





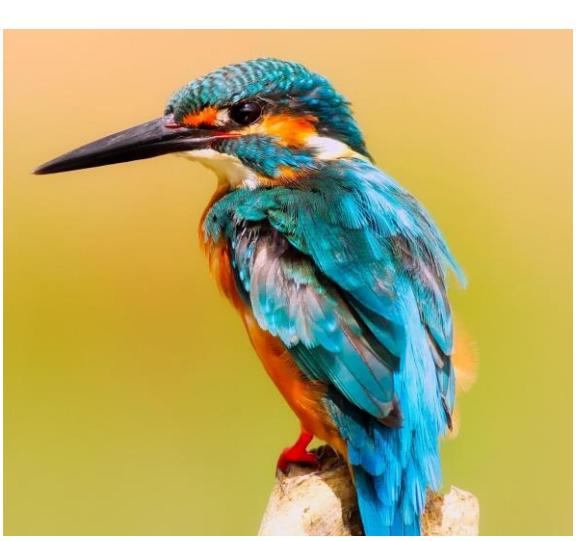
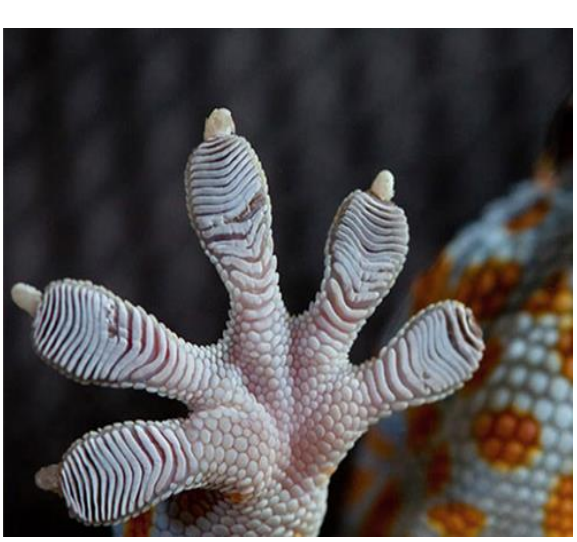
















