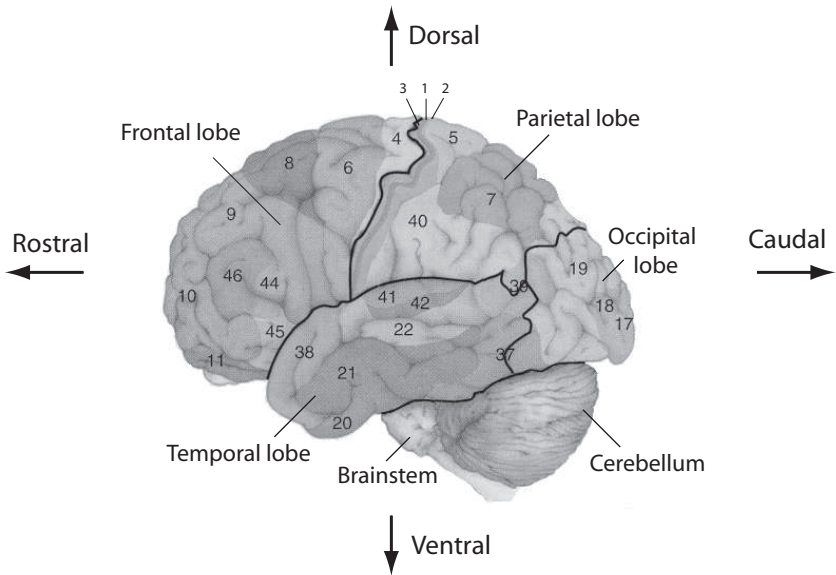


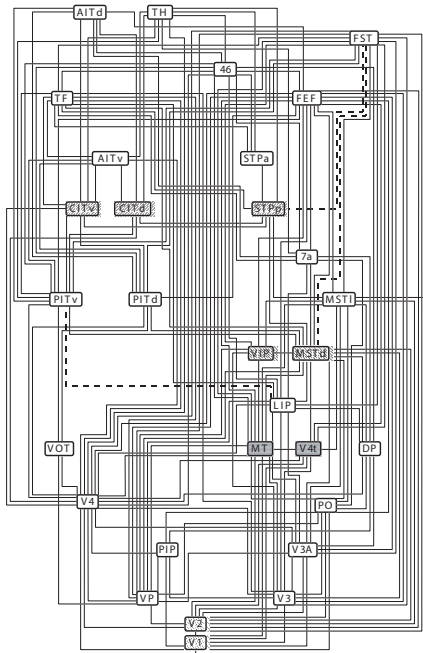
Fundamentals of Computational Neuroscience 2e

Thomas Trappenberg

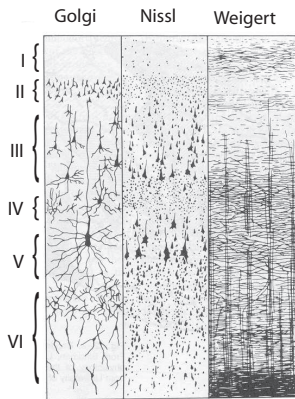
January 30, 2009

Chapter 5: Cortical organizations and simple networks

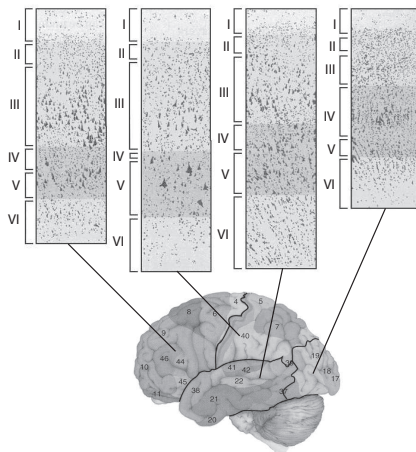




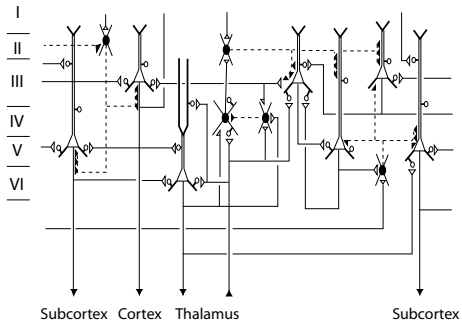
A. Different staining techniques



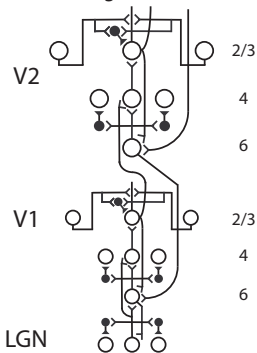
B. Variation in cortex



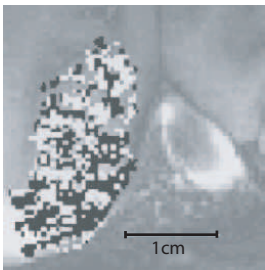
A. Collections of observed laminar connectivity pattern



