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Effects of new medicines on biodiversity

a review from a chemical perspective

Kristian Birkeland * 1867 - 1917

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Kristian Birkeland

- Co-founder of Norsk Hydro, with Sam Eyde
- Production of ammonia out of atmospheric nitrogen with help of electricity (hydro power)
- 7 times nominated for Nobel Prize
- Norsk Hydro now mainly producing metals like aluminum

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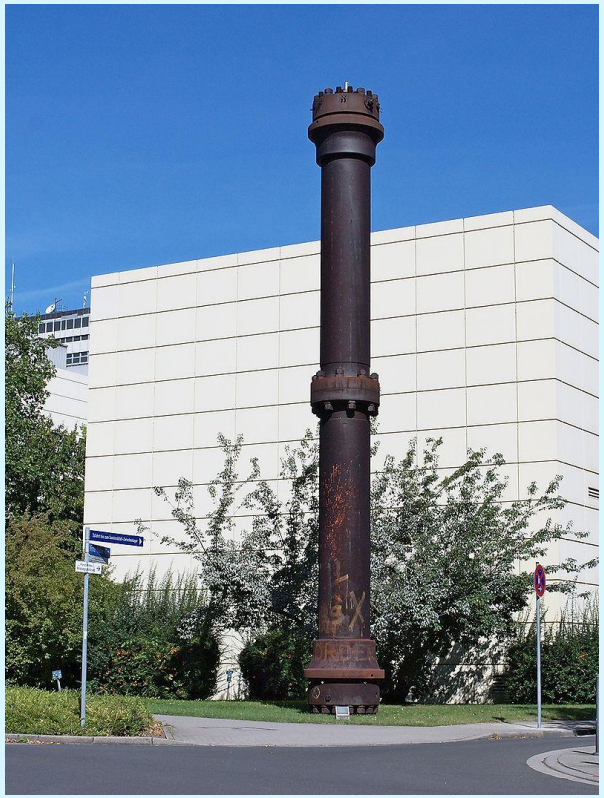
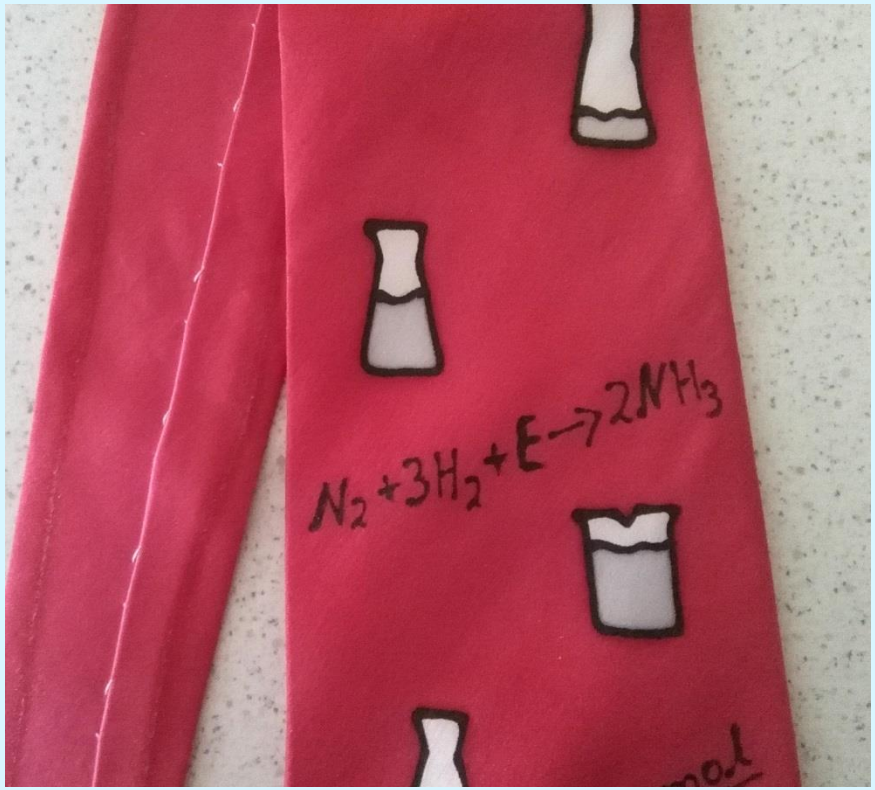
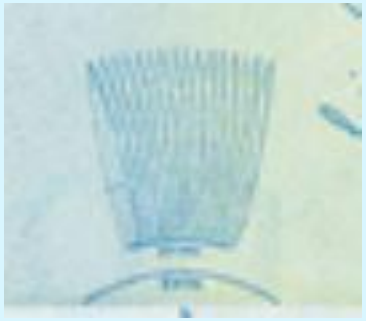
Haber-Bosch process