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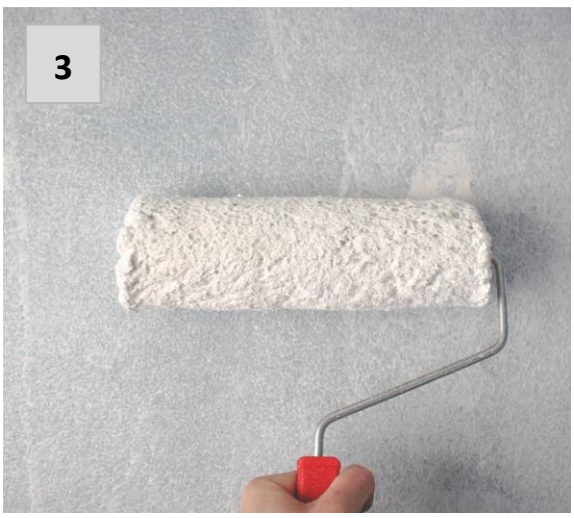
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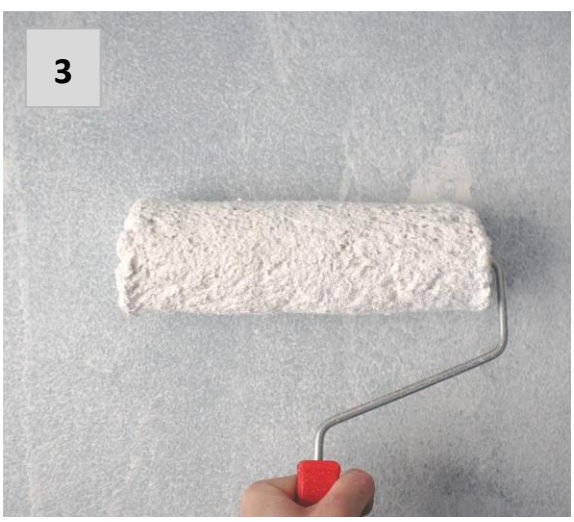
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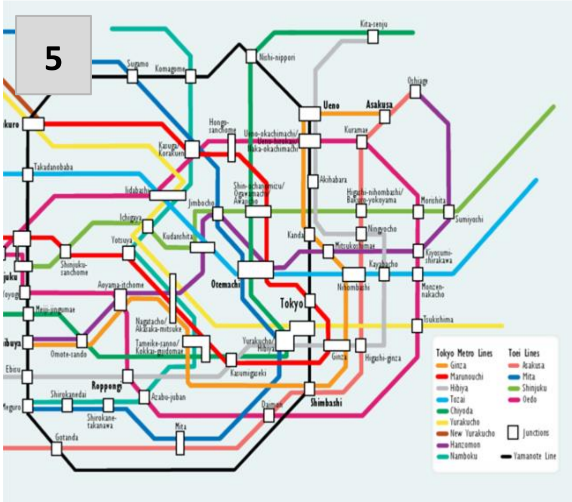
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Kita-senju
Nishi-nippori
Sugamo
Komagome
Oshiage
Ueno
Asakusa
Kuramae
Takadanobaba
Akihabara
Jimbocho
Morishita
Sumiyoshi
Ichigaya
Kudanshita
Kanda
Ningyocho
Yotsuya
Kiyosumi-shirakawa
Shinjuku-sanchome
Kayabacho
Otemachi
Nihombashi
Monzen-nakacho
Aoyama-itchome
Tokyo
