

## Description

Such invisible nano-synthetics feed off similar misgivings about encryption and secret messaging, and are targets of concern amongst some citizens. According to a Reuters fact check site

## DNA origami encryption (DOE)

A short message is coded as a sequence of dots, a bit like braille. Zhang and colleagues illustrate this with the letters H, E, and Y which they code as



That's just a 3x3 visual array of dots that are either on or off. The bottom row indicates the position of the letter in the message. That's needed as the message eventually appears as a coded "alphabet soup," like random dominoes, and the recipient needs to be able to order the letters. These dot patterns are imprinted as identifiable DNA markers on folded DNA nano-scaffolds, typically flat plates formed of folded DNA strands. The pattern of folding is crucial as the dots will appear in different positions to the original message if the folds are misplaced. Here's what gets transmitted to the message recipient:

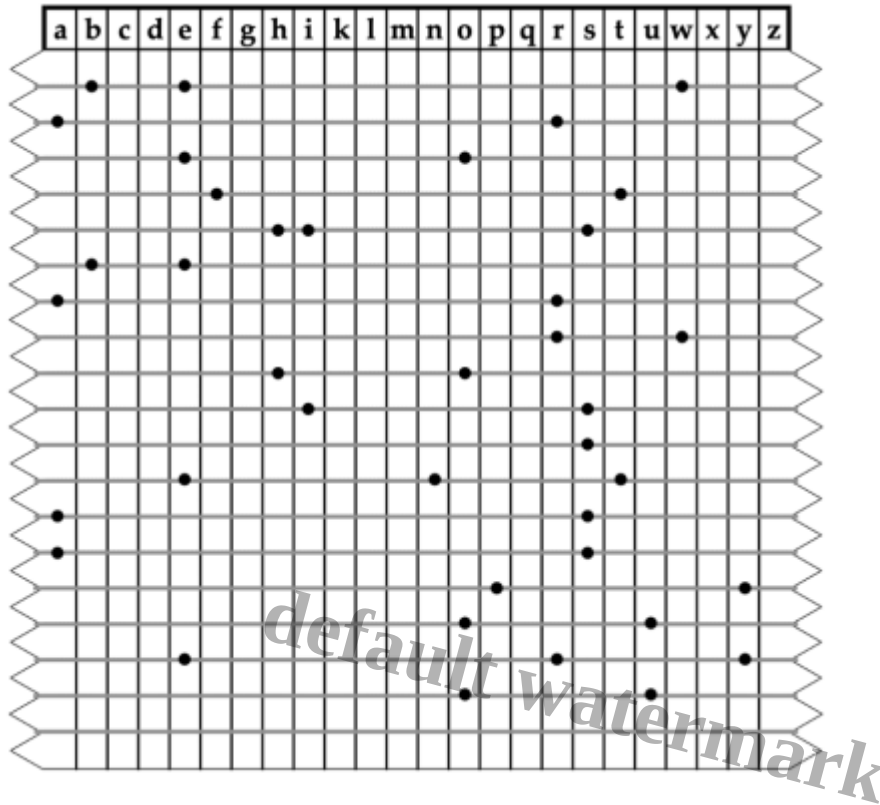
1. a test tube (or impregnated paper) with the fluid containing the relevant DNA
2. other DNA material extraneous to the message but important for the process
3. a "defined DNA origami folding scheme" which is secret textual information presumably already agreed between the sender and the receiver.

The folding scheme delivers the composition of DNA strand chemicals needed to re-establish the scaffold on which the dots are "printed." The recipient essentially mixes chemicals to re-establish the folds (staples) to reform the transmitted DNA nano-scaffold. Centrifuge filters remove surplus short DNA strands, and chemicals are added so that the dots show up on scans. The dot configurations appear on the scaffolds under special fluorescent light (stochastic optical reconstruction microscopy "STORM") and the patterns are interpreted and ordered back into the plain text message: "HEY."

The decryption process in the experiment so described in the Zhang et al article is painstakingly precise, and apparently took 1-2 hours per pattern, which I take to mean per character in the message. The process is clearly costly, noisy and error prone. Never-the-less the researchers claim that the method holds promise of much better security than the Advanced Encryption Standard (AES). In summary,

"the DOC method uses information-based DNA self-assembly to create physical puzzles, resulting in extraordinarily strong all-around protection of a secret message" (7).

The method reminds me of the old string cipher method of delivering a secret message. The plain text message is coded as a series of knots in a length of string. When the string is unfurled and zigzagged across a correctly proportioned wooden template (scaffold) the knots line up against the letters of the alphabet to reveal the secret message. Both parties have to have the a scaffold to the same design. I've redrawn it here from Wilkins's *Mercury* (1641) (p.46). See post: [Beware of this message](#).



## Bibliography

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