



COOPERATION: HOW TO MODEL IT, HOW TO FOSTER IT, AND HOW IT MIGHT HAVE EMERGED

COOPERATION IN THE FIELD

Adrian Haret

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November 2-9, 2023

A breakdown of what we'll be
focusing on.

The Story of Cooperation



Cooperation is everywhere among living things.

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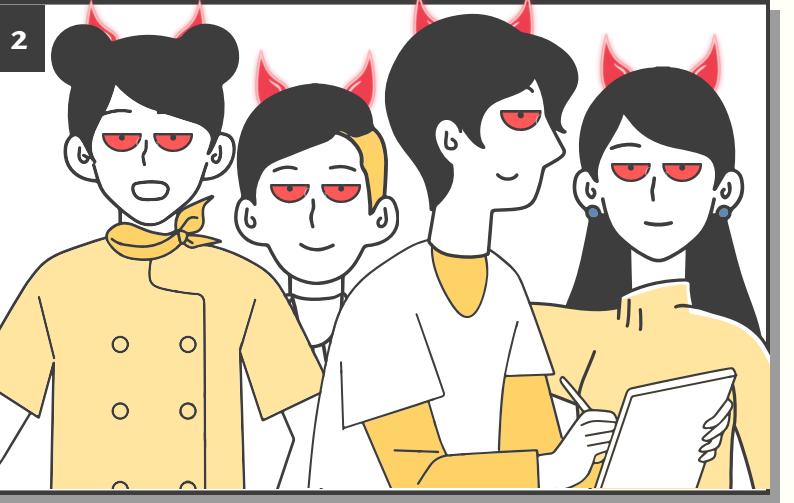
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But how, when everyone is in it only for themselves?

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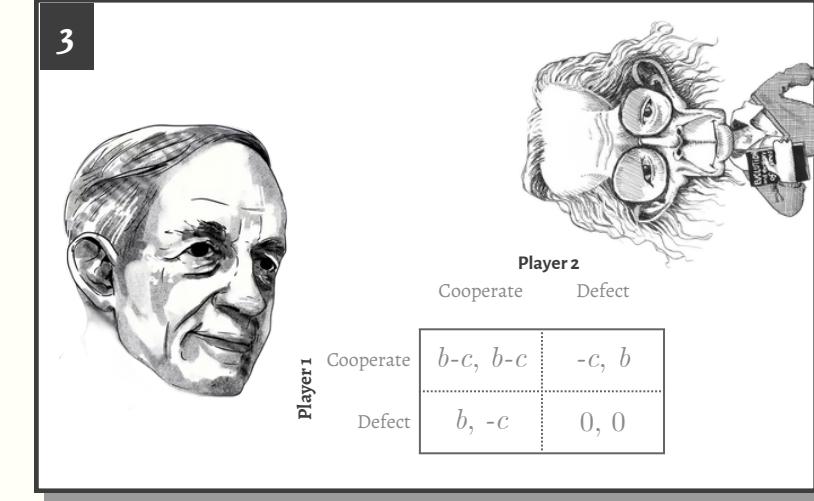
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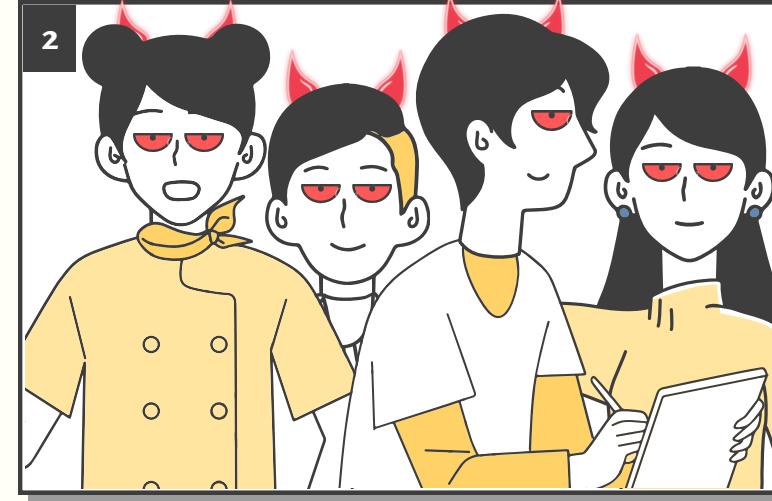


Game theory is the perfect tool to study the puzzle of cooperation.

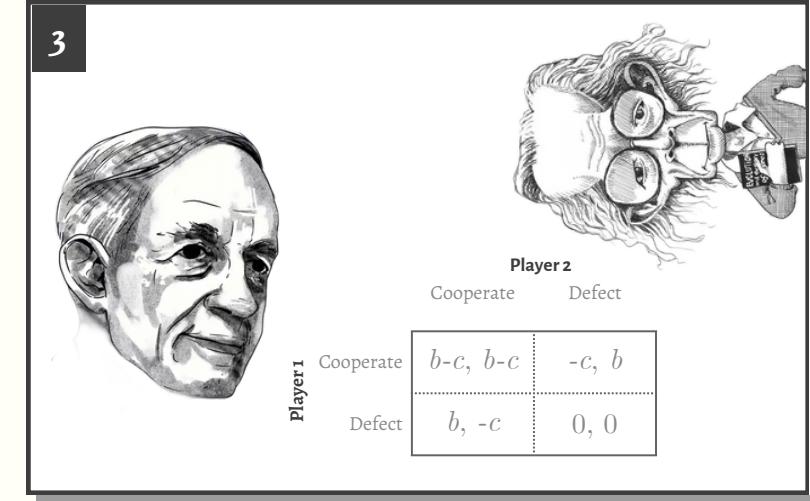
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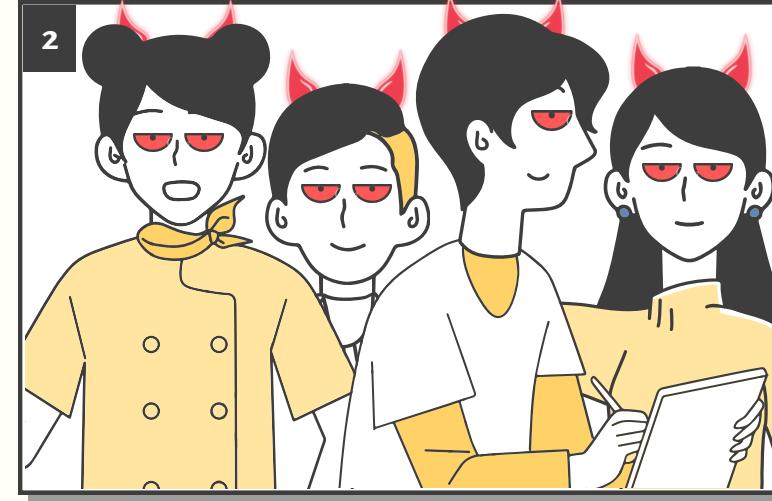


We'll look for plausible mechanisms capable of ensuring cooperation in a world of selfish individuals.

