

Topologe, LLC

- Small Disadvantaged Business
- Founded in Boston (2002)
- Headquarters in Fairfax, VA
- FAA, USAF, DOT, DOI, USACE, etc.
- Multiple GSA Best-in-Class vehicles
- Partnerships in academia
- ISO 9001:2015, 20000-1:2018, 270001:2013 Cert.
- CMMI ML3
- DCAA Audited

LLMs **can't** be trusted with
automated reasoning





Given the increase in agricultural productivity in central African over the last 50 years due to the influx of fertilizer from the global markets, how will the Russia-Ukraine conflict affect food prices in Africa over the next year?



It is not possible for me to accurately predict how the Russia-Ukraine conflict will affect food prices in Africa over the next year. The prices of agricultural products, including food, are influenced by a variety of factors, including production costs, supply and demand,



"The heart of reasoning is having the means for algebraically manipulating previously acquired knowledge for answering new questions."

-Leon Bottou, 2011



Patient has early-stage cardiovascular disease

Lab results indicate very low folic acid



...
bilirubin, total	1.2	mg/dL
BUN 6	15	mg/dL
calcium (total)	9	mg/dL
carbon dioxide	33	mEq/L
chloride	99	mEq/L
creatinine	1.1	mg/dL
ethanol	0	gm/dL
folic acid	0.4	ng/mL
glucose	78	mg/dL
iron	134	µg/dL
...





John Henry Smith, patient 12345, has cardiovascular disease. Lab results indicate low folic acid. Folic acid is a folate. Folate and vitamin B-12 are required for the primary metabolic pathway to reduce Hcy concentrations. The increased level of Hcy in plasma, hyperhomocysteinemia, is considered to be an independent risk factor for cardio and cerebrovascular diseases. Describe a scenario where a doctor talks to patient 12345. What does the doctor suggest?





Here is a scenario of how a doctor might talk to patient 12345 about his lab results indicating low folic acid:



Doctor: "Hello, Mr. Smith. I'm Dr. Jones. I'm reviewing your lab results and I noticed that your folic acid levels are low. Do you have any questions about this?"

Patient 12345: "What does that mean?"

Doctor: "Folic acid, also known as folate, is an important nutrient that plays a role in many of the body's functions. It is especially important for the production of red blood cells and for proper brain function. Low levels of folic acid can lead to anemia and other health problems. Did you have any symptoms that might be related to low folic acid?"

Patient 12345: "No, I didn't have any symptoms."

Doctor: "Well, it's important to maintain sufficient levels of folic acid in your body to support your overall health. I'm going to recommend that you take a daily folic acid supplement and make sure that you are getting enough folate in your diet. Leafy green vegetables, beans, and citrus fruits are all good sources of folate. I'm also going to order a follow-up lab test in a few weeks to check your folic acid levels again and make sure they are improving. Does that sound okay to you?"

Patient 12345: "Yes, that sounds fine. Thank you, Doctor."

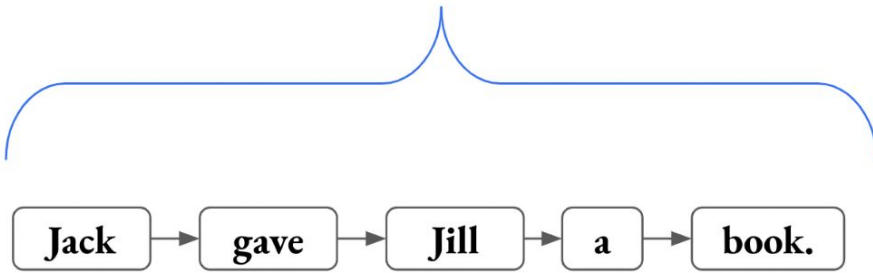


But, how might we implement

"algebraically manipulating" ?

