

RESTful API

The RESTful API is a collection of 8 resources that can be accessed over HTTP. The format to retrieve data is `http://hypothesis.ornl.gov/app/v1.0/SpecificGraphReasoning?start=start term` for applications 1 to 5, and `http://hypothesis.ornl.gov/app/v1.0/SpecificGraphReasoning?start=start term&end=end term` for applications 6 to 8 (with **start term** and **end term** replaced with the actual terms). In addition, the size of the results can also be set with `&size=100`, as an example. The number of hops can be set for applications 4 and 5 (maximum = 2) and for applications 6 and 8 (maximum=7) with `&hops=5`, as an example.

You can use directly reach the resources through curl, a browser, or any programming language that can communicate through HTTP. Results are returned in JavaScript Object Notation (JSON) format.

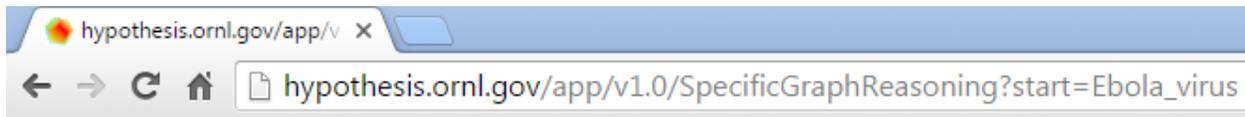
Example of cURL command line:

```
C:\curl>curl -i http://hypothesis.ornl.gov/app/v1.0/SpecificGraphReasoning?start=Ebola_virus
HTTP/1.1 200 OK
Date: Mon, 04 Jan 2016 18:48:25 GMT
Server: Werkzeug/0.10.4 Python/2.6.6
Content-Type: application/json
Content-Length: 1680
Connection: close

{
  "SpecificGraphReasoning": {
    "head": {
      "vars": [
        "similar",
        "count"
      ]
    },
    "results": {
      "bindings": [
        {
          "count": {
            "datatype": "http://www.w3.org/2001/XMLSchema#integer",
            "type": "typed-literal",
            "value": "15"
          }
        }
      ]
    }
  }
}
```

App1: Specific Reasoning on Graph

http://hypothesis.ornl.gov/app/v1.0/SpecificGraphReasoning?start=Ebola_virus

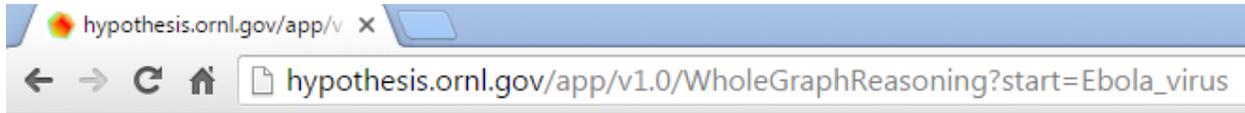


```
{
  "SpecificGraphReasoning": {
    "head": {
      "vars": [
        "similar",
        "count"
      ]
    },
    "results": {
      "bindings": [
        {
          "count": {
            "datatype": "http://www.w3.org/2001/XMLSchema#integer",
            "type": "typed-literal",
            "value": "15"
          },
          "similar": {
            "type": "uri",
            "value": "urn:sm/Marburg_Virus_Disease"
          }
        }
      ]
    }
  }
}
```

Specific Reasoning on Graph finds terms that uniquely connect to the start term. These terms are more informative than the descriptive terms shown in **Reasoning on Whole Graph**. This search can produce novel connections and show meaningful relationships, leading to new insights.

App2: Reasoning on Whole Graph

http://hypothesis.ornl.gov/app/v1.0/WholeGraphReasoning?start=Ebola_virus

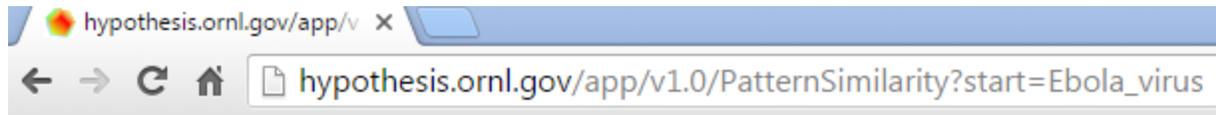


```
{
  "WholeGraphReasoning": {
    "head": {
      "vars": [
        "similar",
        "count"
      ]
    },
    "results": [
      {
        "bindings": [
          {
            "count": {
              "datatype": "http://www.w3.org/2001/XMLSchema#integer",
              "type": "typed-literal",
              "value": "1049"
            },
            "similar": {
              "type": "uri",
              "value": "urn:sm/Proteins"
            }
          }
        ],
        {
          "count": {
            "datatype": "http://www.w3.org/2001/XMLSchema#integer",
            "type": "typed-literal",
            "value": "975"
          },
          "similar": {
            "type": "uri",
            "value": "urn:sm/Antibodies"
          }
        }
      ]
    }
  }
}
```

Reasoning on Whole Graph finds terms that have many connecting links to the **Search/Start Term**. A high number of connecting links is one way of determining similarity between the terms. For the whole graph, these terms tend to be descriptive of the search term.

