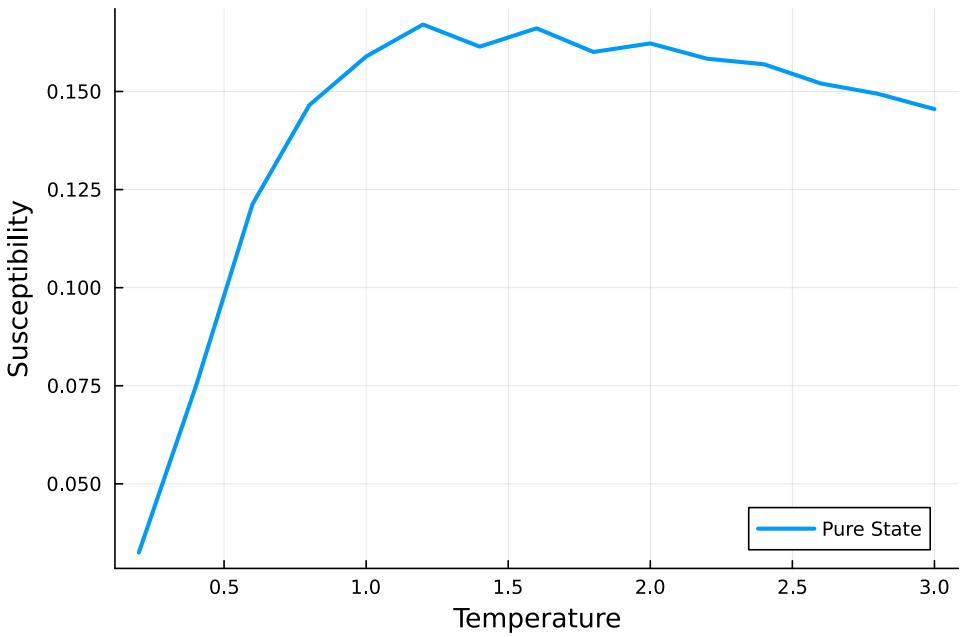
In [1]:
```
import Pkg
Pkg.add("DataStructures")
Pkg.add("Shuffle")
Pkg.add("Plots")
Pkg.add("Distributions")
Pkg.add("Random")
using DataStructures
using Shuffle
using Plots
using Random
using Distributions


#takes in an integer n
#returns array of length n of integers +/- 1 (randomly chosen) that represent s
function initial_config(n::Int)
  config = zeros(n)
  if n%2 != 0
    println("Size n must be even.")
    return
  else
    for i=1:n
      config[i] = rand([-1, 1])
    end
  end
  #print(config)
  return config
  #essentially from N, we get a randomized array of spin ups and downs
  #e.g., N=2 may equal [1,-1]; N=4 may equal [1,-1,-1,1] as our initial configu
end

function gaussian_rf(N)
  nd = Normal(0, 1)
  return rand(nd, N)
end

function unit_rf(N)
  field = zeros(N)
  for i=1:N
    field[i] = rand([-.5, .5])
  end
  return field
end


#standard function for getting the hamilitonian of 1/r^2
#Ising Model
function get_energy(s::AbstractArray, h::AbstractArray, J)
  E0 = 0.0
  E1 = 0.0
  E2 = 0.0
  for i=1:length(s)
    #if i != length(s)
      #E0 += J*s[i]*s[i+1]
    #else
      #E0 += J*s[i]*s[1]
    #end
    for j=i:length(s)
      if j != i
        E1 += J*(s[i]-s[j])^2/(i-j)^2
      end
    end
    E2 += h[i]*s[i]
  end
  E = -E1/2 - E2
  return E
end
```

