



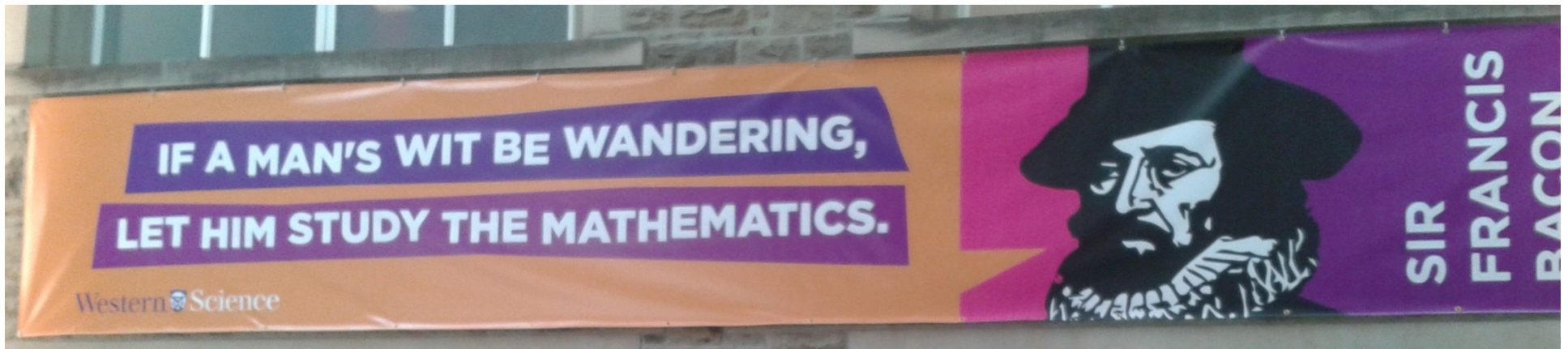
(Bio)chemistry as Liberal Education
or
Why *More* Science with *Less* Arts and Humanities is a Really Bad Idea

David M. Morgan, Ph.D.
Department of Chemistry
St. Francis Xavier University

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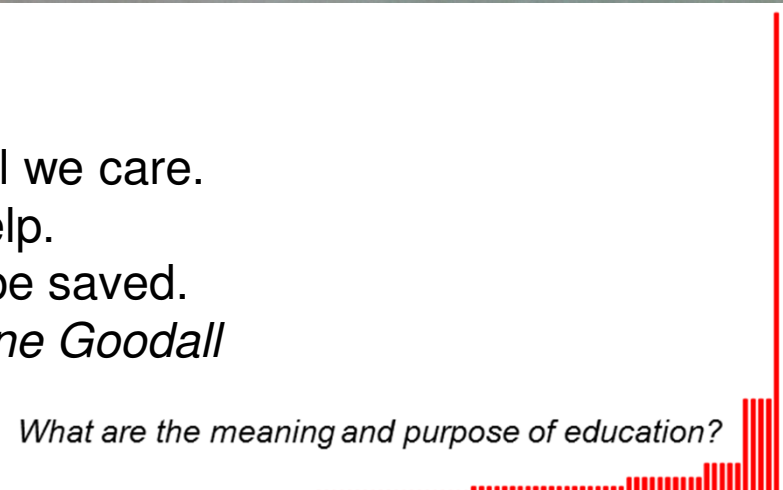
Discovered in the PAB Atrium

Imagination is more important than knowledge.
Albert Einstein



Only if we understand, will we care.
Only if we care, will we help.
Only if we help, shall we be saved.
Jane Goodall

What are the meaning and purpose of education?

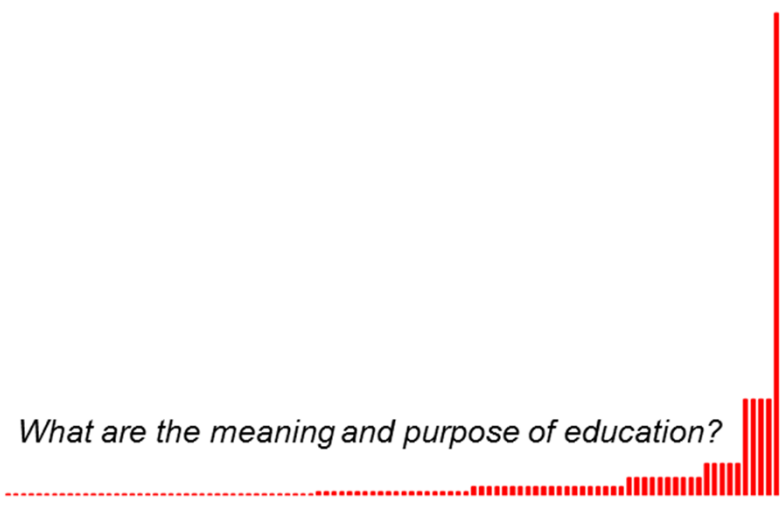


What is Liberal Education?

What are the Liberal Arts?

What are the meaning and purpose of education?

What are the meaning and purpose of education?



The Phenomenon – 1

The University of Salford, UK, Announces Plans to Close its School of the Humanities, Languages, and Social Sciences in Order “to secure the future of the university”

“...as we would no longer recruit, after 2013, to modern languages, linguistics and areas of politics and contemporary history (except postgraduate security studies programmes), the School of Humanities, Languages and Social Sciences would eventually be disestablished”.

Vice-Chancellor Martin Hall, as quoted in
Salford culls courses ‘to secure future’
Times Higher Education
5 June 2013 | By John Morgan

What are the meaning and purpose of education?

