Alternative solutions to antibiotics

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Best defense against pathogens and troubles is:

the microbiota, an adequate and healthy flora

- Promote immunity
- Promote organs functionality
- Promote selective environmental conditions

Digestive
Skin
Lung
Genital
Best defense against pathogens and troubles is:
the digestive microbiota, an adequate and healthy flora

**Lactate producing**
- Lactobacillus
- Streptococcus
- ...

**Lactate utilizing**
- Selenomonas
- Megasphaera
- ...

**Pathogen or putrefying**
- Clostridium
- E.coli
- ...

- Second brain of the organism
- Decrease of the risk of colic
- Management of insulin sensitivity
- Reduction of the risk of gastric ulcers
- Management of the production of a good colostrum
- Improvement of normal cells development and function
Best defense against pathogens and troubles is:
respiratory microbiota, an adequate and healthy flora

- Modulate bronchial reactivity threshold
- Prevent hyper sensibility
- Act on asthma prevention
- Improve normal cells development and function
• AB are less and less available and resistance is more and more observed.

• The first side effect of AB is the impact on the microbiota

- Promote immunity
- Promote organs functionality
- Promote selective environnemntal conditions
Alternative solutions to antibiotics

- Phage therapy
- Phytotherapy
- Ions environmental control
- Cu / Ag...
- Duox system
Bacteriophages have been approved by FDA in order to control specific bacteria in food.

PT improves zootechnical characteristics in poultry and aids to control AEPC.

Phage bank are yet established targeting numbers of bacteria.

Risk?

Host immunity?

Control of the sources...
Phytotherapy

- Essential oils
- Plant extracts

- Bacteria
- Virus
- Fungi

Risk?
Control of the sources (doping)…
Halogen ions are a part of:
- the body response to inflammation
- the non-specific immunity

DUOX/LPO/Halide system
Physiologically active in saliva, lung and milk

Br\(^-\)  Cl\(^-\)  I\(^-\)  SCN\(^-\)  LPO + H\(_2\)O\(_2\)  OBr\(^-\)  OCl\(^-\)  OI\(^-\)  OSCN\(^-\)

Bacteria  virus  fungi
Ion therapy has now been tested in different conditions and showed effectiveness on several bacteria/fungi/viruses without any risk of resistance:

<table>
<thead>
<tr>
<th>Organism</th>
<th>Host</th>
<th>Organ</th>
</tr>
</thead>
<tbody>
<tr>
<td>E coli</td>
<td>Calve/children</td>
<td>digestive</td>
</tr>
<tr>
<td>RSV/adenoV</td>
<td>Lamb</td>
<td>lung</td>
</tr>
<tr>
<td>Influenza</td>
<td></td>
<td>in-vitro</td>
</tr>
<tr>
<td>Pseudomonas</td>
<td>human</td>
<td>lung</td>
</tr>
<tr>
<td>Fusarium</td>
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<td></td>
</tr>
<tr>
<td>Actinomycete</td>
<td>Dog/human</td>
<td>periodontal</td>
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<tr>
<td>Schistosomas</td>
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<tr>
<td>Aspergilus</td>
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<tr>
<td>Candida</td>
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<td></td>
</tr>
<tr>
<td>Helicobacter</td>
<td>children</td>
<td>stomach</td>
</tr>
<tr>
<td>...</td>
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</tbody>
</table>
Ion therapy is not only used in animals but also as a very interesting approach of environmental control:

**Food preservation**

**phytotherapeutic agent (Xylella, Iodium, ...)**

**Water sterilization**
Ions, focus on physiology:

**OX^-/X^-**

**Kills micro-organisms**

- **I (−) is more virucidal**
- **SNC (−) is more antibacterial**

**Inhibits leucocytes necrosis**

**Neutrophils are more effective**

**Decrease T4**

**Reduce chemokines signaling**

**Antioxidant vs oxidant**

Ion therapy, focus on \( X(\cdot) \) production:

- Milk extraction
  - \( \text{I}^- \)
  - \( \text{SCN}^- \)
- LPO + \( \text{H}_2\text{O}_2 \)
- \( \text{OI}^- \)
- \( \text{OSCN}^- \)
- \( \text{LPO} + \text{H}_2\text{O}_2 \)
- \( \text{Dry cooled} + \text{H}_2\text{O} \)
- \( \text{Environmental control} \)
- \( \text{Liquid stored at 6° C and protected from light} \)

Direct production:
- \( X^- + \text{LPO} + \text{H}_2\text{O}_2 \)
- Remove LPO
- Time = 1 min
Effect of X(-) on 3 relevant equine bacteria

- Rhodococcus equi ATCC 25729
- *Streptococcus equi subsp equi* ATCC 53185
- *Streptococcus equi subsp zooepidemicus* ATCC 43079
Effect of X(-) on 3 relevant equine bacteria

- Rhodococcus equi ATCC 25729 / inhibition measured after culture for 48h / 5min of contact with OX- when bacterial spore reach $10^6$ spores/ml (T0)
Effect of X(-) on 3 relevant equine bacteria

- Streplococcus equi subsp equi ATCC 53185 / inhibition measured after culture for 48h / 5min of contact with OX- when bacterial spore reach 10⁶ spores/ml (T0)
Effect of X(-) on 3 relevant equine bacteria

- *Streptococcus equi subsp zooepidemicus ATCC 43079* / inhibition measured after culture for 48h / 5min of contact with OX- when bacterial spore reach $10^6$ spores/ml (T0)

![Graph showing % inhibition with dilutions and solutions](image)
Ions, focus on toxicity and tolerance test:

**Oral administration:**
- Is active (KI, KSCN) but with risk of hypothyroidism
- LPO system can be absorbed without risk and will act on digestive system against diarrhea and digestive inflammation.
- $X(-)$ will be active locally and mainly on stomach

**Aerosol:**
- In the past HS was used to promote self production of $X(-)$ with side effects
- $OX(-)$ can be use in environment or by nebulization without risk
The use of antibiotics is still the solution to solve specific well diagnosed troubles, under controlled protocols and taking into consideration the resistance and the impact on the microbiota.

Alternative solution already exist and may be used in practice.

Ions are available to manage the environment and fight equine pathogens.