Trade off

compete among neighbour

↕

neighbourhood against other

$$\frac{f'(x)g(x) - f(x)g'(x)}{g^2(x)}$$

- Gain by compete other molecule
- Resource usage

$$[f(x)\cdot g(x)]' = f'(x)g(x) + g'(x)f(x)$$

$$\checkmark \quad \frac{dw}{dx} = \frac{1}{y}\cdot G(y)\frac{dy}{dx} + \left[-\frac{1}{y^2}G(y) + \frac{1}{y}G'(y)\right]\frac{dy}{dx}$$ competitive

$$\checkmark \quad w = \frac{y}{y}\cdot G(y)$$

Appendix 1

$$\frac{dw}{dx} = \left(\frac{y(x)}{y(x)}\right)' G(y(x)) + \frac{y(x)}{y(x)} G'[y(x)]$$

$$= \frac{y'(x)y(x) - y(x)y'(x)}{y^2(x)} G[y(x)] + \frac{y(x)}{y(x)} G'(y)\cdot\frac{dy}{dx}$$

$$= \left[\frac{dy}{dx}\frac{y(x)}{y^2(x)} - \frac{y(x)y'(x)}{y^2(x)}\frac{dy}{dx}\right] G[y(x)] + \frac{y(x)}{y(x)} G'(y)\frac{dy}{dx}$$

$$= \frac{dy}{dx}\frac{y(x)}{y^2(x)} G[y(x)] - \frac{y(x)}{y^2(x)}\frac{dy}{dx} G[y(x)] + \frac{y(x)}{y(x)} G'(y)\frac{dy}{dx}$$

$$\frac{dw}{dx} = \frac{1}{y(x)} G(y)\frac{dy}{dx} + \left[-\frac{y}{y^2}G(y) + \frac{y}{y}G'(y)\right]\frac{dy}{dy} = 0$$

$y = y - y^*$

At opt

$$G(y) = 1 - c\cdot y$$

$$\frac{dw}{dy}\frac{dy}{dx} = \frac{1}{y^*} G(y^*)\frac{dy}{dx} + \left[-\frac{1}{y^*}G(y) + G'(y)\right]\frac{dy}{dx}\,dy$$

$$\frac{dw}{dy} = \frac{1}{y^*} G(y^*) + \left[G'(y) - \frac{1}{y^*}G(y)\right]\frac{dy}{dy}$$