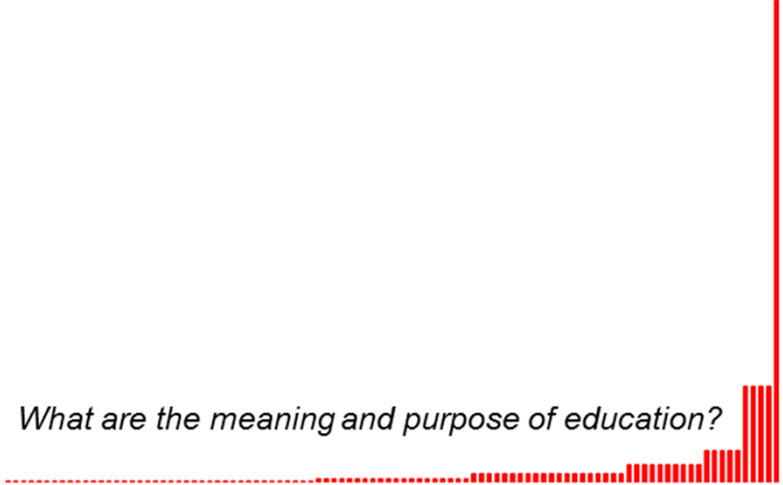


The Phenomenon – 2
Faced with a Decline of More than 30 % in its State Funding,
SUNY Albany Eliminates 5 Programs in the Arts and Humanities

President Philip issued a directive today to suspend all new admissions to five program areas – Classics, French, Italian, Russian, and Theatre.

From the University's News Release,
"University at Albany Announces Measures to Rethink, Balance and
Reallocate Resources in Face of Reduced State Fiscal Support,"
October 1, 2010

What are the meaning and purpose of education?



The Phenomenon – 3

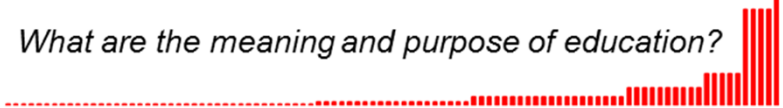
On the Closure of the Philosophy Department at Middlesex University, UK

Sources told THE that, internally, management said the decision was part of a drive to increase teaching income from the Higher Education Funding Council for England by switching to science, technology, engineering and mathematics (STEM) subjects.

A banding system operated by Hefce puts humanities subjects such as philosophy in band D, *which receives the lowest funding*.

Loss of philosophy at Middlesex raises fears for humanities
Times Higher Education
6 May 2010 | By John Morgan

What are the meaning and purpose of education?



On the Expectations Students Bring to Higher Education: It's the \$\$\$, Copain.

Le second constat est l'importance qu'ils accordent à l'autonomie économique. Ils travaillent, ils consomment et le cégep ne sert plus qu'à acquérir un emploi bien rémunéré.

(The second thing is the importance they place on economic independance. They work, and they buy things, and CEGEP is just a means of finding a well-paying job. (My translation.))

Libre opinion - À la recherche de l'intelligence perdue
Xavier Brouillette
Le Devoir
June 7, 2011

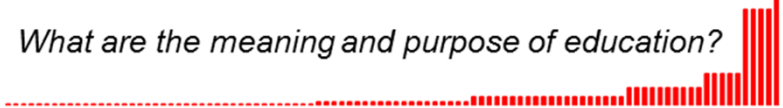
In Fairness, Some Folk are Jumping to the Defense of the Arts and Humanities

The study of the humanities evolved during the 20th century “to focus almost entirely on personal intellectual development,” said Richard M. Freeland, the Massachusetts commissioner of higher education. “But what we haven’t paid a lot of attention to is how students can put those abilities effectively to use in the world.”

For example?

Patricia Cohen
In Tough Times, The Humanities Must Justify Their Worth
February 25, 2009
The New York Times

What are the meaning and purpose of education?



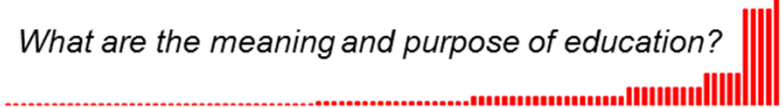
In Fairness, Some Folk are Jumping to the Defense of the Arts and Humanities: (Sort of)

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Mr. Freeland is part of what he calls a revolutionary movement to close the “chasm in higher education between the liberal arts and sciences and professional programs.” The Association of American Colleges and Universities recently issued a report arguing *the humanities should abandon the “old Ivory Tower view of liberal education” and instead emphasize its practical and economic value.*

Patricia Cohen
In Tough Times, The Humanities Must Justify Their Worth
February 25, 2009
The New York Times

What are the meaning and purpose of education?

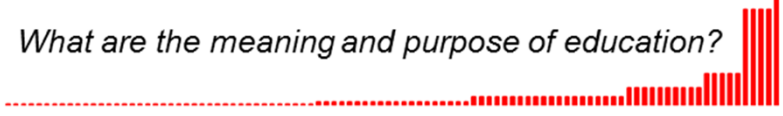


Some Selections From the Shapers of Public Opinion in Canada – 1

Sky-high tuition fees are charged by American colleges and universities to feed bloated administrations and ... faculty — *some teaching in fields where there are far too few jobs relative to the number of students. The cost of tuition has fuelled growing discontent among unemployed and underemployed graduates saddled with enormous student debts and no way to pay them.*

Paul Schneidereit
The Chronicle Herald
November 15, 2011

What are the meaning and purpose of education?



Some Selections From the Shapers of Public Opinion in Canada – 2

And for companies unable to find people to do skilled work, it means stymied growth that *reduces Canadian productivity and prosperity*. Such is the sad toll when publicly financed universities *put “academic freedom” to teach whatever they choose ahead of the interests of their students, and the national economy.*

Divisions between haves and have-nots begin with having skills – or not
Gwyn Morgan
From the Globe and Mail, Nov 4, 2012.

What are the meaning and purpose of education?

