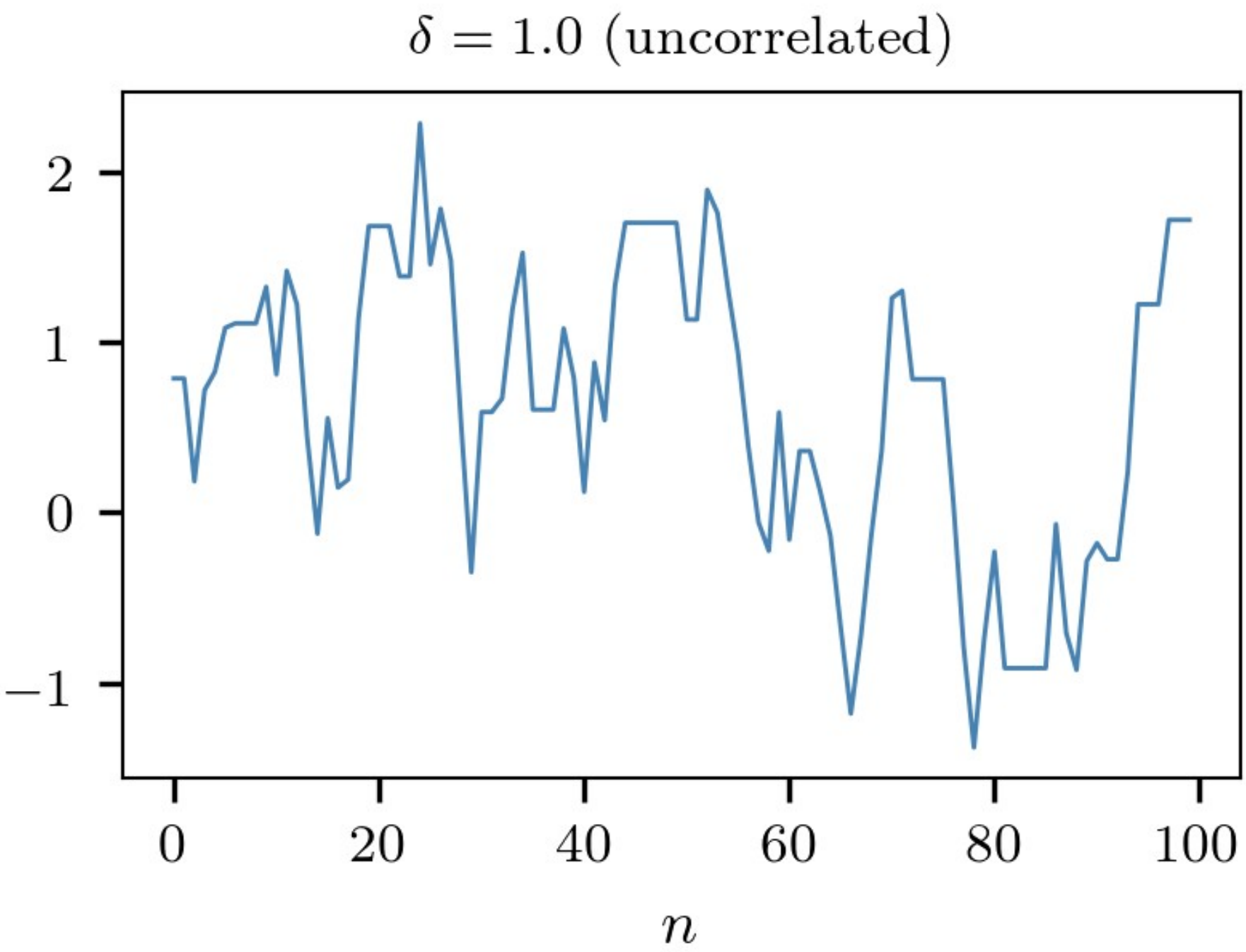
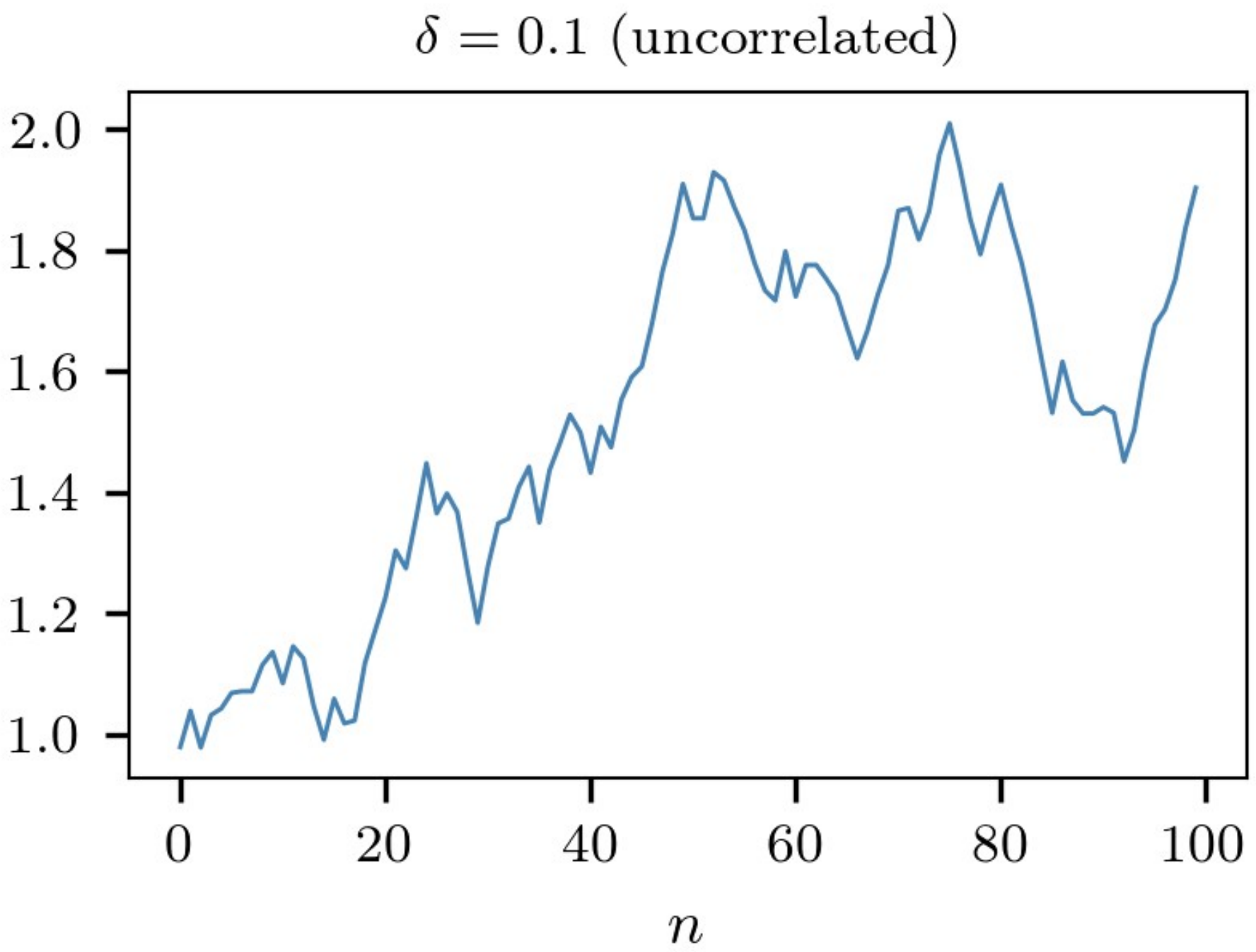
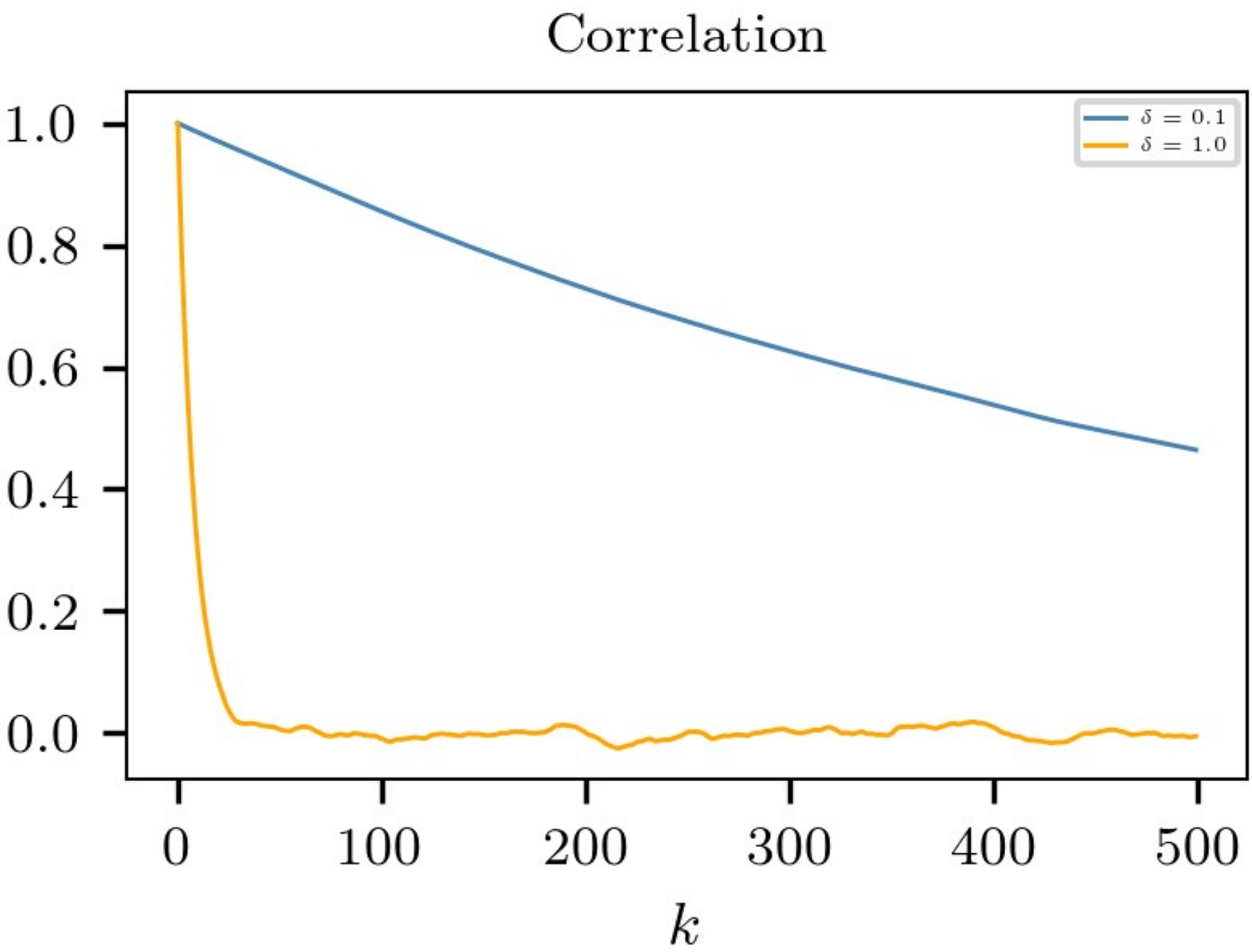
Metropolis-Montecarlo

```
for(i=0;i<N;i++)
   {
     p = myrand();
     x = trial(x0);
     w = exp(-0.5*(x*x-x0*x0));

     if (p<w) x0 = x;

     if (i%100==0) printf("%lf\n",x0);
   }
```

```
double myrand()
  {
   double p;
   p = (double)rand()/(double)RAND_MAX;

   return p;
  }

double trial(double x0)
  {
     double p,x;

   p = myrand();

   x = 2.0*DELTA*(p-0.5)+x0;

   return x;
  }
```