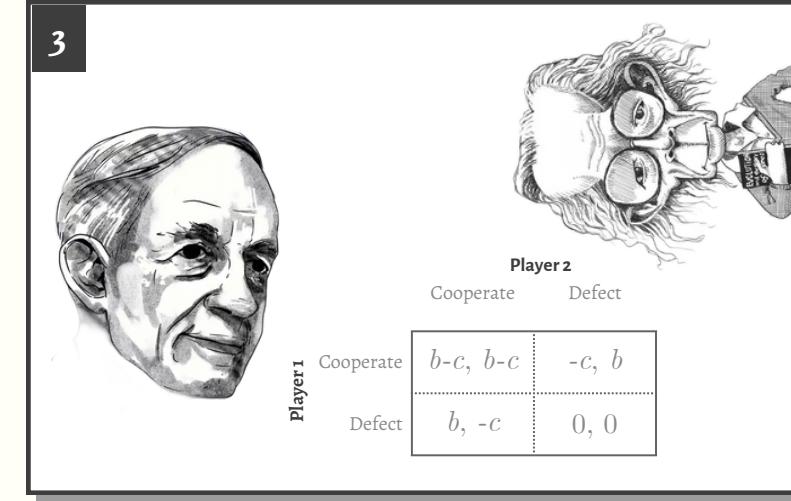
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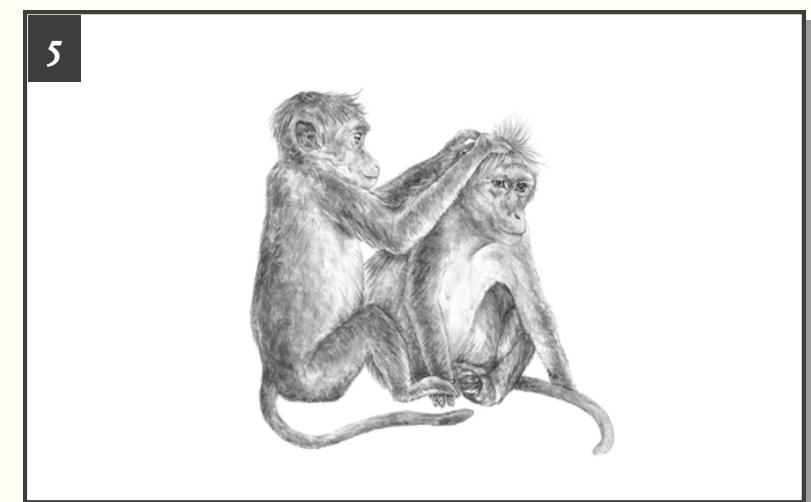
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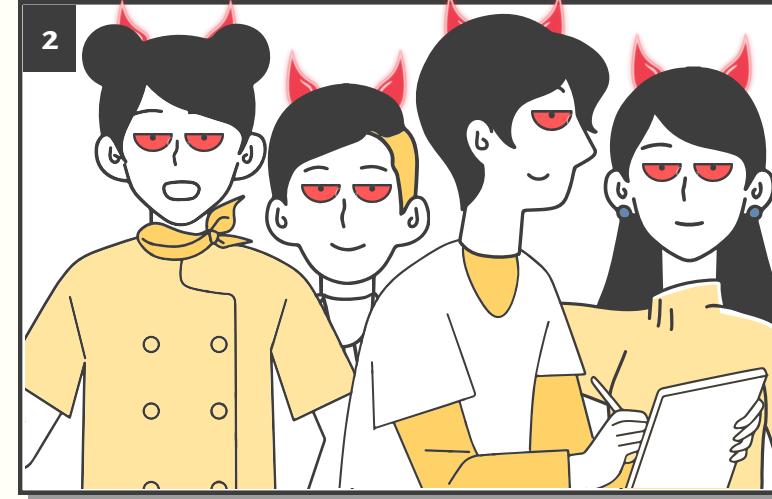


Such as reciprocity...

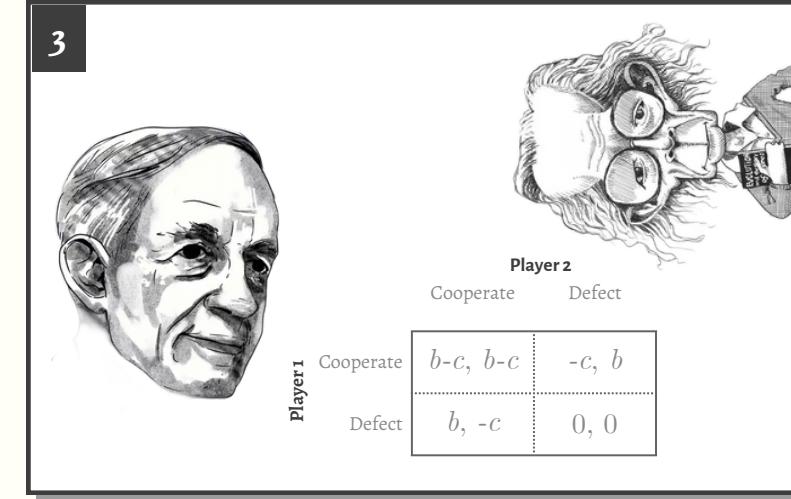
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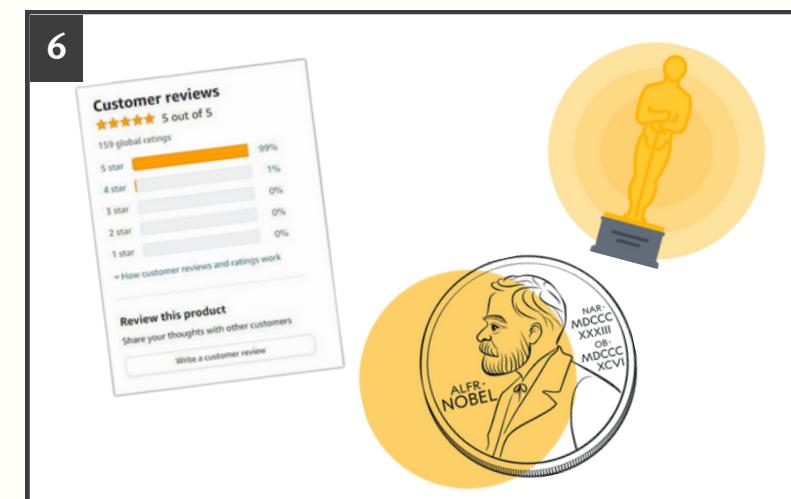
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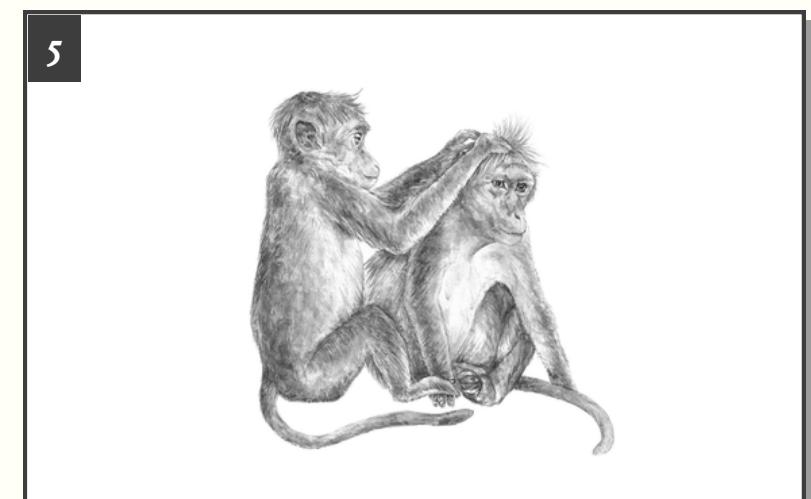
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trust and reputation...



