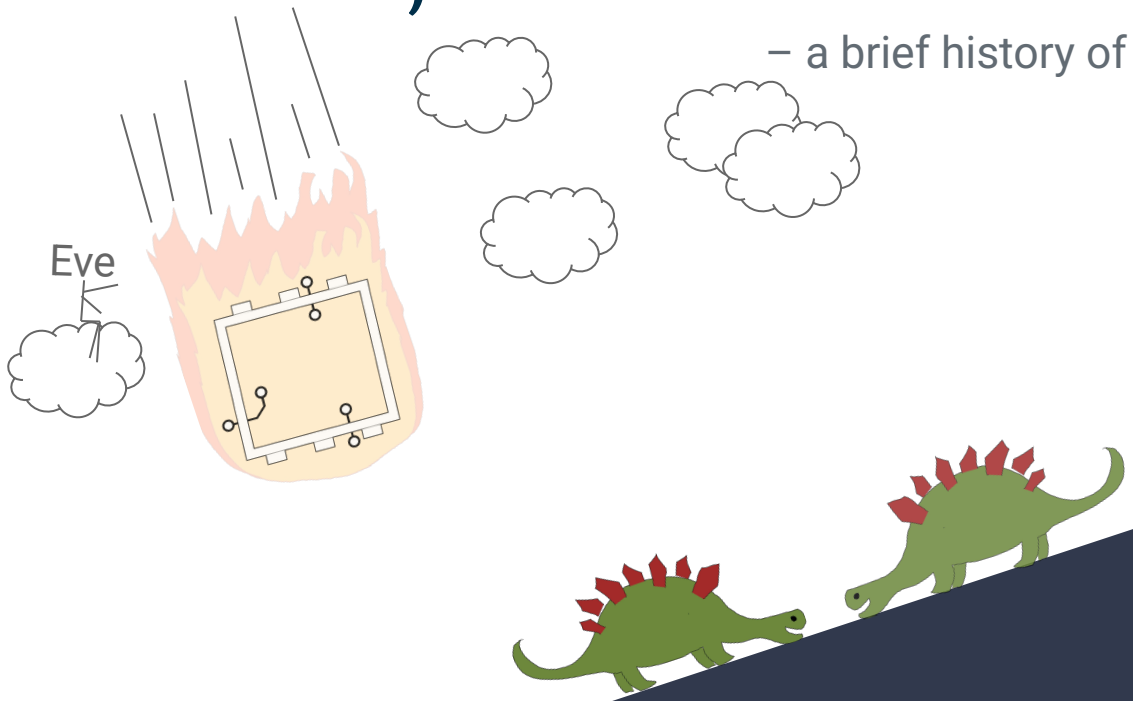
# Sharks, dinos and mammals

– a brief history of animals and cryptography

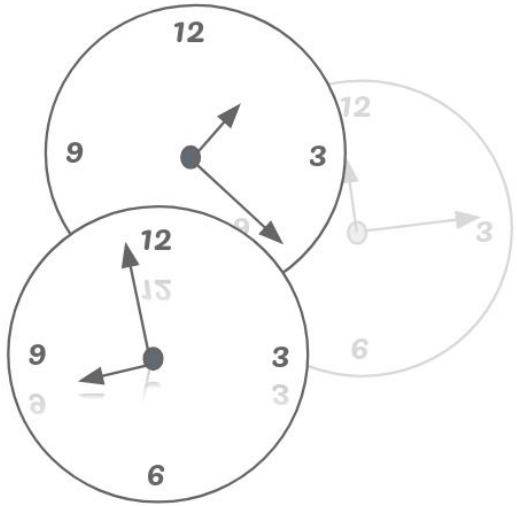



KASTEL Kolloquium 2025
– Marcel Tiepelt

# Goals of this talks

1. Oblivious learning about cryptography

2. Explain the above with **bold** claims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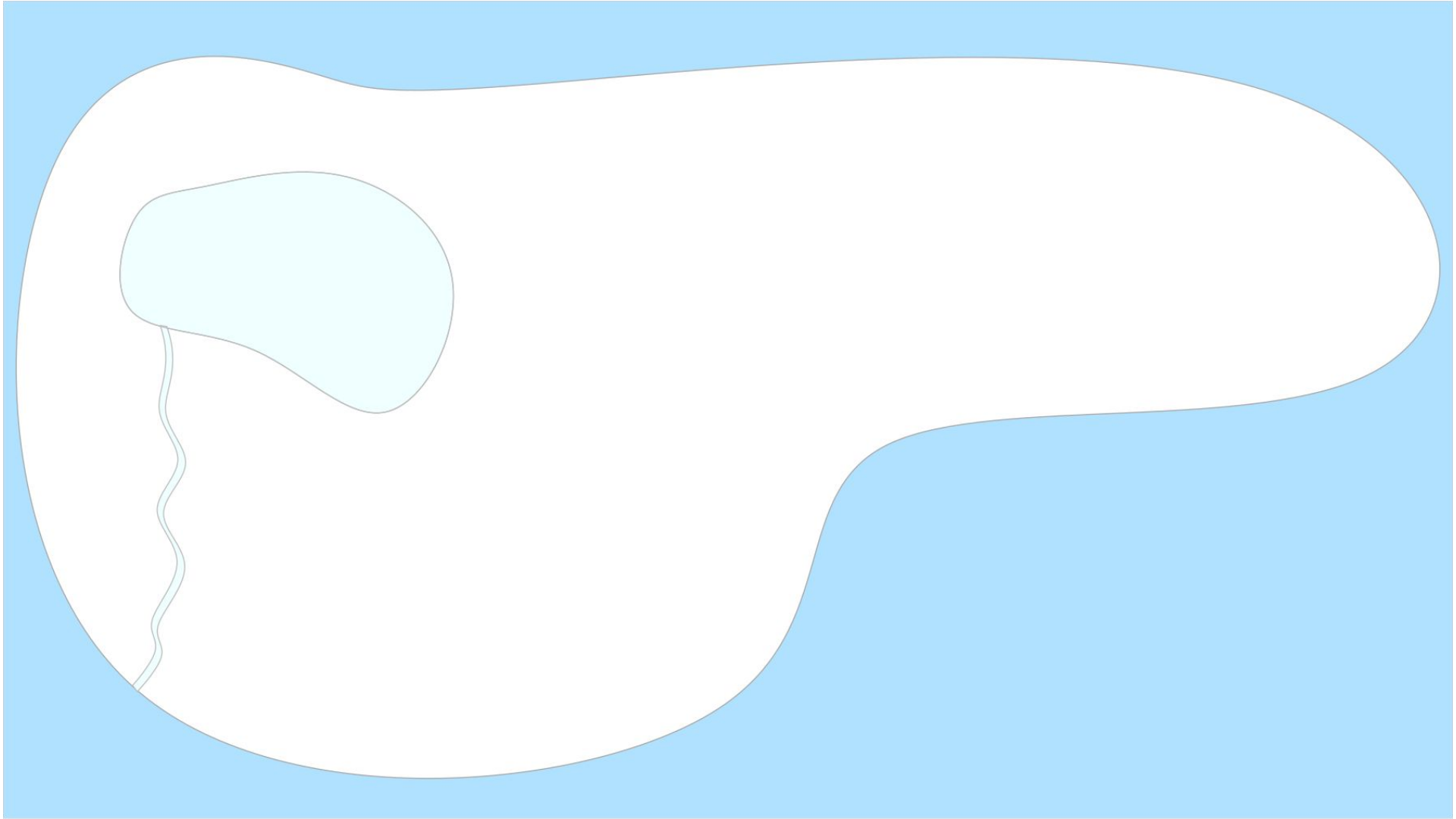
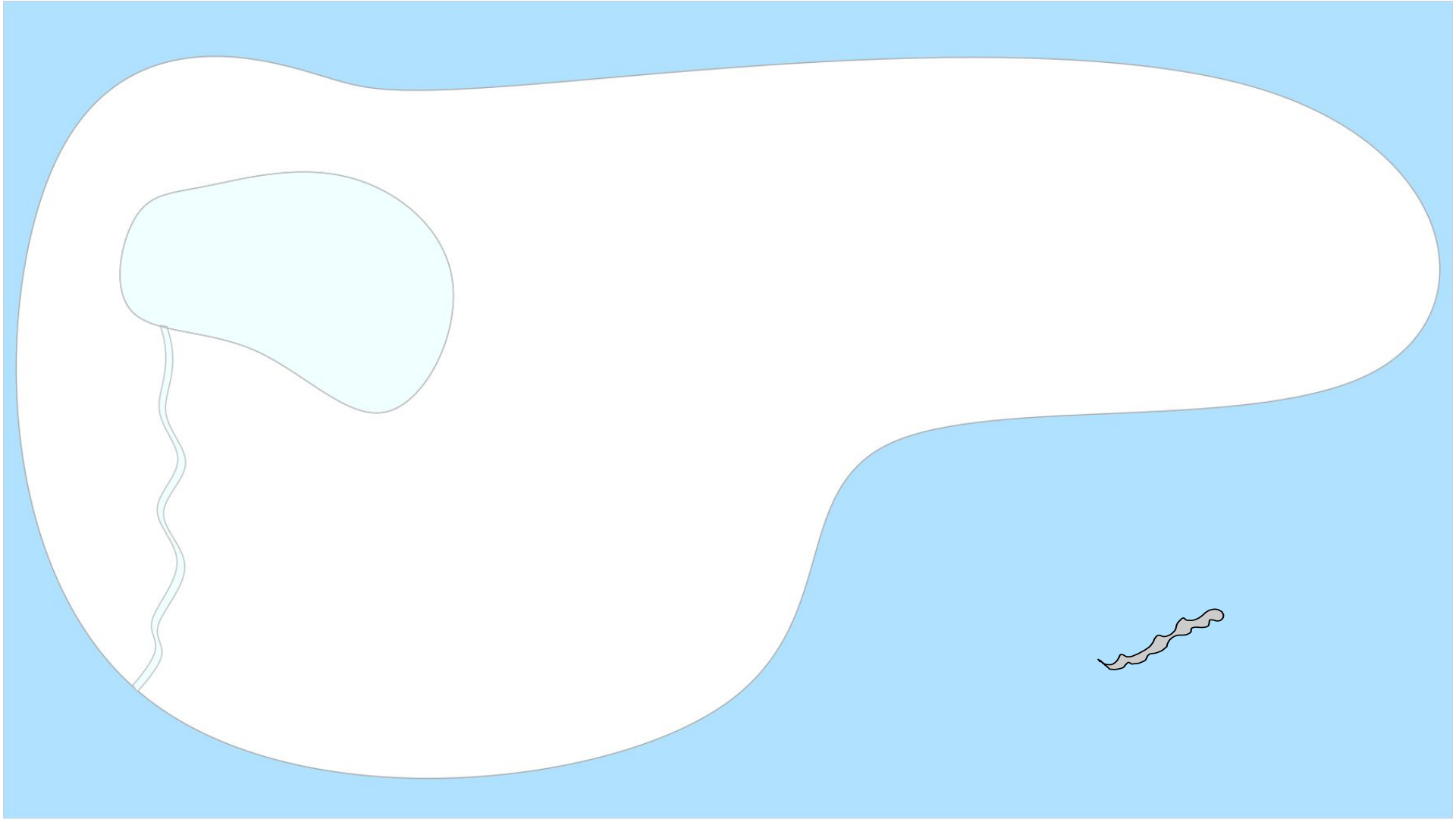
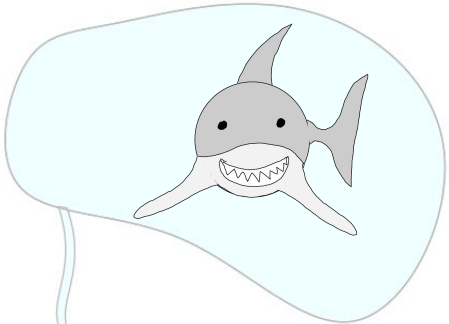
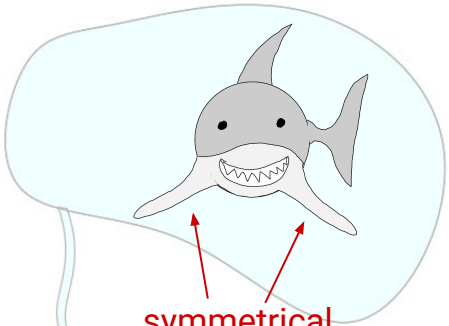


