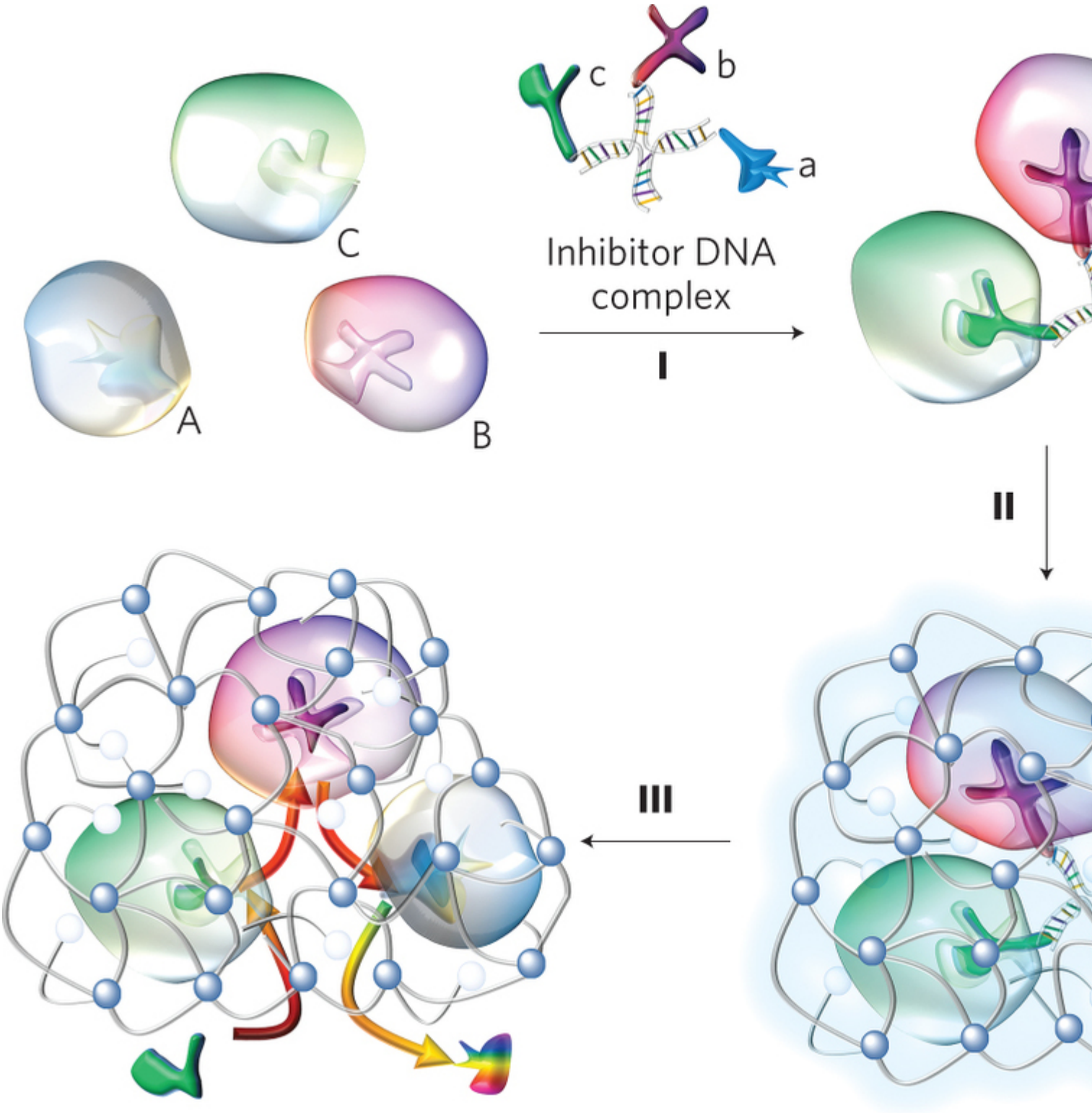
Designer Biomimetic Enzyme Nanocomplexes?Creating the Ultimate Hangover Pill [1]



Imagine being able to turn your intoxication off. Imagine taking a pill after having a few drinks to sober up or giving an enzyme complex to a teenager admitted to the hospital for alcohol poisoning. Researchers have developed a novel method for creating biomimetic [2] enzyme nanocomplexes[1], and have demonstrated the methods effectiveness by creating an enzyme that can reduce blood alcohol content and prevent alcohol induced liver damage[2].

The method used to create this alcohol buffer can be used to create a number of other enzyme nanocomplexes, which could be used in tailored treatments of immunodeficiency and neurodeficiency disorders, cancers and metabolic diseases. Biomimetic enzymes could be used in treatments for those who suffer from genetic disorders that create enzyme deficiencies that can cause severe diseases and detract from a patient?s quality of life. Using the DNA directed enzyme synthesis and in-situ nanopolymerization techniques to develop a designer nanocomplex would allow for the treatment [3] of enzymatic disorders with great efficacy and no side effects.