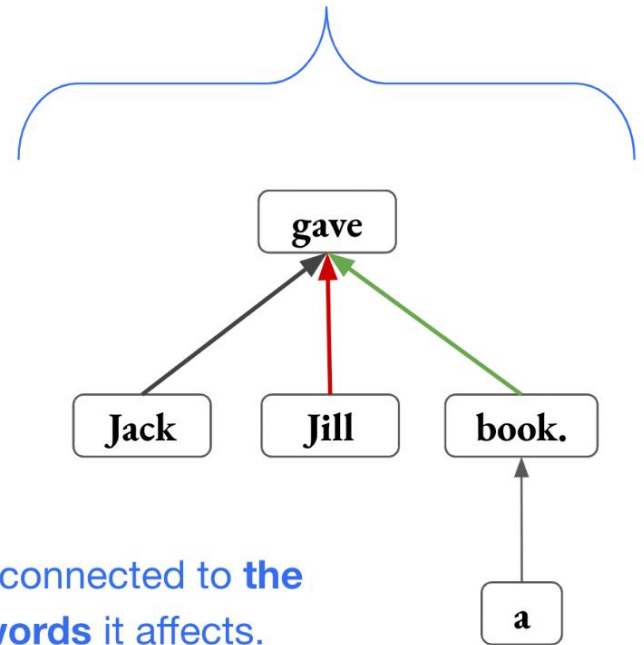


Sequence Structure



"gave" is connected to only **two words**

Tree Structure



"gave" is connected to **the three words** it affects.



Am J Clin Nutr. 1994 Apr;59(4):940-8.

Plasma homocyst(e)ine, folate, and vitamin B-12 concentrations and risk for early-onset coronary artery disease.

Pancharuniti N¹, Lewis CA, Sauberlich HE, Perkins LL, Go RC, Alvarez JO, Macaluso M, Acton RT, Copeland RB, Cousins AL, et al.

⊕ Author information

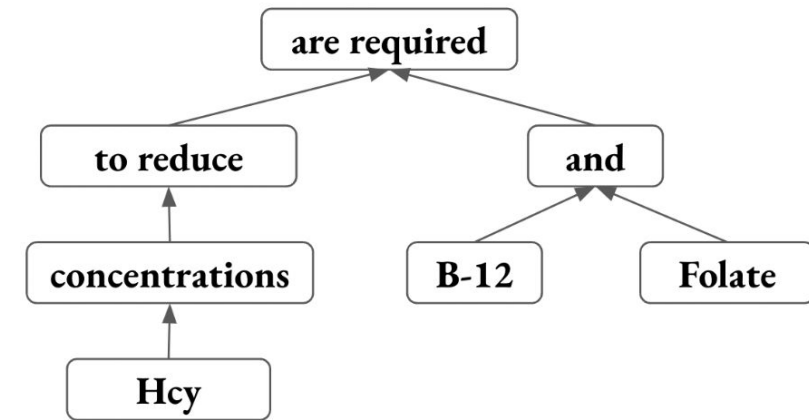
Erratum in

Am J Clin Nutr 1996 Apr;63(4):609.

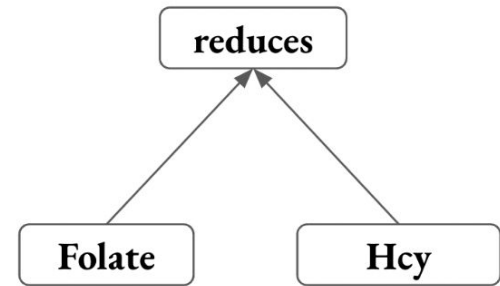
Abstract

High plasma homocyst(e)ine (Hcy) concentrations may be a determinant of coronary artery disease (CAD). Folate and vitamin B-12 are required for the primary metabolic pathway to reduce Hcy concentrations. The interrelationships of Hcy and these two vitamin cofactors were investigated in a case-control study of 101 white males aged 30-50 y with angiographically demonstrated CAD, and 108 white male, similarly aged, control subjects living in the same community as the patients. The odds ratio (OR) of CAD per quartile increase of plasma Hcy concentration based on control values was 1.6 (95% CI: 1.3, 2.1). After age, HDL and LDL cholesterol, body mass index, smoking, hypertension, and diabetes were controlled for, Hcy remained an independent risk factor (OR: 1.4; 95% CI: 1.0, 2.0). The OR change per quartile increase of folate concentration was 0.8 (95% CI: 0.6, 1.0). This difference was reduced (OR: 0.9; 95% CI: 0.7, 1.2) after Hcy adjustment. No difference in the geometric mean of vitamin B-12 concentration was found between patients and control subjects, both 5.8 nmol/L. However, after Hcy and the other CAD risk factors were controlled for, the OR per quartile increase in vitamin B-12 concentration was 1.5 (95% CI: 1.0, 1.8). Reduction in plasma Hcy by interventions to increase plasma folate concentration may decrease CAD risk.