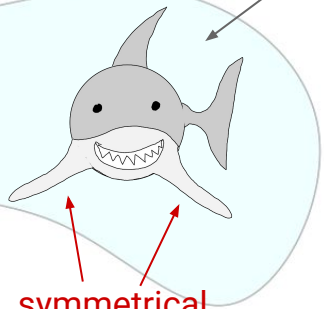






symmetrical
fins

Megalodon ~ 10m



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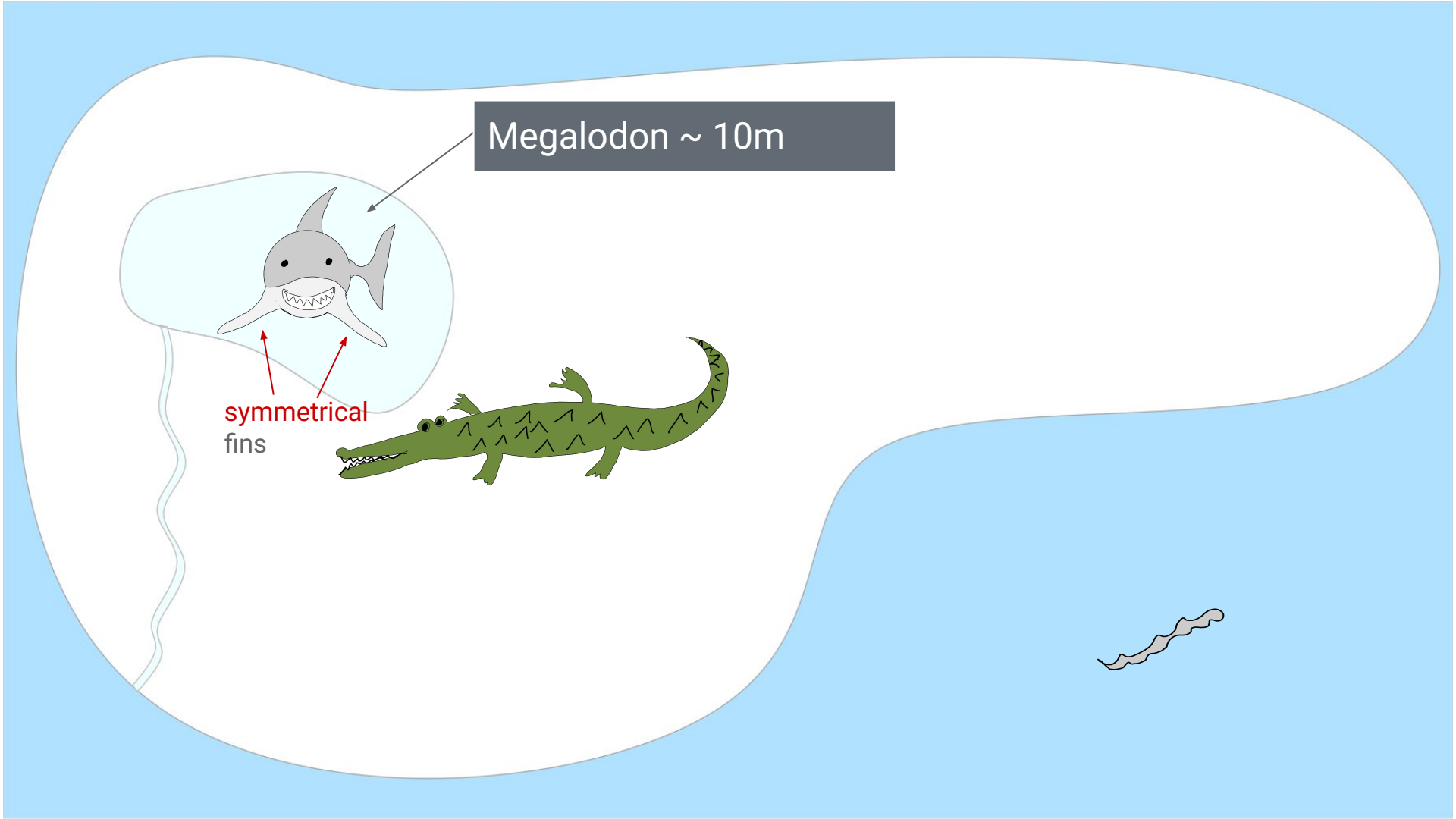
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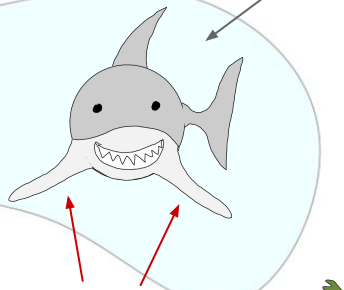

symmetrical
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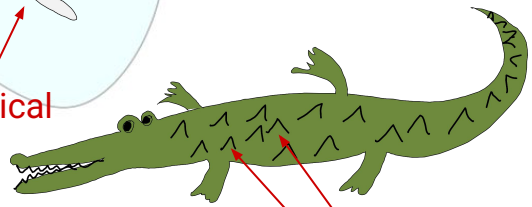
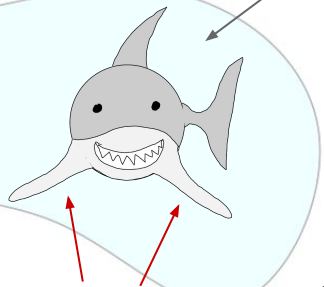


asymmetrical
scales

Megalodon ~ 10m

Sarcosuchus Imperator
~ 12m



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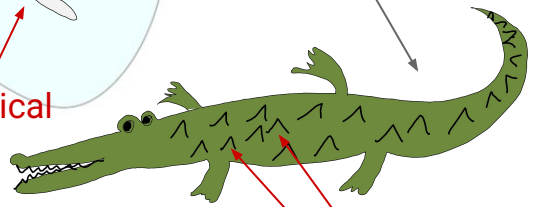

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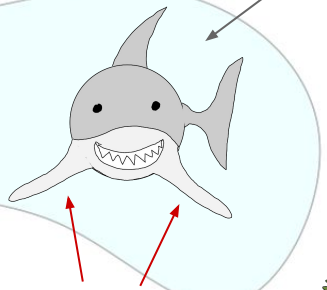

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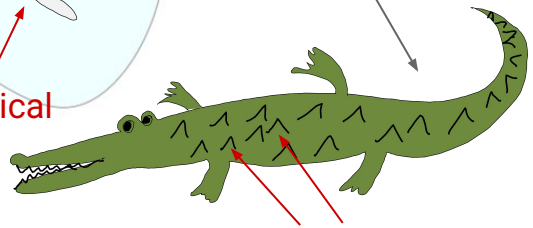

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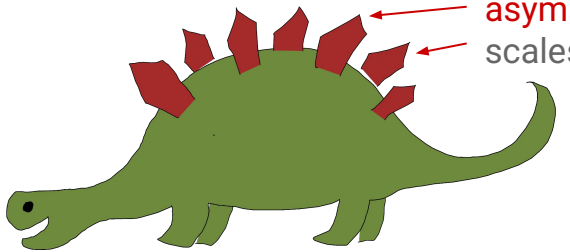