Kristian Birkeland

- Proposed theory for the forming of Aurora Borealis, through experiments with a 'Terrella', but at the time nobody believed him
- Died, probably suicide, on 15 June 1917
- Northern Light theory widely accepted by 1957



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Biodiversity

Before the start of the anthropocene, the Earth was dominated by large mammals:

- Whales (oceans)
- Elephants (Africa, Asia), Mammoths (Europe)
- Buffalos (America, Africa, Europe)
- Polar bears (Arctic)
- Rhinoceros (Africa, Asia)

No natural enemies, on top of the food chain

Most of them herbivores

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Hunting

Man started to hunt large mammals for:

- Meat → food
- Whale oil → lamp oil, soap, margarine
- Fur, skin → clothing
- Tusks, antlers, horns → weapons, ornaments, traditional medicines
- Fun → very funny indeed…

Result: many (sub)species have gone extinct

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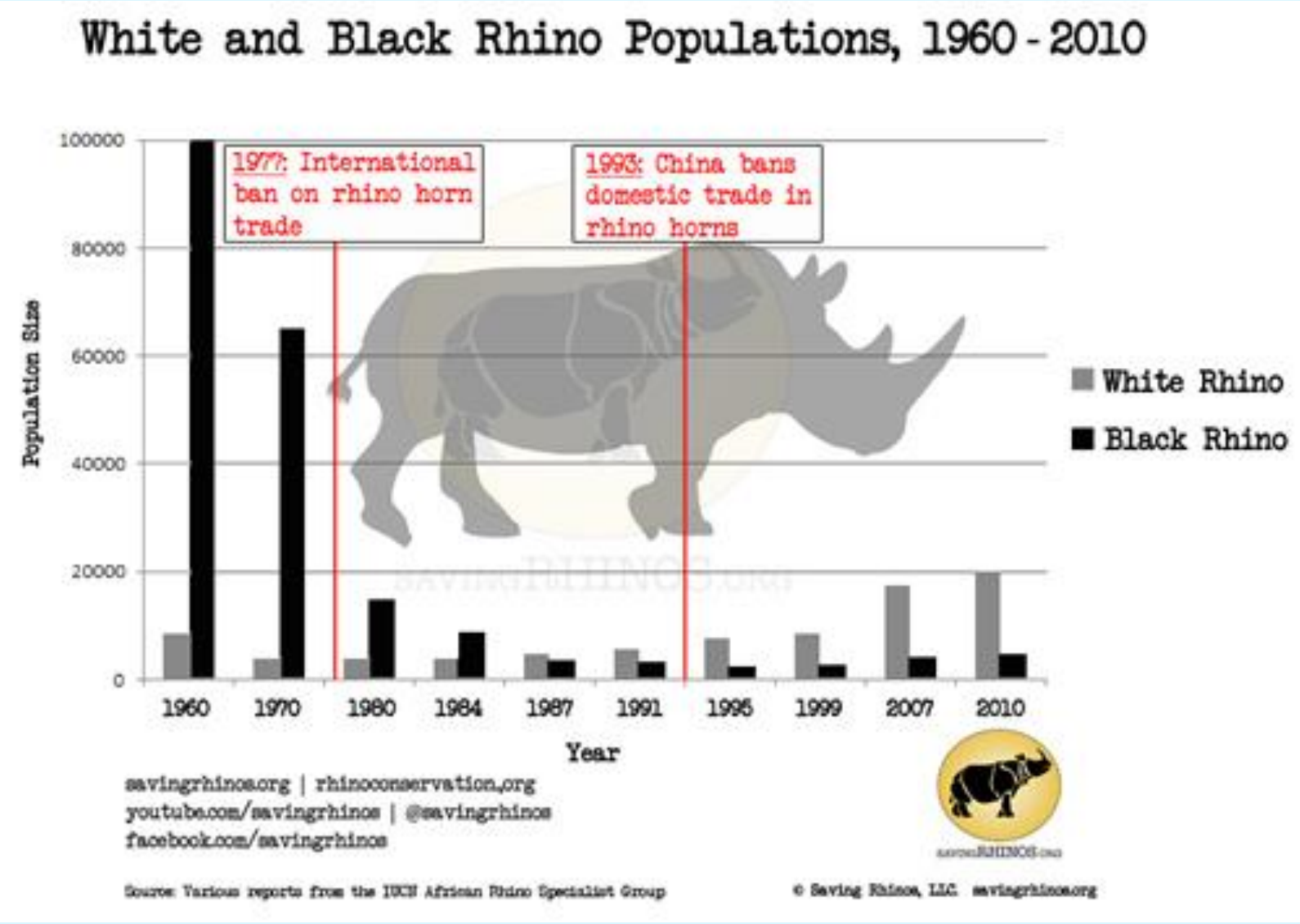
Rhinceros

