soft-bodied fossils from the Burgess Shale and similar Cambrian Lagerstatten could preserve chemical evidence of their original biology, a number of specimens from different groups were analyzed with synchrotron-based X-ray fluorescence imaging to determine the spatial distribution of a range of elements, especially those in exceedingly trace amounts that cannot be detected by more conventional analytical methods. The relative distribution of common elements like Fe, K, Ti, and Ca is related to the composition of the host shale, abundance of pyrite, and presence or absence of preserved exoskeletal calcite. However, the black stain commonly preserved with the arthropod Marrella splendens is preferentially enriched in Cu due to localized residue in the carbon and minute crystals of chalcopyrite. This is interpreted as indicative of the original chemical composition of a primary biotic fluid, likely blood. Since modern-day arthropods generally utilize Cu-containing hemocyanin for oxygen transport, it is hypothesized that hemocyanin was the biogenic source of the observed Cu. This is the first chemical evidence for blood composition in the invertebrate fossil record. These observations reinforce the consensus molecular clock age for the hemocyanin gene family, which traces its origins back to the 'Cambrian explosion', thus providing evidence for the early origin of this oxygen carrier among some arthropod groups.*"

Speirs: The Burgess Shale is a 508-megayear fossil deposit in Yoho National Park, British Columbia, just west of the Kicking Horse Pass on the Alberta border. It is adjacent to Lake Emerald and Takkakaw Falls, which I illustrated in OPUNTIA #282. As the scientific paper mentions, arthropod blood is based on copper, not iron as with mammals. The Cambrian explosion is when multicellular life suddenly blossomed in the fossil record as oxygen became widely available in the atmosphere and oceans, allowing larger animals to evolve.

Barber, M.F., and N.C. Elde (2014) **Escape from bacterial iron piracy through rapid evolution of transferrin.** SCIENCE 346:1362-1366

Authors' abstract: "*Iron is a precious cellular metal, sequestered by hosts and scavenged by pathogens. Vertebrate iron transport is mediated by serum transferrin, a protein that binds circulating iron and delivers it to cells via receptor-mediated endocytosis. Modern transferrin arose through a tandem duplication event in ancestral metazoans that produced two homologous domains, the N and C lobes, each of which binds a single iron ion with high affinity. Transferrin also contributes to host nutritional immunity by sequestering essential iron away from microbial pathogens. ... Iron sequestration provides an innate defense, termed nutritional immunity, leading pathogens to scavenge iron from hosts. Although the molecular basis of this battle for iron is established, its potential as a force for evolution at host-pathogen interfaces is unknown. We show that the iron transport protein transferrin is engaged in ancient and ongoing evolutionary conflicts with TbpA, a transferrin surface receptor from bacteria. Single substitutions in transferrin at rapidly evolving sites reverse TbpA binding, providing a mechanism to counteract bacterial iron piracy among great apes. Furthermore, the C2 transferrin polymorphism in humans evades TbpA variants from Haemophilus influenzae, revealing a functional basis for standing genetic variation. These findings identify a central role for nutritional immunity in the persistent evolutionary conflicts between primates and bacterial pathogens.*"

Speirs: When you get sick from a bacterial disease, one of the things that the bacteria try to do is steal the iron from your blood. Your body uses a protein called transferrin to keep the iron atoms away from the bacteria.

Ronen, S., et al (2014) **Links that speak: The global language network and its association with global fame.** PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES (USA) 111:E5616–E5622

Authors' abstract: "*Languages vary enormously in global importance because of historical, demographic, political, and technological forces. However, beyond simple measures of population and economic power, there has been no rigorous quantitative way to define the global influence of languages. Here we use the structure of the networks connecting multilingual speakers and translated texts, as expressed in book translations, multiple language editions of Wikipedia, and Twitter, to provide a concept of language importance that*

goes beyond simple economic or demographic measures. We find that the structure of these three global language networks (GLNs) is centered on English as a global hub and around a handful of intermediate hub languages, which include Spanish, German, French, Russian, Portuguese, and Chinese. We validate the measure of a language's centrality in the three GLNs by showing that it exhibits a strong correlation with two independent measures of the number of famous people born in the countries associated with that language. These results suggest that the position of a language in the GLN contributes to the visibility of its speakers and the global popularity of the cultural content they produce."

