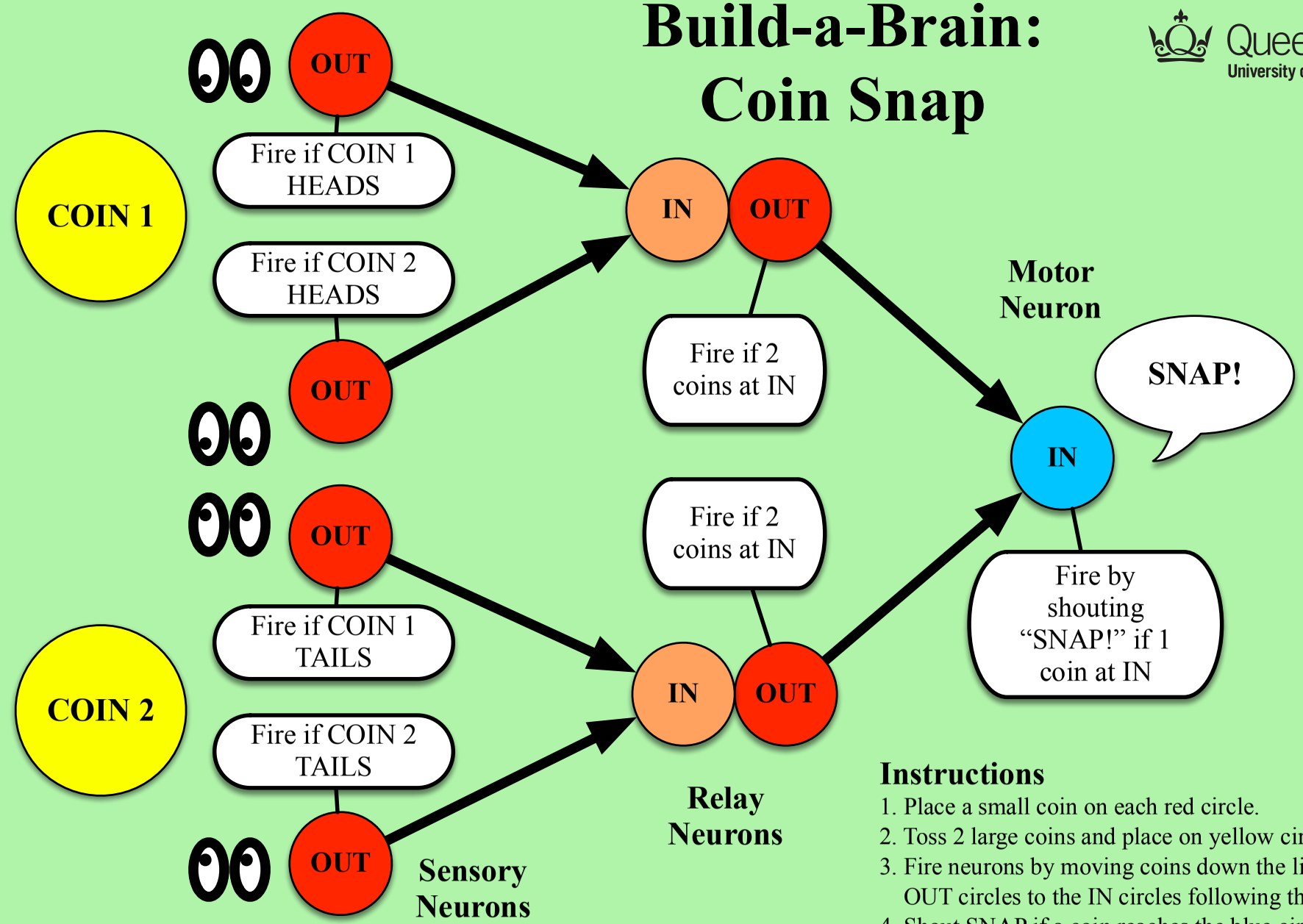
Build-a-Brain: Coin Snap

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Instructions

1. Place a small coin on each red circle.
2. Toss 2 large coins and place on yellow circles
3. Fire neurons by moving coins down the lines from the OUT circles to the IN circles following the linked rules
4. Shout SNAP if a coin reaches the blue circle
5. Remove all coins and repeat from step 1

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Building a Brain to Play Coin Snap

How do our brains work? Are they following rules like a computer program? Could we build an artificial brain that works the same way?

Your brain is made of billions of nerve cells called neurons. They communicate with each other by 'firing' which just means they send chemical messages to each other depending on the messages they receive themselves. Each neuron follows simple rules, a simple algorithm, that tell it when to fire.

You can make your own working artificial brain or 'neural network'. Let's build one to play Coin Snap. All you need is our `build a brain' board, 6 small and 2 large coins.

Rules of coin snap

To play Coin Snap, just toss 2 coins. If they are the same (both Heads or both Tails) then shout "Snap!". Otherwise keep quiet. If you are the first to shout Snap then you get a point. If you shout "Snap!" when the coins are different, you lose a point. The winner is the person getting the most points in an agreed number of rounds (e.g., 10).

How to build a brain

The neurons on our 'Build-a-Brain' board are connected in a way that means it can play coin snap. It is made up of four *Sensory Neurons*. They are the brain's link to the outside world: linked to its eyes. They are also connected to two *Relay Neurons* that can't sense anything in the outside world. They can only react to the messages coming to them from the sensory neurons. Finally our brain has one *Motor Neuron*. It allows the brain to do things in the world by controlling the body's muscles. Here it controls the mouth, shouting "Snap!" when the neuron fires. The neurons follow similar rules about firing but based on different amounts, or *thresholds,* of signal coming in. The motor neuron fires on a single message coming in. The two relay neurons have a threshold of two. They only fire when they get two messages. The sensory neurons each focus on a different coin position and follow a rule that tells them to fire if they see either a head or a tail.

Sending messages

Our neurons need messages to work - the *neurotransmitters* that act as the chemical messages in our brains. We will use small coins for that. Place a small coin on each red circle to act as the messages for that neuron. When a neutron fires you move its coin down the arrow to the orange (or blue) circle of its connected neuron. If that neuron reaches its own threshold, it fires in turn. If the blue motor neuron gets a coin and so fires, you shout, "Snap!" acting as the actual mouth of your brain.

Playing Coin Snap

To play a round of Snap (perhaps between two Build-a-brain boards controlled by different people), a referee tosses 2 large coins and places them on the large yellow circles. They are the positions the motor neurons are focusing on. Fire the neurons according to each one's rules. Shout "Snap!" if a coin reaches the blue circle. Finally reset the brain sending the messages back to where they came from, ready for the next round.

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