

# Ciência e Inovação



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# Tales de Mileto

- Primeiro cientista (?)
  - primeiro a observar um fenômeno elétrico
- Geômetra
- Astrônomo
- **Transformador de conhecimento em riqueza:**
  - Tendo previsto que haveria uma grande safra de olivas, em um certo ano...



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- Primeiro cientista
- Geômetra
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  - Tendo previsto que haveria uma grande safra de olivas, em um certo ano, **comprou muitas prensas de óleo, revendendo-as na safra.**

# Contexto: o desafio global



- População crescente
  - Expectativas de aumento de consumo
  - Recursos naturais finitos
- Desenvolvimento sustentável (durável)
  - Requer novas bases, novo conhecimento
- É preciso mudar **atitudes**

# Qual ciência, qual inovação?

- Recursos são sempre limitados, especialmente nos países com renda *per capita* e IDH baixos
  - e pouca infra-estrutura.
- Onde se deve gastar?
- Quanto se pode gastar?
- Quem vai desembolsar, como?
- Os gastos feitos criam sustentabilidade?
  - do sistema, do País, global?

# Dilema

- GSO do G8 que trata de “Research Facilities of Global Interest”
  - aceleradores, observatórios astronômicos
- Necessidades de ciência para
  - sustentabilidade
  - transição para a economia verde
- Conclusão

O que existe não é o que precisa existir.

# Qual ciência?

- Original, relevante, competitiva
  - no estado da arte
    - inclui ler patentes
  - criadora de impactos radicais
- Significativa em um contexto amplo
  - não apenas baseada em modas ou tribos
  - que contribua para se enfrentar os grandes problemas da humanidade



É preciso abandonar idéias errôneas e superadas sobre a estrutura da ciência: positivismo, hierarquias...

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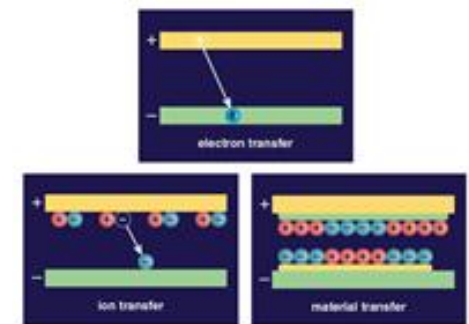
FEATURE ARTICLE

## What Creates Static Electricity?

**Traditionally considered a physics problem, the answer is beginning to emerge from chemistry and other sciences**

Meurig W. Williams

Everyone knows how to create a static shock—just drag your feet across the carpet before touching something. But what actually causes that shock to form is amazingly still unknown. Is it electrons, ions, or something else? The answer isn't merely academic—electrostatic charges are central in laser printers. They can cause big problems for the space program, and can increase the impact of dust storms. Understanding static charges (also called contact charging, or triboelectricity) has



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traditionally been considered a physics problem, but the author argues that chemistry and other sciences are required to really get what's going on at these surfaces. The author has researched three different mechanisms which have been demonstrated to create triboelectric charging.



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FEATURE ARTICLE

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# Qual inovação interessa?

- Satisfaz necessidades emergentes?
  - Em quais setores da agricultura, indústria e serviços?
- Pode provocar mudanças radicais?
- Tem impacto econômico, estratégico ou social?
  - em quais cenários?
  - em qual contexto?
  - para quem?
    - beneficiados vs. prejudicados
  - quais são os riscos?
    - ambientais, sociais, econômicos

Considerações sobre o uso

EDISON

BOHR

Contribuição fundamental

O quadrante de  
Pasteur

(tributo de um *ex-lycéen*)



# Pasteur: ciência básica e aplicada

- Não existe uma categoria de ciência que se possa chamar de ciência aplicada. **O que existe são ciências e aplicações da ciência, interligados como uma árvore e seu fruto.**
- *Lembrete: A árvore que produz maus frutos não é boa e a árvore que produz bons frutos não é má...(São Lucas, cap. VI, v.43-45)*

# Lição aprendida

## US PATENT & TRADEMARK OFFICE PATENT APPLICATION FULL TEXT AND IMAGE DATABASE

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Institut Pasteur  
Titular de 382 “applications”,  
desde 2001

**PUB. APP.**  
**NO. Title**

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- 2 [20120208176 Multivalent Epitope in Complex with a Detection Marker for the Early Serodiagnosis of Infections](#)
- 3 [20120201825 CHIMERIC POLY PEPTIDES AND THE THERAPEUTIC USE THEREOF AGAINST A FLAVIVIRIDAE INFECTION](#)
- 4 [20120189662 Identification of virulence associated regions RD1 and RD5 leading to improve vaccine of M. bovis BCG and M. microti](#)

# Ney Galvão da Silva

- Presidente da Indústria Química Santo Amaro S/A
  - produtora de tetraciclina, do grupo Laborterápica-Bristol
- Supervisor do meu primeiro estágio
  - penicilinas semi-sintéticas
  - levantamento e análise de “papers” e patentes
- ...mas a indústria farmacêutica brasileira mudou de mãos, nos anos 60.