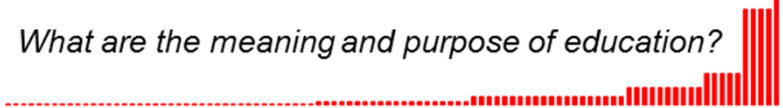


Some Selections From the Shapers of Public Opinion in Canada – 3

...but the call for reallocation of resources to programs in demand generated real indignation. In response to statistics showing the majority of arts graduates either end up in low skill-level jobs, I was told that “there’s more to getting an education than turning out workers for corporations” *(as if my advocacy of programs focused on where the jobs are were part of some sort of a capitalist plot)*.

Divisions between haves and have-nots begin with having skills – or not
Gwyn Morgan
From the Globe and Mail, Nov 4, 2012.

What are the meaning and purpose of education?



Counterpoint – 1

The Humanities in Crisis? Not at Most Schools

Scott Saul, Associate Professor of English, Berkeley

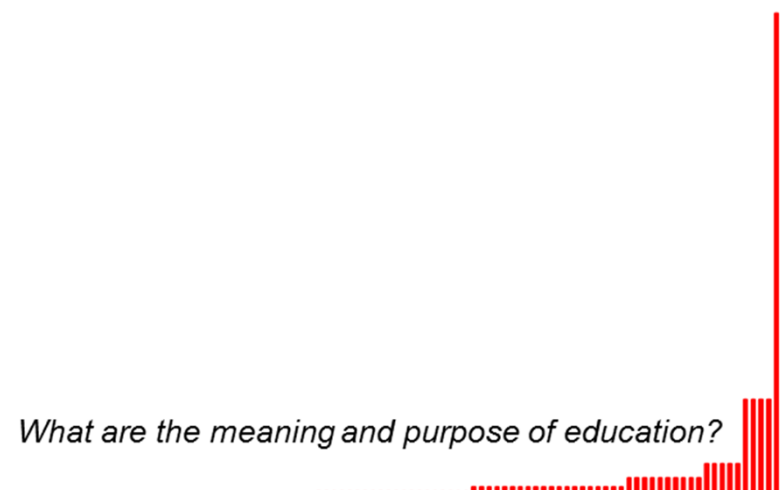
The New York Times

Op-ed

July 3, 2013

–argues that students are still drawn to the humanities (even if they're no longer majoring in them) in numbers that have been pretty constant over the past twenty years.

What are the meaning and purpose of education?



Counterpoint – 2

Steven Pinker, Professor of Linguistics, MIT (now Harvard)
The Blank Slate: The Modern Denial of Human Nature
Viking, New York, 2002.

Notes that, in fact, the arts are flourishing in society. Witness the enormous popularity of television drama, comedy, (reality), etc. shows, the availability and variety of music, the availability of film, novels, and so on. Actually, we're surrounded by art.

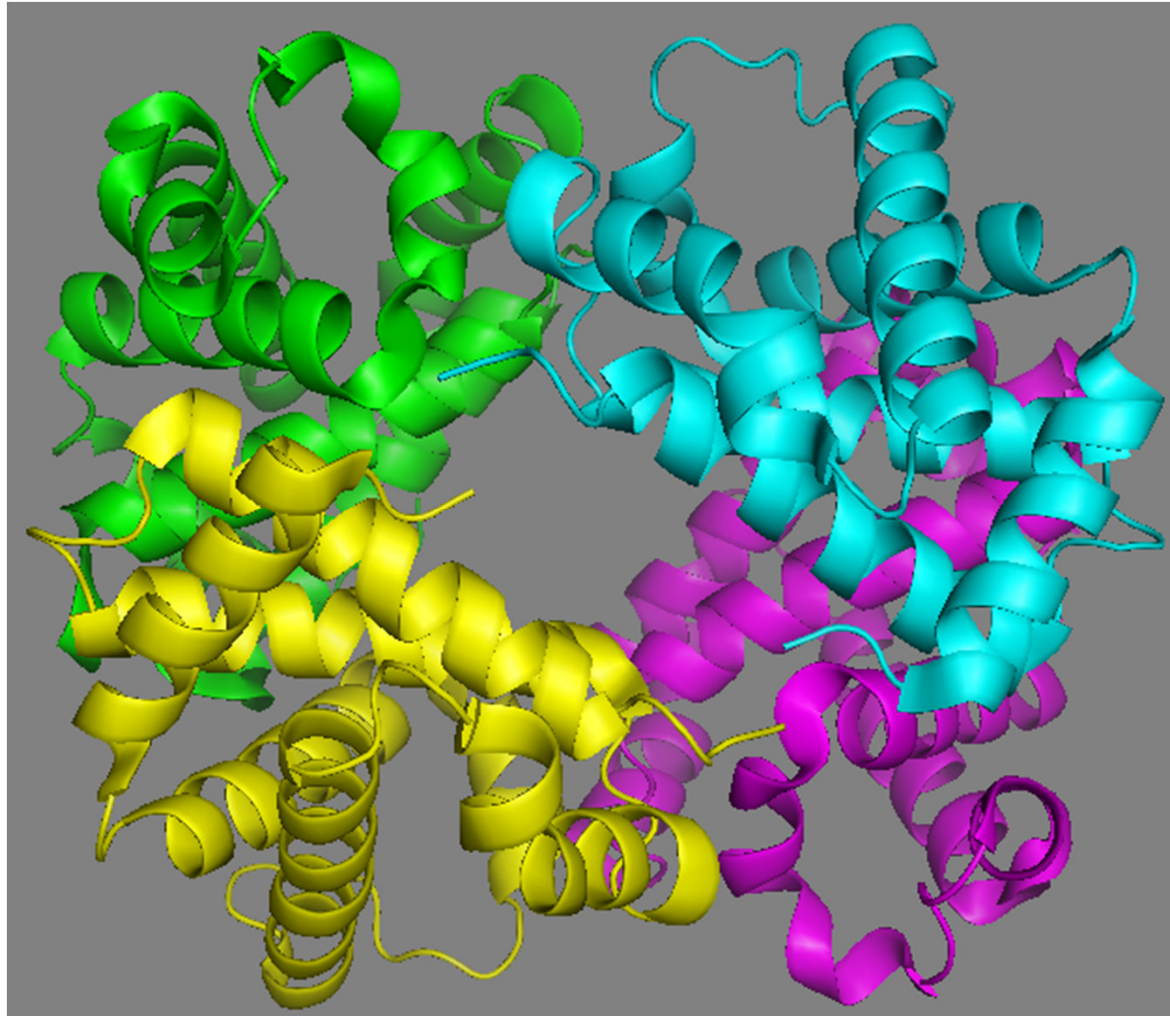
*OK – So there's some debate
Maybe I'm overreacting.*