Meiji-jingumae
Tsukishima
Nagatacho/Akasaka-mitsuke
Tameike-sanno/Kokkai-gijidomae
Omote-sando
Kasumigaseki
Ginza
Higashi-ginza
Ebisu
Roppongi
Azabu-juban
Shirokanedai
Shimbashi
Meguro
Shirokane-takanawa
Mita
Gotanda
Tokyo Metro Lines
Ginza
Marunouchi
Hibiya
Tozai
Chiyoda
Yurakucho
New Yurakucho
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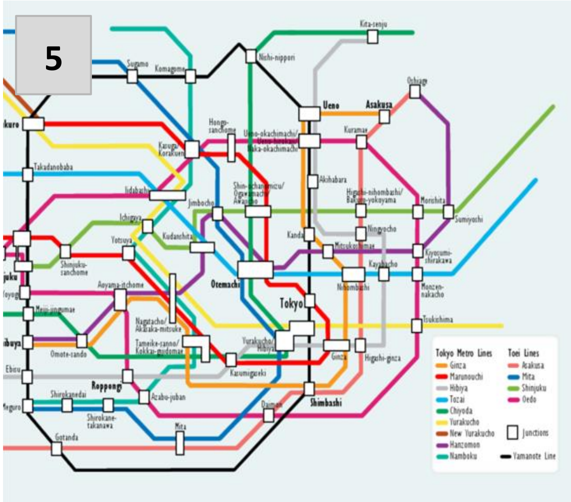
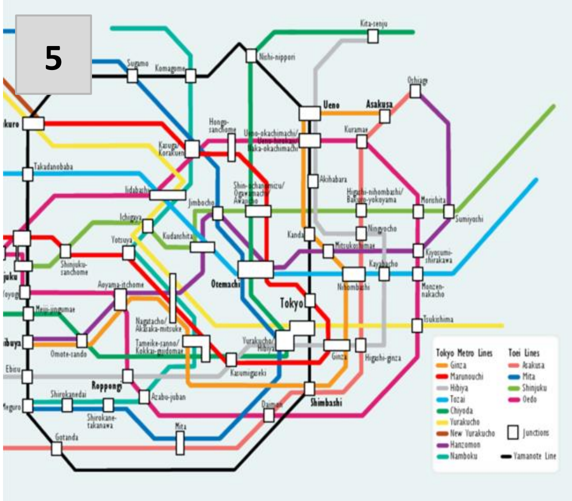
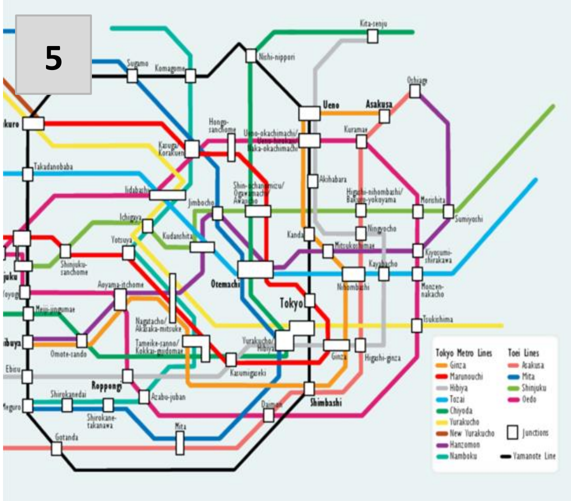
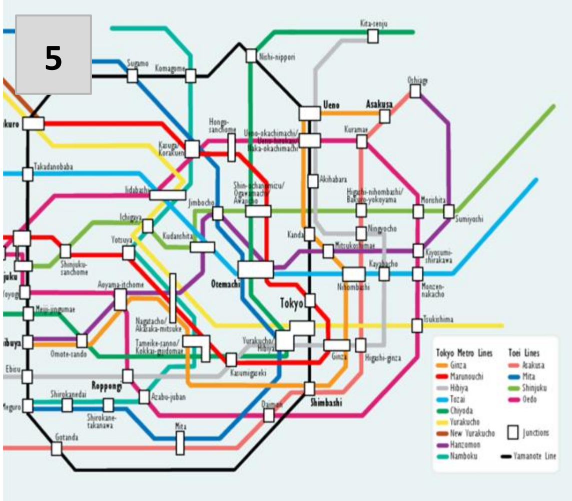
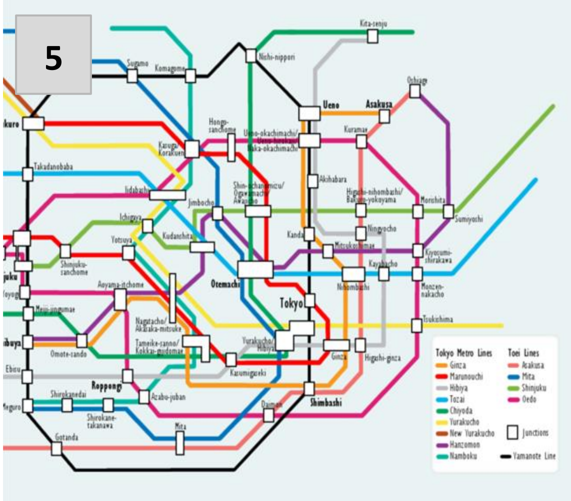
Asakusa
Mita
Shinjuku
Oedo
Junctions
Yamanote Line