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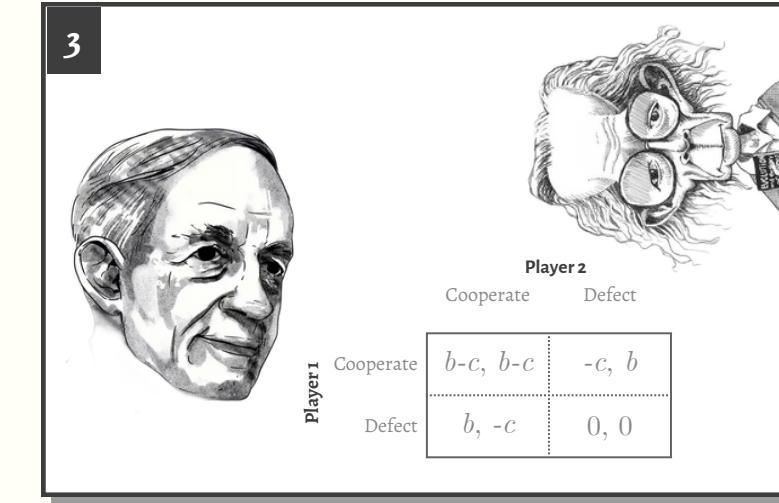
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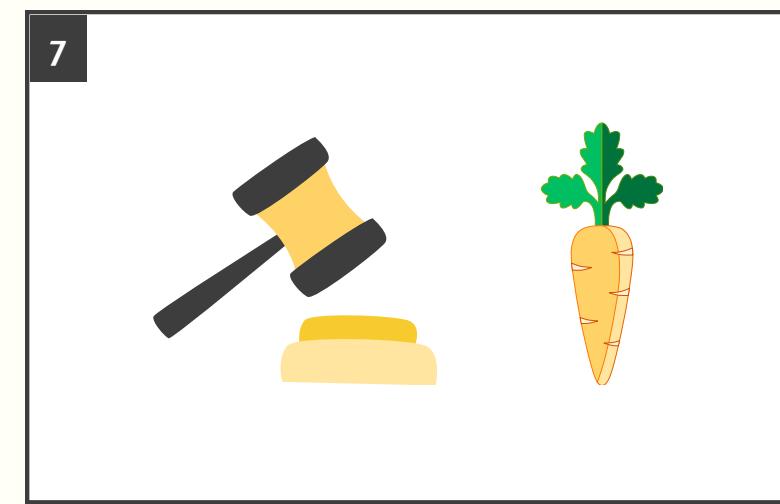
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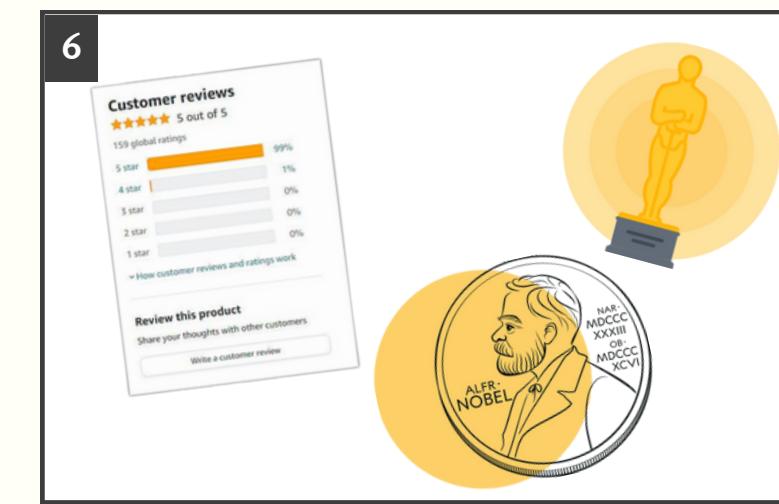
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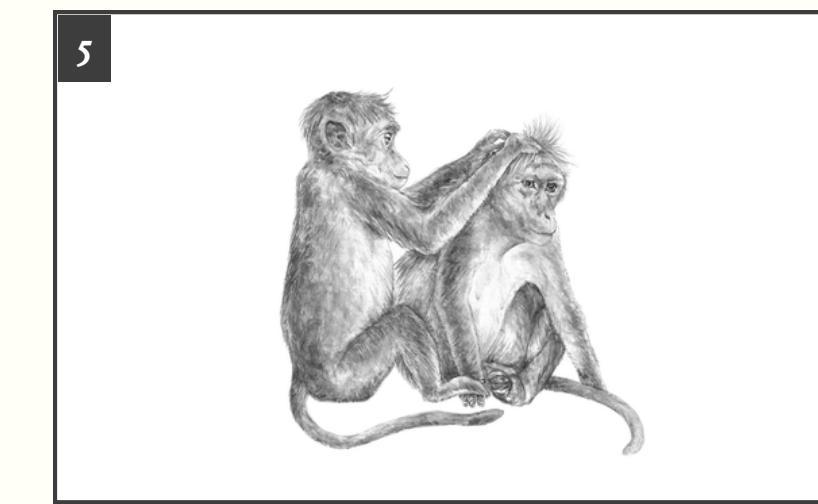
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punishments and rewards...



trust and reputation...



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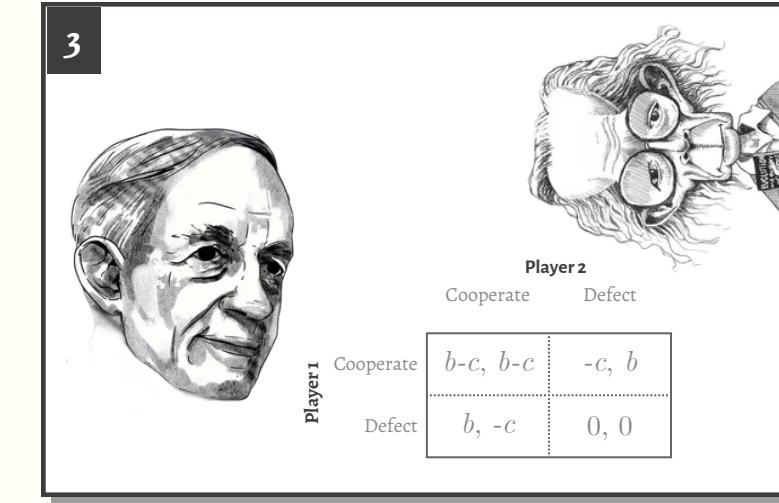
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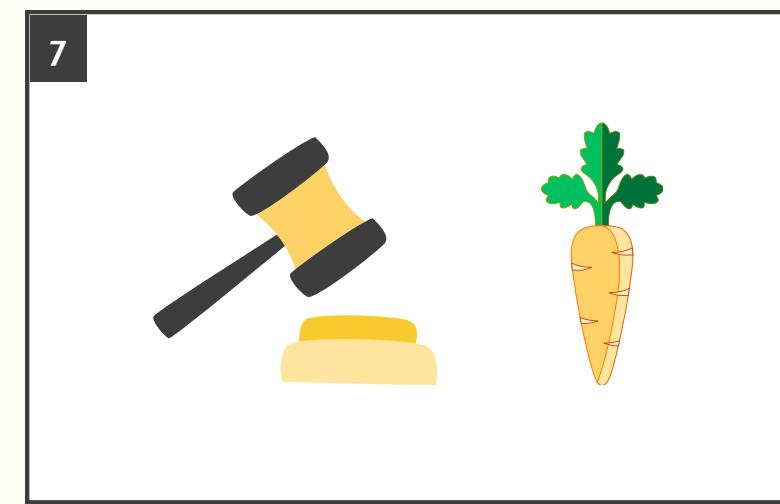
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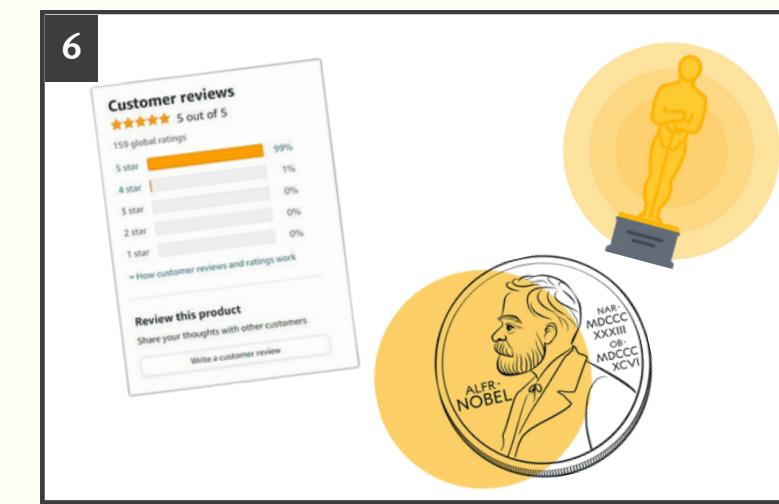
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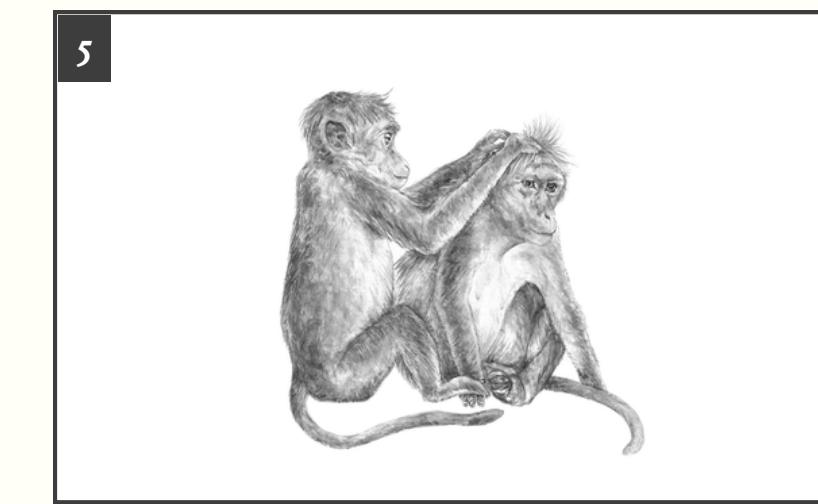
or selection based on kinship and group membership.