" ... An alternative method to measure the global influence of a language is to focus on who speaks that language, and in particular, on how connected the speakers of that language are. In the words of linguist David Crystal, "Why a language becomes a global language has little to do with the number of people who speak it. It is much more to do with who those speakers are." In the past, Latin was the pan-European language, not because it was the mother tongue of most Europeans, but because it was the language of the Roman Empire and later the language of the Catholic Church, scholars, and educators. The use of Latin by well-connected elites set it apart from other languages and helped Latin endure as a universal language for more than 1,000 years. However, can we use these ideas to identify which modern languages are globally influential? If global languages are those connecting international elites, then we can identify the global languages associated with particular elites by mapping their networks of multilingual co-expressions. Examples of multilingual co-expressions include book translations, edits to multiple language editions of Wikipedia, and posting short messages on Twitter ("tweets") in multiple languages. These co-expressions define networks that, even though not representative of the world's general population, represent a coarse map of the links connecting the elites that participate of these three important global forums, as social connections often require a shared language."

Neyskens, P., et al (2015) **The temperature and chronology of heavy-element synthesis in low-mass stars.** NATURE 517:174-176

Authors' abstract: "*Roughly half of the heavy elements (atomic mass greater than that of iron) are believed to be synthesized in the late evolutionary stages of stars with masses between 0.8 and 8 solar masses. Deep inside the star, nuclei (mainly iron) capture neutrons and progressively build up (through the slow-neutron-capture process, or s-process) heavier elements that are subsequently brought to the stellar surface by convection. ... The radioactive pair 93Zr–93Nb* [zirconium and niobium] *used to estimate the s-process temperature also provides, together with the pair 99Tc–99Ru* [technetium and ruthenium], *chronometric information on the time elapsed since the start of the s-process, which we determine to be one million to three million years.*"

Speirs: All metals and heavy elements were synthesized inside stars from iron, then expelled into space. Over billions of years, those elements condensed into dust which in turn condensed into planets. The elements were melted, segregated, mined, refined, and eventually came your way. When you hold an iron object or a silver coin in your hand, think about the fact that it was once in the core of a long-extinct star.

Jackson, M.D., et al (2014) **Mechanical resilience and cementitious processes in Imperial Roman architectural mortar.** PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES USA 111:18484–18489

Authors' abstract: "*A volcanic ash–lime mortar has been regarded for centuries as the principal material constituent that provides long-term durability to ancient Roman architectural concrete. A reproduction of Imperialage mortar based on Trajan's Markets (110 CE) wall concrete resists microcracking through cohesion of calcium–aluminum–silicate–hydrate cementing binder and in situ crystallization of platey strätlingite, a durable calcium-aluminosilicate mineral that reinforces interfacial zones and the cementitious matrix. In the 1,900-y-old mortar dense intergrowths of the platey crystals obstruct crack propagation and preserve cohesion at the micron scale. Trajanic concrete provides a proven prototype for environmentally friendly conglomeratic concretes that contain about 88 % by volume of volcanic rock yet maintain their chemical resilience and structural integrity in seismically active environments at the millennial scale."*

"The builders of the monuments of Imperial Rome (from 27 BCE, when Octavian became Emperor Augustus, through the fourth century CE) used pyroclastic volcanic rock to create unreinforced concrete structures with dramatic vaulted spans, as at the Markets of Trajan (110 CE). The concrete

foundations, walls, and vaulted ceilings are composed of decimeter-sized volcanic tuff and brick coarse aggregate (caementa) bound by volcanic ash–lime mortar. The conglomeratic fabric of the concretes is analogous to sedimentary rocks made of coarse rock fragments and a matrix of finer grained material. The concretes have resisted structural scale failure during moderate magnitude earthquakes (<8 on the Mercalli–Cancani–Sieberg intensity scale) associated with slip on Appennine fault systems 80–130 km to the northeast, as well as chemical decay associated with repeated inundations of foundations and walls by Tiber River floods. To date, at least six episodes of moment magnitude 6.7–7 ground shaking and damage to monuments have been recorded since 508 CE."