In [2]:
```
#Pure State:
@time begin X_list1 = Vector{Float64}()
for kT = initkT:iter:finalkT
  println("At ", kT, " kT.")
  data = metropolis(config0, kT, J, h3, mcsteps)
  X = get_susceptibility(data[1], data[2], kT, length(config0))
  push!(X_list1, X)
end
plot(initkT:iter:finalkT, X_list1, xlabel = "Temperature", ylabel = "Susceptibi
end
```

```
At 0.2 kT.
At 0.4 kT.
At 0.6 kT.
At 0.8 kT.
At 1.0 kT.
At 1.2 kT.
At 1.4 kT.
At 1.6 kT.
At 1.8 kT.
At 2.0 kT.
At 2.2 kT.
At 2.4 kT.
At 2.6 kT.
At 2.8 kT.
At 3.0 kT.
51242.544917 seconds (4.41 M allocations: 244.320 MiB, 0.00% gc time, 0.01% co
mpilation time: 19% of which was recompilation)
```

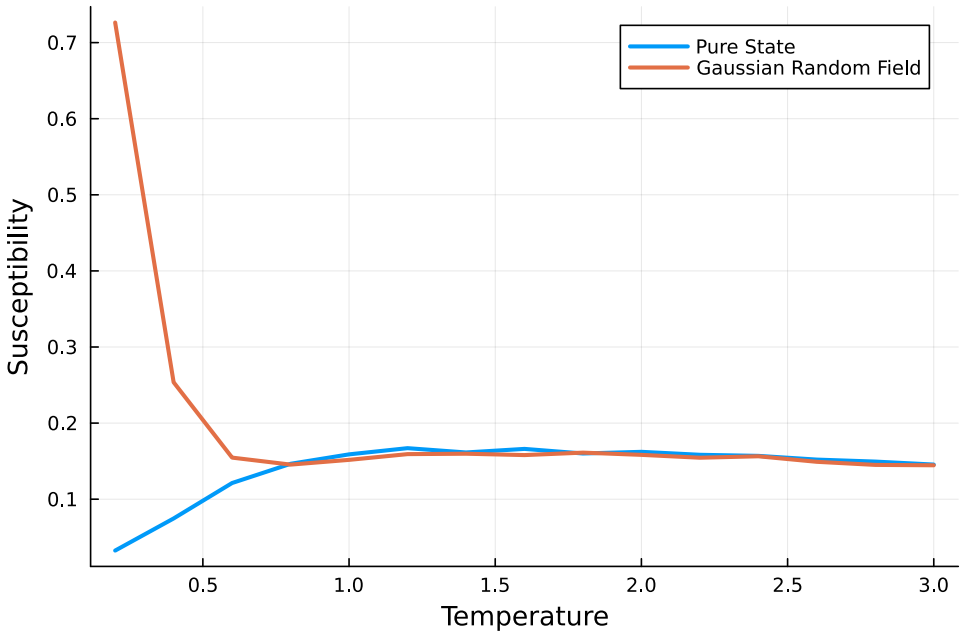
Out[2]:



In [3]:
```
#Gaussian Random Field:
@time begin X_list2 = Vector{Float64}()
for kT = initkT:iter:finalkT
  println("At ", kT, " kT.")
  data = metropolis(config0, kT, J, h2, mcsteps)
  X = get_susceptibility(data[1], data[2], kT, length(config0))
  push!(X_list2, X)
end
plot!(initkT:iter:finalkT, X_list2, xlabel = "Temperature", ylabel = "Susceptib
end
```

```
At 0.2 kT.
At 0.4 kT.
At 0.6 kT.
At 0.8 kT.
At 1.0 kT.
At 1.2 kT.
At 1.4 kT.
At 1.6 kT.
At 1.8 kT.
At 2.0 kT.
At 2.2 kT.
At 2.4 kT.
At 2.6 kT.
At 2.8 kT.
At 3.0 kT.
41466.535724 seconds (335.45 k allocations: 22.430 MiB, 0.00% compilation tim
e)
```

Out[3]:



In [17]:
```
print(X_list2)
```

```
[0.25007999999999997, 0.28896, 0.24372000000000005, 0.23897, 0.223208, 0.21837
333333333334, 0.2132457142857143, 0.201125, 0.19762666666666667, 0.19142399999
999998, 0.17792727272727274, 0.18039666666666668, 0.1668, 0.16540285714285716,
0.15995199999999998]
```

In [ ]:

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