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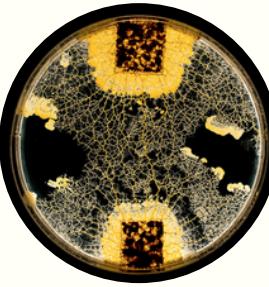
Where does cooperation occur?

Where does cooperation occur?
Let's see some examples.



SLIME MOLDS

SLIME MOLD ELDER
Slime molds are single-celled organisms, amoebas living in the
ground.



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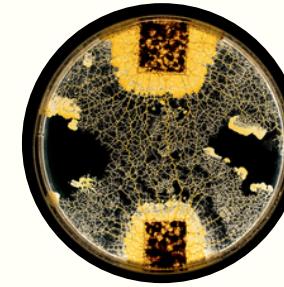
The fruiting body contains spores that end up producing other slime mold cells.

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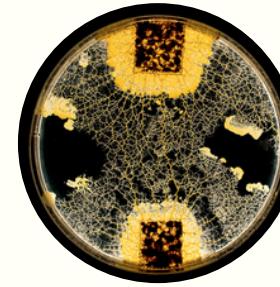
Meanwhile the cells in the stalk die, having ‘sacrificed’ themselves.

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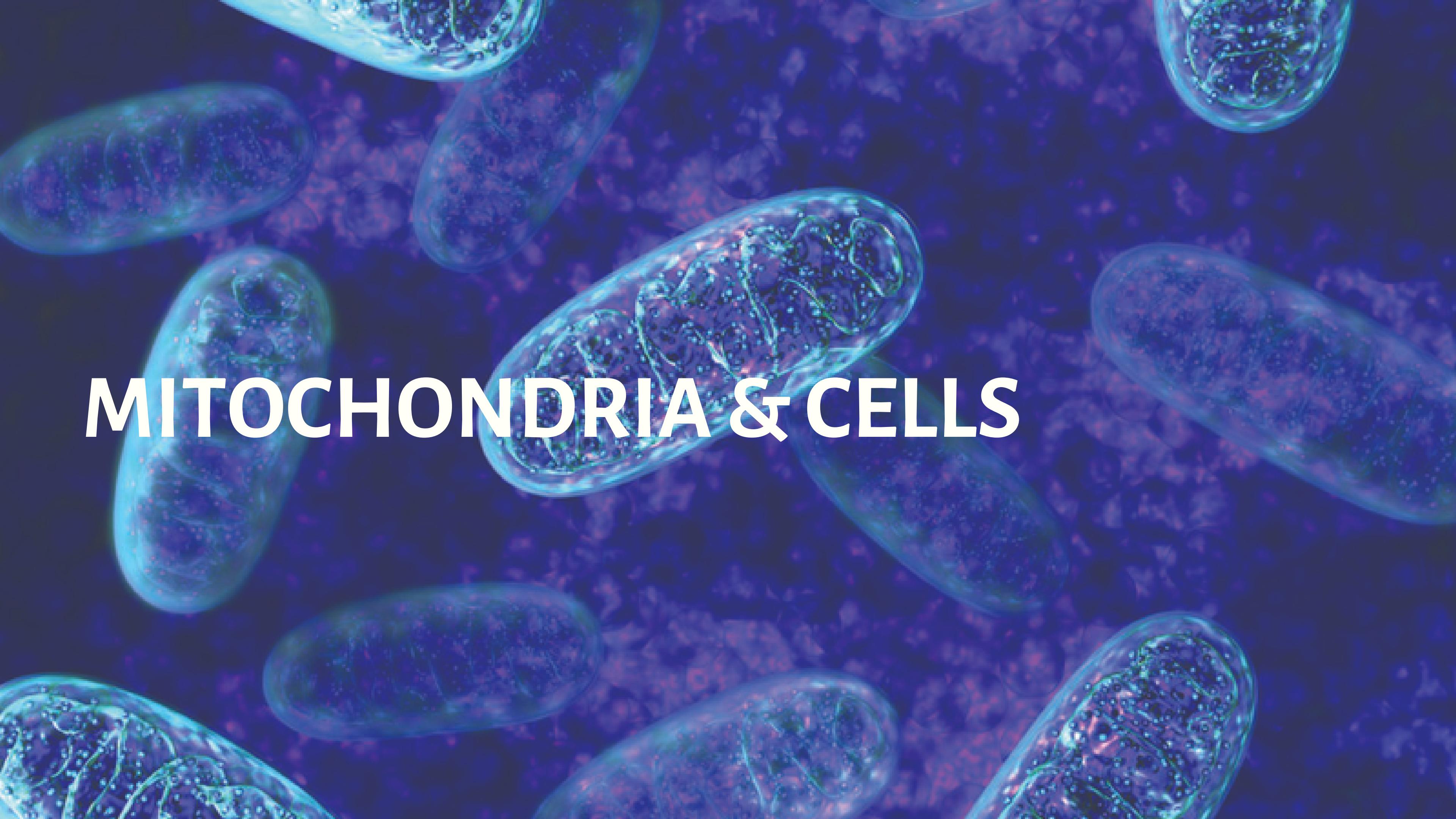
why would they do that?