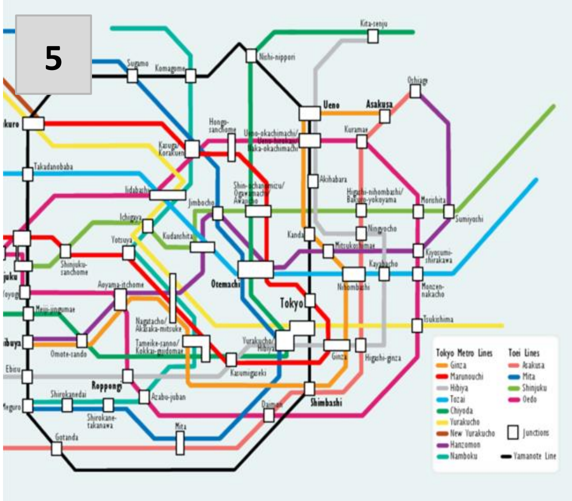


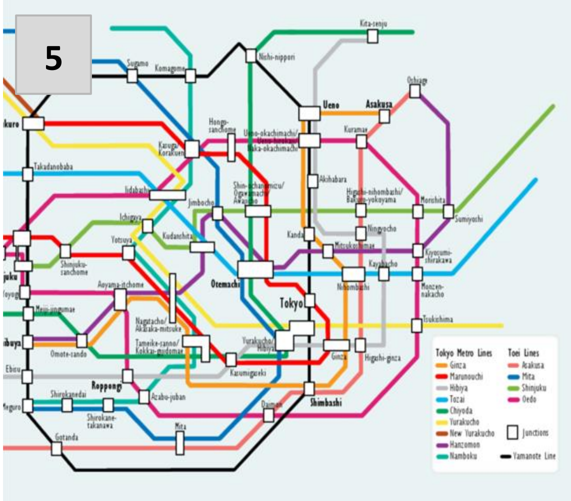












Fold & glue

Challenge 1:

Japanese Bullet trains travel so fast they produce a loud boom when they exit tunnels caused by a cushion of air building up in front of the train. This cushion of air slows them down. How does the Kingfisher transition between different environments and how has it helped to inspire the new design of Bullet train?

Nature's strategy to meet the challenge:

The Kingfisher dives from the air (low drag) into rivers to catch fish, creating very little splash as it enters to water (high drag). It achieves this due to its streamlined beak which steadily increases from tip to head. Engineers mimicked this on the train and found it not only removed the boom, but also saved 10-15% more energy by being more aerodynamic.

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Challenge 2:

We want things to stick together tightly yet come apart easily and readily; seemingly an impossible challenge.
Q: How can we use nature to help us design a material that holds two surfaces strongly together, yet allows them to detach easily?

Nature's strategy to meet the challenge:

Geckos adhere (stick) to vertical surfaces using millions of tiny setae (microscopic hairs) on their feet. Unlike glue they leave no residue behind. Gecko tape mimics the concept of Gecko feet using millions of synthetic fibers which replicate the function of these setae (hairs). Used appropriately, these can provide enough attractive force to hold the weight of a human!

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Challenge 3:

Newly painted buildings quickly get dirty, requiring time and effort to clean them. How does nature keep surfaces clean? How could we learn from this?

Nature's strategy to meet the challenge:

Lotus leaves stay clean without detergents. The plant's cuticle is extremely water repellent. This is accomplished through microscopic bumps on their leaf surface. This reduces the stickiness of water droplets to the surface so they run off easily and take dirt away at the same time.

This is now being mimicked in self cleaning paints and glass. Clever stuff!

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Challenge 4:

How could we connect two things quickly and easily, yet in a way that they could also be taken apart just as quickly? How would nature attach things together in this way?

Nature's strategy to meet the challenge:

The Burdock seed has tiny hook-tipped burrs. As an animal brushes past, the hooks connect with the animal's fur and the seed detaches from the plant; it is then carried to a new location and will eventually drop off the fur and into a new environment where it can grow.

Observing this inspired the creation of Velcro which is commonly used in clothing, tents and work equipment where two pieces are material need to be regularly sealed and unsealed.

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Challenge 5:

Working out the most efficient* way to connect a large number of different points requires huge computing power. There are lots of examples in nature where this happens naturally. What is nature's elegant solution?
(*achieving maximum productivity with minimum wasted effort or expense)

Nature's strategy to meet the challenge:

Slime mould grows in patterns which efficiently find the quickest route to food sources. Using oat seeds to represent neighbourhoods in Tokyo, scientists observed how over a number of days the slime mould created a network of connecting "nutrient-tunnels" which closely replicated the Tokyo rail system. This is now being used to inspire new road or underground layouts.

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