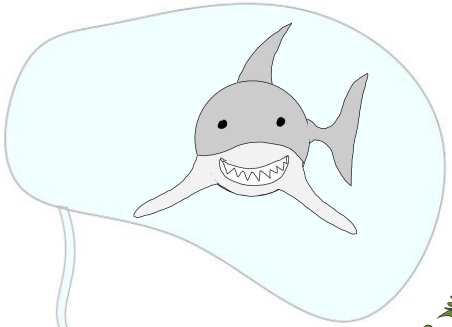

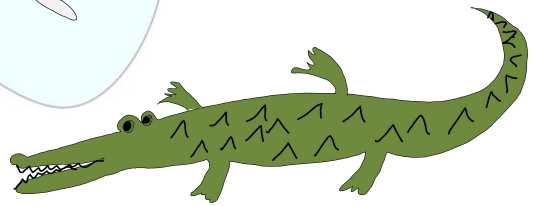

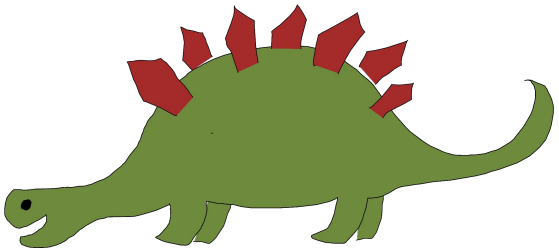

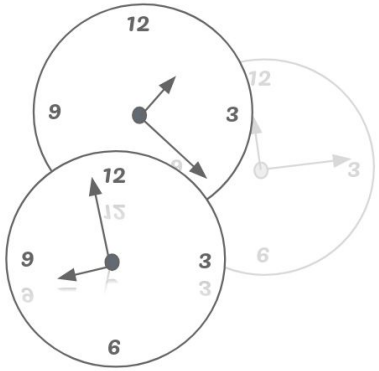
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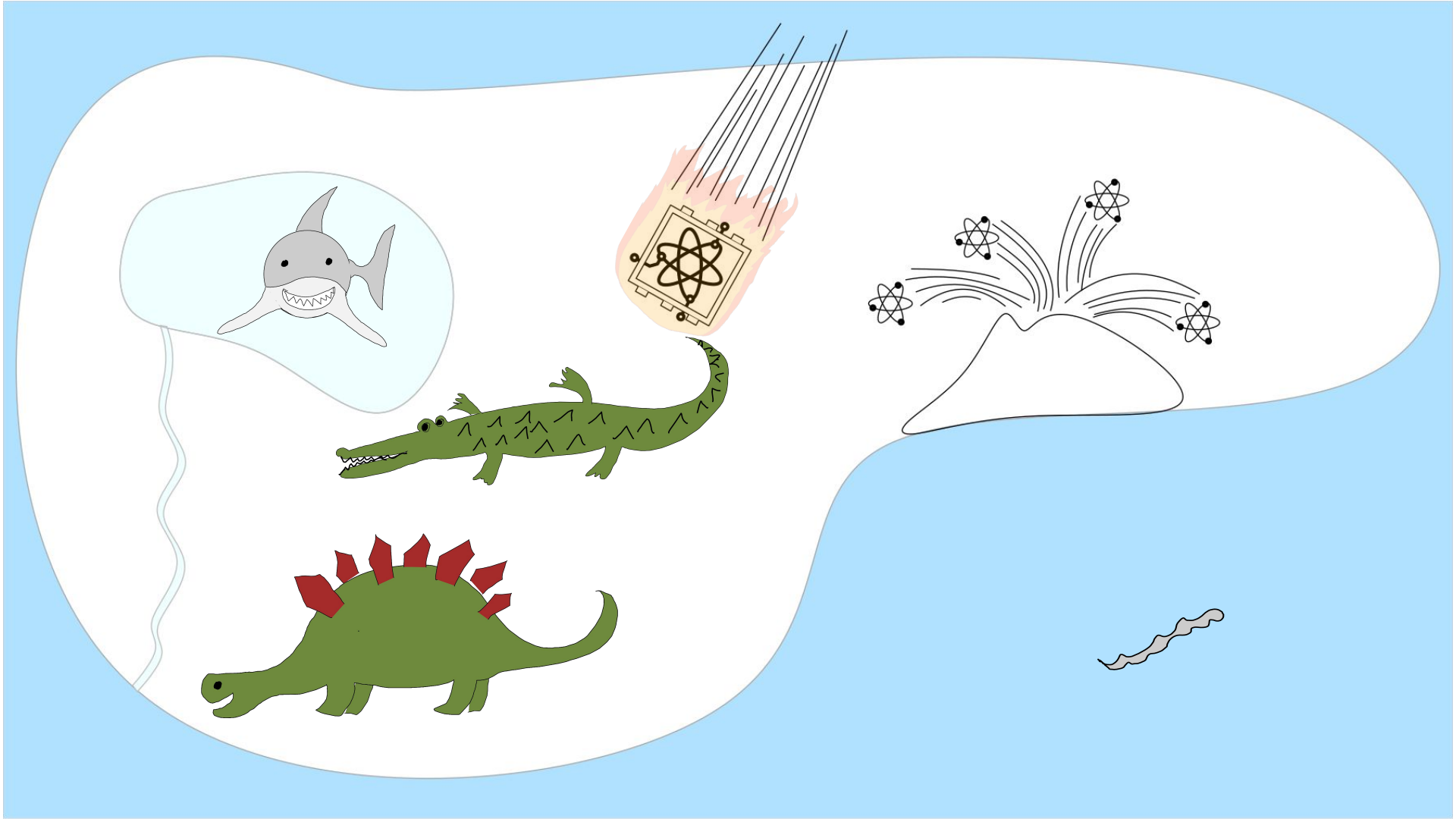
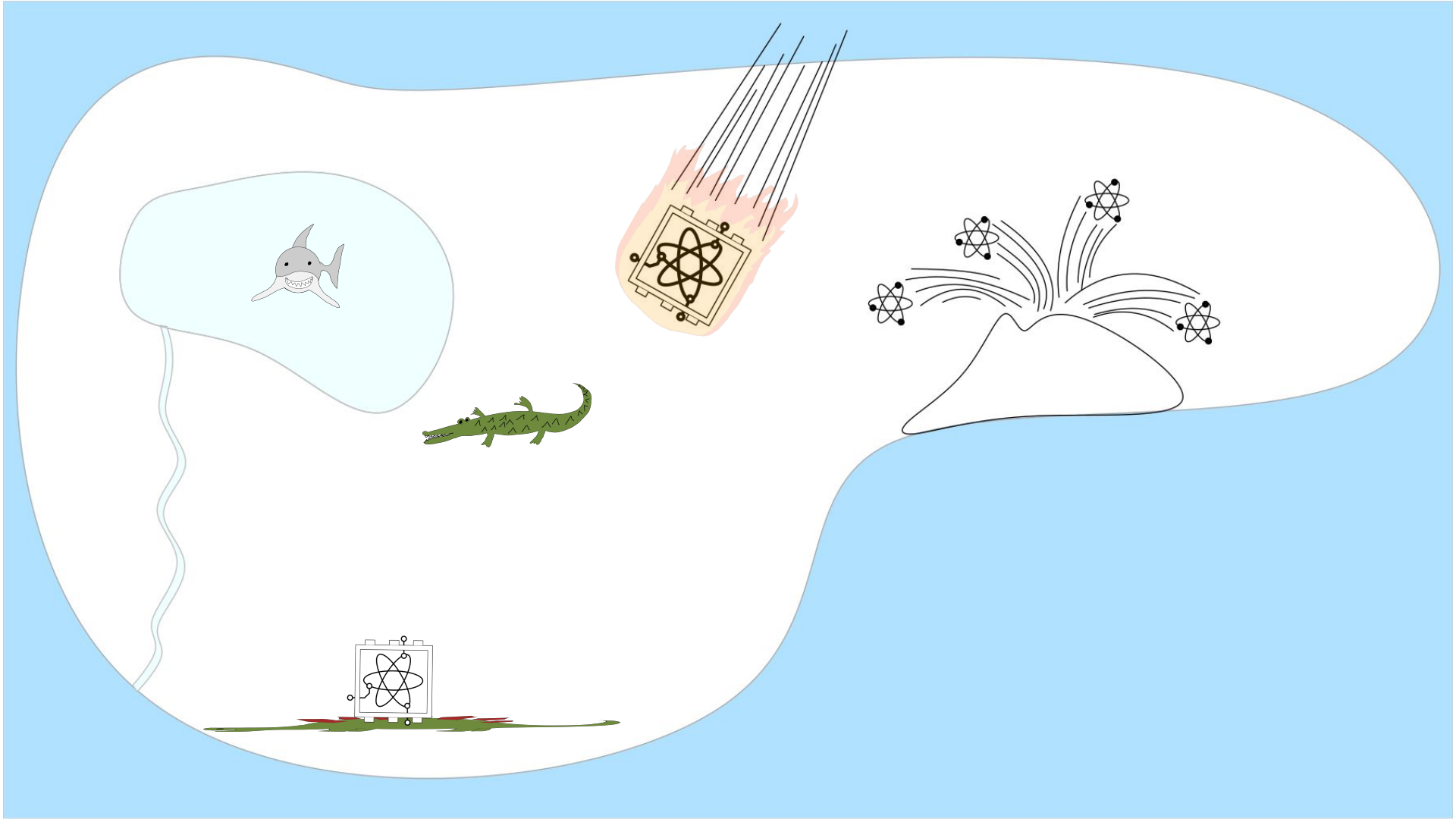
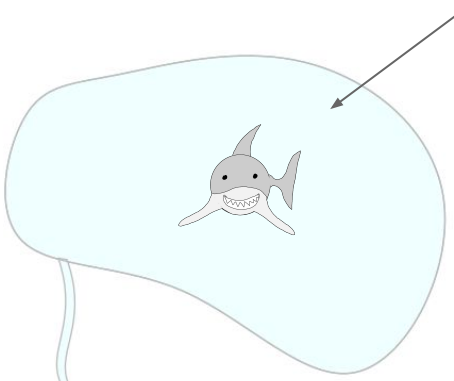
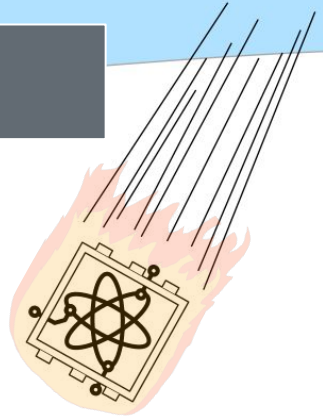
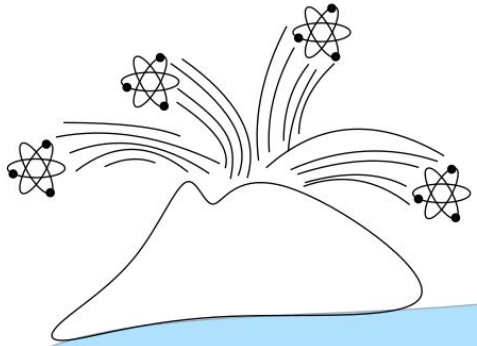


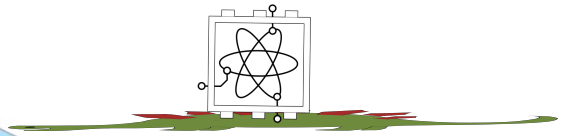


Great White Shark,
~~10m~~ ~6m









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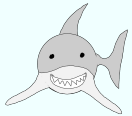
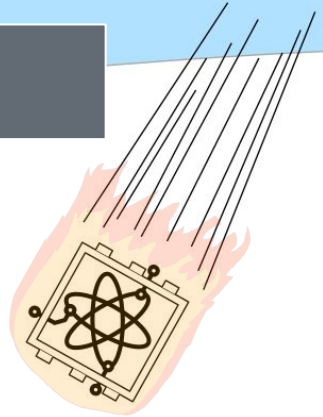
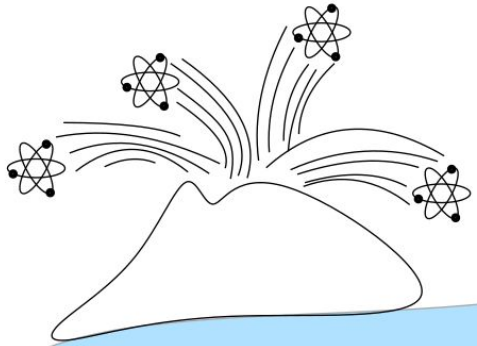
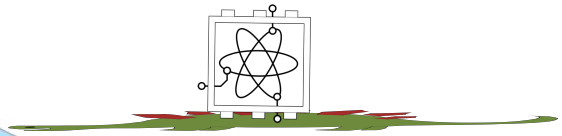






Saltwater Crocodile,
~~12m~~ ~6m



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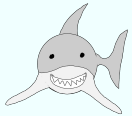

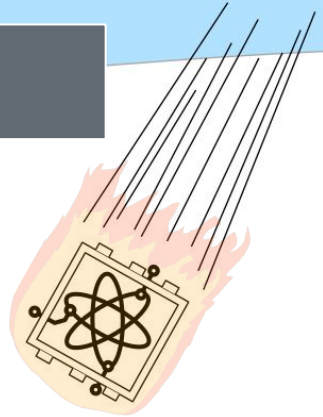

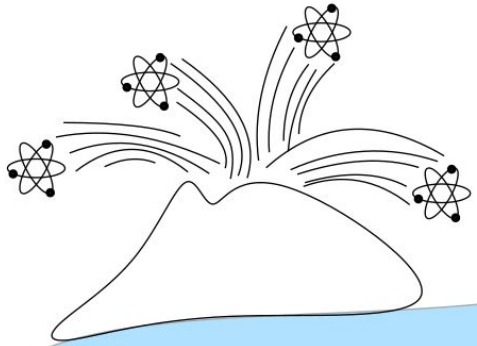

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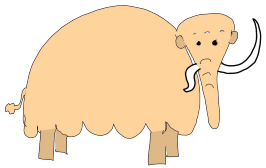
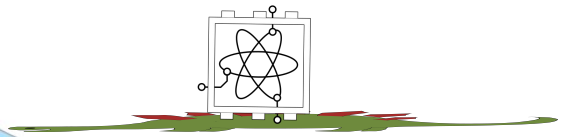
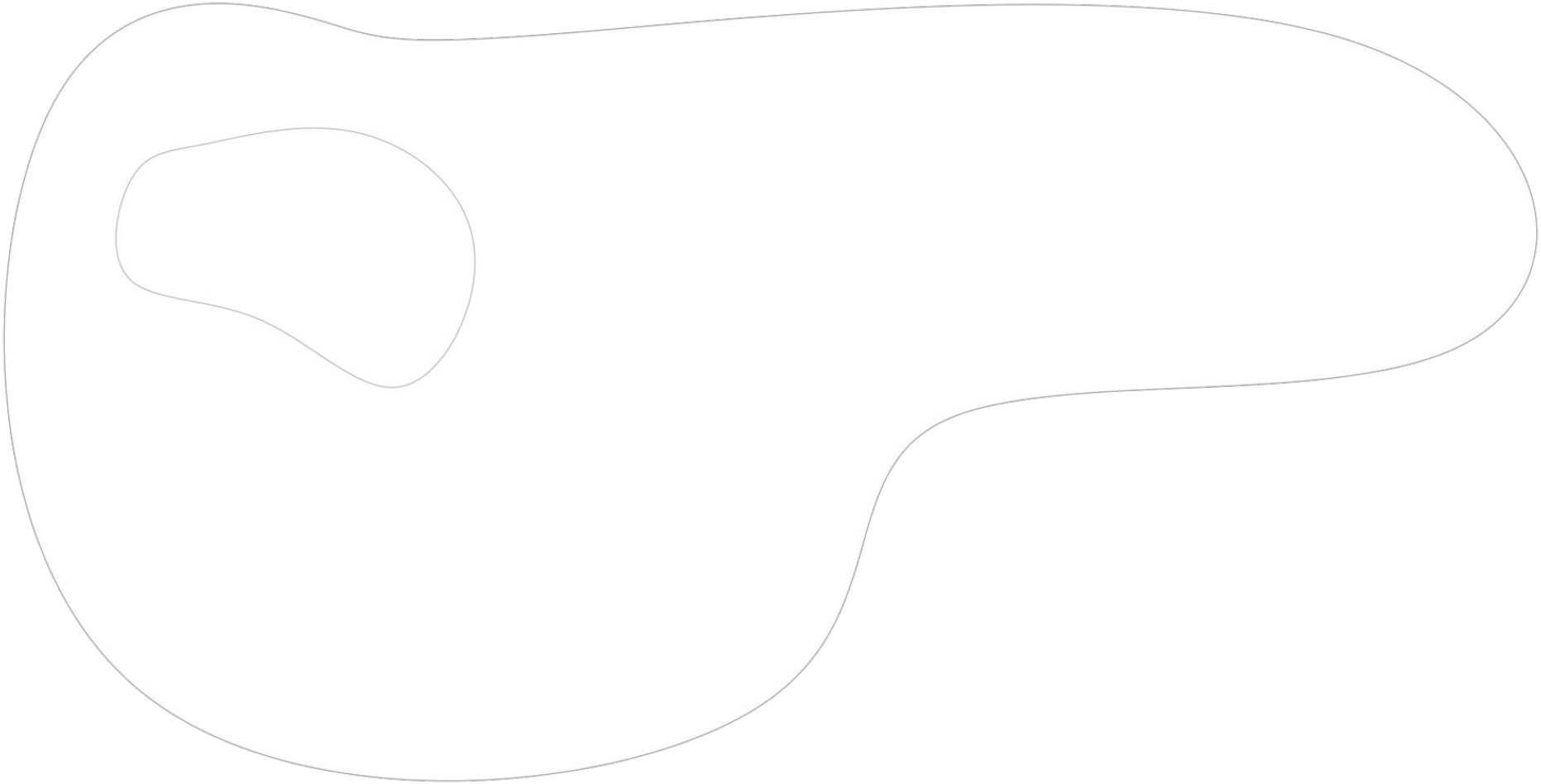




