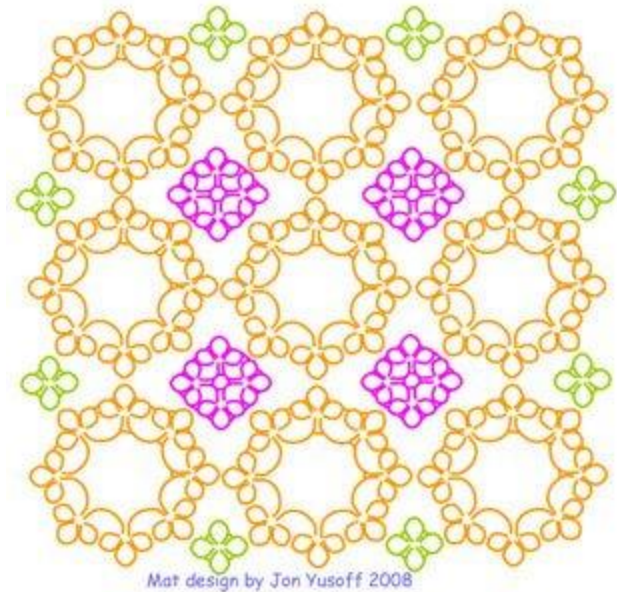


Network Motifs and Modules



Tenth Century Celtic Motifs on the Great Cross at
at Nanhyfer from Nevern Church (N. Pembrokeshire)

<http://www.geolocation.ws/v/W/4d7c154f8786567a40008042/the-great-cross-at-nanhyfer/en>



Contemporary Motif

<http://tatsaway-patterns.blogspot.com/2008/11/clover-matdoilyrunner.html>

Network Motifs and Modules

What is a motif?

A motif is a statistically over-represented subgraph in a network.

A pattern of connections that generates a characteristic dynamical response. A motif is a connection pattern template which could in principle be implemented.

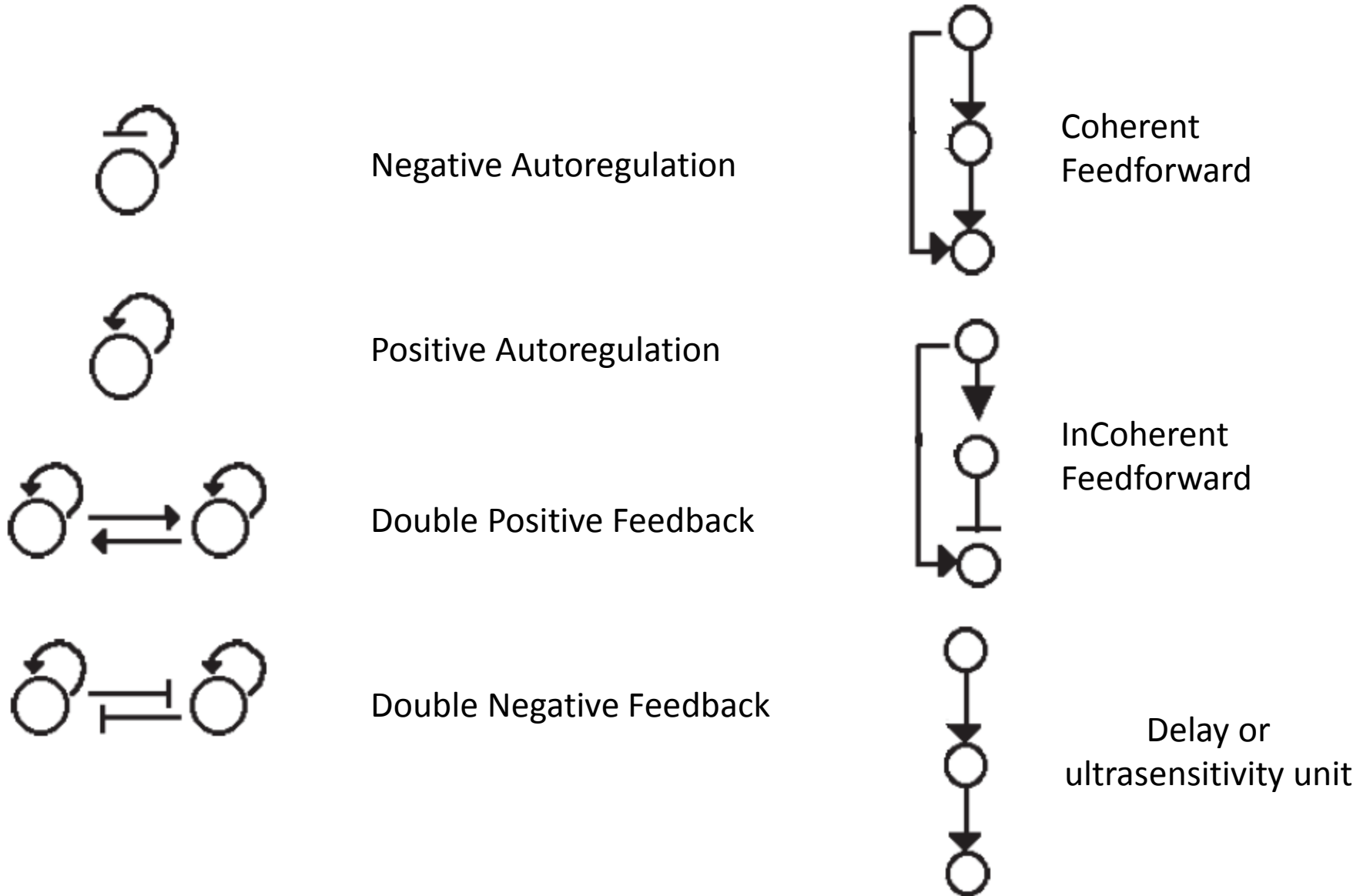
Network Motifs and Modules

What is a module?