Suppose I'm not.

*What **can** STEM faculty do about it?*

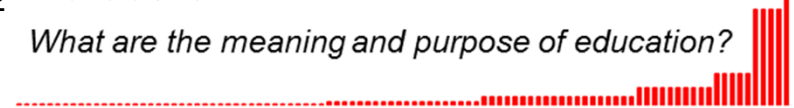
*(Leaving aside, for the moment,
whether STEM faculty **ought** to do something about it)*

Hemoglobin: The Principal Oxygen-Carrying Protein in Blood And the Nature of Scientific Truth-Claims – 1

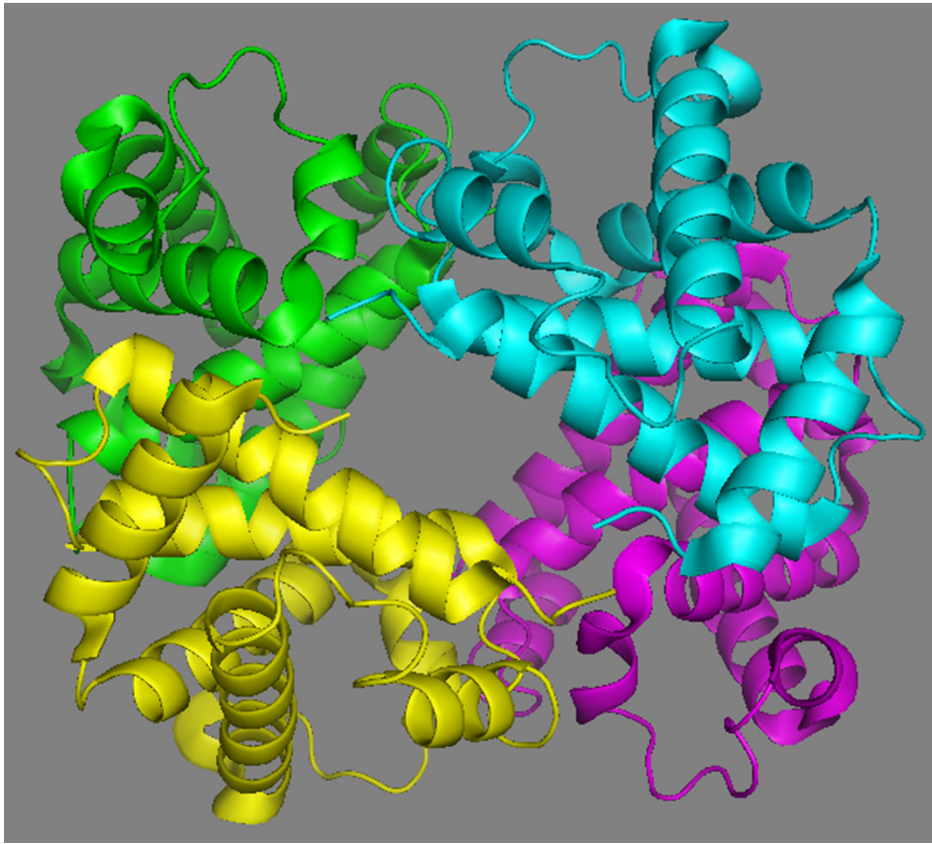


It is tetrameric: there are 4 subunits –
each subunit binds one O₂ molecule.

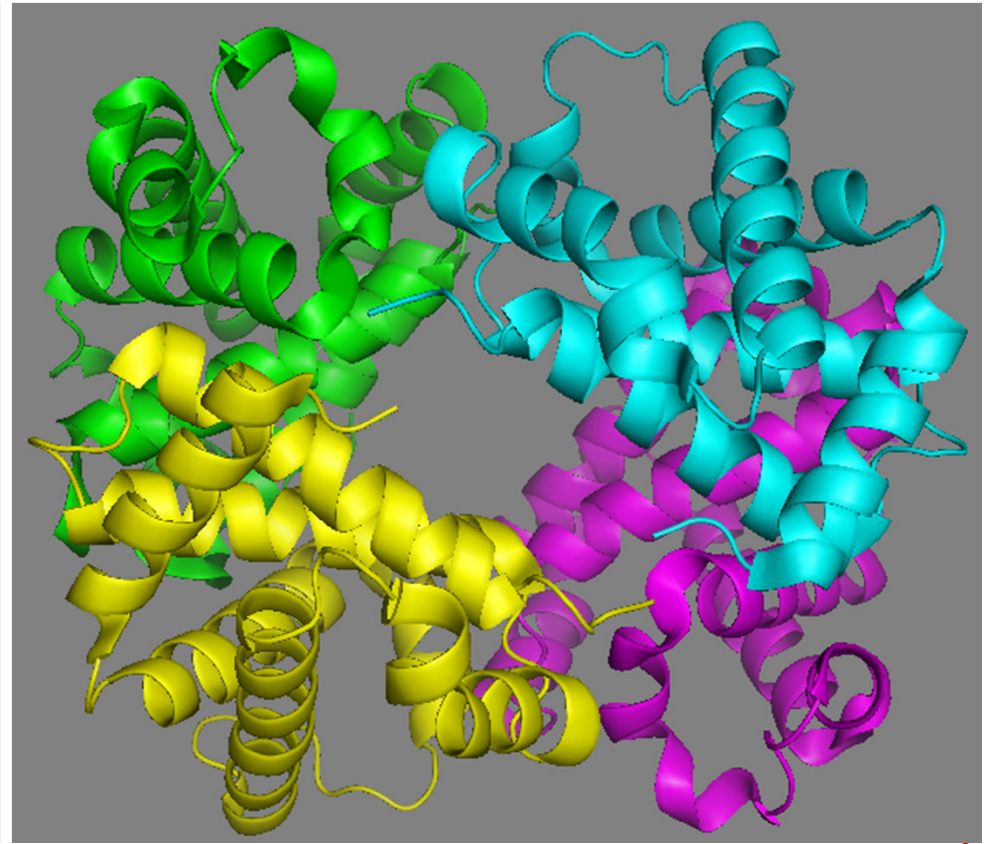
What are the meaning and purpose of education?