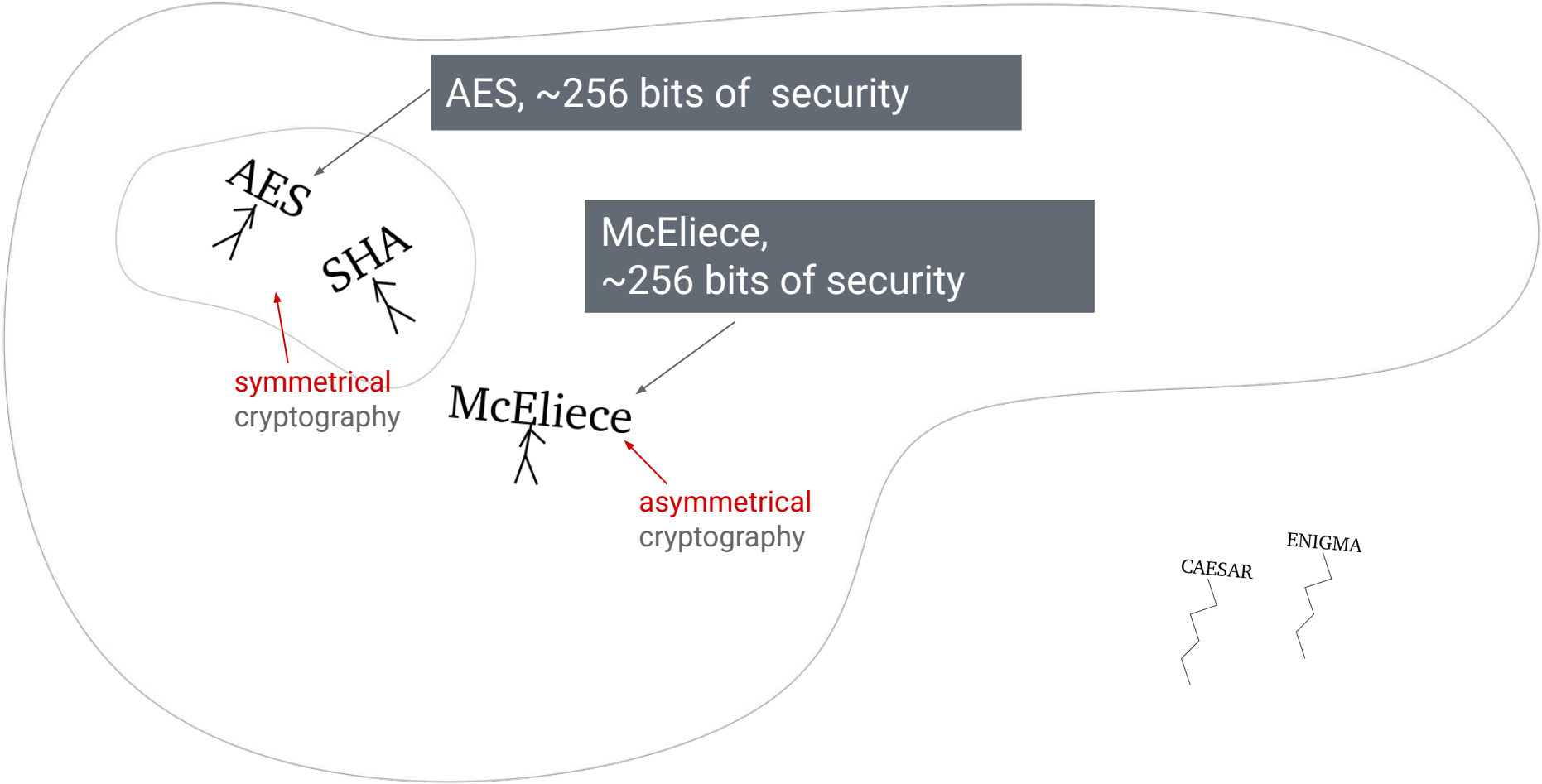
# Did we already learn something about cryptography?




CAESAR
ENIGMA


AES
SHA
symmetrical
cryptography
CAESAR
ENIGMA


AES, ~256 bits of security
AES
SHA
symmetrical
cryptography
CAESAR
ENIGMA


AES, ~256 bits of security
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McEliece
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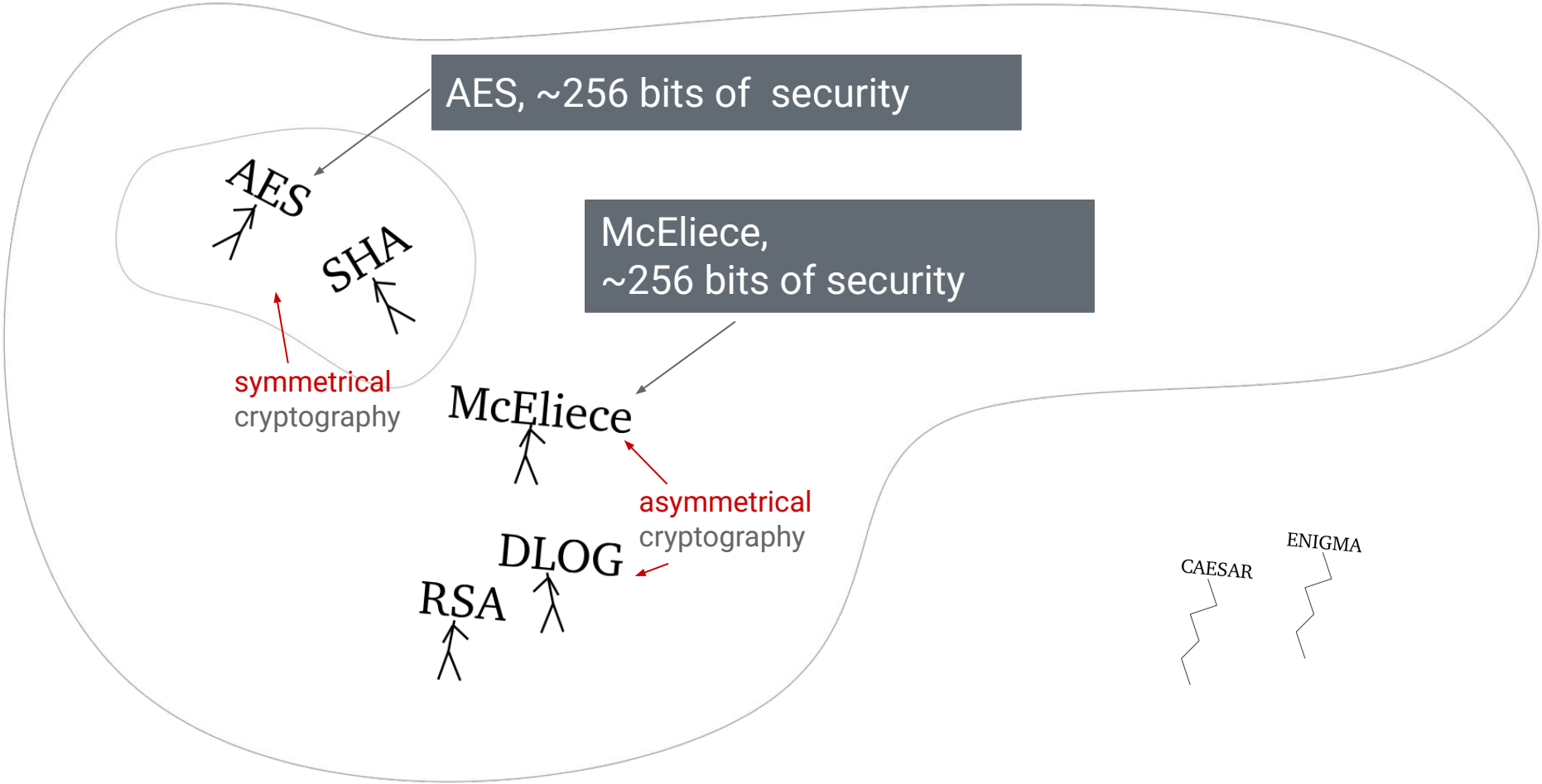
cryptography
CAESAR
ENIGMA


AES, ~256 bits of security
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cryptography

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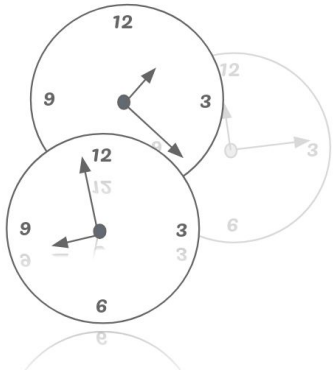
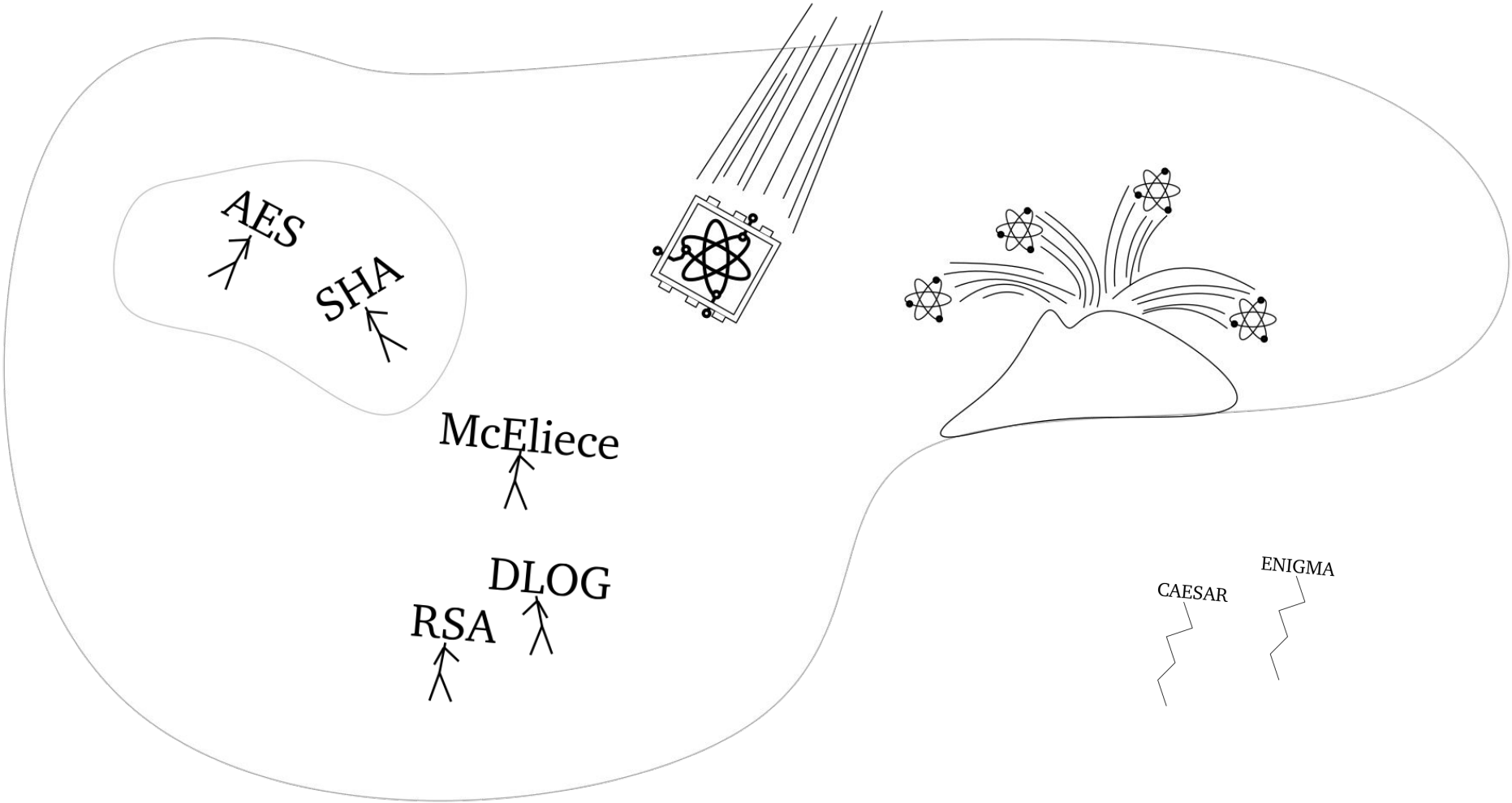
RSA