Empresário, dirigente da  
Orquima SA  
Produziu cafeína por metilação  
de teobromina

Respected as a world authority on  
coordination compounds  
chemistry

Known internationally...performed  
the first studies ...

Discovered...

Discovered...

Hydrometallurgical processes for  
obtaining vanadium, molybdenum  
and iridium from its ores

Discovered new photographic  
sensitizers

Built a medium resolution grating  
spectrophotometer (1951)

<http://www.neglectedscience.com/alphabetical-list/k/pawel-krumholz>

# Pawel Krumholz



## United States Patent Office

3,112,990

Patented Dec. 3, 1963

1

3,112,990  
PROCESS FOR SEPARATING CERIUM FROM  
TRIVALENT RARE EARTHS  
Pawel Krumholz, Rua Maestro Elias Lobo 241,  
Sao Paulo, Brazil  
No Drawing. Filed Aug. 19, 1958, Ser. No. 755,893  
Claims priority, application Brazil Sept. 2, 1957  
1 Claim. (Cl. 23—14.5)

One of the oldest methods used for the separation of cerium from other rare earths consists in the treatment of an aqueous suspension of the oxides or hydroxides of those elements with an excess of chlorine or bromine. The halogens transform the trivalent cerium contained in the mixture into the oxide or basic chloride (or bromide) of quadrivalent cerium which is insoluble in the slightly acid medium. The other rare earths contained in the mixture are transformed by the excess of the halogens into soluble halides by a reaction the mechanism of which is not quite well understood and which probably consists in a catalytic decomposition of the hypohalides formed as the first product of the reaction.

The present invention refers to an improved process of separating cerium from other rare earths present as hydroxides, carbonates or basic salts. According to the present invention, an aqueous suspension of such material

2

cerium precipitate are considerably improved by adding together with the hydrochloric acid, sulfuric acid in an amount between 5% and 20% of the weight of the cerium oxide present in the mixture.

The new and improved process, is equally efficient if the mixture of the hydroxides, carbonates or basic salts also contains thorium oxide. In this case the oxidation of the cerium as well as the dissolution of the trivalent rare earths are performed in the same way as in the absence of thorium, the bulk of the thorium remaining insoluble. The small fraction of thorium solubilized with the trivalent rare earths can be easily and quantitatively precipitated by increasing the pH of the mixture to 3.5 to 4. The mixture of the oxides or basic salts of quadrivalent cerium and thorium thus obtained can be separated using, for instance, the process described in U.S. Patent application Serial No. 755,895, filed August 19, 1958, and entitled "A Process for the Separation of Thorium, Cerium and Rare Earths from their Oxides or Hydroxides."

### Examples

(1) A mixture of rare earth hydroxides of a composition as occurring in monazite and containing about 47% of cerium oxide of total rare earths oxides, obtained by a treatment of rare earths and sodium double sulfates with caustic soda and totaline 500 kg. of oxides is mixed with

# Separação de terras raras!!

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25



# Carmine Taralli

- Diretor de P&D da Pirelli Cabos S/A
- “Hoje, conseguimos copiar ou reformular qualquer produto que nos interesse. Agora, precisamos criar produtos realmente novos, que dão melhor resultado financeiro.”
  - *Em reunião no Centro de P&D em 1989.*
- *Liderou o desenvolvimento dos cabos de alta tensão instalados no Eurotúnel, fornecidos pela Pirelli Cabos brasileira.*

# Carmine Taralli

- “... Como fazer para que as empresas, diante de um risco de inovação reduzido, se atrevam a buscar a inovação. Esta é uma tarefa que eu classifico de maravilhosa, pois **gastei minha vida toda nisso: inovação, desenvolvimento de novos produtos.**”
- *Tecnologia - O Custo e o Risco da Inovação*, seminário realizado no IEA/USP em 18 de junho de 1996: Sistema Nacional de Inovação: Financiamento de Pesquisa e Desenvolvimento, sob coordenação de Alberto Carvalho da Silva