Scientific Truth Claims – 2:
Oxygenated and Deoxygenated Hemoglobin Exhibit Slightly Different Structures

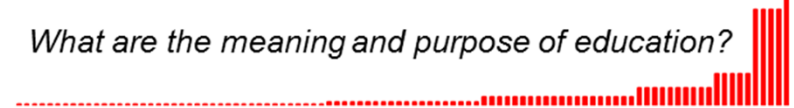


Deoxy-Hb

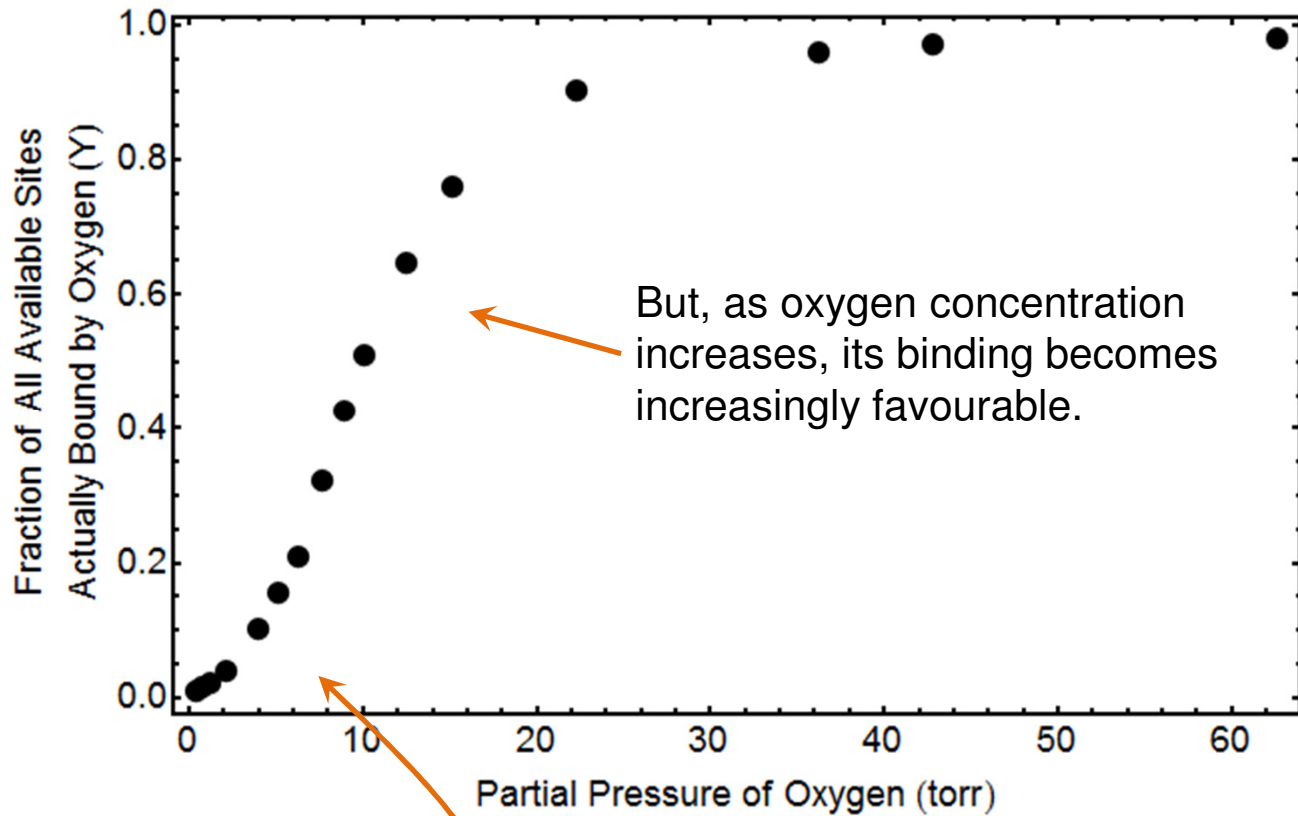


Oxy-Hb

What are the meaning and purpose of education?



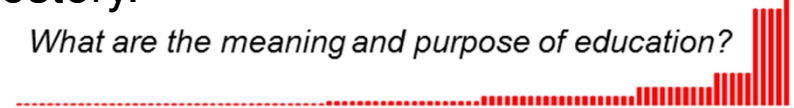
Scientific Truth-Claims – 3: Hemoglobin Binds Oxygen “Cooperatively”



Oxygen binds poorly when its concentration is small.