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MITOCHONDRIA & CELLS



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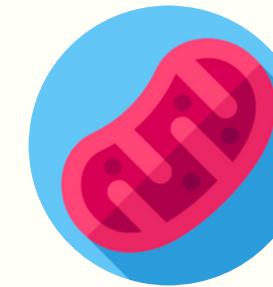
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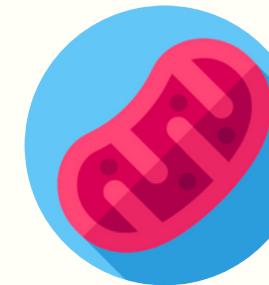
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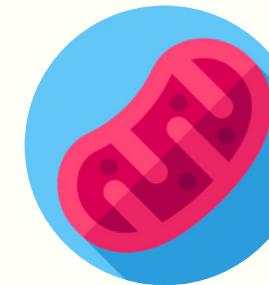
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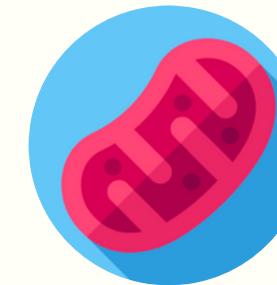
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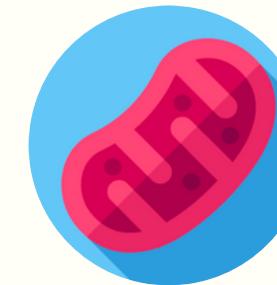
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LYNN MARGULIS

The details of this process are still subject to much debate.



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LEAFCUTTER ANTS



E. O. WILSON

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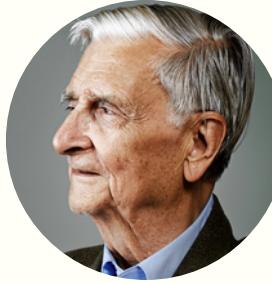


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how does such specialization arise?



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VAMPIRE BATS



VAMPIRE BAT ELDER

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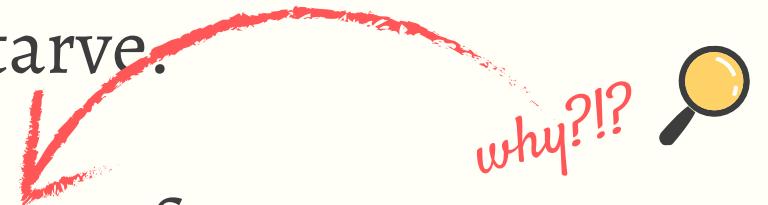
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MEERKATS



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MEERKAT ELDER

It is a truth widely acknowledged that in every group there must be a dominant male and female.



Dominants do most of the breeding: about 90% of the pups are born to the dominant female.

By the natural ordering of things, subordinates help the dominants raise their offspring.

why?!?

For instance, if a subordinate finds a scorpion, common sense dictates they will deliver it to the children of the dominants.



mmm scorpions... 😊

Griffin, A. S., Pemberton, J. M., Brotherton, P. N. M., McIlrath, G., Gaynor, D., Kansky, R., & Clutton-Brock, T. H. (2003). A genetic analysis of breeding success in the cooperative meerkat (*Suricata suricatta*). *Behavioral Ecology*, 14(4), 472–480.

A collage of black silhouettes of people against a bright yellow background. The silhouettes are arranged in a loose, overlapping composition. Some figures are standing, while others are seated or in motion. The overall effect is a high-contrast, graphic representation of a group of people.

PEOPLE

GEORGE FREDERIC WATTS

People sometimes engage in amazing acts of altruism.



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You can see a glimpse of this at the *Memorial of Heroic Self-Sacrifice* in Postman's Park, London.

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(that I set up)

AMELIA KENNEDY

AGED 19

DIED IN TRYING TO

SAVE HER SISTER
FROM THEIR BVRNING HOVSE

IN EDWARD'S LANE STOKE
NEWINGTON · OCT · 18 · 1871 ·



FREDERICK ALFRED CROFT

INSPECTOR · AGED 31

SAVED A LUNATIC WOMAN

FROM SUICIDE AT WOOLWICH
ARSENAL STATION · BUT WAS
HIMSELF RUN OVER BY THE TRAIN

JAN · 11 · 1878 ·

is there anything in it for them?
does that even matter?



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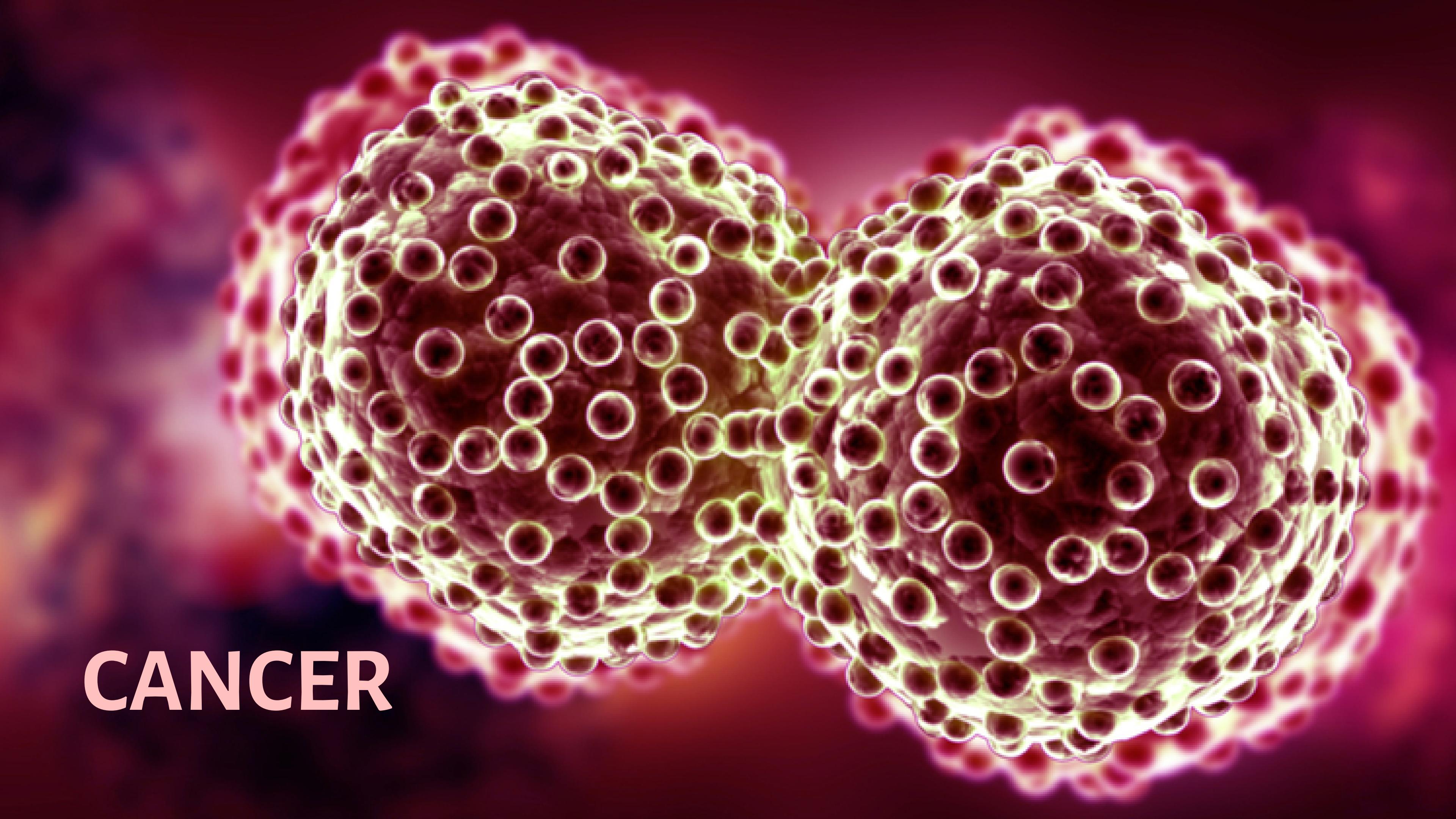
There are many example of humans being altruistic.