App3: Pattern Similarity - Whole Graph

http://hypothesis.ornl.gov/app/v1.0/PatternSimilarity?start=Ebola_virus

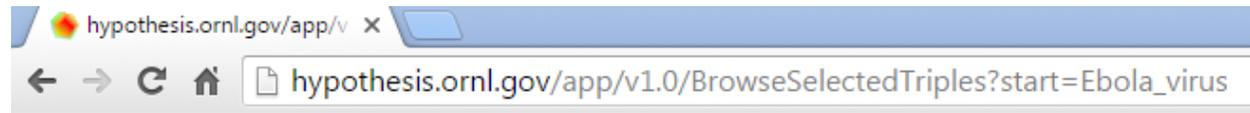


```
{
  "PatternSimilarity": {
    "head": {
      "vars": [
        "similar",
        "count"
      ]
    },
    "results": {
      "bindings": [
        {
          "count": {
            "datatype": "http://www.w3.org/2001/XMLSchema#integer",
            "type": "typed-literal",
            "value": "123"
          },
          "similar": {
            "type": "uri",
            "value": "urn:sm/Virus"
          }
        },
        {
          "count": {
            "datatype": "http://www.w3.org/2001/XMLSchema#integer",
            "type": "typed-literal",
            "value": "99"
          },
          "similar": {
            "type": "uri",
            "value": "urn:sm/HIV"
          }
        }
      ]
    }
  }
}
```

Pattern Similarity – Whole Graph finds terms that have many connecting links, similar to **Reasoning on Whole Graph**, but also accounts for how the terms are connected (predicates). New relationships can be discovered, bringing new insights and leading to serendipitous discoveries.