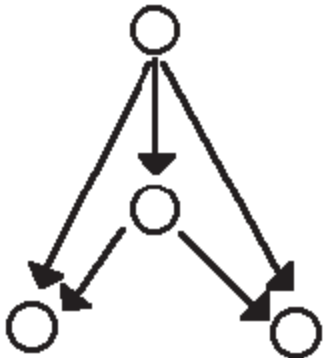
A module is an exchangeable functional unit. Its chief characteristic is that when placed in a different context, its intrinsic functional properties do not change.

All modules are motifs but not all motifs are modules.

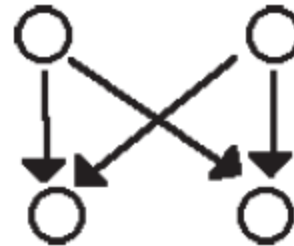
Network Motifs



Network Motifs



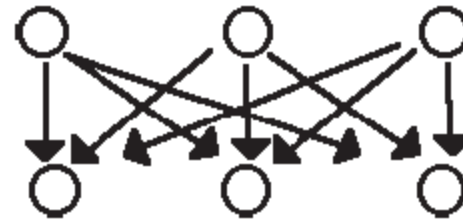
Multi-Output FFL



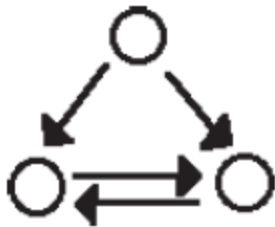
Bi-Fan



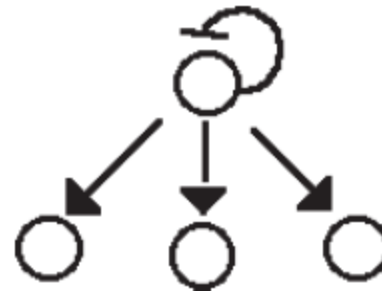
Regulated Double Negative Feedback



Dense Overlapping Regulons



Regulated Double Positive Feedback



SIM – Single Input Module

Network Motifs

Negative Autoregulation



1. Noise Suppression
2. Accelerated Response
3. High Fidelity Amplifier
4. Feedback Oscillation

Positive Autoregulation



1. Bistability
2. Memory Unit



Relaxation Oscillator

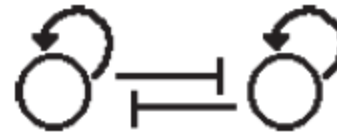
Network Motifs

Double Positive Feedback



Memory unit where both units are **either** on or off

Double Negative Feedback



Memory unit: when one unit is off the **other** unit is on

Network Motifs

Coherent Feedforward



1. Noise rejection
2. Pulse shifter

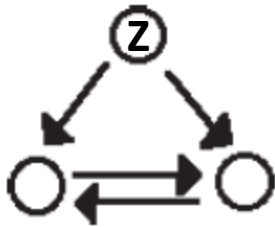
InCoherent Feedforward



1. Pulse generator
2. Concentration detector
3. Response time accelerator

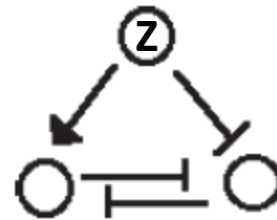
Network Motifs

Regulated Double
Positive Feedback



Memory unit that records
an event in Z

Regulated Double
Negative Feedback

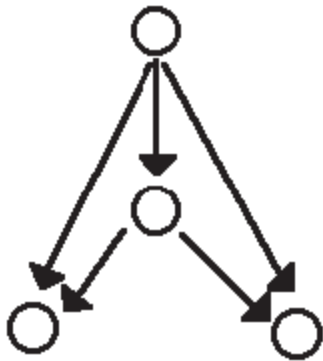


Memory unit that where nodes switch
in opposite directions due to an event in Z



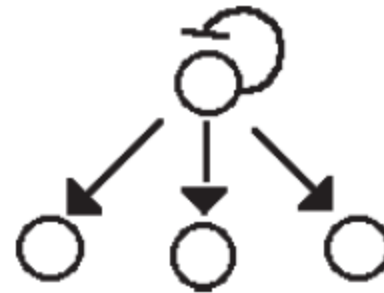
Network Motifs

Multi-Output FFL



1. **Pulse Train Generator**
2. **Temporal Sequencer** – Last in last out, ie the last gene activated is the last gene deactivated.

SIM – Single Input Module



1. **Master/Slave Regulator**
2. **Temporal Sequencer** – Last in first out, ie. The last gene activated is the first gene deactivated