CAESAR

ENIGMA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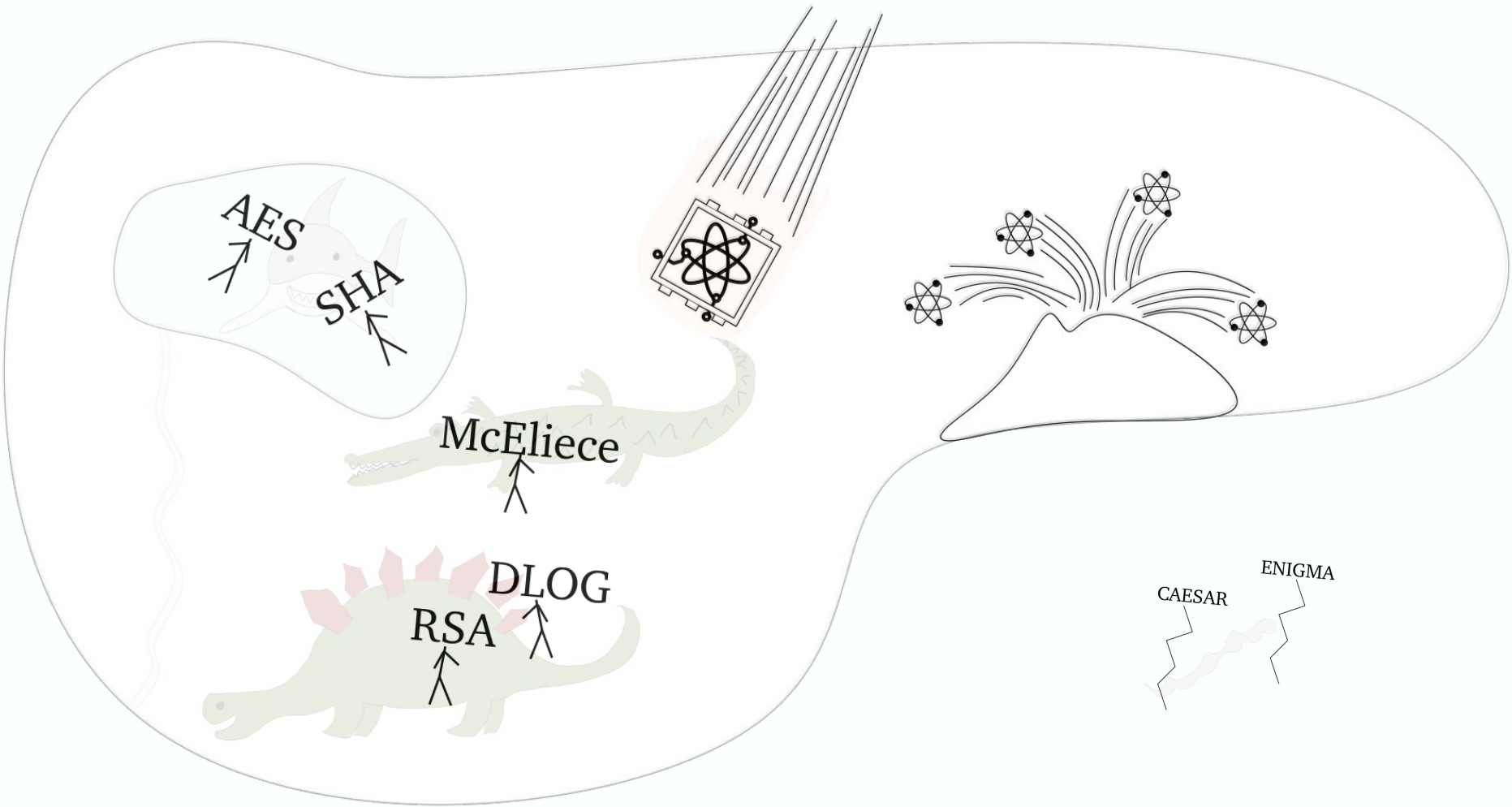
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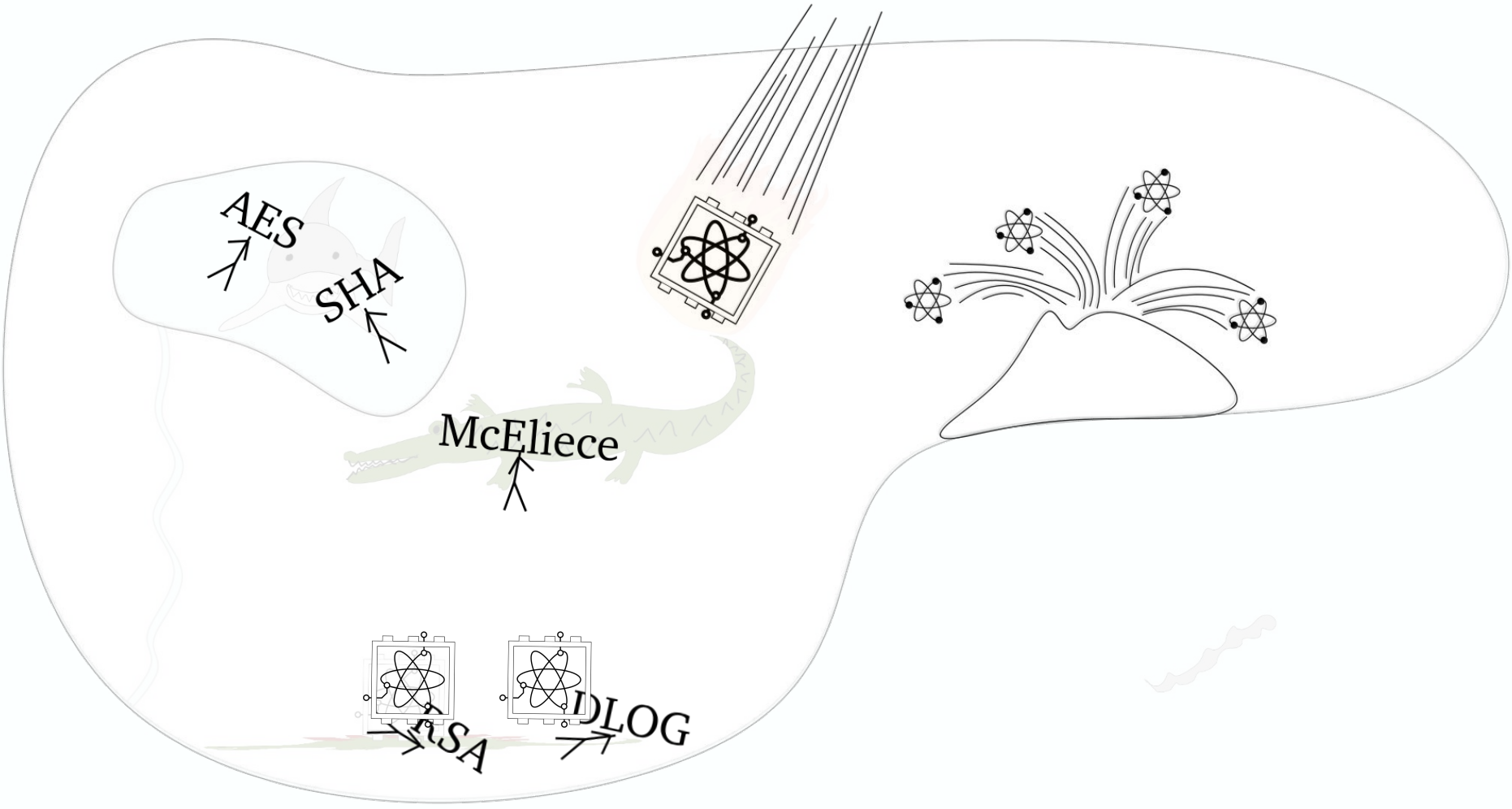
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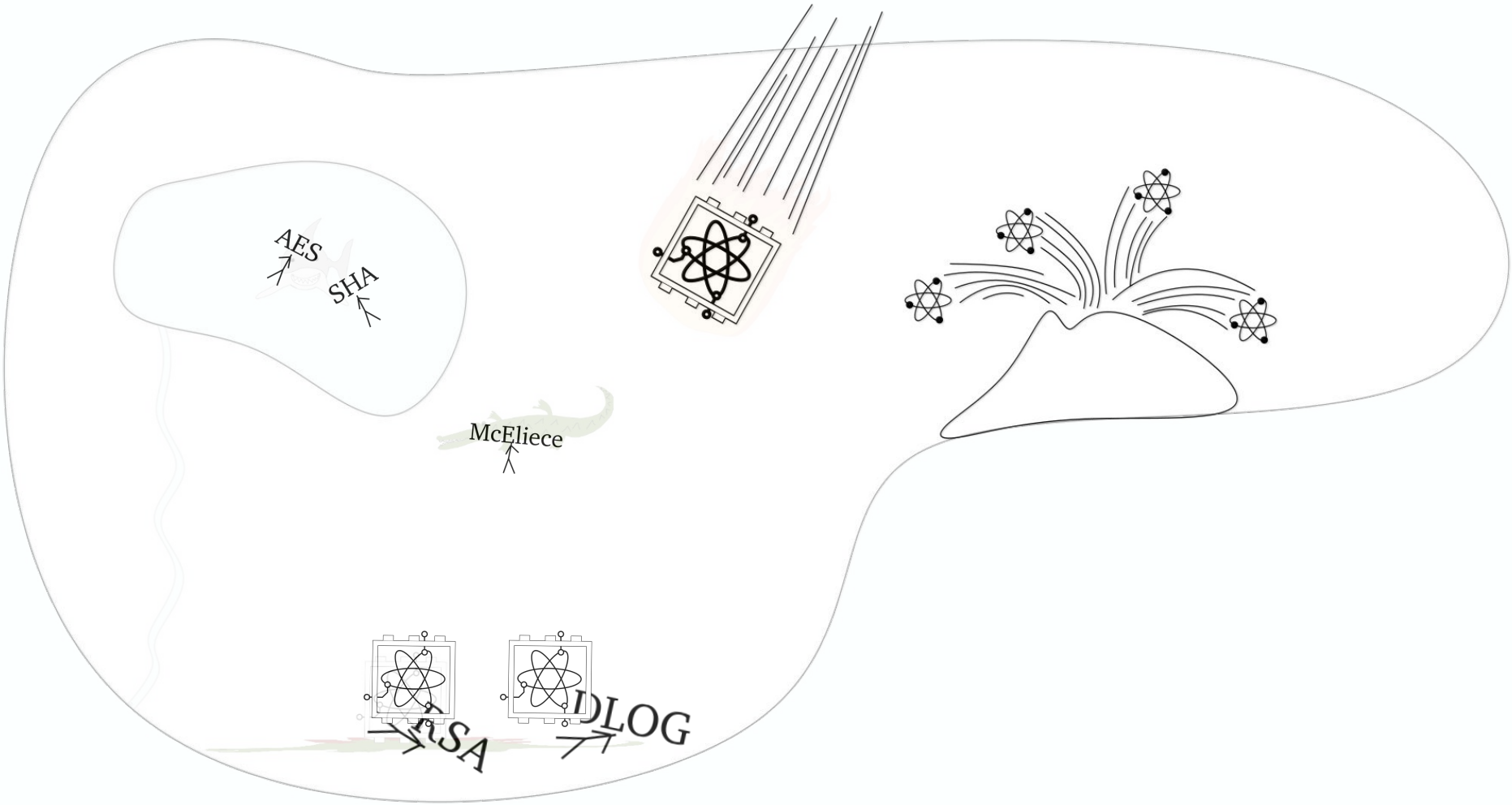
AES
SHA
McEliece
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AES, ~~256~~ ~128 bits of security
AES
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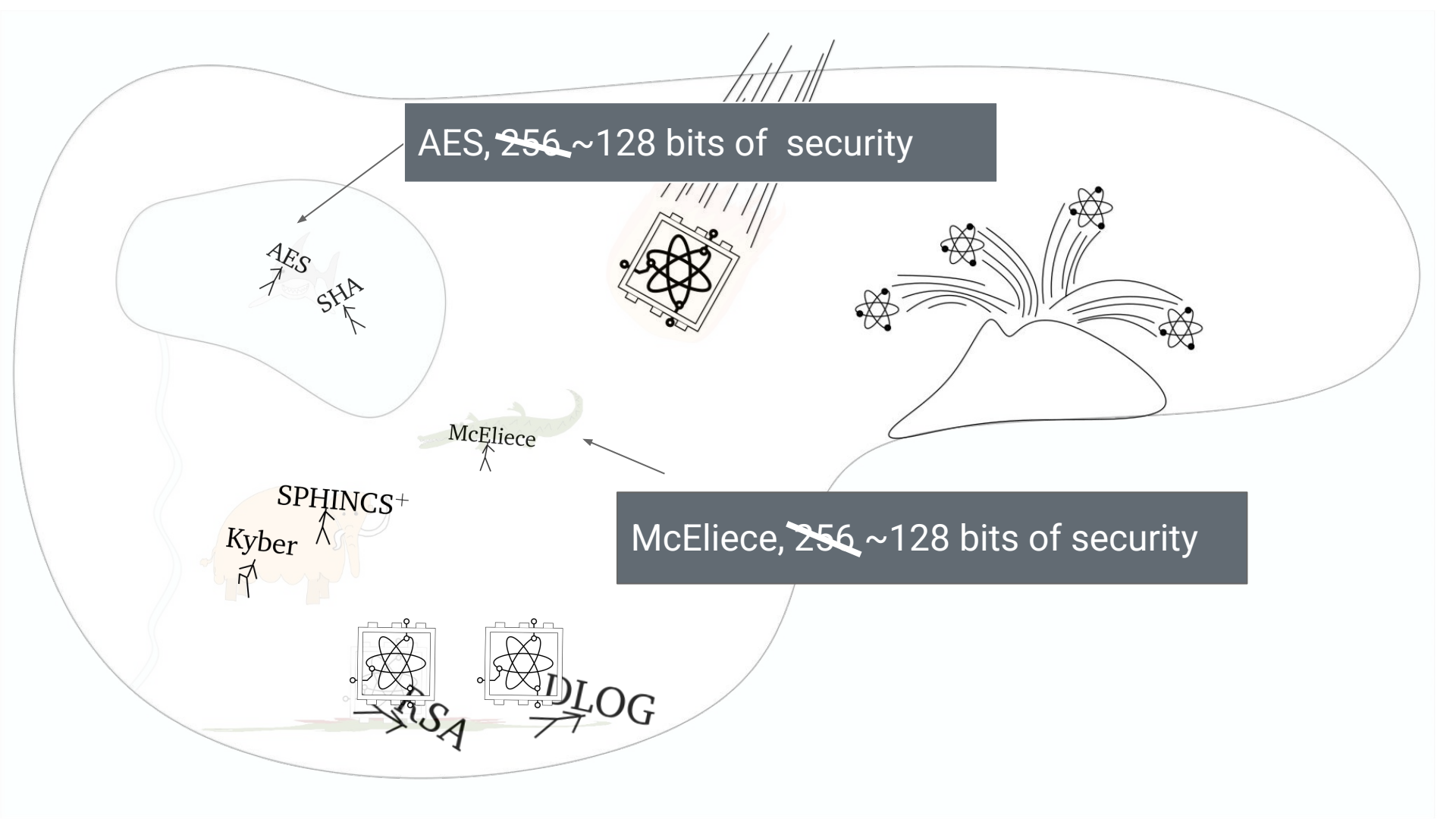
AES, ~~256~~ ~128 bits of security
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SPHINCS+
Kyber
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DLOG

