I. Counterexamples to the DN account of explanation:

A. Common cause examples:

Whenever a barometer drops by .....millibars a storm occurs.
My barometer has dropped by .....millibars.

A storm occurs.

Anyone with Kopolek spots (small white spots on the inside of the cheek) has a fever.
John has Kopolek spots.

John has a fever.

Identical twins have the same color eyes.
Tweedle Dum and Tweedle Dee are identical twins.
Tweedle Dum has has brown eyes.

Tweedle Dee has brown eyes.

In these cases there is a common cause of two effects, neither of which is the cause of the other. Drop in air pressure causes both the storm and the drop in the barometer (which is nothing more than an air pressure meter); and measles infection causes both the Kopolek spots and the fever.

At one time tobacco companies suggested that although smoking and lung cancer are correlated, smoking might not cause cancer. Instead, they argued, smoking and lung cancer might both be effects of some common cause, perhaps a genetic factor predisposing certain people to both smoking and lung cancer.

B. Covariation examples:

The flag pole casts a 50 foot shadow.
The sun is at a 45° angle.
(Various laws about light and geometrical optics).

The flag pole is 50 feet high.

PV = kT	T = 2πroot(l/g)
P = a, V = b	T = a
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$T = ab/k$ $I = a^2g/(4\pi^2)$

Shoe size = foot size.
Pete's shoes are size nine.

Pete's feet are size nine.

An object is fragile if and only if it has molecular structure M
This object is fragile.

This object has molecular structure M.

In covariation examples two kinds of events always occur together. This can be when one is the unique cause of the other (fragility example) or when there is a common cause (Tweedle Dee and Dum example) and also when more complicated causal relations hold (the other examples here).

C. Overdetermination:

All people who take birth control pills do not get pregnant.
Mr Jones takes birth control pills.

Mr Jones does not get pregnant.

(We consider a case in which a begonia is deprived of both sunlight and water. The plant dies because of the lack of water - lack of sun light would have taken longer to kill the plant.)

Begonias deprived of sunlight for two months die.
This begonia was deprived of sunlight for two months.

This begonia died.

D. Failure of the effect implies failure of the cause.

Copper expands when heated.
This object is made of copper.
This object has not expanded.

This object has not been heated.

All pure water at sea level pressure boils when heated to 212°
This sample is pure water at sea level pressure and is not boiling.

This sample is not heated to 212°.

E. Many of the above examples can also be described as ones in which a symptom has been confused with a cause. This can happen in a variety of ways - e.g.,in the barometer/storm example, the flag pole example, and the shoe size example. Here is another one:

If the oil warning light comes on in my car, my car has lost its oil pressure.
The oil warning light has just come on.

My car has just lost its oil pressure.

F. Examples depending on logical tricks and ones otherwise hard to classify:

All things born die.
John was born.

John died.

All passengers on flight 74 to Miami purchased a ticket.
John is on flight 74 to Miami.

John purchased a ticket.

All crows are black.
Henry is not black.

Henry is not a crow.

All copper conducts electricity.
Either my alarm failed to go off this morning, or copper does not conduct electricity.

My alarm failed to go off this morning

Ice melts if salt is put on it.
Salt was put on this ice.
The universe is expanding.

This ice has melted, and the universe is expanding.

All crows are black.

Bob is a crow.
This ball is the same color as Bob.

This ball is black.

II. More general difficulties

A. Explanations rarely proceed by deduction from true general laws.

1. True, exceptionless general laws are rare in psychology, sociology, and political science.

2. Many laws of the physical sciences (and economics) are idealizations, or ceteris paribus (other things being equal) laws.

a. Boyle's law: T = kPV (T, the temperature, P the pressure, V the volume, k a constant.)
i. True only of an "ideal gas".
ii. Applies to real gasses only approximately.

b. "When the government increases the money supply inflation occurs."
i. Assumes no other, anti-inflationary pressures
ii. Such as expansion of the economy.

3. When laws in the physical sciences are relatively exact, they generally don't apply to the world directly

b. Archimedes law applies to explain why a boat floats only on the tacit assumption that there is nothing like a rope attached to the boat pulling it downward.

a. More generally, for F = ma
i. We can apply this to calculate the motion of an object only when we know what the total forces are
ii. We never know the total forces exactly, and except in very special cases we don't know them better than very crudely.

B. Explanations can be answers to what or how questions, as well as why questions:

1. An explanation of WHAT water is.

2. An explanation of HOW the sun produces energy.

3. It is an open question whether these can be reexpressed as DN arguments.

C. Functional explanations:

1. Examples of functions:

a. The heart functions (in a person) to circulate the blood.

b. A resistor functions (in a radio) to reduce the flow of current through a wire.

2. Explaining the function of something is an important case of answering a what question, also involving how questions:

a. What does the heart do?
i. It circulates the blood.
ii. In more detail explaining the function of the heart would involve explaining how it contributes to the life process of organism that have a heart.

b. What does the resistor do?
i. It reduces the current along the wire.
ii. In more detail, explaining the function of the resistor in a radio would involve explaining how it contributes to the radio's ability to turn radio waves into sound waves.

D. Counterexamples to the symmetry thesis:

1. Predictions, but not explanations can be false.

2. There are explanations, but not predictions of general facts (laws or theories).

3. Symptoms (e.g., in the barometer/storm example) can be used to predict but not explain.

4. Answers to what and how questions often explain but do not operate to make predictions.