$\delta = 1.0$ (uncorrelated)
2
1
0
−1
0
20
40
60
80
100
n

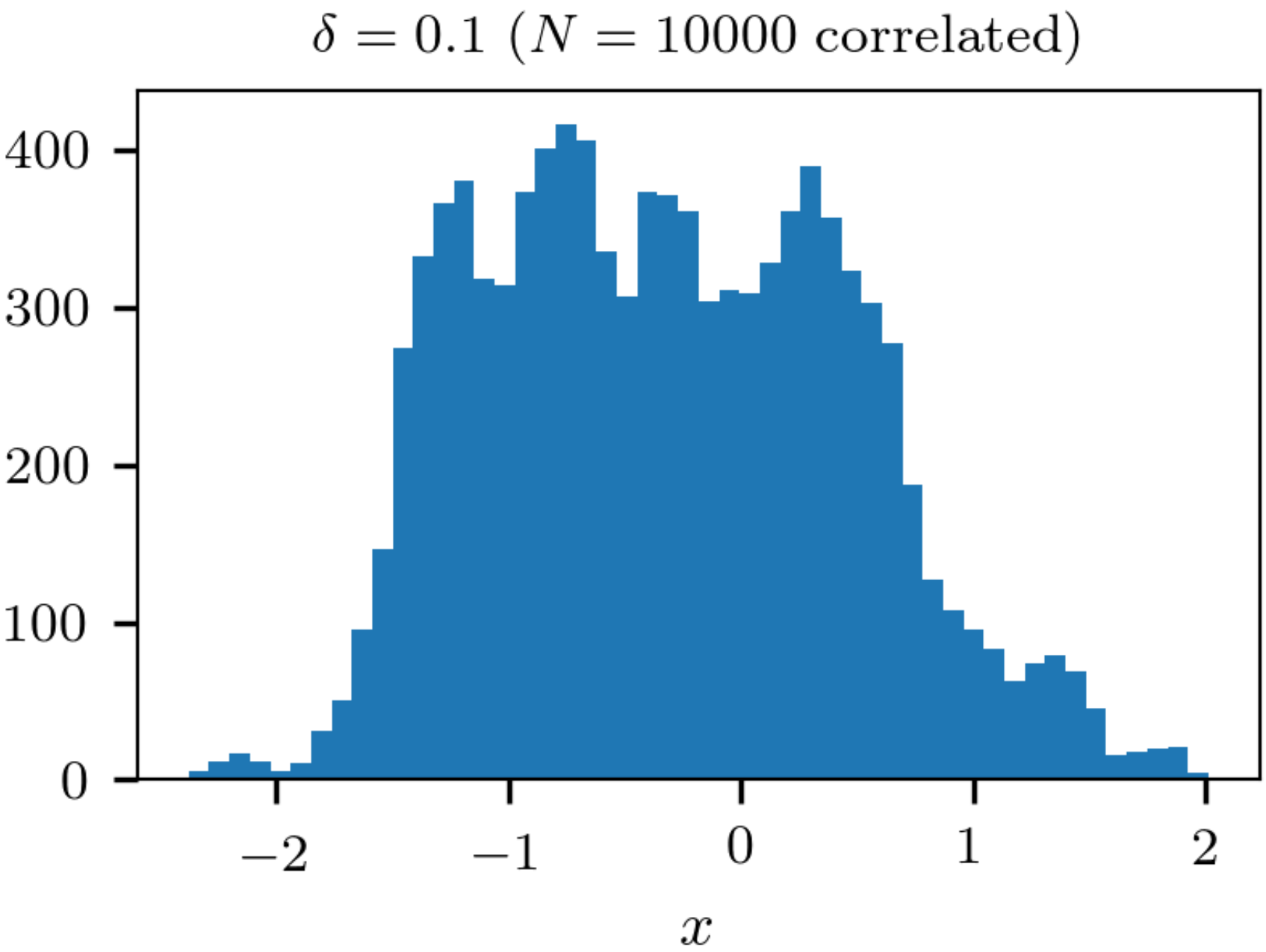

$\delta = 0.1$ (uncorrelated)
2.0
1.8
1.6
1.4
1.2
1.0
0
20
40
60
80
100
n

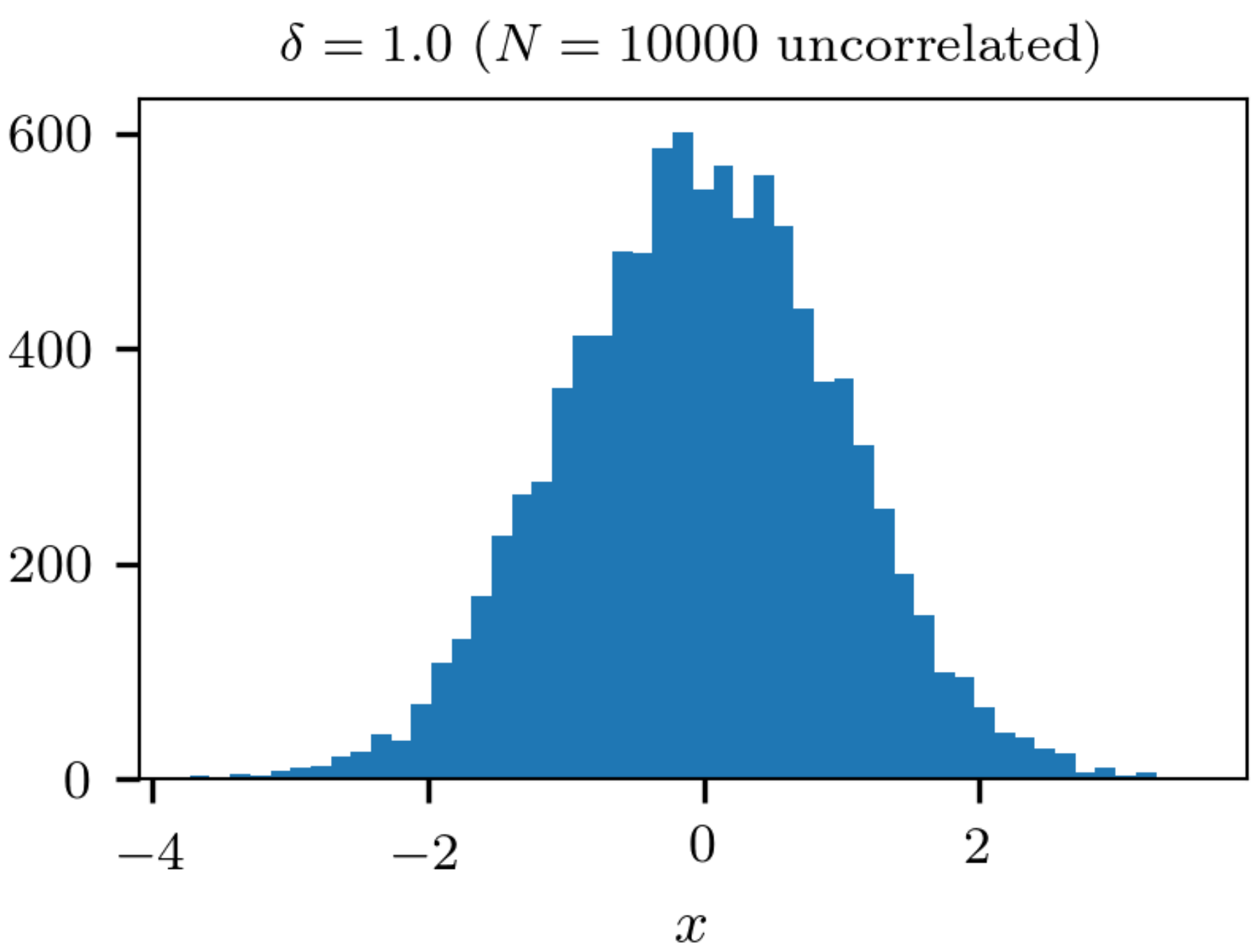

Correlation
1.0
0.8
0.6
0.4
0.2
0.0
0
100
200
300
400
500
k
$\delta = 0.1$
$\delta = 1.0$

```
int correlation(double *c,double *x,int n)
{
  int    i,k;
  double xi,xk,s0,s1,s2;

  for (k=0;k<n;k++)
    {
      s0 = 0.0;
      s1 = 0.0;
      s2 = 0.0;

      for (i=0;i<N-n;i++)
         {
          xi = *(x+i);
          xk = *(x+i+k);

          s1 += xi/(double)(N-n);
          s0 += xi*xk/(double)(N-n);
          s2 += xi*xi/(double)(N-n);
         }

      *(c+k) = (s0-s1*s1)/(s2-s1*s1);
    }

  return 1;
}
```

$$C(k) = \frac{\langle X_i . X_{i+k} \rangle - \langle X_i \rangle^2}{\langle X_i^2 \rangle - \langle X_i \rangle^2}$$

$$\langle X_i . X_{i+k} \rangle = \frac{X_1 . X_{1+k} + \ldots . + X_{N-k} . X_N}{N-k}$$


$\delta = 0.1$ ($N = 10000$ correlated)
400
300
200
100
0
−2
−1
0
1
2
x


$\delta = 1.0$ ($N = 10000$ uncorrelated)
600
400
200
0
−4
−2
0
2
x