# Goals of this talks

1. Oblivious learning about cryptography 
2. Explain the above with **bold** claims

# What did we learn so far?

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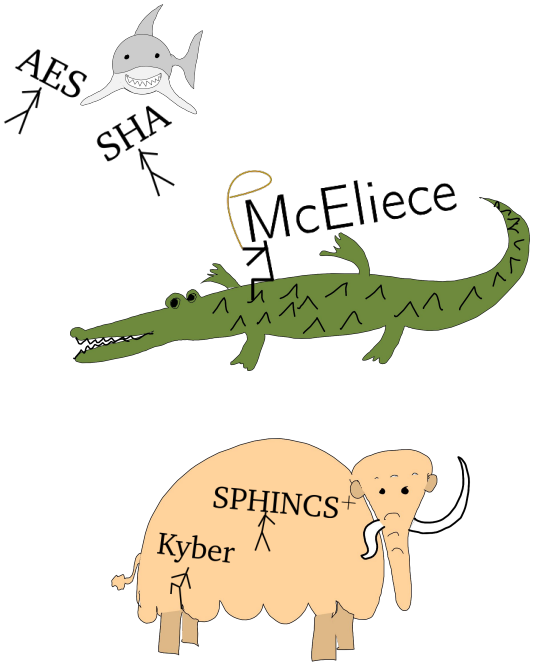
Quantum-secure cryptography exists,
but security is halved.



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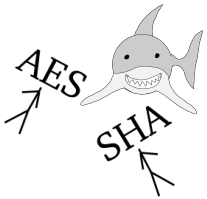
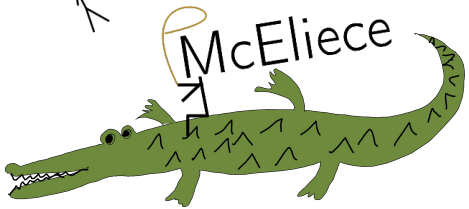
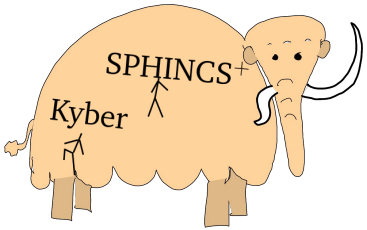



The Why and the How



# The Why and the How

# The Why and the How

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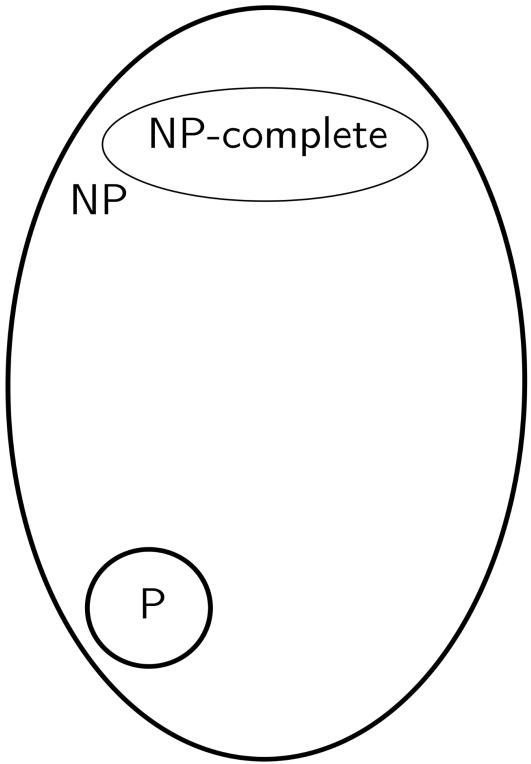
# The Why and the How



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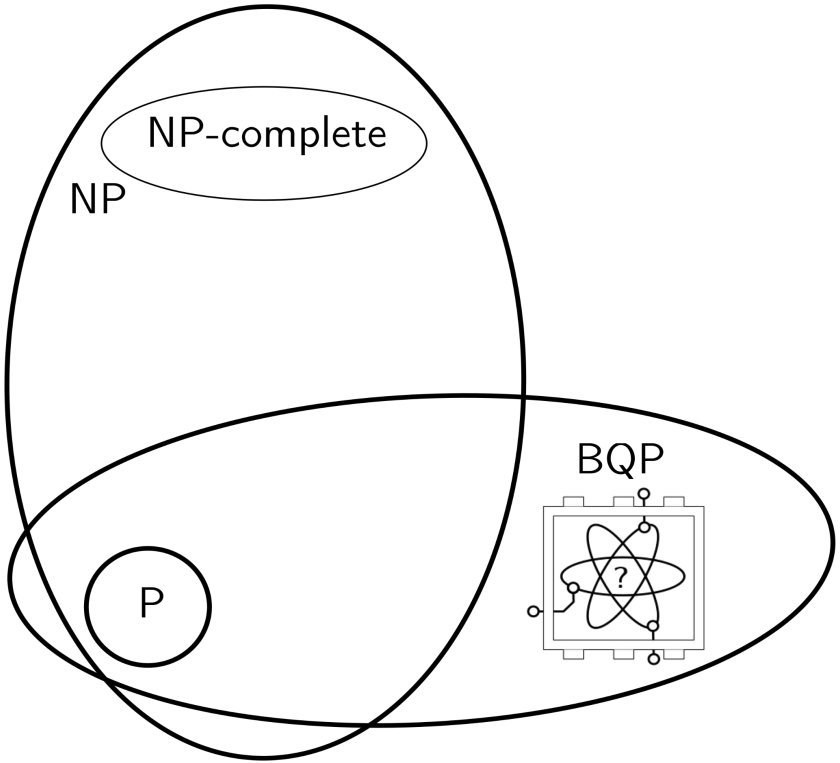

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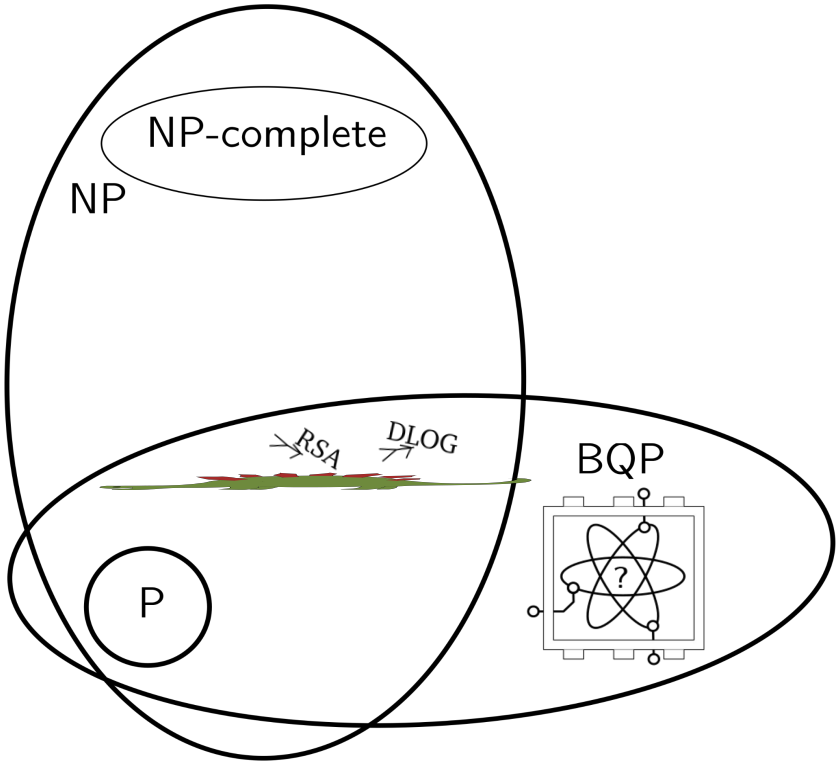