App4: Browse Selected Triples

http://hypothesis.ornl.gov/app/v1.0/BrowseSelectedTriples?start=Ebola_virus

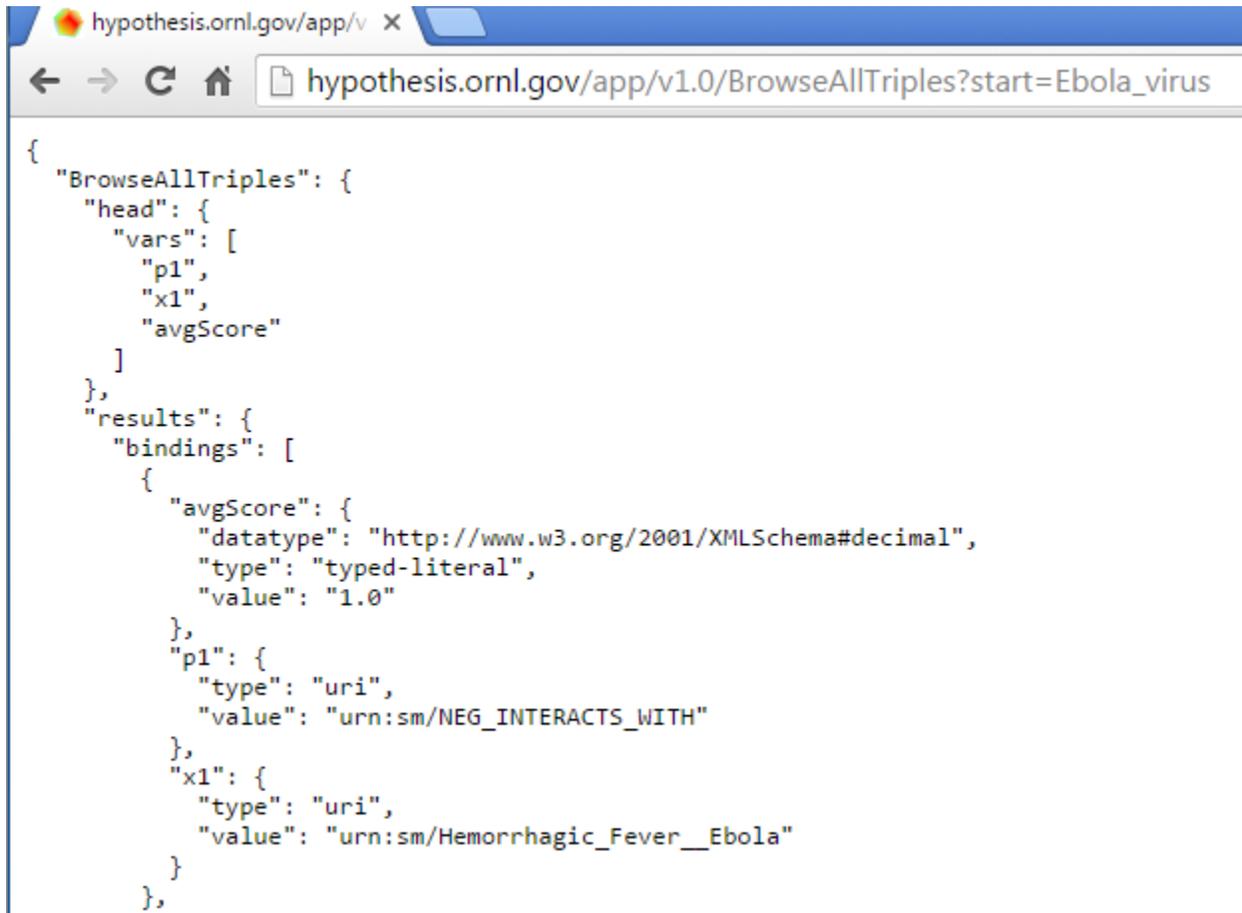


```
{
  "BrowseSelectedTriples": {
    "head": {
      "vars": [
        "p1",
        "x1",
        "avgScore"
      ]
    },
    "results": {
      "bindings": [
        {
          "avgScore": {
            "datatype": "http://www.w3.org/2001/XMLSchema#decimal",
            "type": "typed-literal",
            "value": "1.0"
          },
          "p1": {
            "type": "uri",
            "value": "urn:sm/NEG_INTERACTS_WITH"
          },
          "x1": {
            "type": "uri",
            "value": "urn:sm/Hemorrhagic_Fever__Ebola"
          }
        },
        {
          "avgScore": {
            "datatype": "http://www.w3.org/2001/XMLSchema#decimal",
            "type": "typed-literal",
            "value": "0.125"
          },
          "p1": {
            "type": "uri",
            "value": "urn:sm/Rev_NEG_PART_OF"
          },
          "x1": {
            "type": "uri",
            "value": "urn:sm/Nucleoproteins"
          }
        }
      ]
    }
  }
}
```

Browse Selected Triples shows the data as it is stored in the informative graph, and determines a score based on a measure of uniqueness of the triple. The informative graph is about 10% of the whole graph, and contains relationships that are descriptive of the terms.

App5: Browse All Triples

http://hypothesis.ornl.gov/app/v1.0/BrowseAllTriples?start=Ebola_virus

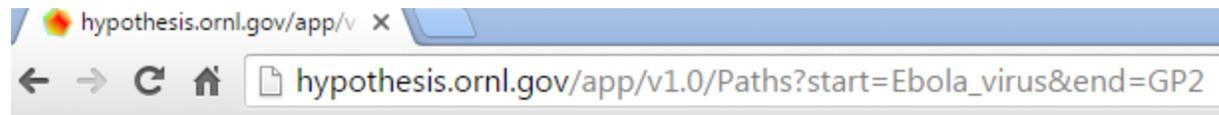


```
{
  "BrowseAllTriples": {
    "head": {
      "vars": [
        "p1",
        "x1",
        "avgScore"
      ]
    },
    "results": {
      "bindings": [
        {
          "avgScore": {
            "datatype": "http://www.w3.org/2001/XMLSchema#decimal",
            "type": "typed-literal",
            "value": "1.0"
          },
          "p1": {
            "type": "uri",
            "value": "urn:sm/NEG_INTERACTS_WITH"
          },
          "x1": {
            "type": "uri",
            "value": "urn:sm/Hemorrhagic_Fever__Ebola"
          }
        }
      ]
    }
  }
}
```

Browse All Triples + shows the raw data as it is stored in the graph, and determines a score based on a measure of uniqueness of each triple. The results are shown sorted by score.