5 main species left after many centuries of hunting


White and Black Rhino Populations, 1960 - 2010
1977: International ban on rhino horn trade
1993: China bans domestic trade in rhino horns
Population Size
100000
80000
60000
40000
20000
0
1960
1970
1980
1984
1987
1991
1995
1999
2007
2010
Year
White Rhino
Black Rhino
savingrhinos.org | rhinoconservation.org
youtube.com/savingrhinos | @savingrhinos
facebook.com/savingrhinos
Source: Various reports from the IUCN African Rhino Specialist Group
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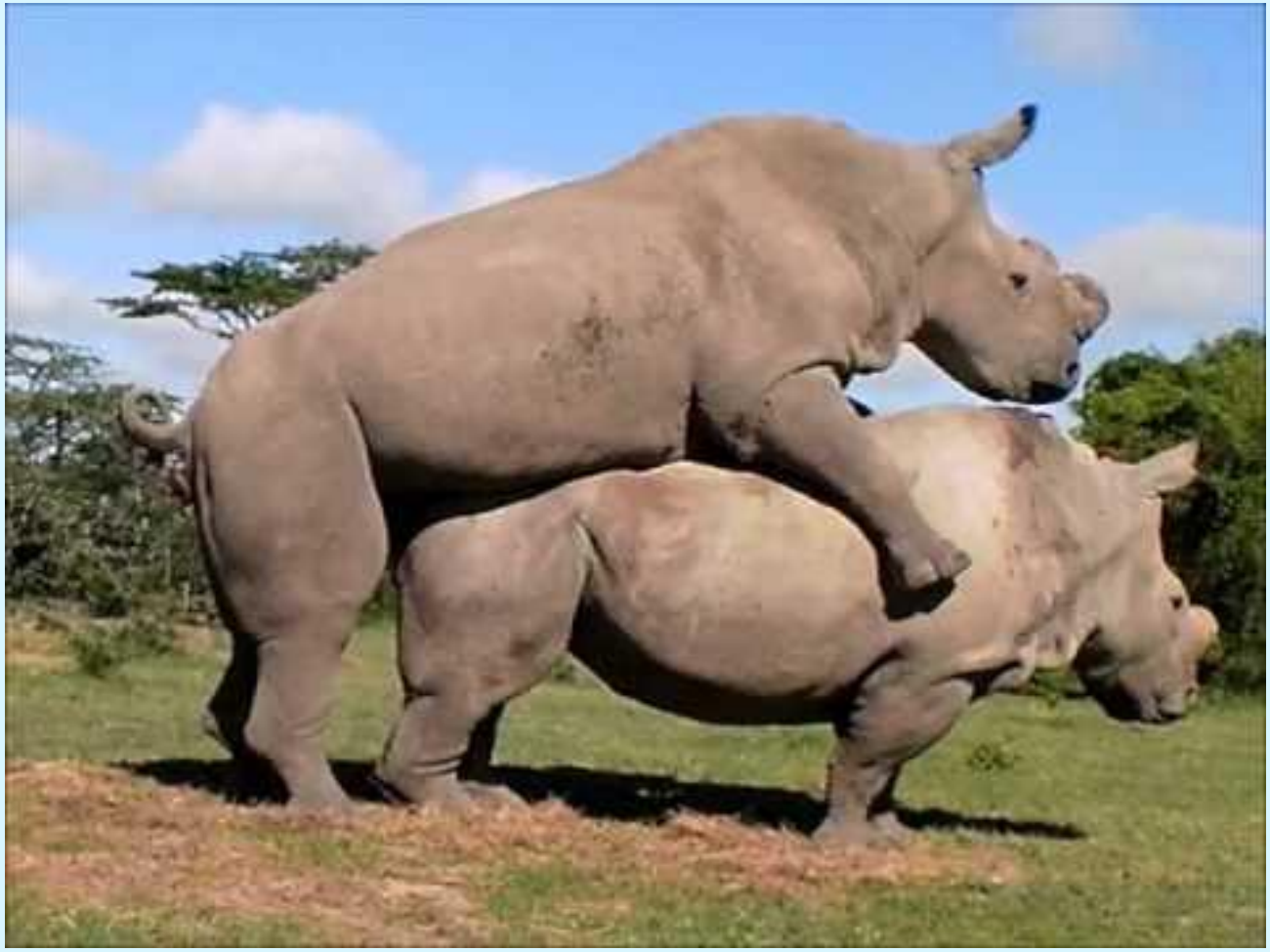
Medicines from Rhino horn?