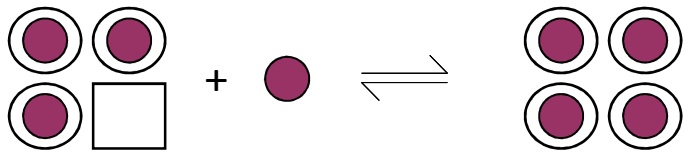
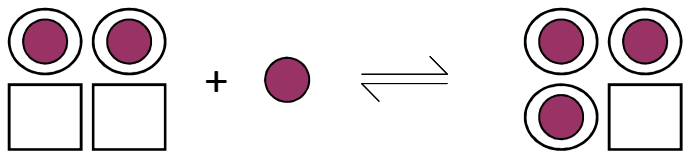
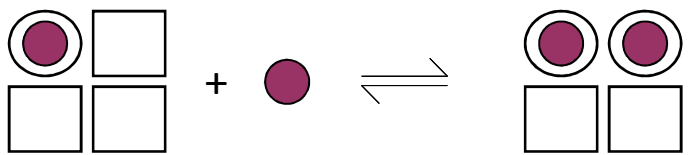
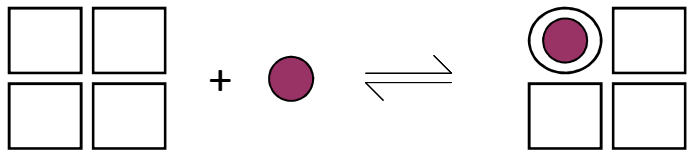
This behaviour suggests that early oxygen binding events increase the probability of subsequent oxygen binding events - this is an example of “allostery.”

What are the meaning and purpose of education?



Truth Claim 1:

The Koshland – Némethy – Filmer “Sequential” Model of Allostery



4 subunits

4 oxygen binding events

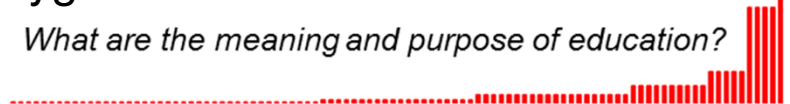
Each binding event causes deoxy → oxy structure shift in one subunit

Subunits change from deoxy → oxy state independently of each other, but:

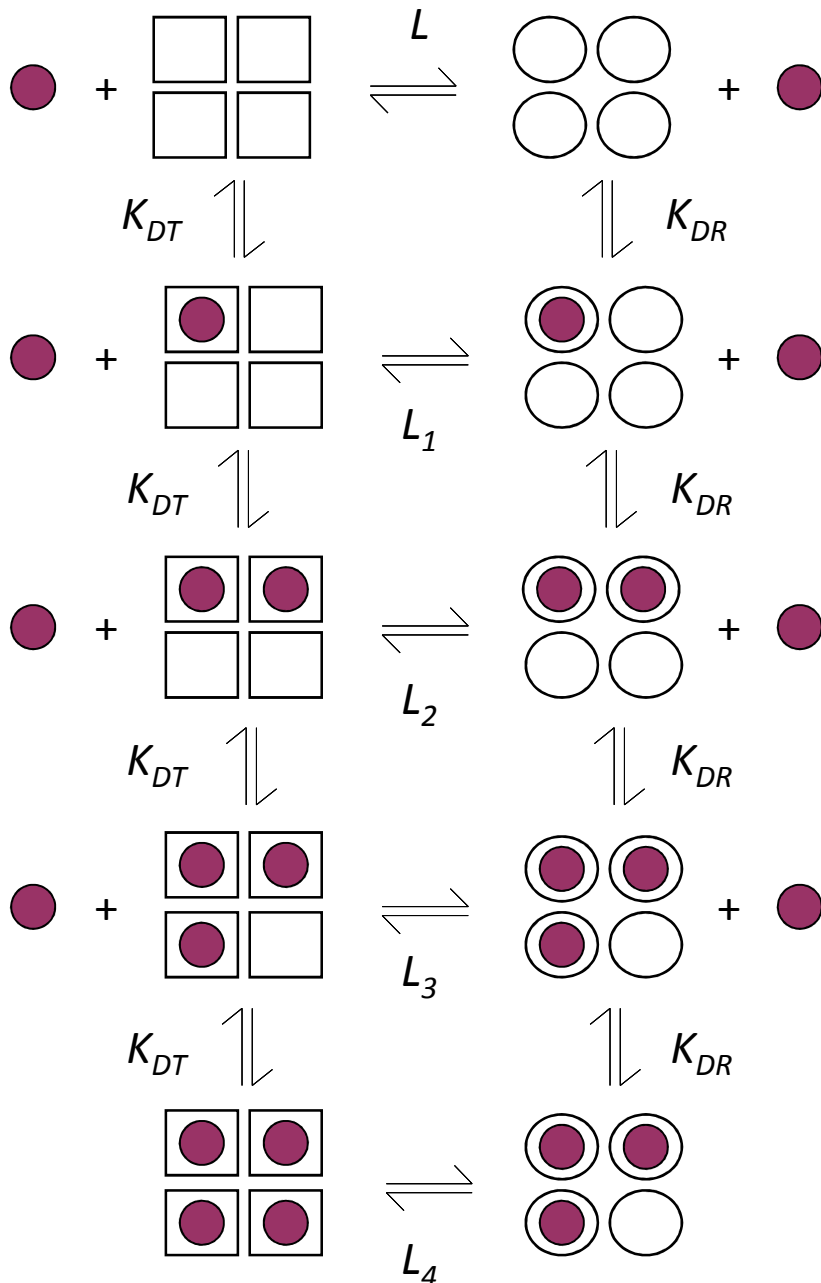
The more oxy subunits there are, the more likely the remaining deoxy subunits are to bind oxygen.

Increasing probability to bind oxygen.

What are the meaning and purpose of education?