The enzyme nanocomplexes are biomimetic [2] in the sense that they mimic the enzyme positioning that occurs in eukaryotic cells. enzymes in these cells are often aggregated with other enzymes or positioned carefully in cellular organelles to minimize the diffusion of toxic intermediate substances, increase enzyme efficiency, or improve the specificity and efficacy of individual enzymes. Essentially, these nanocomplexes are more efficient cellular catalysts than individual enzymes.

Creating these enzyme nanocomplexes involves building individual enzymes on individual DNA scaffolds, the in-situ polymerization of the enzymes, and the purification and sizing of the enzyme nanocomplexes. The enzyme DNA synthesis [4] is achieved by the designed sequencing and spontaneous assembly. The in-situ polymer encapsulation occurs at room temperature in three steps involving a monomer, crosslinker and initiator. Finally, the purification and sizing of the enzyme nanocomplexes is accomplished by dialysis and size exclusion chromatography.

References

1. Liu Y, Du J [5], Yan M [6], Lau MYin [7], Hu J [8], Han H [9], Yang OO [10], Liang S [11], Wei W [12], Wang H [13], et al. **Biomimetic enzyme nanocomplexes and their use as antidotes and preventive measures for alcohol intoxication** [14]. Nature Nanotechnology. 2013 ;8(3):187 - 192.
2. Cossins D. **Buffering against alcohol** [15]. [Internet]. 2013 . Available from: http://www.the-scientist.com/?articles.view/articleNo/34407/title/Buffering-Against-Alcohol/ [16]

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Development Stage:

- Engineering [18]

Key Words:

- Nanobiotechnology [19]
- Nanomedicine [20]
- Synthetic Enzymes [21]
- Biocatalysts [22]
- Enyme Nanocomplexes [23]

Mechanism:

- Molecular Nanosystems [24]

Summary:

The development of DNA directed enzyme synthesis and in-situ nanopolymerization techniques allows for the development of enzyme nanocomplexes. This allows multiple enzymes to be aggregated into a single molecular complex for targeted enzymatic therapy[1][2].

References

1. Liu Y [25], Du J [5], Yan M [6], Lau MYin [7], Hu J [8], Han H [9], Yang OO [10], Liang S [11], Wei W [12], Wang H [13], et al. Biomimetic enzyme nanocomplexes and their use as antidotes and preventive measures for alcohol intoxication [14]. Nature Nanotechnology. 2013 ;8(3):187 - 192.
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Function:

- Enzyme Nanocompplex Manufacturing [27]

Source:

Biomimetic enzyme nanocomplexes and their use as antidotes and preventive measures for alcohol intoxication [14]
Buffering against alcohol [15]

Material:

- Polymer [28]
- Protein [29]

- DNA [30]

Source:

Biomimetic enzyme nanocomplexes and their use as antidotes and preventive measures for alcohol intoxication [14]
Buffering against alcohol [15]

Benefit Summary:

While the initial research led [31] to the development of a drug that can accelerate the metabolism of alcohol and protect the liver, the methods used in the research will enable scientists to develop a myriad of enzyme nanocomplexes[1][2]. This will aid in the treatment [3] of genetic and enzymatic disorders, greatly improving the quality and duration of life, and potentially offering treatment [3] for fatal diseases. All of these benefits are in addition to the lack of side effects from these types of targeted treatments, due mainly to the biomimetic [2] nature of the synthetic enzymes [21] manufactured through the aforementioned processes.

References

1. Liu Y, Du J [5], Yan M [6], Lau MYin [7], Hu J [8], Han H [9], Yang OO [10], Liang S [11], Wei W [12], Wang H [13], et al. **Biomimetic enzyme nanocomplexes and their use as antidotes and preventive measures for alcohol intoxication** [14]. Nature Nanotechnology. 2013 ;8(3):187 - 192.
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Benefit:

- Health [32]
- Eynzmatic Therapy [33]

Risk Summary:

While there have been no studies related to the specific risks associated with the newly developed methods, the biomimetic [2] nature of enzymatic nanocomplexes reduces health [34] and safety risks associated with the treatments these therapies develop. The only foreseeable risk is the potential risk to the human condition by the development of designer therapies that may be

unaffordable to all but the most affluent. It will need to be seen as to how this risk develops as the democratizaation of DNA synthesis [4] advances in the near future.

Risk Characterization:

- Ambiguous [35]
- Complex [36]
- Uncertain [37]

Risk Assessment:

- Human Condition Risks [38]

Facility:

- Medicine [39]

Activity:

- Nanobiotechnology [40]

Challenge Area:

- Health [41]

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[1] http://nice.asu.edu/nano/designer-biomimetic-enzyme-nanocomplexes%E2%80%94creating-ultimate-hangover-pill
[2] http://nice.asu.edu/keywords/biomimetic
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