App6: Paths

http://hypothesis.ornl.gov/app/v1.0/Paths?start=Ebola_virus&end=GP2

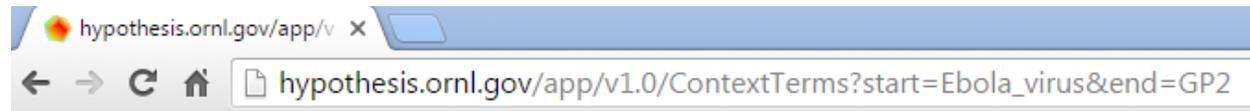


```
{
  "Paths": {
    "head": {
      "vars": [
        "p1",
        "x1",
        "p2",
        "x2",
        "p3",
        "avgScore"
      ]
    },
    "results": {
      "bindings": [
        {
          "avgScore": {
            "datatype": "http://www.w3.org/2001/XMLSchema#decimal",
            "type": "typed-literal",
            "value": "0.375617283950617283950617"
          },
          "p1": {
            "type": "uri",
            "value": "urn:sm/NEG_INTERACTS_WITH"
          },
          "p2": {
            "type": "uri",
            "value": "urn:sm/Rev_INTERACTS_WITH"
          },
          "p3": {
            "type": "uri",
            "value": "urn:sm/Rev_PART_OF"
          },
          "x1": {
            "type": "uri",
            "value": "urn:sm/Hemorrhagic_Fever__Ebola"
          },
          "x2": {
            "type": "uri",
            "value": "urn:sm/Ebola_Virus__Zaire"
          }
        }
      ]
    }
  }
}
```

Paths shows the connections between two terms in the informative graph. This information is useful in discovering relationships between close as well as distant terms.

App7: Context Terms

http://hypothesis.ornl.gov/app/v1.0/ContextTerms?start=Ebola_virus&end=GP2

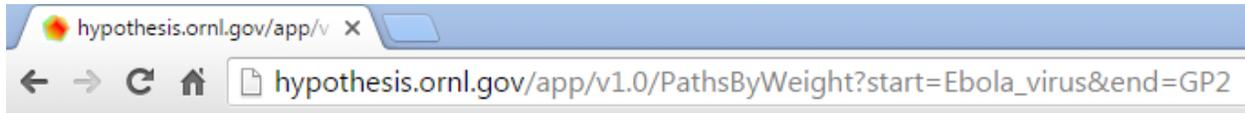


```
{
  "ContextTerms": {
    "head": {
      "vars": [
        "incontext",
        "cnt"
      ]
    },
    "results": {
      "bindings": [
        {
          "cnt": {
            "datatype": "http://www.w3.org/2001/XMLSchema#integer",
            "type": "typed-literal",
            "value": "2"
          },
          "incontext": {
            "type": "uri",
            "value": "urn:sm/Disease"
          }
        },
        {
          "cnt": {
            "datatype": "http://www.w3.org/2001/XMLSchema#integer",
            "type": "typed-literal",
            "value": "2"
          },
          "incontext": {
            "type": "uri",
            "value": "urn:sm/Viral_Proteins"
          }
        }
      ]
    }
  }
}
```

Context Terms looks for the terms that connect to both the **Start Term** and the **End Term**. The common links are an indication of a relationship, and could be used to select terms for additional path searches.

App8: Paths by Predicate Weight

http://hypothesis.ornl.gov/app/v1.0/PathsByWeight?start=Ebola_virus&end=GP2



```
{
  "PathsByWeight": {
    "head": {
      "vars": [
        "p1",
        "x1",
        "p2",
        "x2",
        "p3",
        "avgScore"
      ]
    },
    "results": {
      "bindings": [
        {
          "avgScore": {
            "datatype": "http://www.w3.org/2001/XMLSchema#integer",
            "type": "typed-literal",
            "value": "207"
          },
          "p1": {
            "type": "uri",
            "value": "urn:sm/NEG_INTERACTS_WITH"
          },
          "p2": {
            "type": "uri",
            "value": "urn:sm/Rev_INTERACTS_WITH"
          },
          "p3": {
            "type": "uri",
            "value": "urn:sm/Rev_PART_OF"
          },
          "x1": {
            "type": "uri",
            "value": "urn:sm/Hemorrhagic_Fever__Ebola"
          },
          "x2": {
            "type": "uri",
            "value": "urn:sm/Ebola_Virus__Zaire"
          }
        }
      ]
    }
  }
}
```

Paths by Predicate Weight is similar to **Paths**, except the score is based on how important the predicates have shown to be upon review. This method can produce results that are more reliable.