But these are anecdotes.

How altruistic are people *really*?



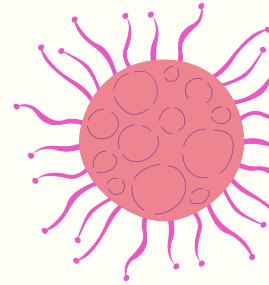
Let's also look at some *failures* of cooperation.



CANCER

CANCER CELL ELDERS

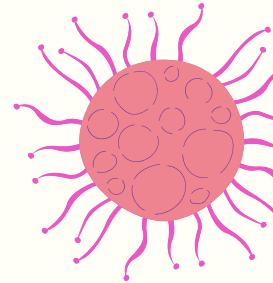
In a normally functioning organism, cells are cooperative:
liver cells do liver stuff, skin cells do skin stuff.



Aktipis, C. A., Boddy, A. M., Jansen, G., Hibner, U., Hochberg, M. E., Maley, C. C., & Wilkinson, G. S. (2015). Cancer across the tree of life: cooperation and cheating in multicellularity. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences*, 370(1673).9

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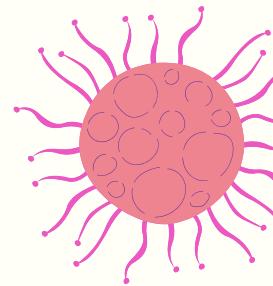


But sometimes, as result of mutation, cells go rogue and start multiplying uncontrolled, siphoning off resources from other cells.

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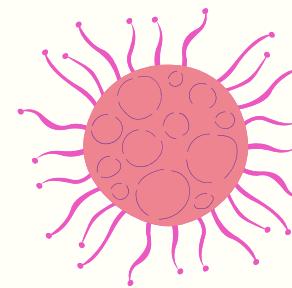


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what keeps 'normal' cells in check?

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ANARCHIST BEES

BEE ELDER
With our distant cousins the ants, workers are usually
sterile.



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ok, but why aren't all bees anarchists?



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CORRUPTION

“

Corruption is an abuse of
entrusted power for private gain.

Transparency International. *Long Methodological Brief*, p.2.

DON CORLEONE

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big pot lying around, and you put it into the pockets of your
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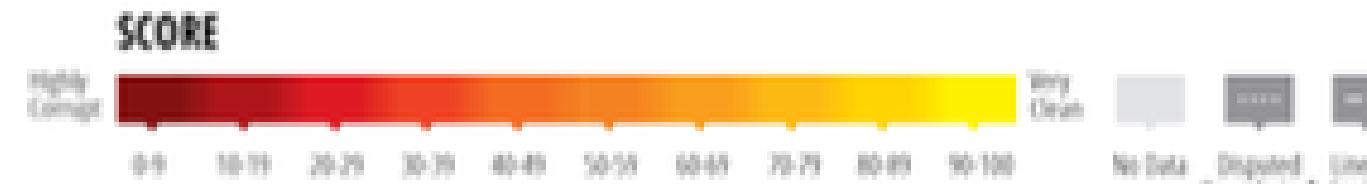


*aren't we all supposed to look
after our families?*

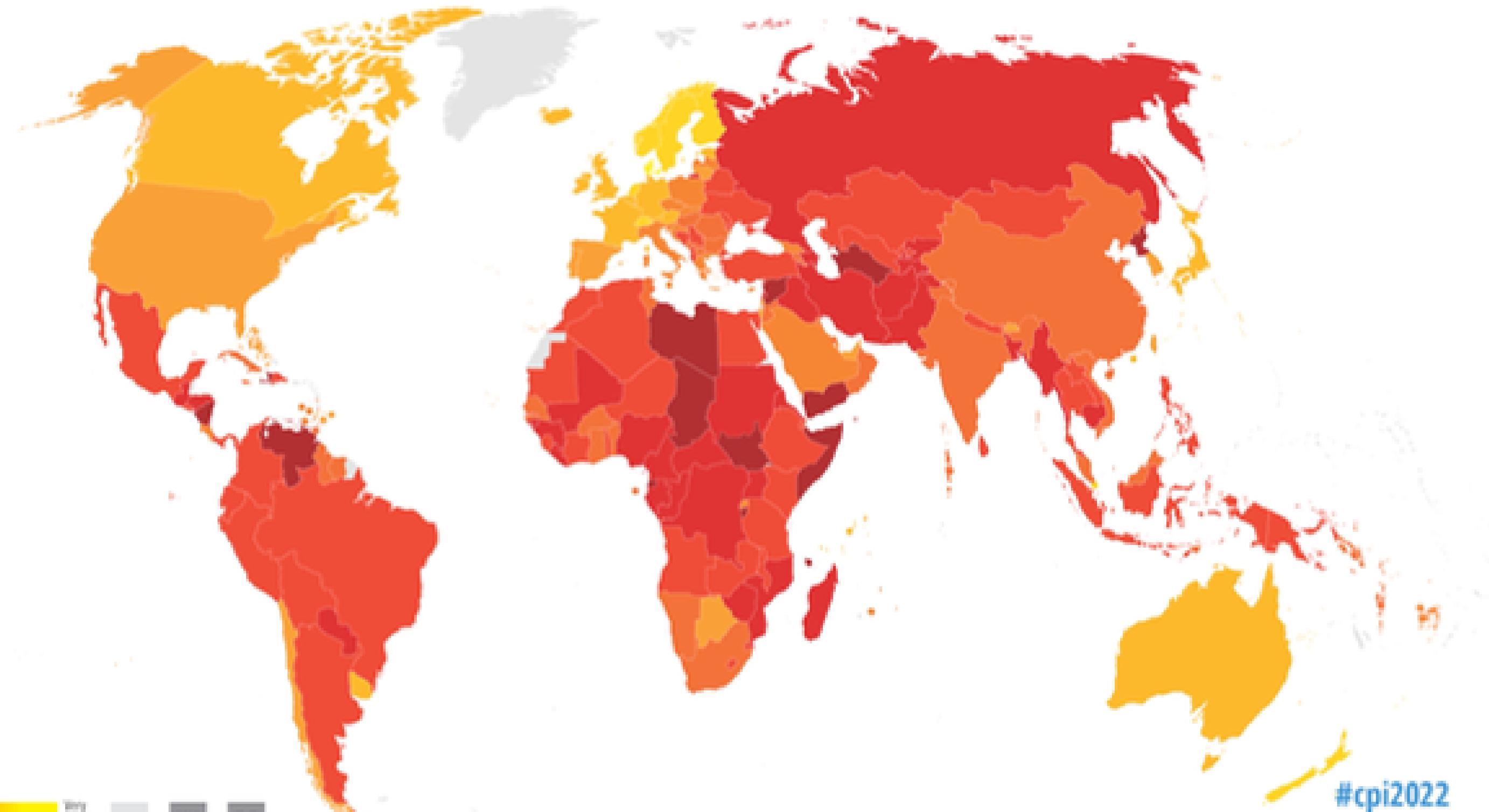


CORRUPTION PERCEPTIONS INDEX 2022

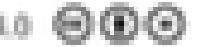
The perceived levels of public sector corruption in 180 countries/territories around the world.