Truth Claim 2: The Monod – Wyman – Changeux “Concerted” Model of Allostery



4 subunits

Oxygen may bind to either the deoxy-state tetramer or the oxy-state tetramer.

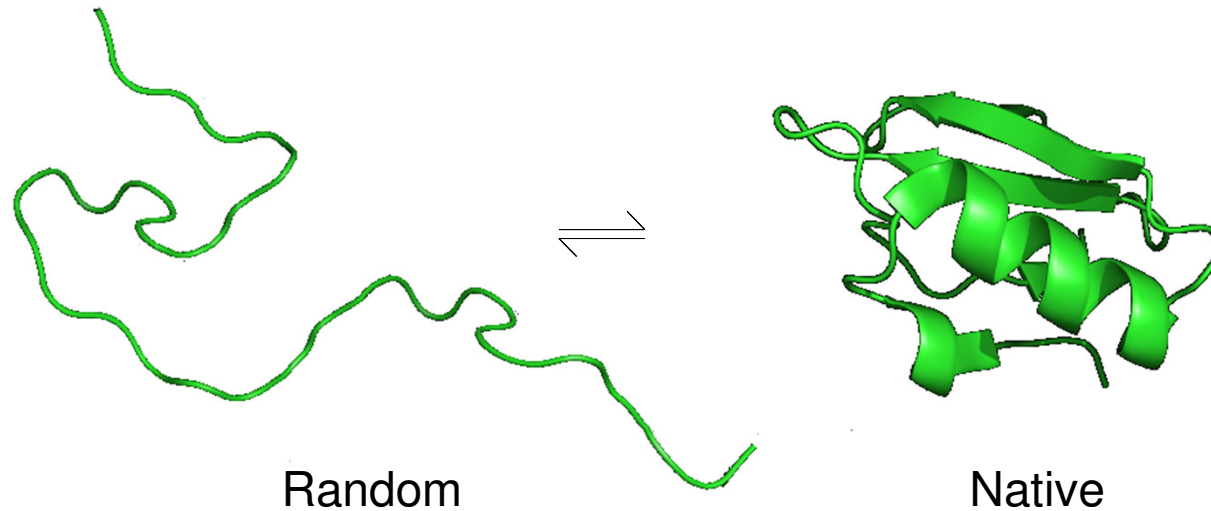
There are no mixed structural states.

As long as the oxy-state tetramer binds oxygen more avidly than the deoxy-state tetramer, the oxy-state predominates at large pO_2 ; the deoxy-state predominates at small pO_2 .

Increasing probability to bind oxygen.

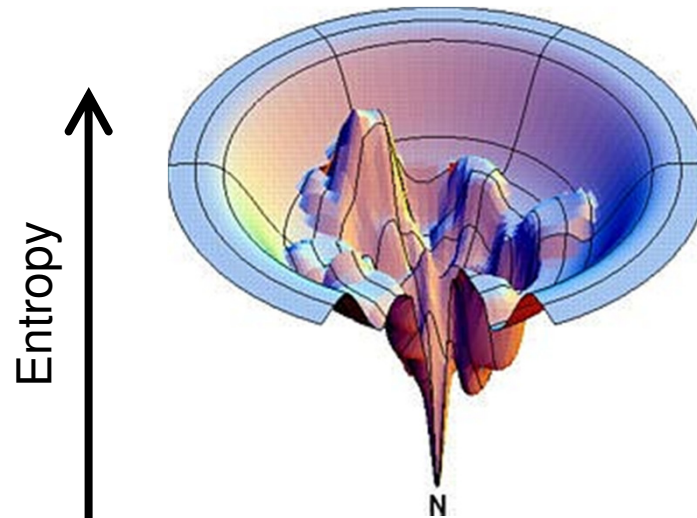
What are the meaning and purpose of education?

On Complex Reasoning in Biochemistry: Protein Folding – 1



Folding is the process by which a polymer of amino acids that is randomly sampling conformational space becomes a specific, compact, functional, 3D object.

On Complex Reasoning in Biochemistry: Protein Folding – 2



Folding is:

Entropically favoured with respect to the conformational freedom of bulk water.

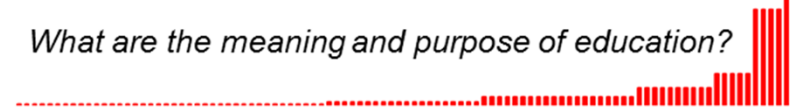
Entropically opposed with respect to the conformational freedom of the protein chain.

Enthalpically favoured with respect to protein – protein self interactions.

Enthalpically unpredictable with respect to protein – water interactions.

The habits of mind required to grasp protein folding are the same as those required to assess whether or not a cultural decline in the liberal arts is underway.

What are the meaning and purpose of education?



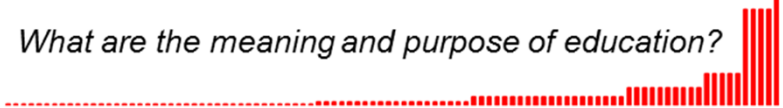
On Why STEM Professors Ought to Care – 1

The best evidence for this is the shrinking number of tenured and tenure-track faculty and the corresponding rise of adjuncts, part-timers more akin to itinerant workers than to embedded professionals.

Tenured and tenure-track teachers now make up only 35 percent of the pedagogical workforce and “this number is steadily falling.”

Stanley Fish
The Last Professor
The New York Times
January 18, 2009

What are the meaning and purpose of education?



On Why STEM Professors Ought to Care – 2

“Bums in seats.”

Declining by Degrees.*

Tri-council funding.

* *Richard H. Hersh and John Merrow, editors. MacMillan, 2005.*

What Have I Suggested?