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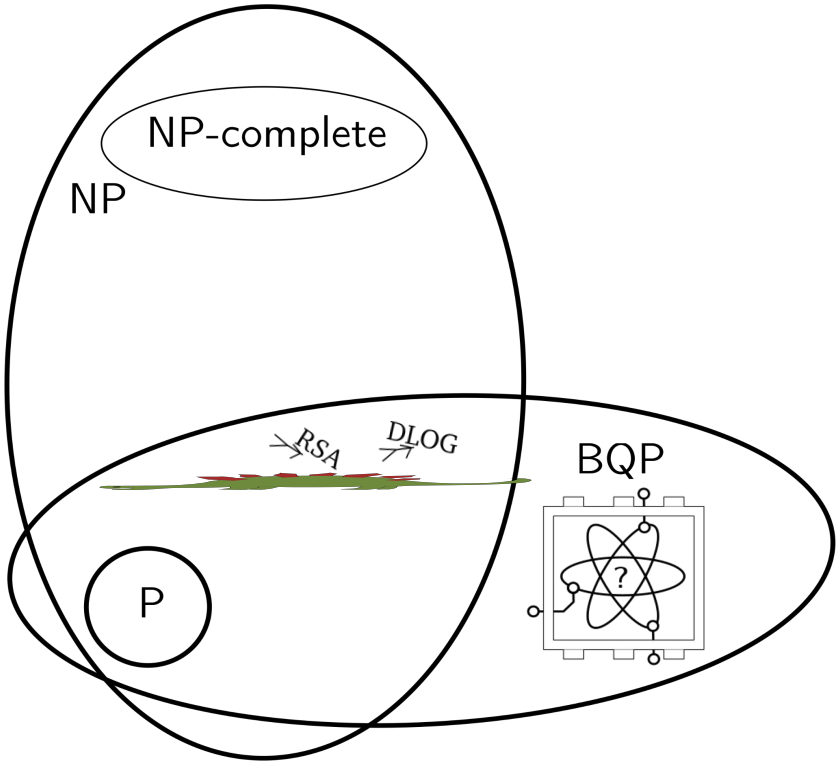
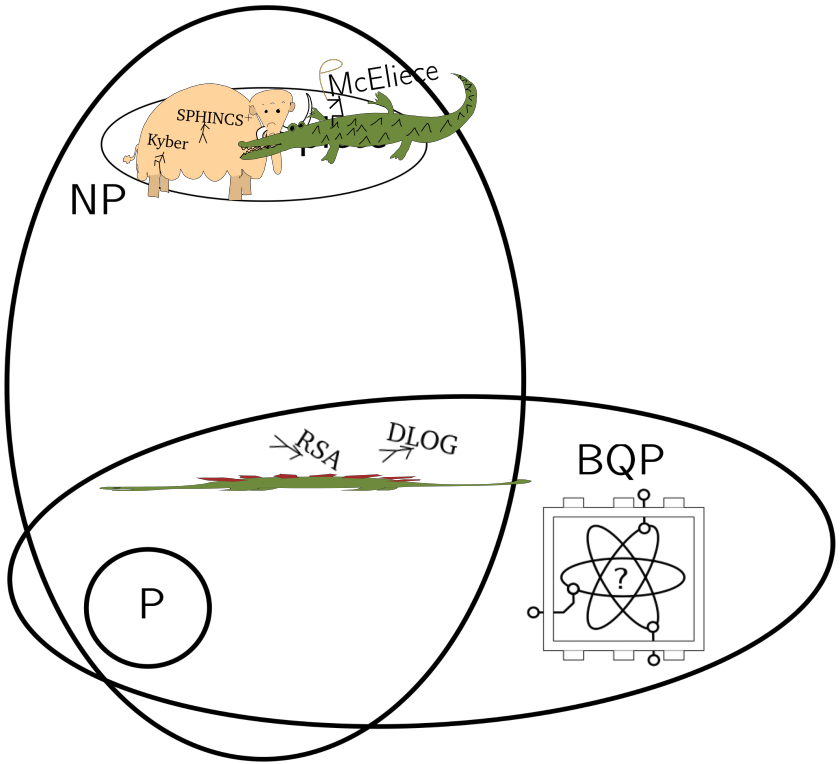



First **bold, unproven** claim

**Quantum computers cannot solve NP-complete problems in polynomial time**

# The Why and the How

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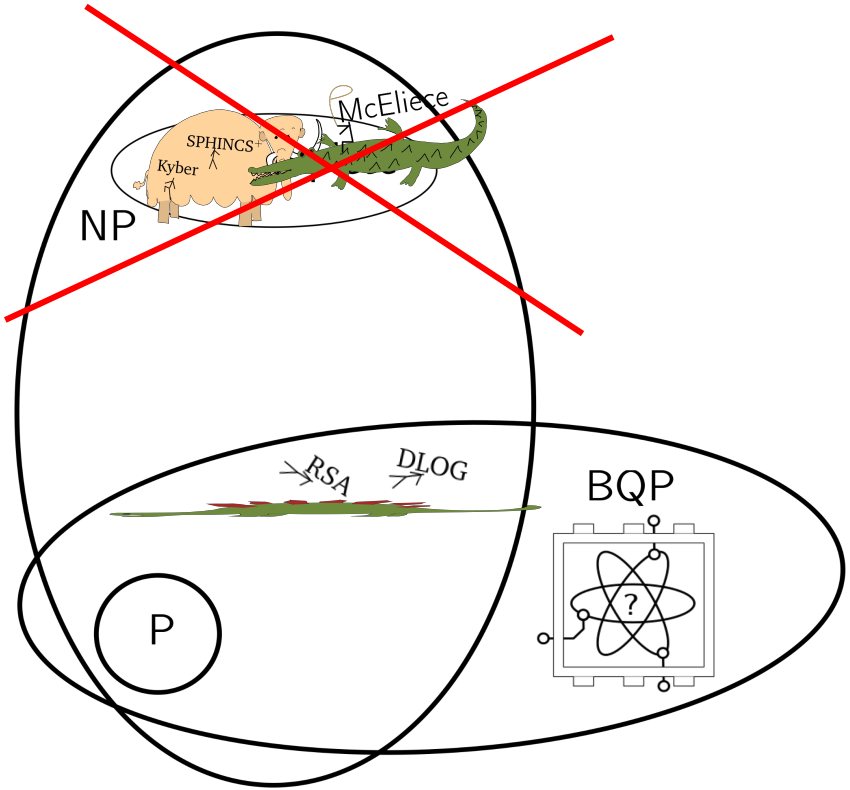
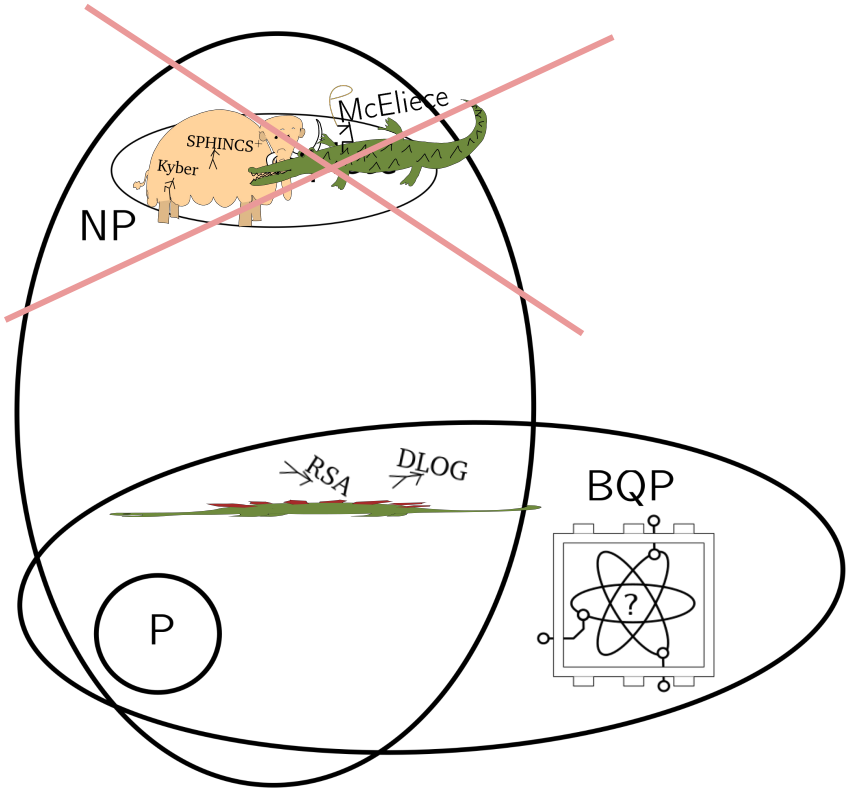



First **bold, unproven** claim

**Quantum computers cannot solve NP-complete problems in polynomial time**

Cryptography as difficult to break as NP-complete problem **not known** to be possible!

# The Why and the How




**NP** Solution can be guessed and verified in poly-time

**co-NP** Non-existence of solution can be guessed and verified in poly-time

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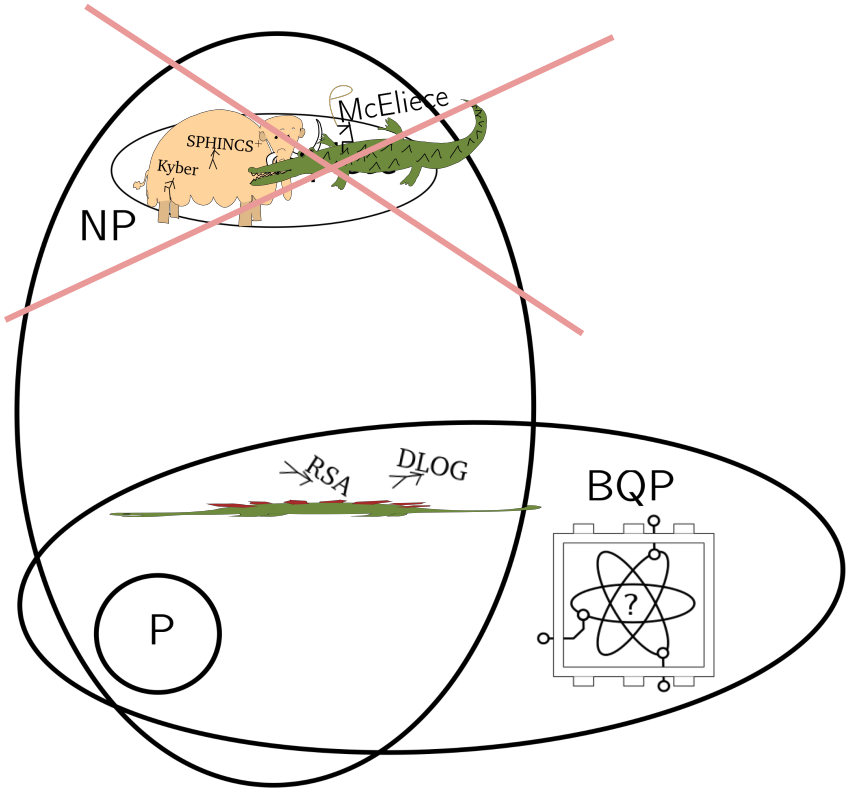


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**Crypto** Enc(pk, M) → C
Dec(sk, C) → M
∈ NP ∩ co-CPs