The designations employed and the presentation of material on this map follow the UN practice to the best of our knowledge and as of January 2022. They do not imply the expression of any opinion on the part of Transparency International concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.



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#cpi2022
www.transparency.org/cpi

Notice anything about this map?

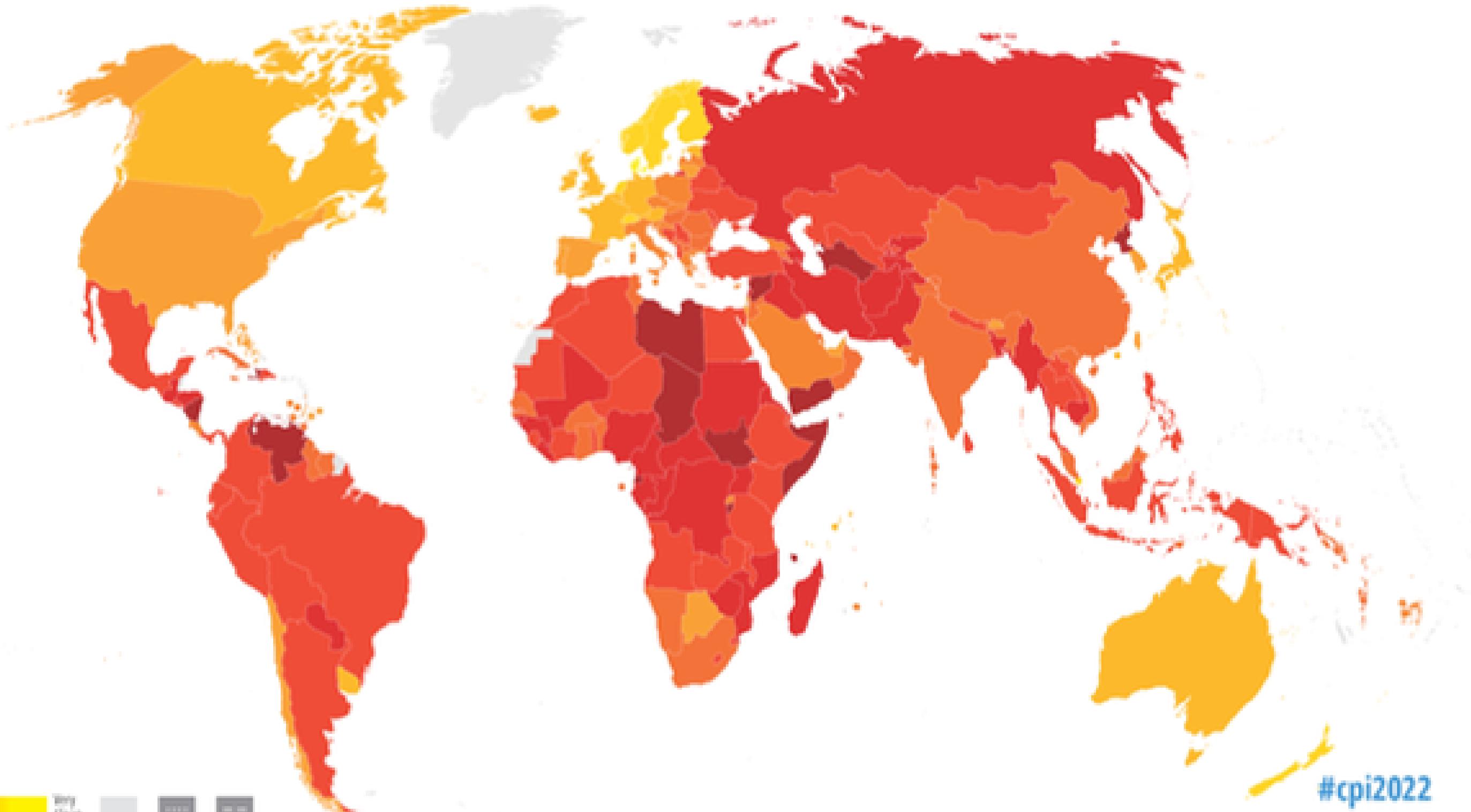


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Most of the least corrupt countries seem to be WEIRD...

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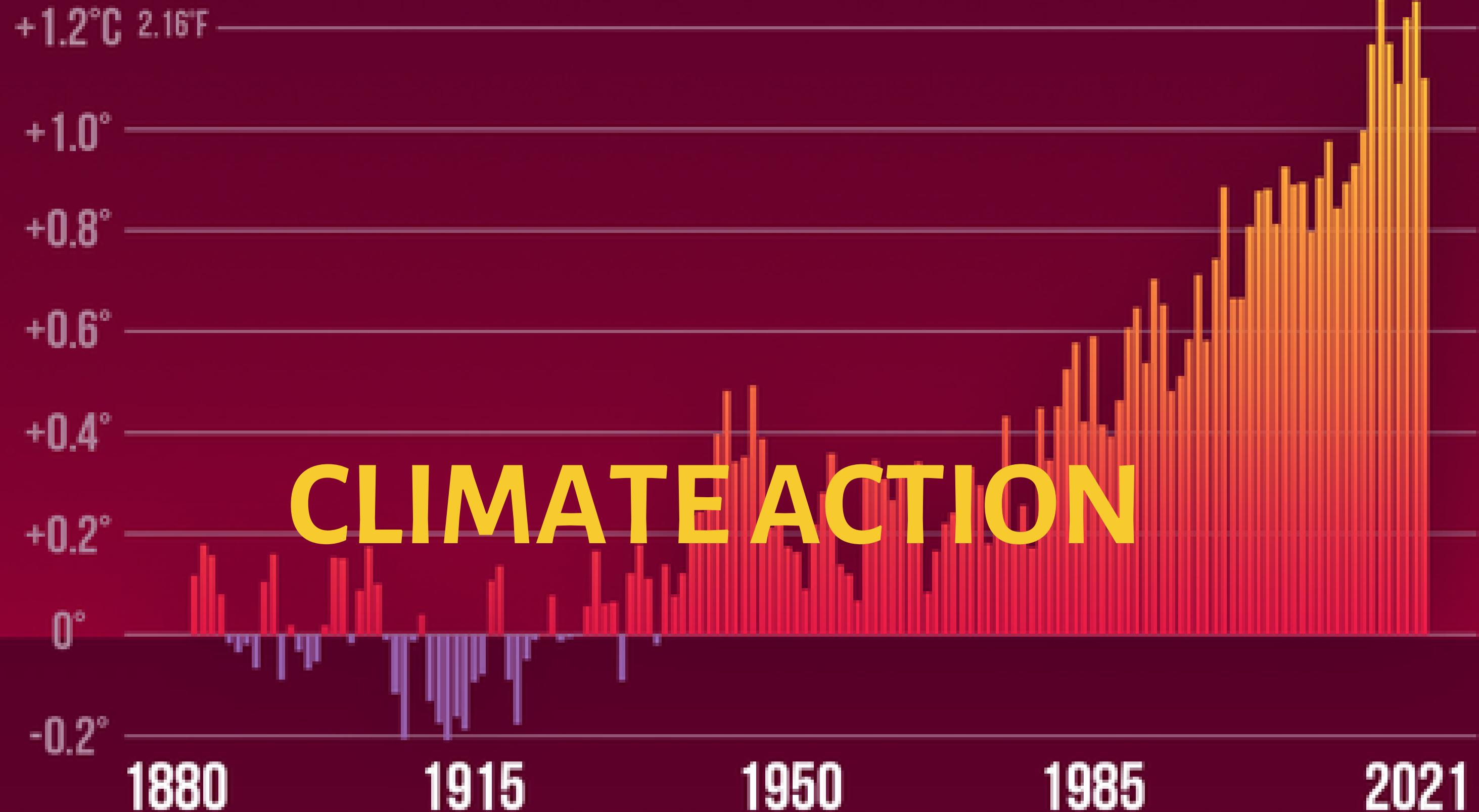
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Coincidence?