"The concrete structures contain common macroscale fractures, with rough surfaces that link by complex segment overlap and bridging, and either follow or traverse caementa interfacial zones. Many monuments remain in active use as residences, offices, museums, and churches. In addition to the Markets of Trajan, these include the Theater of Marcellus (44–13 BCE), Mausoleum of Hadrian (123–39 CE), Pantheon (ca. 126 CE), and Baths of Diocletian (298–306 CE). The monuments that did undergo sectional failure, for example at the Colosseum (70–90 CE), Baths of Caracalla (ca. 215 CE), and Basilica of Maxentius (ca. 313 CE), mainly did so in Late Antiquity or the Middle Ages, when they were several centuries old and had become vulnerable through subsurface instabilities; problematic structural design; removal of marble and travertine dimension stone, columns, and cladding; and lack of regular maintenance."

"The pozzolanic mortar perfected by Roman builders during first century BCE is key to the durability of concrete components in structurally sound monuments well maintained over two millennia of use. [Pozzolans, named after pumiceous ash from Puteoli (now, Pozzuoli) in the Campi Flegrei volcanic district, react with lime in the presence of moisture to form binding cementitious hydrates]. By the Augustan era (27 BCE–14CE), after experimenting with ash mixtures for >100 y, Romans had a standardized mortar formulation using scoriaceous ash of the mid-Pleistocene Pozzolane Rosse pyroclastic flow that substantially improved the margin of safety associated with increasingly daring structural designs. They used this mortar formulation in the principal Imperial monuments constructed in Rome through early fourth century CE."

ZINE LISTINGS

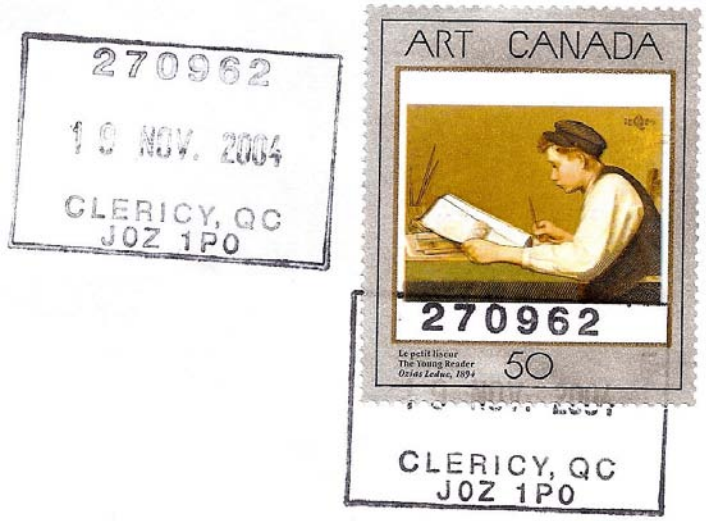
by Dale Speirs

[I only list zines from the Papernet. If the zine is posted on www.efanzines.com or www.fanac.org, then I don't mention it since you can read them directly.]

[The Usual means $5 cash ($6 overseas) or trade for your zine. Americans: please don't send cheques for small amounts to Canada or overseas (the bank fee to cash them is usually more than the amount) or mint USA stamps (which are not valid for postage outside USA). US$ banknotes are still acceptable around the world.]

[SF means science fiction. An apazine is a zine for an amateur press association distro, a perzine is a personal zine, sercon is serious-constructive, and a genzine is a general zine.]

FOR THE CLERISY #82 (The Usual from Brant Kresovich, Box 404, Getzville, New York 14068-0404) Reviews of lesser-known books, this time around mostly mystery novels, and some letters of comment.



CHORRADA #6 (The Usual from Kris Mininger, Calvo Sotelo 13B, 4B, Plasencia 10600, Caceres, Spain) This issue is mostly about Kris's collection of stringed instruments and especially about dulcimers.

XEROGRAPHY DEBT #36 (US$4 from Davida Gypsy Breier, Box 11064, Baltimore, Maryland 21212) Reviewzine that uses multiple reviewers to review hundreds of zines. (Did you get that?) Also some articles about life on the Papernet. A valuable resource about zinedom.