**Secure** If finding M from (pk,C) is NP-complete.

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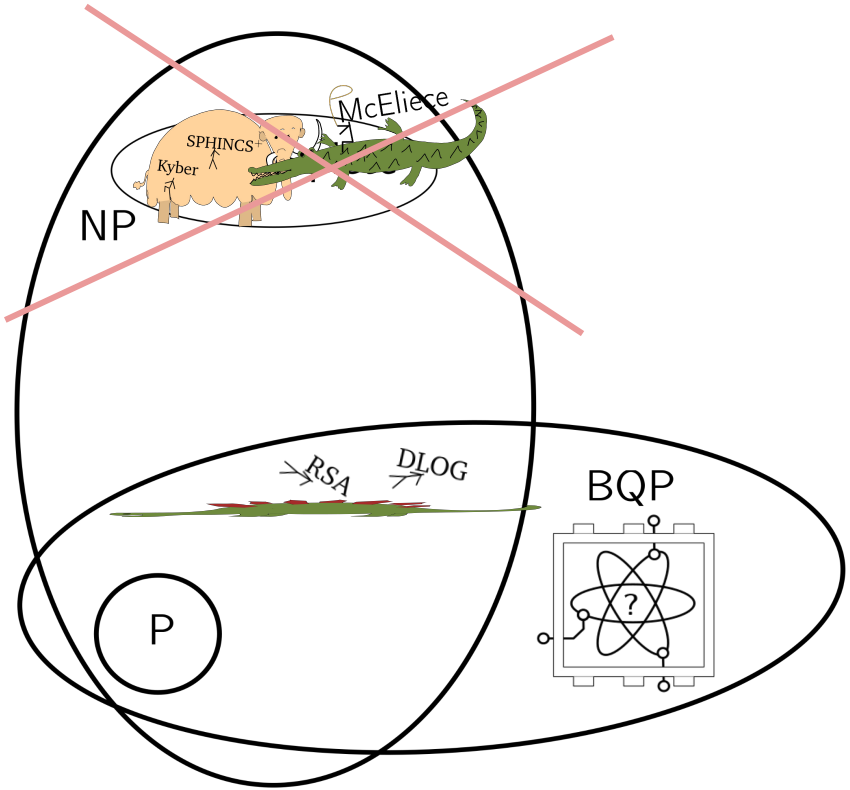


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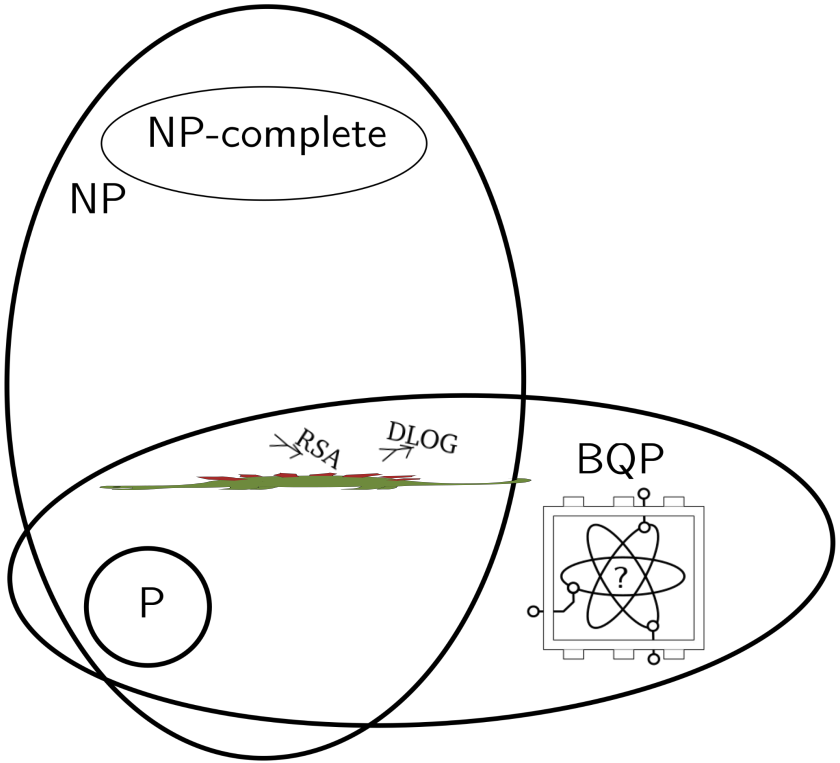
Showing **Crypto** as **Secure** as **NP-complete** problem difficult

means **proving** **NP = co-NP**
(and also P ≠ NP)

# The Why and the How



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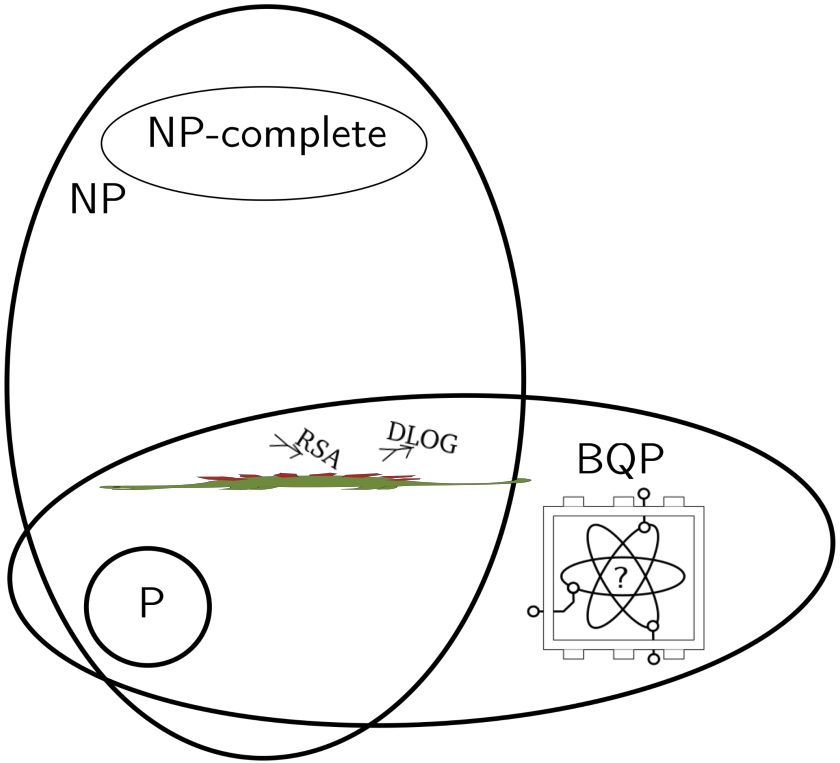
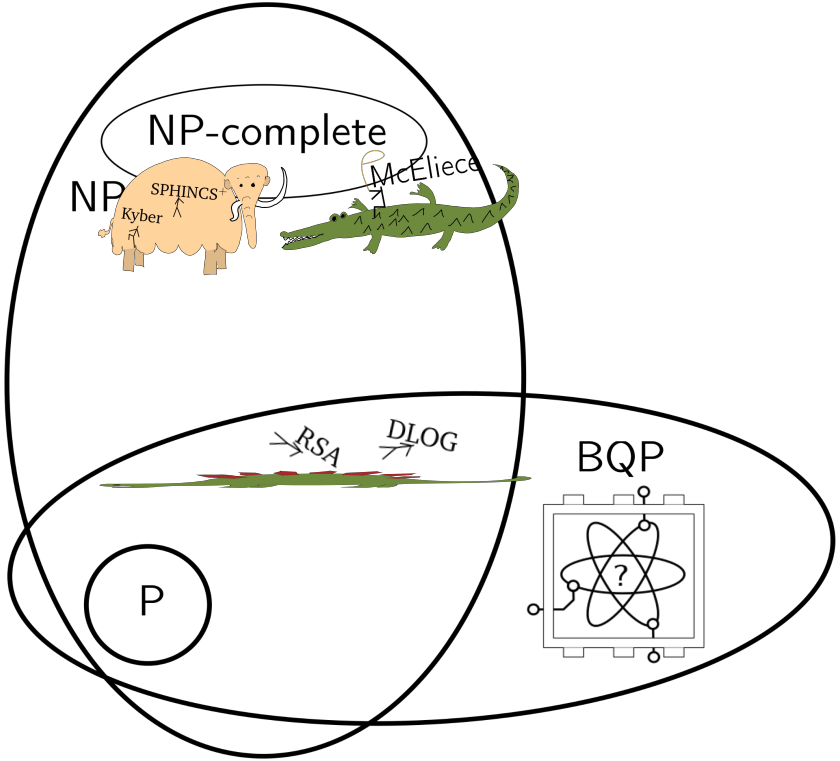



another **bold, unproven** claim

**Take NP-complete problem,**
**make it a bit easier**
**⇒**
**Crypto!**

# The Why and the How

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**Take NP-complete problem,**
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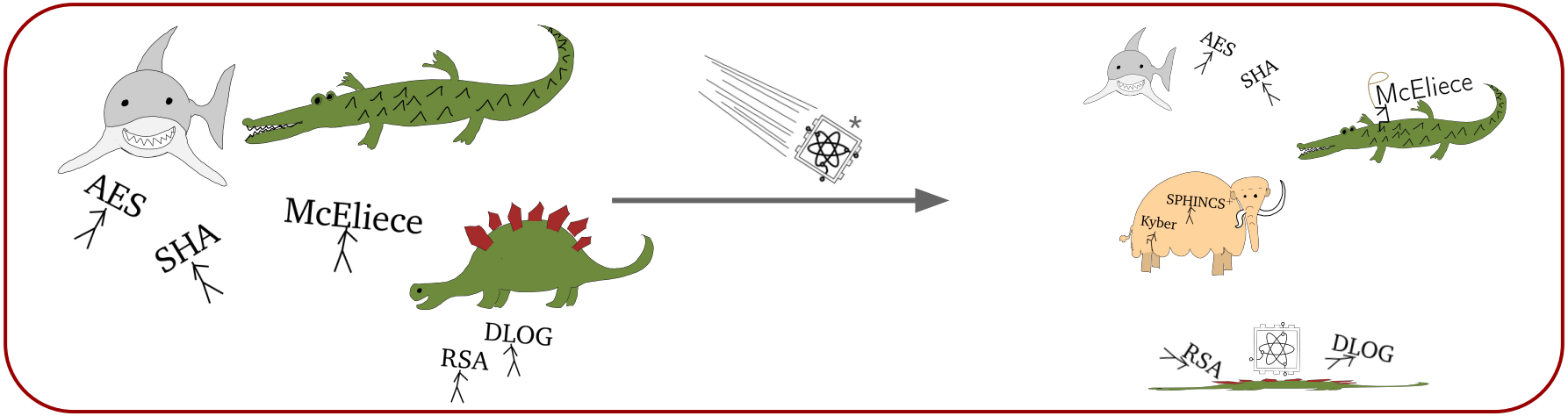
# Goals of this talks

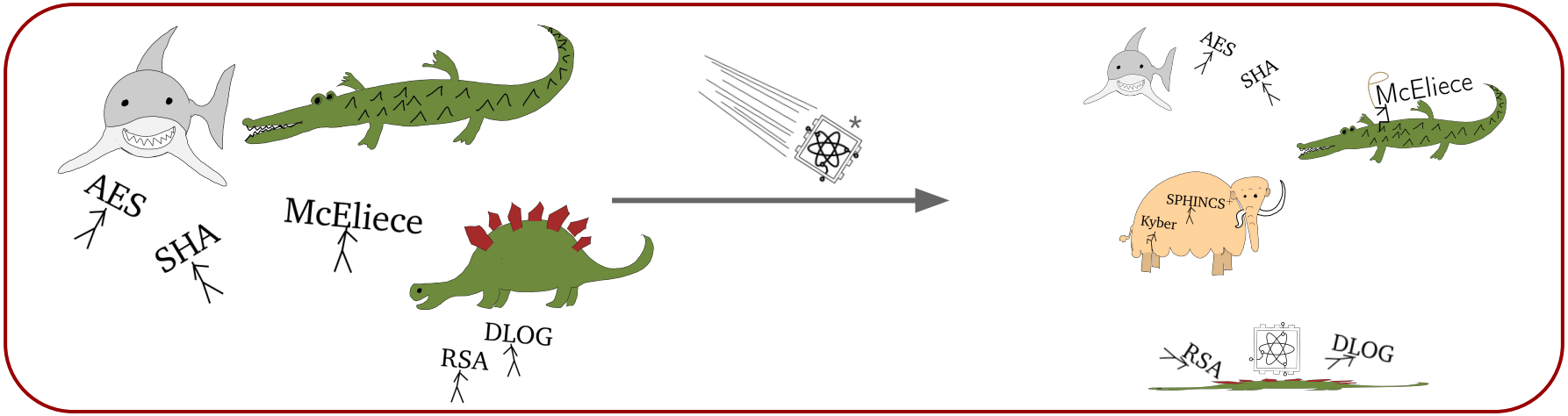
1. Oblivious learning about cryptography 
2. Explain the above with **bold** claims 

# Summary & Conclusion




*No dinosaurs were harmed during the making of these slides.

# Summary & Conclusion




**Quantum-secure cryptography can be build from nearly-NP-complete problems**

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Last **bold**, unproven claim