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Source: NASA GISS & NOAA NCEI global temperature anomalies averaged and adjusted to early industrial baseline (1881-1910). Data as of 1/13/2022.

CLIMATE CO₂ CENTRAL

Cyclone Freddy

In 2023, around 500,000 people were estimated to have been affected by floods, mudslides and wind damage following the passage of Tropical Cyclone Freddy in southern Malawi.



JOSEPH STIGLITZ

Poor countries should be provided with \$300bn a year from
the International Monetary Fund to finance their fight
against the climate crisis.



Elliott, L. (2023, October 13). [IMF should give poor countries \\$300bn a year to fight climate crisis, says Joseph Stiglitz. The Guardian.](#)

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why wouldn't the US want to help
poorer countries?

Elliott, L. (2023, October 13). [IMF should give poor countries \\$300bn a year to fight climate crisis, says Joseph Stiglitz](#). *The Guardian*.

A cell, a worker bee, a person, a US
congressman: why should they
cooperate with others?

Wait a minute. So what exactly do we mean by cooperation?

DEFINITION (PRELIMINARY)

A behavior is *cooperative* if it provides a benefit to another party, at a cost.

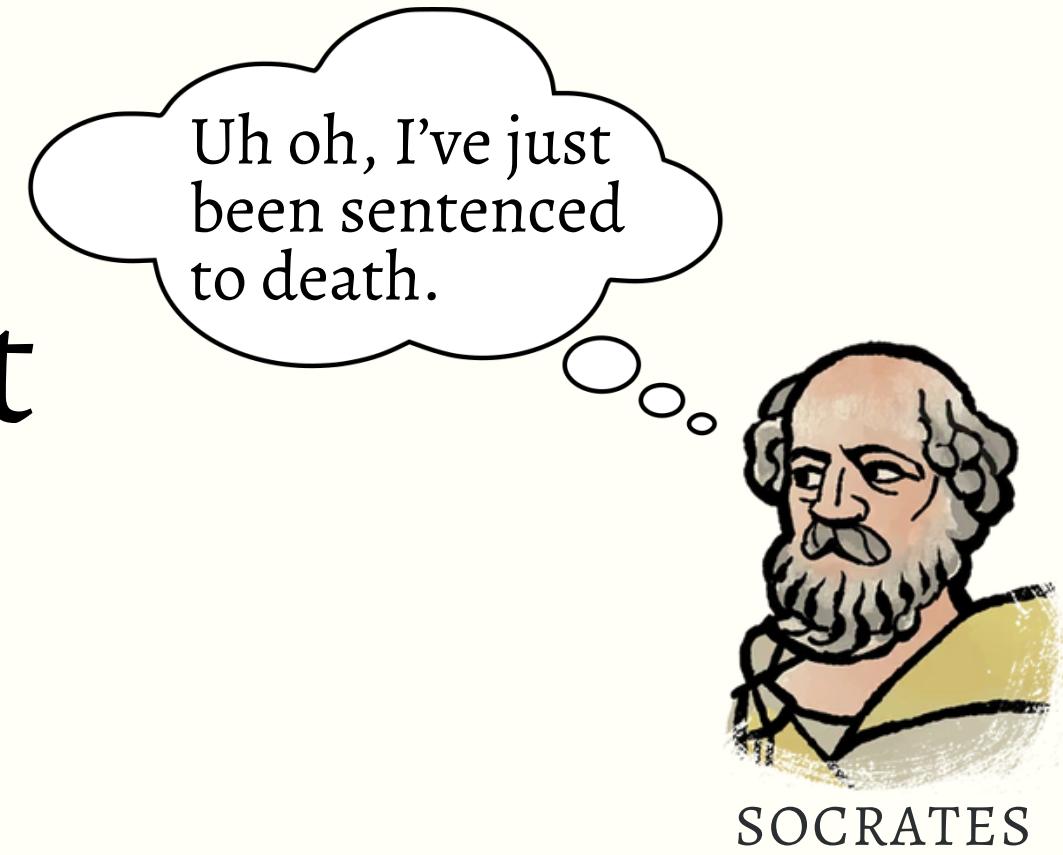
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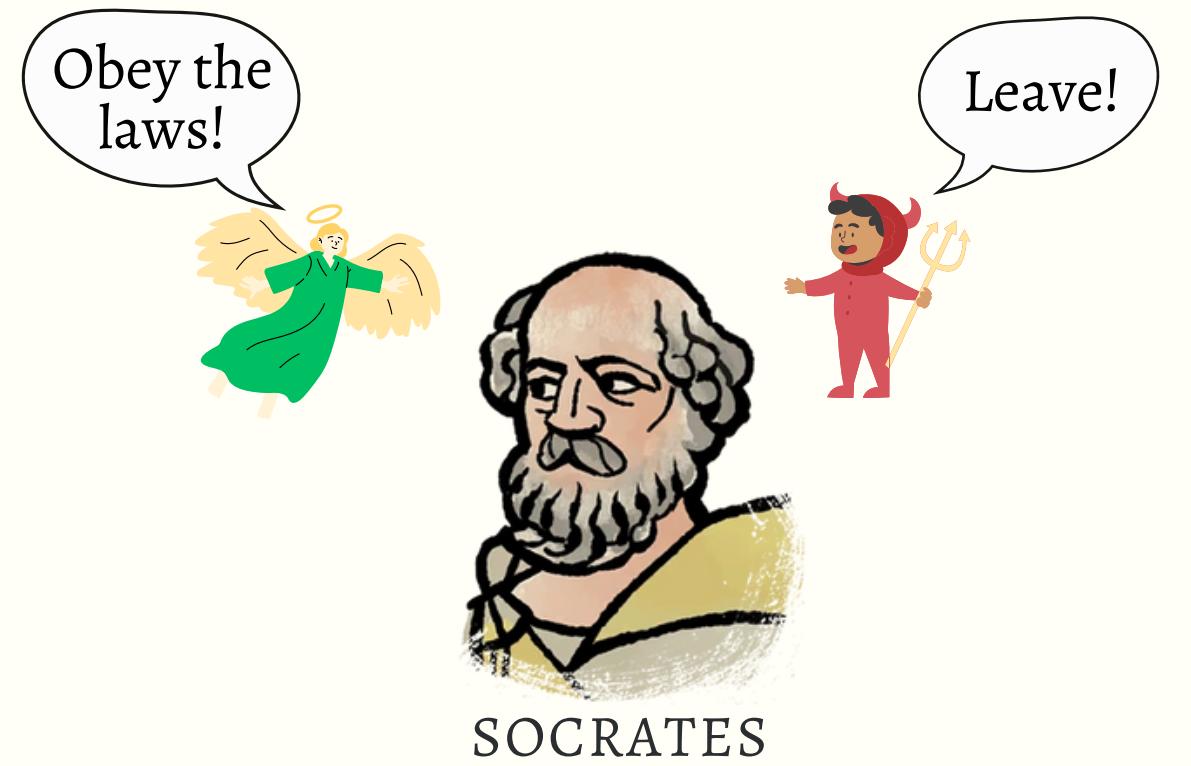
*does not include situations where
both parties are immediately
better off (e.g., trade).*

There should be a cost to
cooperation... and there's the rub.

Cooperation: the age-old
conflict between self-interest
vs (some version of) the
common good.



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We can make this drama more
precise.

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With a little detour through...

GAME
THEORY