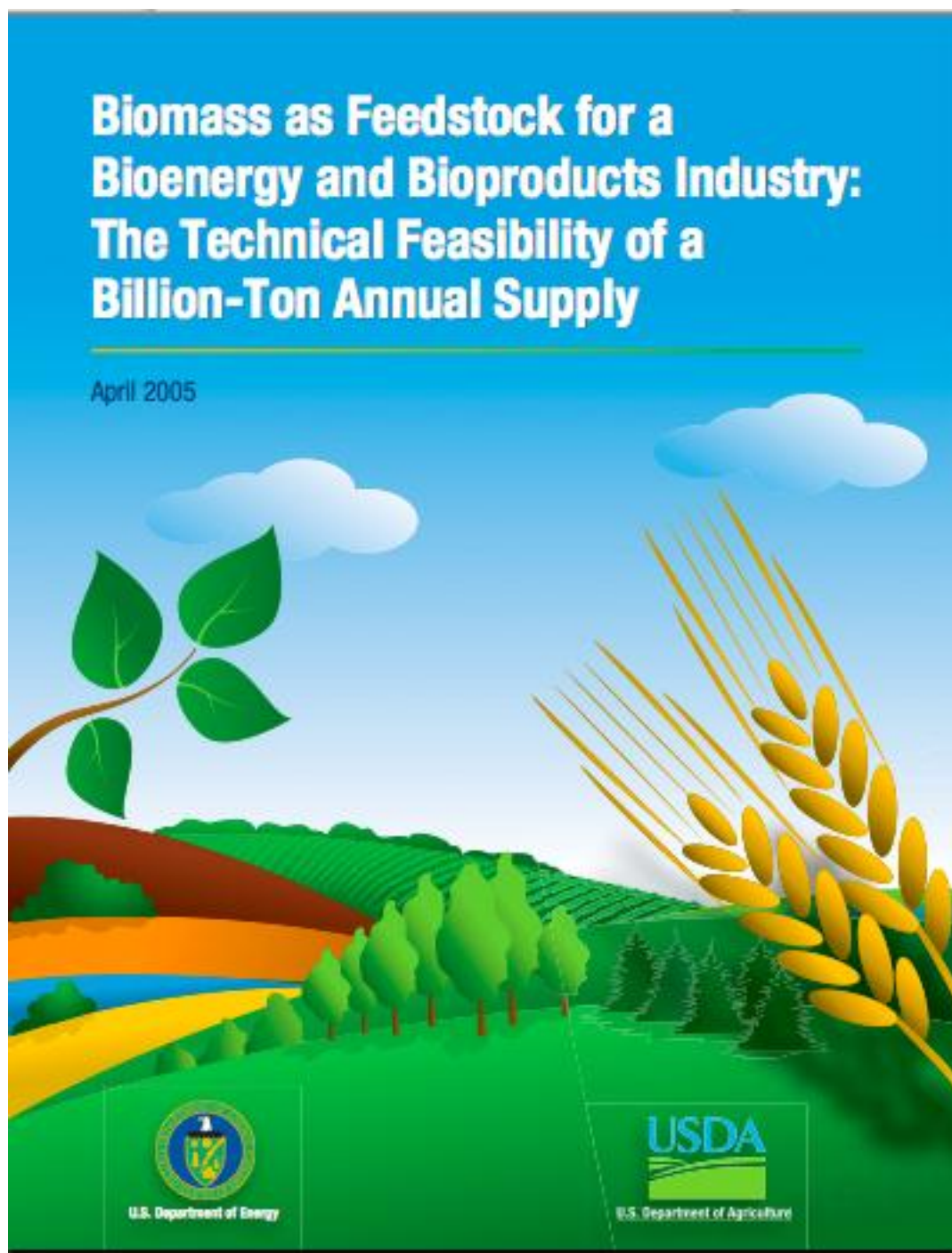
# O desafio global



- Alimentos, matérias-primas e energia para 9 bilhões de pessoas.

# Grande Desafio nos Estados Unidos: 30% em 2030

“Accomplishing this goal would require approximately **1 billion dry tons of biomass feedstock per year.**”



# E aqui, quanto **temos**?

- Produção de **resíduos** de biomassa no Brasil:
  - 1 bilhão de toneladas (2010)
  - Bagaço e palha de cana de açúcar: 174 Mtons
    - L. Valadares (Embrapa)  
<http://www.portaldoagronegocio.com.br/conteudo.php?id=52497>



# Eucalipto

Eucalyptus is among the fastest growing hardwood trees in the world, is grown in more than 90 countries and represents 8 percent of all planted forests. **A large part of the global supply is concentrated in Brazil...** In 2003, global Eucalyptus pulp demand was 8 million tons and it represented 40 percent of the world's hardwood pulp market.

**Eucalyptus is prized globally for excellence in paper and energy production**

Eucalyptus grows faster than other hardwood species

<http://www.eucalyptusfacts.org/>

**Em 1964, aprendi em aula: “*Não se fabrica papel de boa qualidade com eucalipto.*”**



# Um caminho

- O **problema** global
- Uma **solução**: a biomassa
- **Estratégia**: programas amplos de P&D&I
- **Atitude**: atenção às metas + serendipitia
- **Resultados**: nova ciência + produtos, processos, muitos bens para muitos
- Problemas locais: reservas brasileiras e chinesas de fosfato podem durar só 50 anos.



# Why Brazil?

- **Brazil**, unlike any other country on the planet today, **has innovation and creativity at the core of its Cultural DNA.**
- **If you have any doubts about the uniquely innovative nature of Brazil's rich culture of science and technology...**
- **Brazil's unprecedented level of Energy independence from Middle Eastern oil... vehicles run on Ethanol.**

**Joshua Fouts**