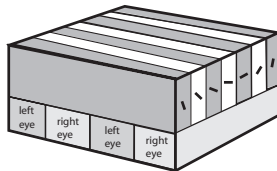
B. Grossberg's Laminar model



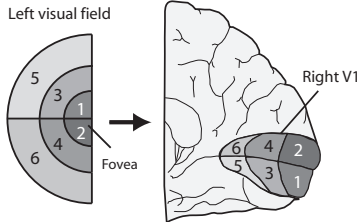
A. Ocular dominance columns



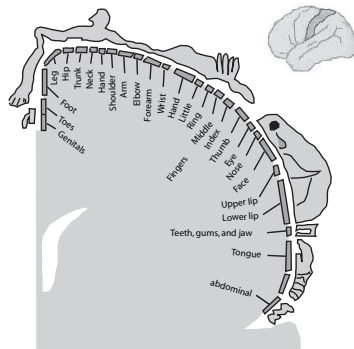
B. Relation between ocular dominance and orientation columns



C. Topographic map of the visual field in primary visual cortex



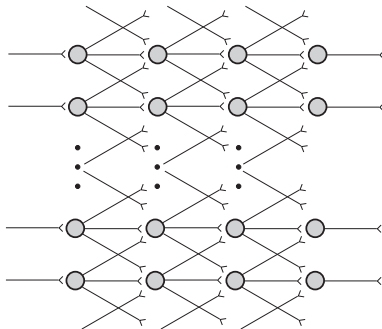
D. Somatosensory map



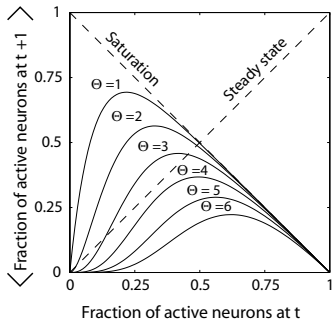
A. Linear chain



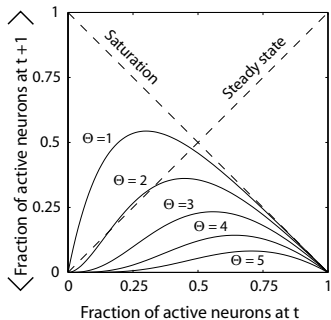
B. Diverging-converging chain



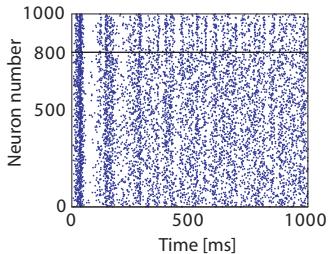
A. Without inhibitory neurons



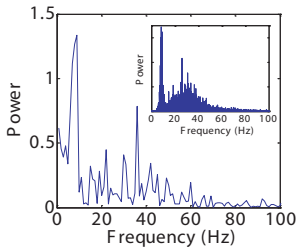
B. With inhibitory neurons



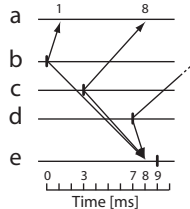
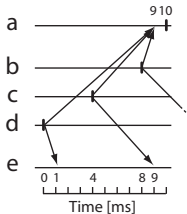
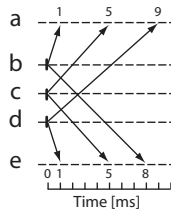
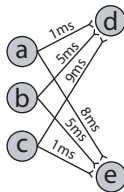
A. Spike trains in random network



B. Power spectrum in random network



C. Spike activation with axonal delay



```

1  % Created by Eugene M. Izhikevich, February 25, 2003
2  % Excitatory neurons      Inhibitory neurons
3  Ne=800;                   Ni=200;
4  re=rand(Ne,1);           ri=rand(Ni,1);
5  a=[0.02*ones(Ne,1);     0.02+0.08*ri];
6  b=[0.2*ones(Ne,1);      0.25-0.05*ri];
7  c=[-65+15*re.^2;        -65*ones(Ni,1)];
8  d=[8-6*re.^2;           2*ones(Ni,1)];
9  S=[0.5*rand(Ne+Ni,Ne), -rand(Ne+Ni, Ni)];
10
11 v=-65*ones(Ne+Ni,1);    % Initial values of v
12 u=b.*v;                 % Initial values of u
13 firings=[];             % spike timings
14
15 for t=1:1000             % simulation of 1000 ms
16     I=[5*randn(Ne,1);2*randn(Ni,1)]; % thalamic input
17     fired=find(v>=30); % indices of spikes
18     if ~isempty(fired)
19         firings=[firings; t+0*fired, fired];
20         v(fired)=c(fired);
21         u(fired)=u(fired)+d(fired);
22         I=I+sum(S(:,fired),2);
23     end;
24     v=v+0.5*(0.04*v.^2+5*v+140-u+I);
25     v=v+0.5*(0.04*v.^2+5*v+140-u+I);
26     u=u+a.*(b.*v-u);
27 end;
28 plot(firings(:,1),firings(:,2),'.');

```

Further Readings

Edward L. White (1989) **Cortical circuits**, Birkhäuser

Moshe Abeles (1991) **Corticonics: Neural circuits of the cerebral cortex**, Cambridge University Press