(AKA Homocysteine)



The Molecular and Cellular Effect of Homocysteine Metabolism Imbalance on Human Health

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Katalin Prokai-Tatrai, Academic Editor

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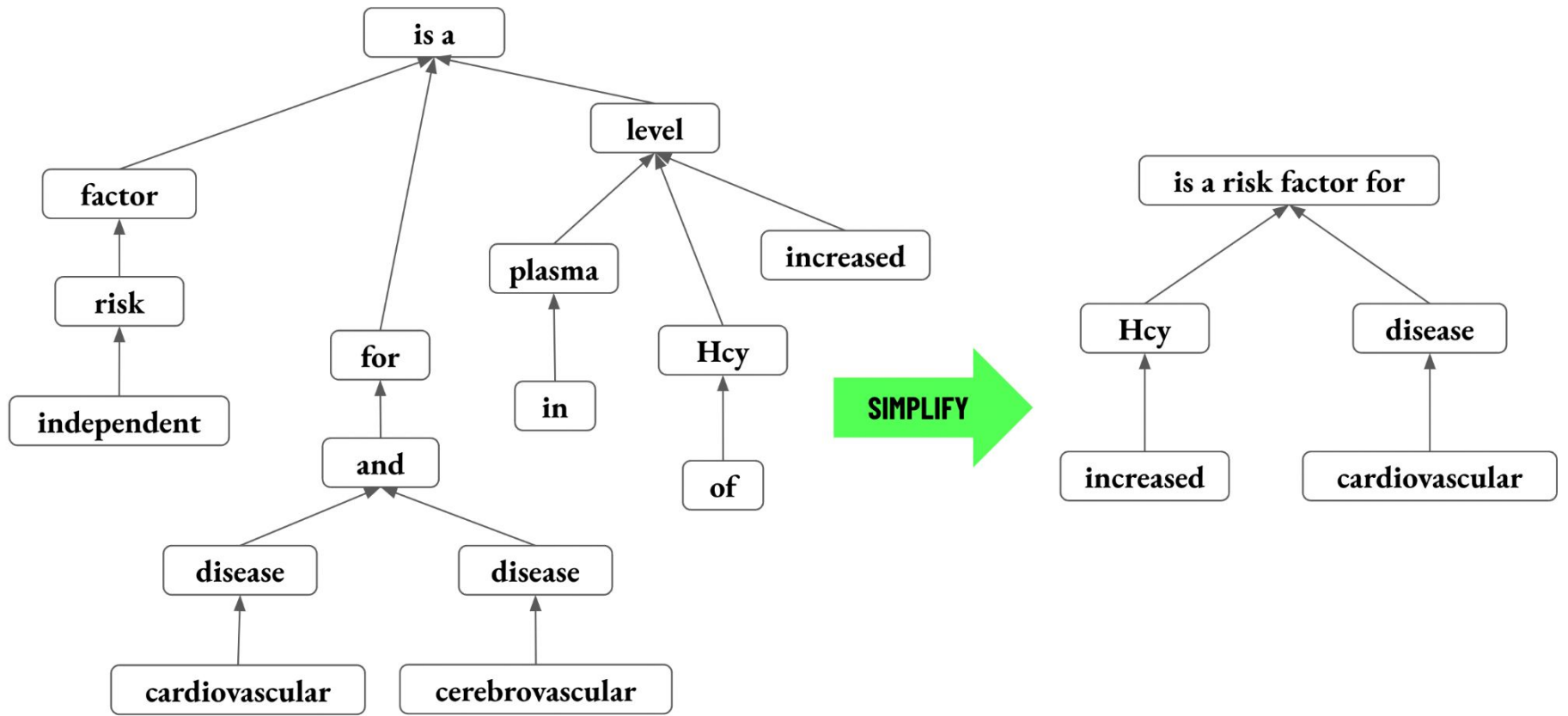
This article has been [cited by](#) other articles in PMC.

Abstract

Go to: 

Homocysteine (Hcy) is a sulfur-containing non-proteinogenic amino acid derived in methionine metabolism. The increased level of Hcy in plasma, hyperhomocysteinemia, is considered to be an independent risk factor for cardio and cerebrovascular diseases. However, it is still not clear if Hcy is a marker or a causative agent of diseases. More and more research data suggest that Hcy is an important indicator for overall health status. This review represents the current understanding of molecular mechanism of Hcy metabolism and its link to hyperhomocysteinemia-related pathologies in humans. The





Patient has early-stage cardiovascular disease

Lab results indicate very low folic acid

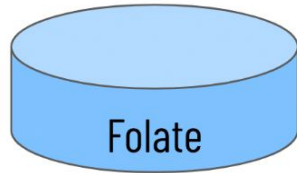
PRESCRIBE

Folate





PRESCRIBE



BECAUSE :

- > patient has cardiovascular disease
- > patient low in folic acid
- > folic acid is a folate
- > folate reduces Hcy
- > increased Hcy a risk factor for cardiovascular disease



Automated reasoning
built on *resolved logical steps*