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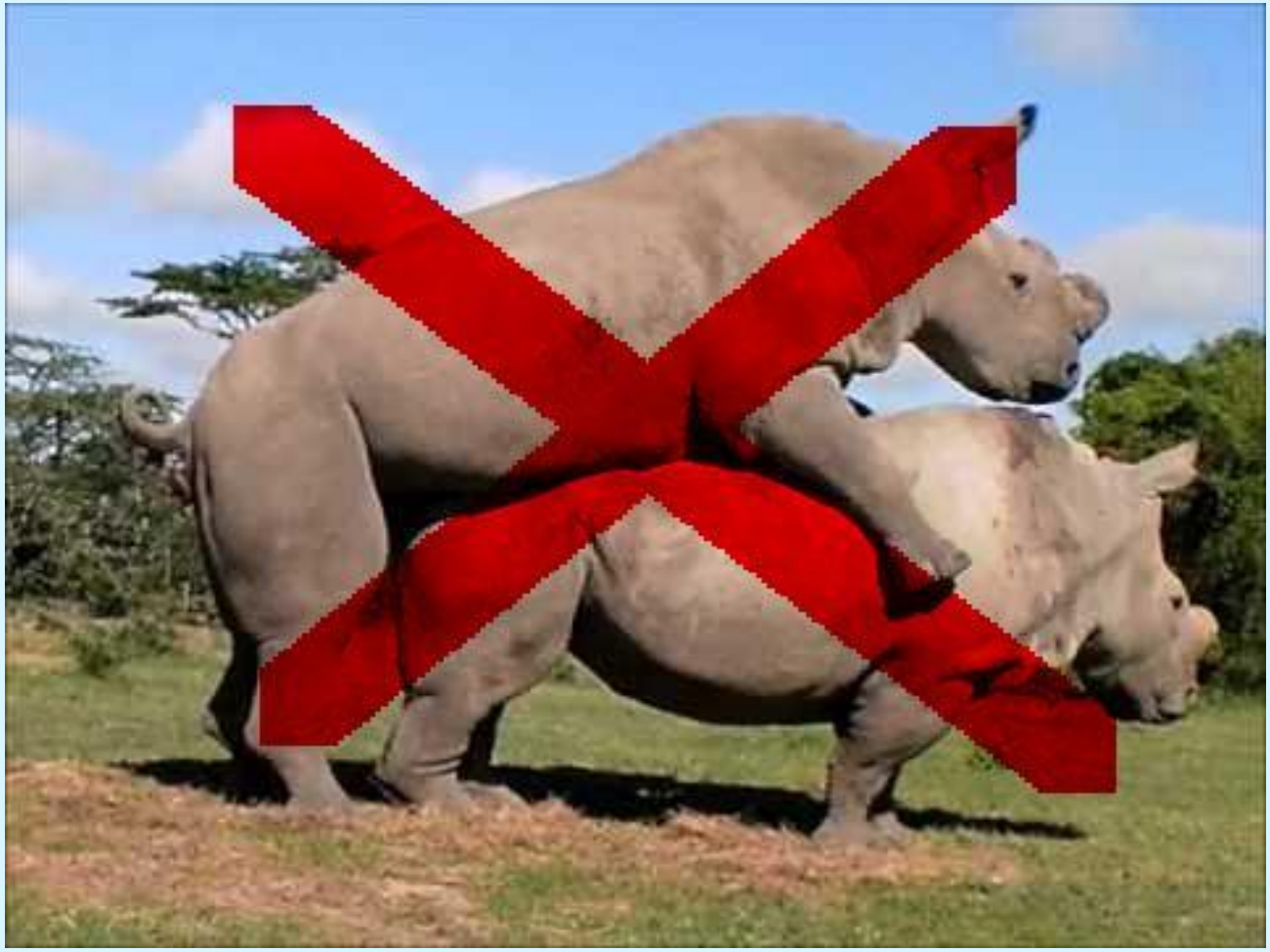
Medicines from Rhino horn!



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Rhino horn use

Traditional medicine (Asia, mainly China, Vietnam) containing rhino horn are believed to cure:

- Fever, arthritis, gout, headaches, nausea
- Vomiting and stomach upsets
- Anxiety
- Boils
- Infantile convulsions
- Food poisoning, hangovers
- Inflammation and infection
- Cancer

No scientific proof whatsoever

Rhino horn demand

Factors influencing the demand for rhino horn:

- Income, e.g. Yemen, Oman: all men want a janbiya
- Scarcity: price up, so does demand!
  (economics: positive price elasticity)
- (Inter)national measures:
  - trade bans
  - Awareness campaigns
- Rumours etc.

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Chemical background

Rhino horn is mainly composed of Keratin, a complex protein containing relatively many disulfide bridges forming permanent crosslinks.

Essentially the same as our **hairs** and **nails**.

The core also contains $CaCO_3$/$Ca_3(PO_4)_2$ and melanin.

'**Fake horns**' could be produced by 3D printing.

Flooding the market with fake horns could eventually reduce the price of the real ones.

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Conclusions

What can we, (environmental) chemists, do in order to save biodiversity and prevent poaching?

-Inform authorities and consumers

-Demystificate old traditions

-Develop new medicines that are REALLY competitive with traditional medicines

-Develop and produce 'fake' horns, tusks etc., aimed to influence their market prices

Thank you!