*A long tradition of liberal education is at risk
of becoming entirely vocational in nature*

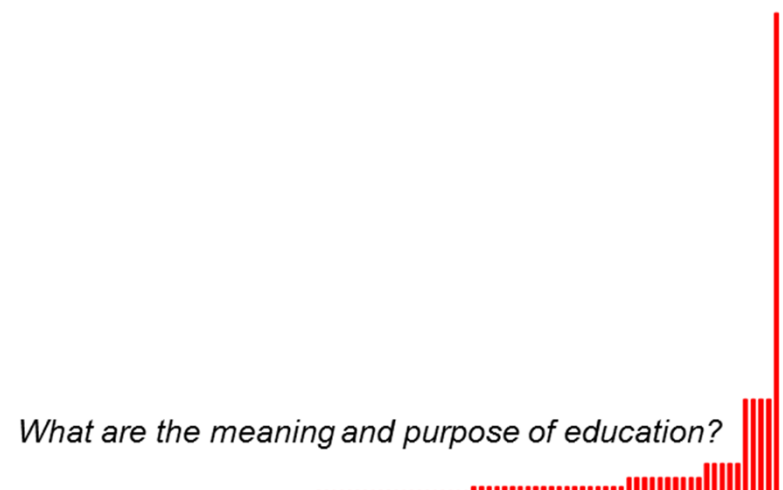
*The risk is primarily brought about by the cultural
privilege afforded to market imperatives*

The long term intellectual health of Western civilization is at stake

The long term health of Western democracy is at stake

STEM faculty are at risk just like everyone else

What are the meaning and purpose of education?





Acknowledgements

Dr. Jeffrey Fryman, Political Science, Transylvania University

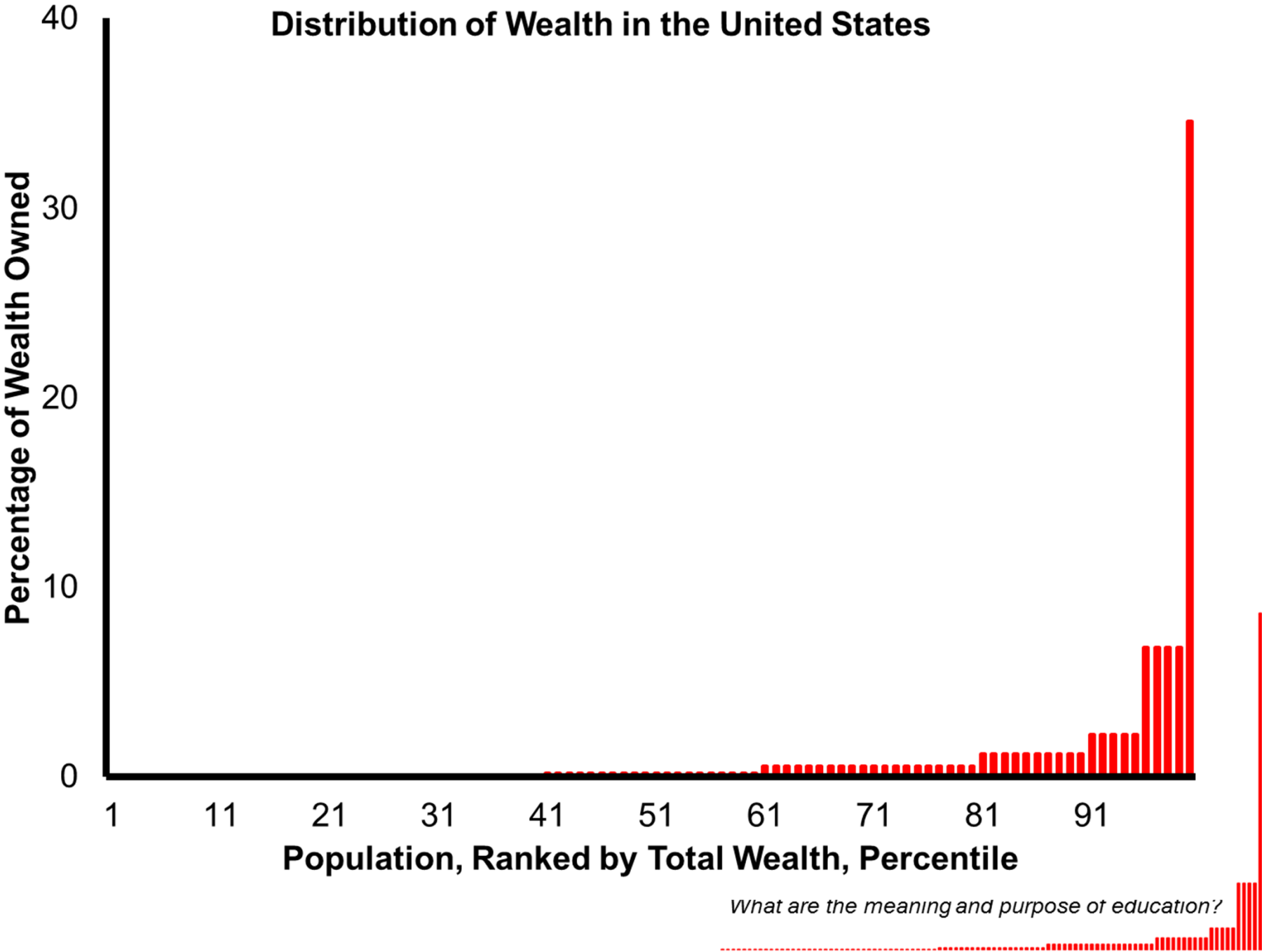
Dr. Michael Newton, St. FX

Dr. Steve Baldner, Philosophy, St. FX

Drs. Anton Allahar and James Coté, Sociology, Western University
and authors of "Lowering Higher Education"

Drs. Richard Arum and Josipa Roska
authors of "Academically Adrift: Limited Learning on College Campuses"

Distribution of Wealth in the United States



What are the meaning and purpose of education?